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Kristina Nevstad

Towards Better Performing Projects

The Impact of Collaborative Project Delivery Models on Project Performance

Doctoral thesis

NTNU
Norwegian University of Science and Technology
Thesis for the Degree of Philosophiae Doctor
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EVERY JOURNEY
BEGINS ALWAYS WITH
THE FIRST STEP

PREFACE

During my professional career working in the public sector in various disciplines relating to infrastructure projects, I became increasingly curious about why we sometimes ended up in disputes with our partners and had to use significant resources to prevent and resolve potential conflicts efficiently. Several times, I witnessed that the ability to safeguard actors' personal interests was related both to the level of collaboration and to a suitable approach to inspire parties to work rationally together to achieve the best project outcomes.

It is not given that it is always best to continue as before. A shift from a traditional delivery method based on a transactional approach to a more collaborative one may be a solution in the right direction to achieve successful projects.

The research for this dissertation was motivated by the need for a better understanding of the link between project-based collaboration and project performance. This is an important topic that needs more research. The audience for the research comprises both researchers and practitioners within the field of project management. The findings can be insightful for the research community and project professionals interested in collaborative project delivery models. The findings can also be insightful, and value adding for project-based organizations contemplating a shift from a traditional delivery method to a more collaborative one.

This dissertation describes the research that I conducted at Department of Mechanical and Industrial Engineering at the Norwegian University of Science and Technology (NTNU). I have no conflict of interests related to the research, which was internally funded at NTNU by my employer at the Department of Ocean Operations and Civil Engineering.

ACNOWLEDGEMENTS

This dissertation would not come into existence without the support and benevolence of others. Through the years, I have had the privilege of being influenced by other researchers and have received support from good friends and family members. I use this opportunity to thank these people.

First, I thank my main supervisor, Professor Bjørn Andersen, and my two co-supervisors, Professor Wenche Aarseth and Associate Professor Anniken Th Karlsen. Thank you for your support, your guidance, and your ability to raise critical questions. Being a PhD student is a journey. In my case, my supervisors have been a perfect combination, and I am especially grateful for how they have supported my choices, and have kindly and patiently helped me to deal with the challenging circumstances involved in the hard work of doing doctoral research.

I would especially like to thank both the head of my department, Professor Hans Petter Hildre, who patiently has followed my process, and the previous head of department, Geirmund Oltedal, who had belief in me and supported me in the beginning.

I would also like to thank two of my co-authors of Paper 2, Professor Pernille Eskerod and Professor Emeritus Tage Koed Madsen, as well as one of my co-authors of Paper 1, Sjur Børve (PhD), for valuable discussions and contributions. Furthermore, I would like to acknowledge and thank Carl Christian Overholt and Sander Busch Sevaldsen, who wrote a master's thesis, on which parts of Paper 3 are based.

The following colleagues and friends are thanks for all our discussions: Associate Professor Haavard Haaskjold, Knut Robert Fossum (PhD), Associate Professor Jan Alexander Langlo, Terje Tvedt, and Nina Lødøen. I would also like to emphasize my friend Anne Strand Alfredsen Larsen (PhD). Our friendship emerged from a mutual desire for us to support each other. The mutual support has been crucial, enjoyable, and rewarding. We have spent various lunch meetings together sharing our 'ups and downs'. I am sincerely thankful to Anne.

Furthermore, I would like to thank Hilde Mentzoni Andersen at 'Andersen Translations' for our inspiring conversations and professional language checking of all three papers prior to submission. Additionally, I would like to thank Catriona Turner (Norwegian organisjonsnr. 991 550 399) for checking the language and formatting of this dissertation. Thanks are also due to graphic designer Torun Hunnes at 'Torusen design', helping me draw the model representing the holistic presentation of the main findings of the dissertation.

I also want to thank sincerely my close family and parents, Kjell-Roger Nevstad and Torill Nevstad, who taught me the importance of hard work during my early life. I am eternally grateful to them for all they have taught me.

To the most important persons in my life, my husband and soulmate, Fridtjof Moe and our sweet little ones, Lone and Luis – this would not have been possible without you.

Ålesund/Trondheim, 23 September 2022
Kristina Nevstad

SUMMARY

There is broad acknowledgment that engineering and construction projects face certain problems. Such projects are associated with low efficiency, due mainly to the significant focus on transactions. Some projects do not reach their goals, end up unfinished, have large cost overruns, or are delayed. One strategy for addressing these problems is the development of collaborative project delivery models (CPDMs).

Researchers and practitioners have recently turned their attention towards collaborative arrangements and new CPDMs, and there is a need for more research to explore the link between project-based collaboration and project performance, especially in the case of CPDMs that lack empirical-based evidence regarding performance. Research has focused on the two CPDMs, project partnering and project alliancing, to address this research gap and increase the understanding of how factors in these CPDMs influence project performance to the extent that better performing projects can be achieved in the future. The dissertation combines the research field of CPDMs and the research field of project performance between client and contractor in two industries, the construction industry and the oil and gas industry. The research undertaken aimed at answering the following research questions regarding partnering and alliancing, as examples of CPDMs:

RQ1: What factors in extant literature describe partnering and alliancing?

RQ2: How to succeed with project partnering?

RQ3: How do project partnering and project alliancing influence project performance?

The dissertation consists of two parts. Part I consists of an overview of conducted research and synthesizes the theoretical background and key findings. Part II consists of three scientific papers that are based on three different datasets. The first dataset was qualitative and contained data relating to 54 interviews with professionals within the construction industry in Norway. The second dataset was quantitative and contained data from 142 engineering consultancies within the engineering consultant industry in Denmark and Norway. The third dataset was qualitative and contained data relating to 13 interviews with professionals within the oil and gas industry in Norway.

The three scientific papers are published in international journals with referee schemes (double-blind-review). Paper 1 investigates how to succeed with project partnering. Partnering success factors identified from existing literature were explored and are described in Paper 2 by linking the partnering success factors to project performance. The study on which Paper 3 is based investigated the impact of a project alliance on project performance.

The main contribution from Paper 1 is to focus and work on the three main dimensions of Who, What, and Way: *Who* relates to participant selection; *What* relates to task clarification; and *Way* relates to partnering means. In the future, an understanding of the three main dimensions could help to enable projects to mature and help projects to achieve successful partnering. The main contribution of Paper 2 is to show that *mutual project objectives* and *commitment* are important for meeting time schedule, budget, and technical specifications. *Trust* and *collaborative problem-solving* are important for meeting time schedule and technical specifications. *Communication* is important for meeting technical specifications. Together, the five partnering success factors are important for project performance. The main contribution of Paper 3 is that a project alliance contributes to better project performance by promoting a better working relationship between the partners compared with in traditional projects. This is achieved through closer cooperation, shorter decision paths, transparent partners, and an overall culture tailored around collaboration.

The overall contribution of this dissertation is a summary of all described findings, and it represents a more holistic approach to how CPDMs influence project performance. This dissertation culminates in a summary model that aims to capture the description and explanation representing a holistic presentation of the main findings. The summary model provides a better understanding of how to succeed with CPDMs, by increasing the understanding of how factors in these CPDMs influence project performance to achieve better performing projects. Education of project members is vital to ensure successful implementation at the project level and to ensure that the outcome of using the CPDMs is successful. Positive outcomes point to several benefits that can be obtained by adopting a more collaborative approach.

The first research question (RQ1) is addressed in all three papers, where factors within the context of CPDMs are identified from extant literature. The findings in this dissertation show which factors researchers have identified as important for partnering and alliancing. In terms of partnering, the most important partnering success factor is *trust*, followed respectively by *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives*. With regard to alliancing, a list of factors identified from extant literature formed the basis or a description of an alliance. Twelve examples of factors describing an alliance are *collaborative problem-solving*, *trust*, *co-location*, *pain/gain share*, *open book approach*, *commitment*, *single alliance culture, communication*, *workshops*, *a single IT system*, *no blame*, and *mutual goals and objectives.* The factors have received a great deal of attention and are regarded as tools for achieving success in projects.

The second research question (RQ2) is addressed mainly in Paper 1. The findings described in Paper 1 can be systematized in a three-dimensional model Who, What, Way, which is named 'The 3W model – How to succeed with project partnering', where *Who* relates to participant selection, *What* relates to task clarification, and *Way* relates to partnering means. Subdimensions of the *Way* dimension are: 3a. partnering attitude; 3b. a collaborative culture; 3c. a holistic perspective; and 3d. an accurate handover. The findings also showed that inadequate training of staff could be a major cause of breakdown in partnering.

All three papers contribute to answering the third research question (RQ3). Overall, the contributions from the papers provide insights into the links between CPDMs and project performance from two different point of view, namely project partnering and project alliancing. Thus, based on the findings and insights gained from the three studies on which this dissertation is built, the overall contribution of this dissertation is shown in Figure I, and the model is called Project-based Collaboration for Future Performance (the PCFP model). The contribution of this research narrows the research gap in relation to project-based collaboration (i.e. the relationship between project participants' collaboration and project performance) by providing insights into factors in these CPDMs that are important for project performance. Having more understanding and insights into CPDMs within the construction industry and oil and gas industry should enable improvement in engineering and construction projects in the future.

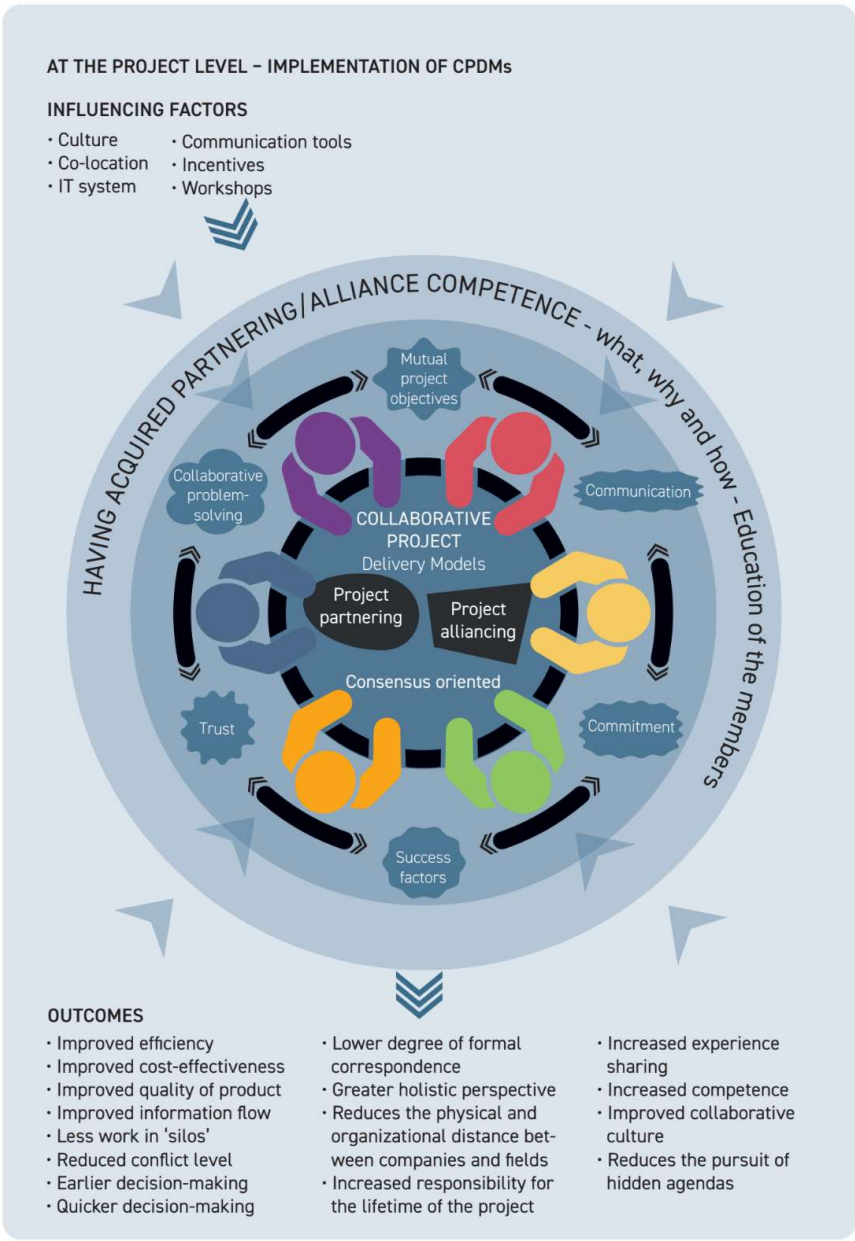

Figure I: Project-based Collaboration for Future Performance (the PCFP model)

The theoretical contribution of this dissertation adds to the general knowledge of CPDMs, project partnering, and project alliancing by exploring and providing insights into factors describing CPDMs that are considered important to project performance. This should serve to advance general understanding, which would make it easier to gain better insights into these collaborative arrangements before they are used in practice. This in turn could make the implementation at project level easier and ensure that the outcomes of using the models are successful and lead to improved performance in projects.

The research undertaken for this dissertation also investigated research gaps in relation to CPDMs at a more detailed level and pertaining to the understanding of relations and interactions among projects participants. This was done by exploring collaboration through factors describing CPDMs, namely social and human aspects that are important in CPDMs that are more person-dependent than traditional models.

The practical contribution of this dissertation is related to real case studies, and the dissertation suggest practical approaches to understanding how to succeed with the CPDMs in order to achieve better performing projects in the future. The approaches are intended for project-based organizations that are contemplating to shift from a traditional delivery method to a more collaborative one, such as project partnering or project alliancing, to achieve better performing projects in the future.

SAMMENDRAG (SUMMARY IN NORWEGIAN)

Det er bred enighet om at ingeniør- og byggeprosjekter står overfor visse problemer. Prosjektene er forbundet med lav effektivitet, mest på grunn av et betydelig fokus på transaksjoner. En rekke prosjekter når ikke målene, ender opp som uferdige, har store kostnadsoverskridelser eller er forsinket. En strategi for å møte disse utfordringene er utviklingen av prosjektgjennomføringsmodeller. Disse modellene beskriver en høyere form for samarbeid hvor deltagerne har et sterkt ønske om å nå et felles mål. Modellene bygger på likeverdige relasjoner som baseres på høy grad av åpenhet og tillit mellom partene. Konflikter løses i fellesskap, og alle ressurser skal involveres i starten av prosjektet.

Forskere og praktikere har rettet oppmerksomheten mot samarbeidsordninger og nye prosjektgjennomføringsmodeller, og det er behov for mer forskning som ser på sammenhengen mellom prosjektbasert samarbeid og prosjekt prestasjoner. Forskningen har satt søkelys på prosjektgjennomføringsmodellene, samhandling og allianse, for å adressere dette forskningsgapet. Målet med denne avhandlingen er å skape økt kunnskap om hvordan faktorer som beskriver disse prosjektgjennomføringsmodellene påvirker prosjektets prestasjoner for å gi flere vellykkede prosjekter i fremtiden. Avhandlingen kombinerer forskningsfeltet prosjektgjennomføringsmodeller og forskningsfeltet prosjekt prestasjoner mellom byggherre og entreprenør i to bransjer, byggebransjen og olje- og gassindustrien. Denne avhandlingen skal besvare følgende tre forskningsspørsmål:

- Hvilke faktorer i eksisterende litteratur beskriver samhandling og allianse?
- Hvordan lykkes med samhandling?
- Hvordan påvirker samhandling og allianse prosjekt prestasjoner?

Denne avhandlingen består av to hoveddeler. Den første delen omfatter avhandlingens teoretiske bakteppe og sammenfatter avhandlingens sentrale funn og bidrag. Den andre delen omfatter tre vitenskapelige artikler basert på tre forskjellige datasett. Det første datasettet var kvalitativt og inneholdt data knyttet til 54 intervjuer med fagpersoner innen byggebransjen i Norge. Det andre datasettet var kvantitativt og inneholdt data fra 142 ingeniørkonsulenter innen ingeniørkonsulentbransjen i Danmark og Norge. Det tredje datasettet var kvalitativt og inneholdt data knyttet til 13 intervjuer med fagpersoner innen olje- og gassindustrien i Norge.

De tre vitenskapelige artiklene er publisert i internasjonale tidsskrifter. Artikkel 1 undersøker hvordan man kan lykkes med samhandling. Suksessfaktorer for samhandling identifisert fra eksisterende litteratur ble utforsket og er beskrevet i artikkel 2 ved å koble suksessfaktorene

for samhandling til prosjektets prestasjoner. Studien som artikkel 3 er basert på undersøkte effekten av en prosjektallianse på prosjektets prestasjoner.

Hovedbidraget fra artikkel 1 er å fokusere og arbeide med de tre hoveddimensjonene (Hvem, Hva og Hvordan), for å gjøre dem i stand til å modnes og oppnå vellykket samhandling. Hovedbidraget til artikkel 2 er å vise at *gjensidige prosjektmål* og *engasjement* er viktig for å møte tidsplan, budsjett og tekniske spesifikasjoner. *Tillit* og *løse konfliktene sammen* er viktig for å møte tidsplan og tekniske spesifikasjoner. *Kommunikasjon* er viktig for å oppfylle tekniske spesifikasjoner. Sammen er de fem suksessfaktorene for samhandling viktige for prosjektets prestasjoner. Hovedbidraget til artikkel 3 er at en prosjektallianse bidrar til bedre prosjektytelse ved å fremme et bedre samarbeid mellom partnerne sammenlignet med tradisjonelle prosjekter. Dette oppnås gjennom tettere samarbeid, kortere beslutningsveier, transparente partnere, og en helhetlig kultur tilpasset samarbeid.

Det overordnede bidraget er en oppsummering av alle beskrevne funn, og den representerer en mer helhetlig tilnærming til hvordan prosjektgjennomføringsmodeller påvirker prosjektets prestasjoner. Denne avhandlingen kulminerer i en oppsummeringsmodell som tar sikte på å fange beskrivelsen og forklaringen som representerer en helhetlig presentasjon av hovedfunnene. Oppsummeringsmodellen gir en bedre forståelse av hvordan man lykkes med prosjektgjennomføringsmodeller, ved å øke forståelsen for hvordan faktorer som beskriver dem påvirker prosjektets prestasjoner for å oppnå bedre resultater. Utdanning av prosjektmedlemmer er avgjørende for å sikre vellykket implementering på prosjektnivå og for å sikre at resultatet av å bruke prosjektgjennomføringsmodellene er vellykket. Positive resultater peker på flere fordeler som kan oppnås ved å ta i bruk en mer samarbeidende tilnærming.

Det første forskningsspørsmålet behandles i alle artiklene, der faktorer innenfor konteksten av prosjektgjennomføringsmodeller ble identifisert fra eksisterende litteratur. Funnene i denne avhandlingen viser faktorer forskere har funnet viktige for samhandling og allianse. Når det gjelder samhandling, den viktigste suksessfaktoren for samhandling var *tillit*, den nest viktigste var *kommunikasjon*, *engasjement* var den tredje viktigste, *løse konfliktene sammen* ble oppført som nummer fire, og til slutt *gjensidige prosjektmål*. Videre dannet en liste over faktorer identifisert fra eksisterende litteratur grunnlaget for å beskrive en allianse. Tolv eksempler på faktorer som beskriver en allianse var *samarbeid i problemløsning, tillit*, *samlokalisering*, *deling av bonus/malus, åpen bok-tilnærming*, *engasjement*, *en enkelt alliansekultur, kommunikasjon*, *workshops*, *ett enkelt nettbasert informasjonssystem*, *ingen uforutsett hendelser-klausul* og *samordning av mål*. Faktorene har fått stor oppmerksomhet og anses som et verktøy for å oppnå suksess i prosjekter.

Svaret på det andre forskningsspørsmålet blir hovedsakelig gitt i artikkel 1. De tre hoveddimensjonene er oversatt og beskrives ved hjelp av 6 faktorer på norsk. Det ble funnet 6 faktorer for å lykkes med samhandling, disse er: *Hvem bør involveres*, *hva er oppgaven, holdning*, *handlingskultur*, *helhet* og *historikk*. *Hvem bør involveres* vil si å involvere alle aktuelle interne deltakere og eksterne interessenter så tidlig som mulig. Med *hva er oppgaven* menes å oppnå felles forståelse av oppgaven hver part har og etablere et godt grunnlag for samarbeid. *Holdning* betyr gjensidig ønske om å samarbeide, kommunisere og bygge gode relasjoner. *Handlingskultur* betegner tidlig involvering og anskaffelse av samhandlingskompetanse – hvorfor og hvordan, og *helhet* vil si å ha en felles forståelse for at helheten er viktig for å lykkes. Til slutt, med *historikk* menes en nøyaktig overlevering. Det vil si å ha en felles forståelse for at historikken i prosjektet er viktig i planperioden, under implementeringen og etterpå. En prosjektbasert organisasjon må fokusere og jobbe med disse 6 faktorene for å modnes og oppnå vellykket samhandling. Viktige funn inkluderer at mangelfull opplæring kan ha en betydning for samhandlingen internt og eksternt.

Alle artiklene bidro til å besvare det tredje og siste forskningsspørsmålet. Samlet sett gir bidraget fra artiklene innsikt i å koble prosjektgjennomføringsmodellene, samhandling og allianse, til prosjektets prestasjoner. Basert på funnene og innsiktene som er oppnådd fra de tre studiene som denne avhandlingen er bygget på, er svaret på det tredje forskningsspørsmålet og det overordnede bidraget til denne avhandlingen, vist ved hjelp av en modell som representerer en mer helhetlig tilnærming til hvordan prosjektgjennomføringsmodeller påvirker prosjekt prestasjoner. Økt forståelse og innsikt i prosjektgjennomføringsmodeller innen byggebransjen og olje- og gassindustrien, bør muliggjøre forbedringer i ingeniør- og byggeprosjekter i fremtiden.

Det teoretiske bidraget til denne avhandlingen legger til den generelle kunnskapen om prosjektgjennomføringsmodellene samhandling og allianse, ved å utforske og gi innsikt i faktorer som beskriver disse prosjektgjennomføringsmodellene som anses som viktige for prosjektets prestasjoner. Dette fremmer generell forståelse, som ytterligere gjør det lettere å få bedre innsikt i disse samarbeidsordningene, før de tas i bruk i praksis. Dette kan igjen gjøre implementeringen på prosjektnivå enklere og sikre at resultatene av bruk av modellene blir vellykket, og føre til forbedret prosjekt prestasjoner.

Den utførte forskningen ser også på forskningshull i forhold til prosjektgjennomføringsmodeller på et mer detaljert nivå, knyttet til forståelsen av relasjoner og interaksjoner mellom prosjektdeltakere, ved å utforske samarbeid gjennom faktorer, dvs. sosiale og menneskelige aspekter som er viktige for prosjektgjennomføringsmodeller som samhandling og allianse.

Det praktiske bidraget til denne avhandlingen er relatert til reelle case-studier, og avhandlingen foreslår praktiske tilnærminger for å forstå hvordan man kan lykkes med prosjektgjennomføringsmodellene for å oppnå bedre resultater i prosjekter i fremtiden. Tilnærmingene er ment for prosjektbaserte organisasjoner som vurderer å skifte fra en tradisjonell leveringsmetode til en mer samarbeidende metode, som samhandling eller allianse, for å oppnå bedre resultater i fremtiden.

PART I

THEORETICAL BACKGROUND AND KEY FINDINGS

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ABBREVIATIONS

CPDM	collaborative project delivery model
DBB	design-bid-build
EPCI	engineering, procurement, construction, and installation
EPCS*	engineering, procurement construction supplier
IPD	integrated project delivery
MPP	multi-partner project
O-SS*	oil service supplier
PCFP	Project-based Collaboration for Future Performance
PDM	project delivery model
RIF	Rådgivende ingeniørers foreningen (association of consulting engineers)
RQ	research question
SMEs	small and medium-sized enterprises
SPSS	Statistical Product and Service Solutions (IBM)

* Non-standard abbreviations, used in this dissertation

DECLARATION OF AUTHORSHIP

Paper no.	Bibliographical details	Declaration of Authorship
Paper 1	Nevstad, K., Børve, S., Karlsen, A.T. & Aarseth, W. 2018. Understanding how to succeed with project partnering *International Journal of Managing Projects in Business*, 11(4), pp. 1044–1065 https://doi.org/10.1108/IJMPB-07-2017-0085	The PhD candidate is the first author. The PhD candidate collected the empirical data through 54 interviews. The PhD candidate performed data analyses and drew conclusions together with fellow researchers.
Paper 2	Nevstad, K., Madsen, T.K., Eskerod, P., Aarseth, W.K., Karlsen, A.S.T. & Andersen, B. 2021. Linking partnering success factors to project performance – Findings from two nation-wide surveys *Project Leadership and Society*, 2: Article 100009 https://doi.org/10.1016/j.plas.2021.100009	The PhD candidate is the first author. Raw data were made available through a research project. The PhD candidate processed and sorted data. The PhD candidate performed data analyses and drew conclusions together with fellow researchers.
Paper 3	Nevstad, K., Karlsen, A.S.T., Aarseth, W.K. & Andersen, B. 2022 How a project alliance influences project performance compared to traditional project practice – Findings from a case study in the Norwegian oil and gas industry *Journal of Modern Project Management*, 9(3) https://doi.org/10.19255/JMPM02809	The PhD candidate is the first author. The PhD candidate collected the empirical data through 13 interviews together with fellow researchers. The PhD candidate performed data analyses and drew conclusions together with fellow researchers.

1 Introduction

1.1 Scientific background

Collaborative models, such as alliancing, early contractor involvement, and partnering are known under the umbrella terms relational contracting and collaborative project delivery models (CPDMs) (Rahman & Kumaraswamy, 2004; Lahdenperä, 2012; Bygballe & Swärd, 2019; Hällström et al., 2021; Moradi et al., 2022). This dissertation focuses on two CPDMs, namely project partnering and project alliancing between companies and their contractors in two different industries, offshore oil and gas, and construction infrastructure. Both project partnering and project alliancing can be defined as CPDMs in which the client and contractor usually collaborate through informal or formal agreements, together with the establishment of trusted-based relationships to achieve common objectives (Lahdenperä, 2012; Moradi et al., 2022).

Project-based collaboration, often spanning national borders and organizations, is challenging for a multitude of reasons, and some complex projects experience substantial cost overruns and delays to completion, as well as failure in delivering what was agreed upon (Williams & Samset, 2010; Chang et al., 2013; Larsen et al., 2021). Today, there is broad acknowledgment that engineering and construction projects are associated with low efficiency and face certain problems. Practitioners and researchers suggest that the causes include productivity problems, opportunistic behaviour, suboptimization, and adversarial relationships (Matthews & Howell, 2005; Laan et al., 2011; Ratajczak et al., 2018; Moradi et al., 2022). Many engineering and construction projects do not achieve their goals and end up as incomplete, far over budget, or delayed, and thus it can be tempting to think that this is a natural part of projects as unique undertakings (Aarseth et al., 2016). To avoid adverse objectives and conflicts, the actors involved should seek to collaborate in order to achieve better performing projects, instead of competing to achieve diverging ones.

To create collaboration, a trust-based relationship between the actors involved must be established, and researchers have argued that this can be achieved through CPDMs such as partnering and alliancing. Therefore, it has been claimed that one strategy for addressing these concerns is the development of CPDMs (Lahdenperä, 2012; Tadayon, 2018; Young et al., 2018; Malvik et al., 2021; Tadayon & Anderesen, 2021).

The choice of CPDM affects projects cost and time schedule, and it has an important role in project success or failure (Moradi et al., 2020). Value creation through projects may lead to the desire for closer collaboration and the development of delivery models that can be used to find solutions to problems relating to transactions, complexity, and uncertainty (Lahdenperä, 2017).

The ability to prevent and resolve potential conflicts efficiently is related to the level of collaboration between different project actors (Børve, 2019, Dietrich et al., 2010). By focusing on relationships rather than transactions, partnership and collaboration facilitate increased efficiency, avoid conflicts, and eliminate adverse relationships (Chan et al., 2003a; Naoum, 2003; Moradi et al., 2022).

Project partnering has the longest traceable history of the two CPDMs in focus in this dissertation. Two types of partnering are discussed in the literature: strategic partnering and project partnering. Strategic partnering extends collaboration across a range of projects and over time with goals to provide continuous improvement and continuous innovation, whereas project partnering occurs at the project level and adapts similar ideas for use on a project-by-project basis, which is a part of the project supply chain (Walker & Lloyd-Walker, 2015). Walker and Lloyd-Walker (2015) define project partnering as a business-to-business and relationship-based form of procurement that is based on the perspective of the project owner.

Project alliance is a relatively new CPDM that has started to become popular, at least within the Norwegian oil and gas industry, as an alternative to traditional delivery methods (Young et al., 2018), and the project alliance approach to relationship-based procurement systems has gained a great deal of attention, particularly in Australia (Walker & Lloyd-Walker, 2015). The Department of Treasury and Finance in Victoria, Australia, describes alliancing as follows:

> a method of procuring […] All parties are required to work together in good faith, acting with integrity and making best-for-project decisions. Working as an integrated, collaborative team, they make unanimous decisions on all key project delivery issues. Alliance agreements are premised on joint management of risk for project delivery. All parties jointly manage that risk within the terms of an 'alliance agreement', and share the outcomes of the project. (Department of Treasury and Finance, Victoria, 2010, p. 9)

Each partnering and alliancing projects comprises a set of hard and soft factors (Yeung et al., 2007; Fotopoulos and Psomas, 2009). According to Hosseini et al. (2018), partnering elements such as trust, common understanding, and conflict resolution mechanisms have been described by the majority of authors as important elements of partnering. Alliancing has certain defining elements, which include the open book approach, an integrated project team, pain share and gain share, alignment of client and commercial participants' objectives, a no-disputes clause, unanimous decision-making, and incentivized cost-reimbursement (Young et al., 2016).

At the time when alliancing was first practised, project alliances shared far more similarities with project partnering than is the case nowadays. Possibly the biggest difference today is that project partnering is not a standalone contract strategy but is generally adapted to fit with a

traditional contract whereas project alliancing is a built-for-purpose, stand-alone contract strategy.

Collaboration has a positive impact on project performance (Bond-Barnard et al., 2018). Compared with projects with poor collaboration, projects with extensive collaboration between the client and contractor experience less ambiguity, and fewer errors and deviations, and they more often meet requirements and have satisfied clients (Sarhan et al., 2017; Walker et al., 2017; Caniëls et al., 2019). Generally, there is a need for more research to explore the link between project-based collaboration and project performance (Meng & Gallagher, 2012; Bond-Barnard et al., 2018; Silva & Harper, 2018), and one aim of the research for this dissertation was to identify ways to improve project partnering and project alliancing.

Furthermore, there exists a need for research on CPDMs, especially in relation to relatively new types of CPDMs (e.g. project partnering, integrated project delivery, and project alliance) (Moradi et al., 2022) that lack empirical-based evidence regarding performance (Mesa et al., 2016; Engebø et al., 2020). This dissertation is important because it narrows the research gap in relation to project-based collaboration, meaning the relationship between project participants' collaboration and project performance, which in turn could lead to improved performance in projects. The research findings should be of interest to both researchers and practitioners who are contemplating a shift from a traditional delivery method to a more collaborative one, in order to achieve better performing projects in the future.

1.2 Personal motivation

My background from infrastructure projects in the construction industry and many years as a project manager has been a significant part of the very foundation of my doctoral research. Researchers and practitioners (including me) have turned attention towards new collaborative arrangements. Project-based organizations usually invest significant resources to safeguard their own interests against potential opportunistic counterparts. I have several times witnessed that the ability to safeguard actors' personal interests was related both to the level of collaboration and to a suitable approach to inspire parties to work rationally together to achieve the best project outcomes.

Empirical research has presented models or frameworks describing how to implement or conceptualize project partnering in different project contexts (Abudayyeh, 1994; Crowley & Karim, 1995; Crane et al., 1997; Cheng & Li, 2001; Aarseth et al., 2012; Bygballe & Swärd, 2019). Studies have determined factors responsible for successful partnering (Ling et al., 2015; Black et al., 2000; Cheng et al., 2000; Chan et al., 2004; Chen & Chen, 2007; Doloi, 2009). However, organizations have acknowledged difficulties in implementing various CPDMs, such as project

partnering (Alderman & Ivory, 2007; Aarseth et al., 2012; Hosseini et al., 2018), and have failed to succeed fully in applying the concepts. One explanation may be that partnering participants fail to understand the specific barriers that may prevent their use, and from research on implementation barriers related to partnering, it has been found that barriers to collaboration between project members constitute the greatest area of potential for improvement (Mollaoglu et al., 2015). However, it was not until my journey to the academic world that I realized that institutionalizing models for project partnering in practice is not that straightforward. Despite the perceived benefits of partnering and identification of factors responsible for successful partnering (Ling et al., 2015; Black et al., 2000; Cheng et al., 2000; Chan et al., 2004; Chen & Chen, 2007; Doloi, 2009), public research to date has focused more on the challenges and less on how to do something about them.

The inability to implement collaborative arrangements, such as project partnering and project alliancing, may be a reason for the variance in project outcomes. One of the challenges is related to the social level. According to Engebø et al. (2019) and Aarseth et al. (2012), CPDM creates confusion related to roles, responsibility, structure, and the process. Questions such as 'where to start?' and 'how to do it?' arise in the everyday life of many practitioners who contemplate a shift from a traditional delivery method to more collaborative methods (e.g. partnering, alliancing, integrated project delivery). When talking with colleagues and practitioners in other projects and other industries, I heard similar stories, which resulted in my growing interest in research and development. From being a permanent employee and teaching bachelor students at NTNU, I became a PhD student after one year of employment, and the journey to understand more about collaborative arrangements started.

Partnering suggests a fundamental shift away from traditional approaches in project management (Bygballe et al., 2010; Gadde & Dubois, 2010; Crespin-Mazet et al., 2015), and it represents a key means of improving construction project performance (Bygballe & Swärd, 2019). Partnering may be viewed as the first CPDM to be written about prior to 1998 and the starting point from which other CPDMs have sprung (Engebø et al., 2020). As I know from the construction industry, partnering is not a standalone strategy, but is generally adapted in addition to a traditional contract (Malvik & Engebø, 2022). My practical background and access to cases led me to start researching project partnering as an example of a CPDM.

A further personal motivation for this dissertation is to show project practitioners that it would be highly appropriate to gain better insights into collaborative arrangements by understanding the specific barriers that may prevent their use. Such an understanding would most likely have an influence on practice (and education) in the discipline, and ultimately influence the development of tools and processes.

1.3 Research objective, research questions, scope, and limitations

The objective of this dissertation is to develop a better understanding of how to succeed with CPDMs, project partnering, and project alliancing by increasing the understanding of how factors in these CPDMs could influence project performance to achieve better performing projects in the future. The research was limited to case projects executed in two countries: a Norwegian case project for project alliancing, and Danish and Norwegian case projects for project partnering. Although CPDMs have been studied within different contexts, my research objective has been studied from different perspectives.

For Paper 1, the research focused on partnering projects from the client perspective. For Paper 2, partnering success factors were studied from the contractor perspective. Finally, for Paper 3, an alliance project was studied from both the client (customer) perspective and the contractor (supplier) perspective. Regarding the industry sector, the investigation was conducted in real-life case projects to understand how the two CPDMs were actually practised in the different industries. For Paper 1, projects within the construction industry in Norway were studied. For Paper 2, projects within the construction industry in Denmark and Norway were studied, and for Paper 3 a project in the offshore oil and gas industry in Norway was studied. The advantages that the construction industry in Norway and Denmark has chosen project partnering and that the oil and gas industry in Norway has chosen project alliance afforded access to research on two different industries. An illustration of the research objective in this dissertation is shown in Figure 1-1.

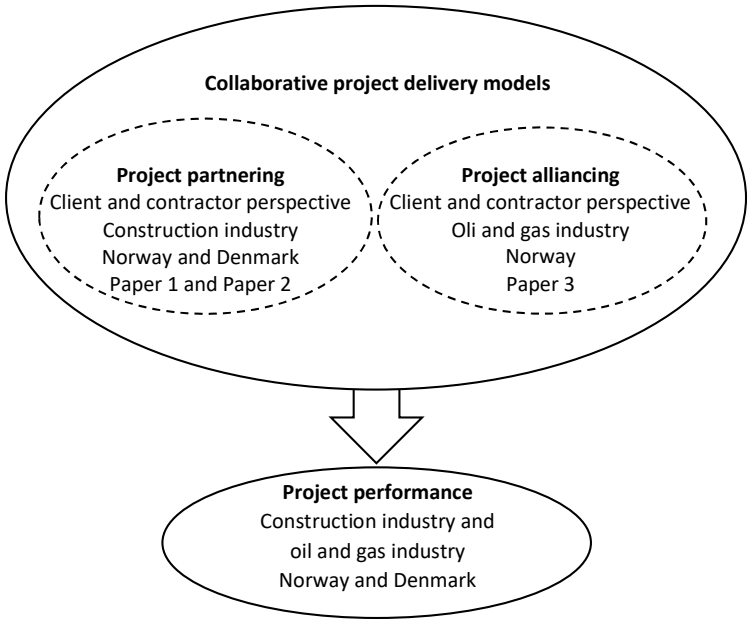

Figure 1-1: The research objective, perspectives, and choice of industries for the dissertation

Regarding the research questions and the rationale behind them, the objective of my doctoral research (as described in Section 1.3), opened up for more holistic answers than those discussed in each of the three papers. I narrowed the scope of my doctoral research to the intersections between CPDMs and to factors within the context of CPDMs and project performance. The research was undertaken to address the following three research questions (RQs):

RQ1: What factors in extant literature describe partnering and alliancing?

RQ2: How to succeed with project partnering?

RQ3: How do project partnering and project alliancing influence project performance?

The purpose of the first research question (RQ1) was to explore the factors in extant literature that describe partnering and alliancing. The aim was to provide the groundwork for a better understanding of these concepts and a deeper understanding of the collaboration between project-participants through the real-life settings of practitioners in the two CPDMs.

Partnering has been described as 'the most significant development to date as a means of improving project performance' (Wood and Ellis, 2005, p. 317). However, organizations have

acknowledged difficulties in implementing project partnering (Aarseth et al., 2012, Hosseini et al., 2018, Alderman & Ivory, 2007) and have fail to succeed fully with the concept. Hence, the purpose of the second research question (RQ2) was to generate new findings for organizations that acknowledge difficulties in implementing and succeeding with project partnering as an example of a CPDM.

Today, there is broad acknowledgment that engineering and construction projects are associated with low efficiency and face certain problems. One strategy for addressing these concerns is the development of CPDMs. Since practitioners and researchers have turned their attention towards collaborative arrangements and new CPDMs (Lahdenperä, 2012; Engebø et al., 2020) in order to achieve better performing projects, and as there exists a need for research on CPDMs that lack empirical-based evidence regarding performance (Mesa et al., 2016; Lahdenperä, 2017; Engebø et al., 2020), the purpose of the third and final research question (RQ3) was to explore how project partnering and project alliancing influenced project performance.

It is relevant to mention some areas that I considered to be outside the scope of my research. The scope of the work was limited to exploring two CPDMs – project partnering and project alliancing. The choice of CPDMs could have been different. As the core CPDMs in construction projects are partnering, alliancing, and integrated project delivery (IPD) (Engebø et al., 2020), it might have been natural to choose IPD as an example of a CPDM, but instead access to cases and data resulted in the selected two CPDMs.

Regarding project partnering, I investigated the management and collaboration aspects of partnering. An exploration and investigation of the hard factors of partnering were excluded from the scope of my doctoral research, due to the fact that in recent years there has been an increased focus on social and human aspects (Hanisch & Wald, 2011; Jacobsson & Roth, 2014). Furthermore, as CPDMs are more person-dependent than traditional delivery methods (Engebø et al., 2019), my research was limited to soft factors. There were some limitations related to project performance, as mainly the classic project performance constructs (time schedule, budget, and technical specifications) were considered. Several researchers perceive the concept of the 'iron triangle' in project management as providing a poor definition of project success (Müller & Jugdev, 2012). However, most project managers in the construction industry have an operational focus, and their mindset and success criteria are focused on 'getting the job done'. My research focused especially on how five partnering success factors influence project performance, and that might have been a limitation. I am aware that other partnering success factors that might influence project performance were not included, but this does not mean that I consider other partnering success factors unimportant.

The next section presents an overview of the specific research questions in the individual publications (Papers 1–3).

1.3.1 Research question from individual papers

The specific research questions in the three scientific papers on which this dissertation is based are presented in Table 1-1.

Table 1-1: Specific research questions addressed in Papers 1–3

Paper	Research question
Paper 1 Understanding how to succeed with project partnering	**RQ:** How to succeed with project partnering in a project-based organization?
Paper 2 Linking partnering success factors to project performance – Findings from two nation-wide surveys	**RQ:** How do partnering success factors influence multi-partner projects' performance in terms of being on time, within budget, and to technical specifications?
Paper 3 How a project alliance influences project performance compared to traditional project practice – Findings from a case study in the Norwegian oil and gas industry	**RQ:** How does a project alliance, as an example of a CPDM, influence project performance compared to traditional project practice?

1.4 Structure of the dissertation

This dissertation consists of two parts: Part I – Theoretical background and key findings, and Part II – Individual publications. Part I consists of Chapter 1–6, a References section, and Appendices. An overview of the structure of this dissertation is presented in Table 1-2.

Table 1-2: Structure of Part I of the dissertation

Chapter/Part	Content
Chapter 1 – Introduction	• Background • Personal motivation • Research objective, research questions • Scope and limitations
Chapter 2 – Theoretical Framework	• Collaborative project delivery models (CPDMs) • Factors within the context of CPDMs • Project performance • Research gaps
Chapter 3 – Research Method	• Research method
Chapter 4 – Findings from Individual Papers	• Specific findings and discussions from the individual papers
Chapter 5 – Main Findings and Discussion	• Presentation of overall findings and discussion of the dissertation
Chapter 6 – Conclusions and Further Research	• Answers to research questions • Theoretical implications • Practical implications • Further research
References	• List of cited literature
Appendices	• Independent and dependent variables • Development of the questionnaire

The first chapter provides an introduction of the dissertation, including the background, personal motivation, research objective, scope and limitations of the research, and the research questions, including the rationale behind them. Chapter 2 presents the theoretical areas for this dissertation and the chapter ends with a description of the research gaps. Chapter 3 describes the research methods used for this dissertation. Chapter 4 contains the findings and discussions from Papers 1–3. Chapter 5 links the findings from the individual papers and provides a holistic presentation of the main findings of the dissertation. Chapter 6 presents the conclusions drawn, theoretical implications, practical implications, and avenues for further research. This is followed by a list of cited sources and appendices containing detailed information such as precise formulations of independent and dependent variables and the questionnaire development.

Part II of this dissertation comprises the individual publications, three scientific papers that presents the core work and contributions of the doctoral research.

1.5 Paper-based dissertation

This dissertation is based on three scientific papers published in international journals, each with a referee scheme (double-blind-review). Each paper addresses a research question related to the objective of this dissertation. The three individual papers together contribute to the field that is larger than the sum of the contributions from each individual paper. The aim is that the reader will be able to read this dissertation as a standalone text without the need for frequent reference to the individual papers in Part II and vice versa. Hence, this dissertation provides an overview of both the literature and findings from the three papers. A summary of the papers on which this dissertation is built is provided in Table 1-3. The third column in Table 3 describes information about the journal as listed in the Norwegian Register for Scientific Journals, Series and Publishers, published by the Norwegian Centre for Research Data (Direktoratet for høgare utdanning og kompetanse n.d.). This includes an assessment of the referee scheme applied by the journal, as well as its scientific level, which is rated from 0 to 2 (0 is the lowest level and 2 is the highest level).

Table 1-3: Paper-based dissertation: summary

Paper	Journal	NSD assessment	PhD candidate is the main author	Status	Purpose
Paper 1	International Journal of Managing Projects in Business (IJMPB)	Peer-reviewed, Level 1	Yes	Published	Present new findings to organizations that acknowledge difficulties in implementing and succeeding with project partnering
Paper 2	Project Leadership and Society (PLS)	Peer-reviewed, Level 1	Yes	Published	Explores the link between partnering success factors and project performance
Paper 3	Journal of Modern Project Management (JMPM)	Peer-reviewed, Level 1	Yes	Published	Explores how two different project types and their influence on project performance: a traditional project compared with a more collaborative one

2 Theoretical Framework

This chapter describes the theoretical framework on which this dissertation is built. As the objective of the research was to develop a better understanding of how to succeed with two CPDMs, project partnering and project alliancing, by increasing the understanding of how factors in these CPDMs influence project performance, the purpose of this literature review is to provide an overview of CPDMs in general, to take a closer look at project partnering and project alliancing, and to look at what contributes to success in projects. Both success in projects and success factors were studied carefully, as they are key to finding solutions to the challenges. In short, the three main research areas are:

- Collaborative project delivery models (CPDMs)
- Factors within the context of collaborative project delivery models
- Project performance

The research areas are shown in Figure 2-1, and the diagram shows that the contribution from this dissertation is in the intersection between these three main research areas.

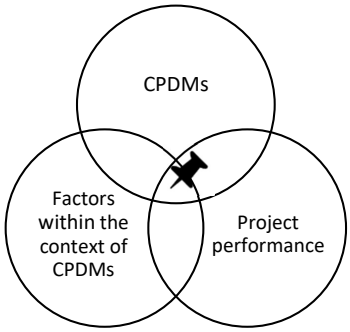

Figure 2-1: Theoretical areas covered in this dissertation

2.1 Collaborative project delivery models (CPDMs)

Practitioners and researchers have turned their attention towards collaborative arrangements and new CPDMs (Lahdenperä, 2012; Engebø et al., 2020). CPDMs such as project partnering and project alliancing can be used to foster collaboration between client and contractor, and they consist of several levels of actors who interact with each other and the project. There has been an increasing interest in promoting CPDMs to avoid the adverse objectives and conflicts that have characterized industry due to the use of traditional procurement forms (e.g. design-bid-

build) (Young et al., 2018; Moradi et al., 2022). This shift has divided the dominant paradigm within project management into traditional and relationship-based project delivery methods (Engebø et al., 2020). Moradi et al. (2022) provide clarification in terms of the differences between collaborative and traditional delivery methods. Table 2-1 shows the common features of collaborative delivery models and differences from traditional delivery models.

Table 2-1: Collaborative delivery models: common features and differences from traditional delivery models (modified from Moradi et al., 2022, p. 3)

Collaborative delivery models	
Common features	Differences from traditional delivery models
Early involvement of key participants Joint planning, design, and control Joint decision-making Open book approach for cost management Fair share of risk and reward Trust-based relationship Open communication Multi-party agreement	Focus is on the production system, not the contract Design and planning priorities joint design of the product and process and pays attention to the completion of the tasks where they are ready, not as soon as possible; contingency reserves are used for reducing system variability, not for self-interest Decision making is unanimous, not divided Learning constantly happens throughout the project life cycle, not occasionally Stakeholder interests are aligned, not divided

Walker and Lloyd-Walker (2015, p. 118) state: 'trust and commitment and the nature of co-learning through collaboration' are all linked elements at the core of CPDMs. Collaborative arrangements are significantly different from traditional ones. According to Moradi et al. (2022), this difference is related to changes in people's mindsets (i.e. the established set of attitudes held by individuals).

In project management, suitable approaches are chosen to inspire parties to work rationally together in order to achieve the best outcomes in accordance with their common objectives and within the expected risk level (Morris & Pinto, 2007). Walker and Lloyd-Walker (2015, p. 26) illustrate three broad forms of project procurement (Table 2-2): traditional – segregated design and delivery procurement forms; focus on integrating design & delivery processes, emphasizing planning and control; and focus on integrating project design and delivery teams, emphasizing collaboration and coordination.

Table 2-2: Project procurements forms (modified from Engebø et al., 2020, p. 281)

Traditional	Focus on integrating design & delivery processes	Focus on integrating project design & delivery teams
Design-bid-build (DBB)	Design & construct (DC)	Partnering
Cost reimbursable	Integrated SCM*	Alliancing
	Management contracting	Early contractor involvement
	Joint venture consortia	Framework agreements
	BOOT** family/PFI***/PPP****	Integrated solutions

*supply chain management;** build-own-operate-transfer; ***private finance initiative; ****public-private partnership

Column 1 in Table 2-2 shows the traditional procurement forms that tend to separate design and delivery. In traditional procurement forms, the contractor is usually either not involved or not involved early enough in the project definition, planning, and design. This causes a few disadvantages associated the traditional procurement forms of engineering and construction projects. The disadvantages are that in the more traditional approach, the designer has greater power and a higher level of authority than the contractor, which sets up the situation for opportunistic behaviour that could undermine trust and collaboration (Walker & Lloyd-Walker, 2015).

Project procurement forms that focus on integrating project design and deliver teams may use CPDMs, which collaboration between internal participants and external stakeholders in the project is of prime importance (Moradi et al., 2020). In terms of project delivery, the literature operates with what can be considered a jungle of terminology. Insights into this terminology are outlined in Table 2-3.

Table 2-3: Terminology for project delivery (modified from Engebø et al., 2020, p. 281)

Terms describing project delivery	Terms describing relationship-based project delivery	Terms describing particular relationship-based project delivery methods
Project delivery system	Collaborative project procurement	Project partnering
Project delivery model	Collaborative project delivery	Strategic partnering
Project delivery method	Collaborative procurement	Integrated project delivery
Project delivery strategy	Integrated project delivery (IPD, IPD-ish, lean IPD, IPD-lite)	Project alliancing
Procurement method	Relationship-based project delivery	Strategic alliancing
Procurement arrangement	Relational/Relationship contracting	Early contractor involvement
Project procurement	Partnering/Partnership	Collaborative procurement
Contract strategy	Framework agreements	Competitive dialogue
Contract arrangement	–	BOOT/PFI/PPP

A project delivery method is a system for organizing and financing design, construction, operations, and maintenance activities that facilitate the delivery of goods or services (Miller et al., 2000). A project delivery model defines roles through the procurement route – the sequence of project phases, and it establishes a framework for organisation, roles, and responsibilities.

Projects more often fail due to cooperation problems and conflicts than due to technical problems (Aarseth, 2014). Hence, regardless of industry affiliation, CPDMs are important for all those who conduct a project. In an often-cited literature review of CPDMs, Lahdenperä (2012) found that such approaches generally are split into three models that have much in common: partnering, alliancing, and IPD. In a more recent literature review, the same three models are the predominant CPDMs, according to Engebø et al. (2020). The role of these arrangements is to deliver better value for money than traditional models, and a major goal of a CPDM is to avoid conflicting objects and problems that have characterized industry for a long period (Ling et al., 2006).

There is a positive relationship between trust and collaboration (Kadefors, 2004; Bond-Barnard et al., 2018). In order to create collaboration, a relationship based on trust must be established, and this type of relationship and teamwork can be accomplished through CPDMs, such as alliancing, partnering and IPD (Lahdenperä, 2012, Moradi et al., 2022). IPD is the most recent addition to CPDMs (Haaskjold et al., 2021) and its use has increased more or less consistently since 2013–2014 (Engebø et al., 2020). The IPD model is used mainly in the US, where it has many similarities to Australian alliancing, with one main difference being that IPD includes several lean construction elements (Raisbeck et al., 2010; Lahdenperä, 2012; Young et al., 2016). One view is that IPD is created by combining the alliancing governance system with the lean construction operating system (Raisbeck et al., 2010). IPD is not explored further in this dissertation but has been discussed in studies by Haaskjold et al. (2021), Lahdenperä (2012), and Raisbeck et al. (2010).

For an owner organization, adopting a new approach may need comprehensive changes in both its work processes and existing organizational structures. The challenge of implementing such changes has two main dimensions: (1) the organization level and (2) the project level. Information about how changes should be implemented is limited, especially at the organization level (Migliaccio et al., 2008). Changing from one way of doing things to another way, such as shifting from a traditional procurement form to a more collaborative one is not easy. The reasons are probably complex, but the establishment costs of a comprehensive CPDM may not be justified and thus an important reason to continue as before. Alliancing and partnering require large investments in resources and it is therefore important to ensure that the outcomes of using the models are successful.

As project-based organizations with no partnering/alliancing experience and either limited experience or no experience with collaborative arrangements begin to adopt CPDMs, they will undoubtedly face several challenges. Engebø et al. (2020) outlines several challenges that occur when shifting from a traditional procurement form to a more collaborative one. First, to understand the concept, one needs some sort of innovation, conceptualisation, and practical description. Second, in relation to justification, one must show something to be right or reasonable, and create a need for pioneers to input effort. Third, new CPDMs need to be researched and documented, particularly with regard to effects, barriers and enablers, and success factors. To help overcome challenges, project practitioners need to be educated in the factors that make collaborative approaches successful (Young et al., 2016).

In the following sections, I elaborate on the CPDMs on which this dissertation is built.

2.1.1 Project partnering

Partnering within the construction industry is a key competence and has been the most frequently discussed institutional form of CPDM in the building and construction industry (Wood et al., 2002; Eriksson, 2010; Engebø et al., 2020). It has been described as 'the most significant development to date as a means of improving project performance' (Wood & Ellis, 2005, p. 317). Unlike other systematic approaches to management, partnering focuses on the importance of all parties in the construction process as opposed to in the top-down approach (Naoum, 2003). According to Cheng and Li (2004), the success of partnering refers to how the involved parties perceive their effectiveness. If the parties perceive that partnering helps to obtain positive outcomes, the partnering arrangement will be regarded as successful (i.e. it will have achieved effectiveness).

Partnering represents a key means of improving construction project performance (Bygballe & Swärd, 2019), and it has been explained and defined by several researchers (e.g. Thompson & Sanders, 1998; Walker et al., 2002; Nyström, 2005; Bresnen, 2007; Anderson & Polkinghorn, 2011; Børve et al., 2017). Despite partnering having been studied in recent decades, there is no commonly shared or widely accepted definition of the term (Bygballe et al., 2010; Eriksson, 2010; Børve et al., 2017). There are variations in how partnering is defined. Currently, project partnering is a concept for value delivery throughout a project, and is defined by Walker and Lloyd-Walker (2015) as a business to-business and relationship-based form of procurement based on the perspective of the project owner. Hosseini et al. (2016) define partnering as a collaborative procurement form that focuses on integration of the project design and delivery by weighting collaboration and coordination between involved parties.

In Norway, there has long been interest in implementation models based on closer and earlier collaboration between the client and contractor. These are often referred to as partnering projects. They are not a standalone strategy, but are generally adapted by adding a supplementary agreement on partnering (Malvik & Engebø, 2022) to a traditional contract (such as D&Cs). This is reminiscent of what is described in the literature as project partnering (Lahdenperä, 2012). In this dissertation, I follow the definition of project partnering given by Børve et al. (2017, p. 694):

> Project Partnering is a relationship strategy whereby a project owner integrates contractors and other major contributors into the project. Through commitment to mutual project objectives, collaborative problem solving and a joint governance structure, partners pursue collaborative relationships, trust, and improved performance.

Through partnering and active involvement of appropriate internal and external parties at an early stage, a project is more likely to be completed within budget, on time, and with the least number of conflicts, claims, and work defects (Chan et al., 2003a). Thus, the use of partnering as an CPDM represents a key means of improving construction project performance (Bygballe & Swärd, 2019). All internal and external stakeholders are brought together at an early stage and thus have time to get to know each other, and this in turn has led to fewer conflicts between the companies. Communication has been shown to be better in partnering projects and the internal and external stakeholders find it easier to reach an agreement on common solutions (Aarseth et al., 2016).

2.1.2 Project alliancing

The project alliance is a relatively new CPDM (Lahdenperä, 2017) and has started to become popular as an alternative to traditional contracts (Young et al., 2016; Young et al., 2018). Most research that has been done in relation to 'alliancing' can be traced back primarily to Australia and New Zealand. The starting point of the studies was the National Museum of Australia project (Walker et al., 2002; Hauck et al., 2004). Later, the CPDM was adapted for a wide range of projects. Studies of alliancing increased after 2011 and a possible explanation is the increased numbers of projects that have used the alliancing approach (Engebø et al., 2020).

Providing a clear definition of alliance has been one of the main foci in earlier studies (e.g. Hobbs & Andersen, 2001; Hietajärvi et al., 2017; Che Ibrahim et al., 2018). One of the most widely accepted definitions of alliancing in literature comes from the Australian Department of Finance and Treasury in Victoria (Department of Finance and Treasury, Victoria, 2010, p. 9), which describes alliancing as follows:

> a method of procuring … All parties are required to work together in good faith, acting with integrity and making best-for-project decisions. Working as an integrated, collaborative team, they make unanimous decisions on all key project delivery issues. Alliance agreements are premised on joint management of risk for project delivery. All parties jointly manage that risk within the terms of an 'alliance agreement', and share the outcomes of the project.

Alliancing has certain defining elements, which include an open book approach, integrated project team, pain share and gain share, alignment of client and commercial participants' objectives, no-disputes clauses, unanimous decision-making, and incentivized cost-reimbursement (Young et al., 2016). Deciding what alliancing is by means of a literature search might be confusing, but according to the literature it is possible to identify factors that appear to be key in an alliance. Thus, according to Young et al. (2018) alliancing can be identified by factors, and the combination of factors makes the alliance model a unique CPDM.

According to Suprapto et al. (2016b), an alliance project is likely to be more collaborative than traditional forms of procurement. Alliancing can lead to improved outcomes in projects and value for money. This is in part due to the increased level of integration and collaboration between the actors involved (customer and suppliers) (Love et al., 2010; Walker & Lloyd-Walker, 2016). Project alliance does not necessarily result directly in better project performance, but achievements can be gained through relational attitudes and how they play out throughout the project in terms of team members' behaviour (Suprapto et al., 2016a).

2.1.3 Project partnering versus project alliancing

Categories of collaborative forms of project management (Figure 2-2) have been described by Walker and Lloyd-Walker (2015). The categorization shown in Figure 2-2 implies that project alliances have a high level of both pain-share/gains-hare and early contractor involvement and is categorized as fourth order of collaboration. Project partnering is categorized as a second order of collaboration and focused on fair processes and common purpose. Project alliances have added focus on committed relationships (Walker & Lloyd-Walker, 2015). Factors that are directly regulated by the project contract or have their basis in the procurement process, such as pain-share/gains-hare and early contractor involvement, are considered hard factors. Likewise, these hard factors, soft factors such as trust, commitment, cooperation and communication are also important to achieve high extant of collaboration (Yeung et al., 2007).

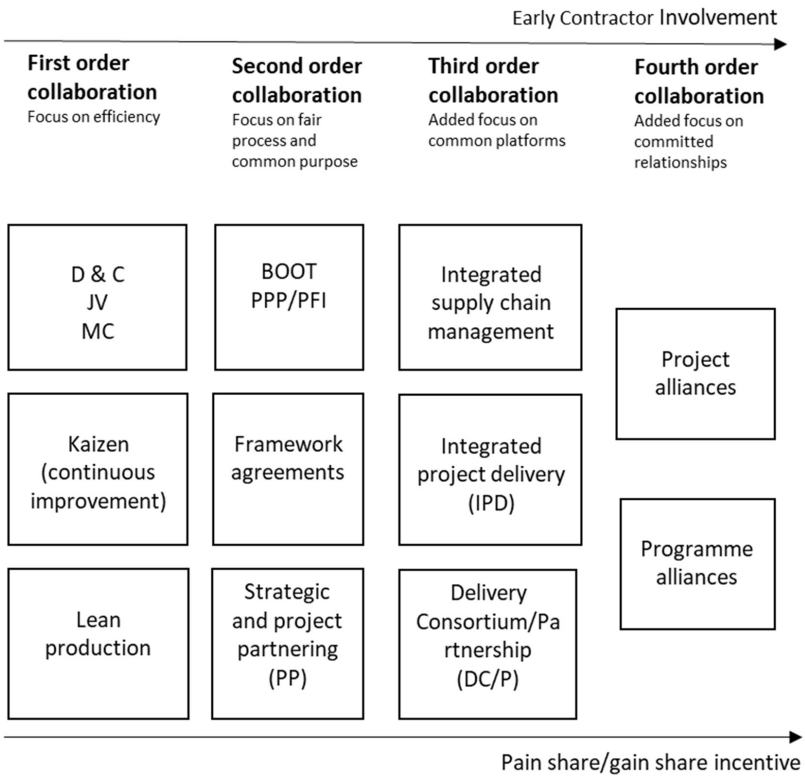

Figure 2-2: Categorizing collaboration forms of project management delivery (modified from Walker & Lloyd-Walker, 2015, p. 131)

Early project alliances shared far more similarities with project partnering than is the case today. The definitions of different types of CPDM, such as project partnering or project alliance, vary widely according to different practices (Lahdenperä, 2012). The terms project partnering and project alliancing used to be used almost interchangeably before project alliancing evolved over time and away from project partnering (Ingirige & Sexton, 2006). Today, the biggest difference is perhaps that project partnering is not a standalone contract strategy but is generally adapted in addition to a traditional contract (such as D&Cs), whereas project alliancing is a built-for-purpose, stand-alone contract strategy.

2.2 Factors within the context of CPDMs

This section focuses on project management literature that addresses factors within the context of CPDMs. What factors lead to success and how to measure success are both topics that have

attracted a great deal of interest (Klakegg et al., 2010; Rolstadås et al., 2014; Aarseth et al., 2016). The development of project management has been influenced by a hard approach (Williams, 2005), in which traditional project management theory has focused on the control side of projects. In recent years, researchers have turned their focus to a soft approach to project management, which both makes practical use of learning that in turn has facilitated the exploration of projects, and relates to the social processes to the management of projects to ensure success (Tadeu de Oliveira Lacerda et al., 2011). This leads my discussion to aspects of human behaviour in project management.

Extensive studies of success factors in projects have been carried out, but a study conducted by Pinto and Slevin (1987) is perhaps one of the most frequently referenced. There is no valid list of success factors because, while existing challenges may be known, new ones are always cropping up which in turn means that the list of factors that lead to project success will change constantly (Aarseth et al., 2016). However, this is still an interesting area to explore in more detail. The next section (Section 2.2.1) focuses on key factors that contribute to a successful partnering project. Section 2.2.2 takes a narrower look and highlights examples of factors that researchers have found useful for describing alliances.

The literature distinguishes between hard and soft factors (Yeung et al., 2007; Fotopoulos & Psomas, 2009). Factors that are directly regulated by the project contract or that have their basis in the procurement process are considered hard factors (e.g. a formal contract, and pain share/gain share), whereas soft factors contribute to the relationship between the project participants (e.g. trust, communication, and commitment) (Yeung et al., 2007). Such factors have received a great deal of attention among researchers and are regarded as a tool for use towards the achievement of success in projects (Aarseth et al., 2016).

In the literature, a difference exists between success factors and success criteria, which makes it important to distinguish success factors from success criteria, as partly defined by Cooke-Davies (2002) and Shenhar et al. (2001). Success criteria are measures against which the success or failure of a project or activity are considered, whereas success factors are factors added to a management system and either directly or indirectly lead to a successful project. Although the terms are used interchangeably in the literature, the focus in this dissertation is on factors that influential in increasing the likelihood of success (Müller & Jugdev, 2012).

2.2.1 Partnering success factors

Project success in partnering has been found to be multidimensional in cases where success criteria and success factors come together in complex causal interactions (Williams, 2016). It is known that partnering success factors relate to the basic principles of partnering –

commitment, trust, respect, communication, and equality – that intended to protect the interest of all parties at all levels (Cowan et al., 1992; Chan et al., 2003b). Opportunistic behaviour goes against the fundamental principles of partnering (Biong et al., 1994).

According to Hosseini et al. (2018), trust, common understanding, and conflict resolution mechanism have been described by the majority of the authors as important elements of partnering. In recent years, researchers have increasingly turned their focus from hard factors to soft factors, namely social and human aspects, which relate to working in project-based collaborations (Hanisch & Wald, 2011; Jacobsson & Roth, 2014). The emphasis may be placed on social aspects such as trust, commitment, and communication because these factors often are pointed out as benefits of using a CPDM such as project partnering. Identified groups of partnering success factors and the publications in which the factors were found are presented in Table 2-4. Researchers have highlighted *trust*, *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives* among partners as the key factors that contribute to a successful partnering project.

Table 2-4: Five groups of partnering success factors and references

Factor group	References
Trust	Associated General Contractors of America (1991), Construction Industry Institute (1996), Black et al. (2000), Cheng et al. (2000), DeVilbiss and Leonard (2000), Kumaraswamy and Matthews (2000), Cheng and Li (2001), Cheung et al. (2003), P.S-P. Wong and Cheung (2004), P.S-P. Wong and Cheung (2005), Kaluarachchi and Jones (2007), Doloi (2009), Lau and Rowlinson (2009), Meng (2012), Suprapto et al. (2015a), Du et al. (2016), Suprapto et al. (2016b), Raslim and Mustaffa (2017), Hosseini et al. (2018), Moradi and Kähkönen (2022)
Communication	Associated General Contractors of America (1991), Sanders and Moore (1992), Bennett and Jayes (1995), Black et al. (2000), Cheng et al. (2000), Cheng and Li (2001), Cheung et al. (2003), Chan et al. (2004), P.S-P. Wong and Cheung (2004), P.S-P. Wong and Cheung (2005), Kaluarachchi and Jones (2007), Doloi (2009), Meng (2012), Suprapto et al. (2015b), Du et al. (2016), Smith and Thomasson (2016), Raslim and Mustaffa (2017), Moradi and Kähkönen (2022)
Commitment	Associated General Contractors of America (1991), Construction Industry Institute (1996), Larson (1997), Black et al. (2000), Cheng et al. (2000), Kumaraswamy and Matthews (2000), Cheung et al. (2003), Chan et al. (2004), Kaluarachchi and Jones (2007), Du et al. (2016), Smith and Thomasson (2016), Raslim and Mustaffa (2017)
Collaborative problem-solving	Sanders and Moore (1992), Bennett and Jayes (1995), Construction Industry Institute (1996), Kumaraswamy and Matthews (2000), Cheng et al. (2000), DeVilbiss and Leonard (2000), Cheung et al. (2003), Chan et al. (2004), Doloi (2009), Du et al. (2016), Raslim and Mustaffa (2017), Hosseini et al. (2018)
Mutual project objectives	Associated General Contractors of America (1991), Sanders and Moore (1992), Bennett and Jayes (1995), Construction Industry Institute (1996), Kumaraswamy and Matthews (2000), Cheung et al. (2003), Meng (2012), Suprapto et al. (2015a), Du et al. (2016), Smith and Thomasson (2016), Moradi and Kähkönen (2022)

Each of the above-mentioned five groups of partnering success factors is described in detail in the following Sections, both as a guide to background literature and in order to understand the partnering success factors described in the literature. The most frequently mentioned group factor responsible for successful partnering is *trust*, followed respectively by *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives*.

Trust

Trust is a broad term (Kadefors, 2004; W.K. Wong et al., 2008) and factors of trust vary in the literature from 'mutual trust' (e.g. Cheung et al., 2003; Moradi and Kähkönen, 2022) to the more specific 'system-based trust (satisfactory terms, alignment, adoption of alternative dispute resolution)' (P.S-P. Wong and Cheung, 2005) and 'inter-firm trust' (Lau & Rowlinson, 2009). Researchers who have focused on partnering have described trust variously as a prerequisite

(Construction Industry Institute, 1991; Kaluarachchi and Jones, 2007; Aarseth et al., 2012), a measure (Chan et al., 2004, Meng, 2012; Mesa et al., 2016), an objective (Cheung et al., 2003; Construction Excellence, 2009) and an outcome (Eriksson, 2010). Implicitly, the factors of trust refer to involved partners (Cheung et al., 2003; P.S-P. Wong & Cheung, 2005; Lau & Rowlinson, 2009; Meng, 2012). Kaluarachchi and Jones (2007) adopted a broader view in claiming that trust is required between all stakeholders. Furthermore, trust is related to the no-blame factors (Meng, 2012; Suprapto et al., 2015b) when legal conflict becomes a contractual option only after the occurrence of gross negligence or criminal offence. In a no-blame contract, partners have to trust each others' intentions.

Communication

Mentions of the factors of communication have varied in the literature from merely 'communication' (Cheung et al., 2003; Doloi, 2009; Meng, 2012) to 'effective communication' (Black et al., 2000, Raslim and Mustaffa, 2017) and 'open and honest communication' (Suprapto et al., 2015b; Moradi & Kähkönen, 2022). The group also includes the factor 'permeability of partners,' which involves communication, information flow, and openness (P.S-P. Wong & Cheung, 2005). Kaluarachchi and Jones (2007) use the term 'early contractor involvement' to explain 'effective communication.' The factors encompassed in the communication group are all means for achieving partnering goals. However, it is unclear with whom to communicate and what the specific objectives pursued by implementing the means of communication are.

Commitment

In the third most frequently mentioned factor group, the type or direction of commitment varies from 'commitment to teamwork' (Larson, 1997) and 'commitment from senior management' (Black et al., 2000, Raslim and Mustaffa, 2017) to 'long-term-' and 'resource commitment' (Cheung et al., 2003). In the sense of internal or external commitment, commitment factors are close to 'top management support' (Larson, 1997; Cheng & Li, 2001; Suprapto et al., 2015b; Moradi & Kähkönen, 2022). Also, to have something to lose, which concerns 'equity' (Bresnen, 2007; Du et al., 2016), concerns commitment.

Collaborative problem-solving

Collaborative problem-solving is a known success factor in project partnering. Terms used to describe the factor group vary from 'joint risks' (Doloi, 2009) and 'conflicts' (Cheng et al., 2000; Raslim & Mustaffa, 2017) to 'problems' more broadly (Bennett & Jayes, 1995; Cheung et al., 2003; Kaluarachchi & Jones, 2007; Meng, 2012; Du et al., 2016). As a group, collaborative problem-solving factors are means aimed at mitigating risks for the parties involved. The broader 'joint governance structure' (Walker & Lloyd-Walker, 2015) applies to both project

risks and opportunities. Hence, the joint governance structure aims at value creation by capturing the value of opportunities and not merely avoiding conflict by mitigating risks through collaborative problem-solving.

Mutual project objectives

'Mutual project objectives' are described in literature with little variation in wording, such as 'mutual,' 'joint,' 'common or shared objectives', or 'common or shared goals'. The term 'objectives', which are measurable in projects, is used more frequently than the more intangible term 'goals'. The term 'measurable objectives' fits well with the practices of 'continuous evaluation' and 'annual review of performance' emphasized by Bennett and Baird (2001). Benchmarks are highlighted by Bresnen (2007). Furthermore, the concept of partnering evaluation has been developed into the concept of 'performance measurement' by Meng (2012).

Examples of formulations that researchers have described the group factors *trust*, *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives* are summarized in Table 2-5.

Table 2-5: Five groups of factors in successful partnering

Partnering success factors	Formulations used to describe the factor	References
Trust	'Mutual trust'	Cheung et al. (2003) Moradi and Kähkönen (2022)
	'System-based trust' (satisfactory terms, alignment, adoption of alternative dispute resolution)	P.S-P. Wong and Cheung (2005)
	'Inter-firm trust'	Lau and Rowlinson (2009)
	Described as a prerequisite	Aarseth et al. (2012) Kaluarachchi and Jones (2007) Construction Industry Institute (1991)
	Described as a measure	Mesa et al. (2016) Meng (2012) Chan et al. (2004)
	Described as an objective	Construction Excellence (2009) Cheung et al. (2003)
	Described as an outcome	Eriksson (2010)
	Implicitly, the factors of trust refer to involved partners	Meng (2012) Lau and Rowlinson (2009) P.S-P. Wong and Cheung (2005) Cheung et al. (2003)
	Require trust between 'all stakeholders'	Kaluarachchi and Jones (2007)
	Related to the no-blame factors	Suprapto et al. (2015b) Meng (2012)
	Trust-control balance	Walker and Lloyd-Walker (2015)

Communication	Just, 'communication'	Meng (2012) Doloi (2009) Cheung et al. (2003)
	'Effective communication'	Black et al. (2000) Raslim and Mustaffa (2017)
	'Open and honest communication'	Suprapto et al. (2015b) Moradi and Kähkönen (2022)
	'Permeability of partners', comprising communication, information flow and openness	P.S-P. Wong and Cheung (2005)
	'Early contractor involvement', to explain 'effective communication'	Kaluarachchi and Jones (2007)
Commitment	'Commitment to teamwork'	Larson (1997)
	'Commitment from senior management'	Black et al. (2000) Raslim and Mustaffa (2017)
	'Long-term commitment' and 'resource commitment'	Cheung et al. (2003)
	'Top management support' (as a kind of internal or external commitment)	Suprapto et al. (2015b) Cheng and Li (2001) Larson (1997) Moradi and Kähkönen (2022)
	'Equity' (to have something to lose) 'Joint risks'	Du et al. (2016) Doloi (2009)
Collaborative problem-solving	'Conflicts'	Cheng et al. (2000) Raslim and Mustaffa (2017)
	'Problems'	Du et al. (2016) Meng (2012) Kaluarachchi and Jones (2007) Cheung et al. (2003) Bennett and Jayes (1995)
	'Joint governance structure' (applies to both project risks and opportunities)	Walker and Lloyd-Walker (2015)
	'Measurable objectives', fits well with the 'continuous evaluation' and 'annual review of performance'	Bennett and Baird (2001)
Mutual project objectives	'Benchmarks'	Bresnen (2007)
	'Performance measurement'	Meng (2012)

2.2.2 Alliancing factors

Various authors have identified factors within the context of an alliance (Lahdenperä, 2012; Young et al., 2016). Hard factors, such as pain share/gain share, the open book approach, and co-location are identified in literature as important factors in an alliance (Young et al., 2018). A summary of factors that researchers have used to describe alliances is presented in Table 2-6; the listed factors are referred to variously as critical success factors, success factors, and elements in the literature. Each of the following factors are outlined in further detail: *collaborative problem-solving, trust*, *co-location*, *pain/gain share*, *open-book approach*, *commitment*, *single alliance culture, communication*, *workshops*, *a single IT system*, *no blame*, and *mutual goals and objectives*.

Table 2-6: Examples of twelve factors describing an alliance

Factor	Reference
Collaborative problem-solving	Biggs (2004), Jefferies et al. (2014), Young et al. (2016), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)
Trust	Biggs (2004), Lahdenperä (2012), Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Moradi and Kähkönen (2022)
Co-location	Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)
Pain/gain share	Young et al. (2016), Tadayon (2018), Young et al. (2018)
Open-book approach	Jefferies et al. (2014), Young et al. (2016), Tadayon (2018), Young et al. (2018)
Commitment	Elmuti and Kathawala (2001), Biggs (2004), Lahdenperä (2012), Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Moradi and Kähkönen (2022)
Single alliance culture	Biggs (2004), Tadayon (2018), Young et al. (2018)
Communication	Elmuti and Kathawala (2001), Lahdenperä (2012), Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Moradi and Kähkönen (2022)
Workshops	Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)
A single IT system	Jefferies et al. (2014), Young et al. (2016), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)
No blame	Tadayon (2018), Young et al. (2018)
Mutual goals and objectives	Lahdenperä (2012), Jefferies et al. (2014), Young et al. (2016), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)

Collaborative problem solving emphasizes that all members of the project alliance work together to overcome problems that arise (Tadayon, 2018).

Trust is especially important to realize the full potential of the project alliance. Examples of formulations used to describe the factor are 'trust between parties' (Jefferies et al., 2014) and 'mutual trust' (Biggs, 2004).

Co-location of a project alliance is a mechanism for realizing the effect of an integrated project team (Tadayon, 2018). A central alliance office combining all alliance partners (Jefferies et al., 2014, Raslim & Mustaffa, 2017) is often identified in the literature as a key factor in project alliance (Laan et al., 2011).

Pain/gain share. All members of the alliance share in the profits and losses of the alliance project and ensure that no single participant is held responsible for financial performance (Laan et al., 2011).

Open-book approach. A key factor in project alliance (Tadayon, 2018), but one that is not unique to alliancing (Young et al., 2016), is the open-book approach, which allows individual alliance partners to have an open and trusting relationship with one another (Jefferies et al., 2014).

Commitment to the project alliance is a key factor, as having a dedicated client and stakeholders shows commitment to the project through participation at a senior level (Jefferies et al., 2014). This is important not only to ensure that the alliances receive the necessary resources, but also to convince others throughout the organization of the importance of the alliances (Elmuti & Kathawala, 2001).

S*ingle alliance culture*. Project alliances can be seen as being established to unite culturally different partners in the pursuit of a common objective (Biggs, 2004). All members of the alliance, regardless of their holding company, are part of the team (Tadayon, 2018).

Communication. Effective communication between the partners is a vital factor for a project alliance to be successful (Elmuti & Kathawala, 2001).

Workshops are organized to develop and maintain the culture in the project alliance and the best-for-project mindset (Tadayon, 2018). Jefferies et al. (2014) identified pre-project and planning workshops as important factors in project alliance by organizing early workshops for all members of an alliance prior to the client-focused workshops to build good working relationships.

No blame. The foundation of an alliance agreement is based on everyone working in the same team (Tadayon, 2018). A key factor in such an agreement is the development of a no-blame culture, which culture refers to the degree to which parties take responsibility for problems as they arise, rather than avoiding them (Walker & Lloyd-Walker, 2015).

A single IT system can be seen as a tool used by an alliance (Young et al., 2018), to ensure that each member of the alliance has access to the same programs and files (Tadayon, 2018) and to enable individual alliance partners to manage resources and share knowledge (Jefferies et al., 2014).

Mutual goals and objectives. Examples of formulations used to describe the factor are 'common goals' (Young et al., 2018), 'shared objectives' (Biggs, 2004), and 'common goals and objectives' (Lahdenperä, 2012).

The topics of what leads to success in a project and how to measure success have attracted a great deal of interest and can be seen in isolation. Unfortunately, the list of factors that lead to success changes constantly. However, it is still interesting explore this list in more detail (Aarseth et al., 2016).

The question of whether or not the factors might be unique to partnering/alliancing is not explored in this dissertation, but a discussion can be found in, for example, the study by Tadayon (2018). However, not surprisingly, factors in projects in general (Pinto & Slevin, 1987) also apply to partnering/alliancing projects. Furthermore, Haaskjold et al. (2019) identified the quality of communication and trust between the parties as two of the five most important factors for project practitioners to prioritize in order to reduce transaction costs through improved collaboration. In addition, engineering and construction projects have many similarities and therefore managers of such projects can learn from each other. Experience can lead to increase skill levels, such that mistakes are not repeated in projects in the future, and knowledge acquired from success and success factors in one project may be transferred to other projects (Aarseth et al., 2016).

To summarize, in Section 2.2 (Factors within the context of CPDMs), I have distinguished between success criteria and success factors, and have discussed what factors might lead to project success. In the next section, Section 2.3, I distinguish between project success and project management success, and I discuss how success in projects is understood.

2.3 Project performance

Project performance in terms of cost, time, and quality is commonly known as the 'iron triangle' (Rezvani & Khosravi, 2018). This concept is fundamental to how we understand success in

projects. It is a representation of the most basic and classic criteria by which project success is measured, specifically whether the project is delivered by the due date, within budget, and to some agreed level of quality, performance, or scope (Julien et al., 2018). The idea behind three aspects of performance is well known in the literature and remains important for project management.

Success in projects may be an ambiguous concept. The literature distinguishes between project success (measured against the purpose and overall objectives of the project) and project management success (measured against the widespread and classic measures of performance, i.e. cost, time, and quality) (de Wit, 1988; Cooke-Davies, 2002).

Several researchers have perceived the 'iron triangle' concept as a poor definition of project success, as it does not take into account fulfilment of the project's purpose about bringing value (Müller & Jugdev, 2012). Traditionally, projects were perceived as successful when they met time, budget, and performance goals (Shenhar et al., 2001). This understanding is probably still highly relevant to practitioners, and most project managers in the construction industry have an operational focus, and their mindset and success criteria are focused on 'getting the job done'. While other success criteria have emerged, such as environmental impact and societal value, industries still put heavy emphasis on finishing projects on time, within budget, and to specifications (Shenhar et al., 2001), implying that this is the first step towards fulfilling the other success criteria. While the 'iron triangle' is unquestionably an important part of any successful project and projects comprise many parts and more than the three parts that make up the 'iron triangle', it is easier to measure than other performance measures.

Some studies have shown that projects are influenced by several variables, including types of projects and the management techniques used (Tadeu de Oliveira Lacerda et al., 2011). The choice of a suitable approach for a project will affect project performance in terms of cost, schedule, and quality (Sullivan et al., 2017). There are several positive outcomes related to project-based collaboration – the relationship between project participants that enhances project success (Suprapto et al., 2016a) – and several of these outcomes are included in Figure 2-3. The outcomes include, among others, improved change order and issue resolution, enhanced project culture, reduced cost, and scheduled growth (Børve, 2019).

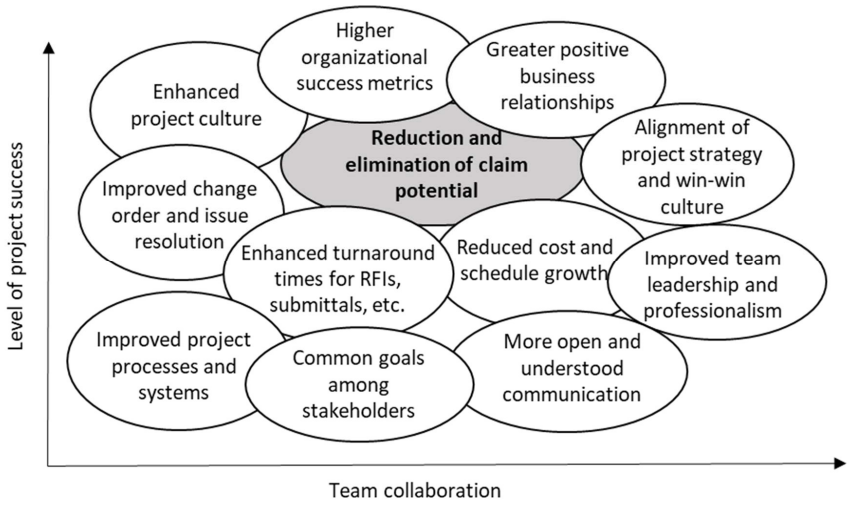

Figure 2-3: Project partnering outcomes (modified from Børve, 2019, p. 48)

2.4 Research gaps

Thus far (in Sections 2.1–2.3), I have described the theoretical background to the three core concepts in the research underlying this dissertation: the intersection between the research areas of CPDMs, factors within the context of CPDMs, and project performance.

In recent years, researchers have increasingly turned their focus from hard elements to social and human aspects, meaning soft elements related to working in project-based collaborations (Hanisch & Wald, 2011; Jacobsson & Roth, 2014). Understanding the relations and interactions among partners in engineering and construction projects stood out early as an important issue, in which collaboration plays an important part. Several authors state that improved collaboration has a positive effect on performance in construction projects (Sarhan et al., 2017; Walker et al., 2017; Caniëls et al., 2019). The lack of research investigating the link between collaboration and project performance, as described by Silva and Harper (2018), Bond-Barnard et al. (2018), and Meng and Gallagher (2012), was one of my main reasons for engaging in my doctoral research.

According to Sullivan et al. (2017), researchers need to identify clear advantages and disadvantages of each CPDM in specific situations. The existing literature describes what has been done in CPDMs (Tadayon, 2018; Young et al., 2018; Malvik et al., 2021; Tadayon & Anderesen, 2021). While CPDMs proposes to be a response to poor performance in engineering and construction projects, there is a knowledge gap relating to how CPDMs influence project

performance, especially in relation to relatively new types of CPDMs (e.g. project partnering, IPD, and project alliance) (Moradi et al., 2020), which lack empirical based evidence regarding performance (Mesa et al., 2016; Engebø et al., 2020). However, there are knowledge gaps related to all CPDMs, and some of these research gaps are elaborated in more detail in the following discussion.

Partnering, is perhaps the most well studied CPDM in the literature, and extensive studies of partnering have been carried out internationally (Abudayyeh, 1994; Latham, 1994; Ng et al., 2002; Cheung et al., 2003; Bayliss et al., 2004). Despite the perceived benefits of partnering and identification of factors responsible for successful partnering (Ling et al., 2015; Black et al., 2000; Cheng et al., 2000; Chan et al., 2004; Chen & Chen, 2007; Doloi, 2009), there is no widely accepted definition of the concept (Bygballe et al., 2010; Eriksson, 2010; Børve et al., 2017) and its influence on performance is unclear (Nyström, 2005; Jacobsson & Roth, 2014; Mollaoglu et al., 2015). Most of the public research to date has focused on the challenges in construction projects, thus making partnering an attractive approach for more effective collaboration (Abudayyeh, 1994; Cheung et al., 2003; Yiu et al., 2011). From the literature review presented in Section 2.2.1 it is evident that success factors for project partnering are unclear. The number of contributions in the field is scarce: of 318 papers published in the period 1991 to 2022, only 19 papers have been published on this theme (see Table 3-1), which confirms that there is insufficient existing research on this topic.

Extensive studies of success factors in projects have been conducted (Pinto & Slevin, 1987; Chan et al., 2004; Dvir & Lechler, 2004; Fortune & White, 2006; Turner, 2008. By contrast, studies of human project success factors, in the context of project teams, have been explored only to some extent (Eriksson & Westerberg, 2011). For example, some studies have investigated communication (Turner & Müller, 2004; Bond-Barnard et al., 2014; Henderson et al., 2016) and trust (Kadefors, 2004; Henderson et al., 2016), but studies of human project success factors have been investigated in relative isolation from the other factors (Bond-Barnard et al., 2018). Even though research has been conducted, several studies were based on surveys with limited empirical support (Meng & Gallagher, 2012; Bond-Barnard et al., 2018; Silva & Harper, 2018; Haaskjold et al., 2020) and therefore testify to a gap in the existing literature. Moreover, soft factors are an important aspect of CPDMs. The number of contributions to the literature that seek to link soft factors and performance is scarce (Engebø et al., 2020), and in order to explore this relationship further, it is apparent that more research is needed.

With reference to the other CPDMs that underly this dissertation. There is a need for more research regarding social aspects and performance, which are important in alliances. Alliancing has a knowledge gap regarding how to build partnerships and why partnerships increase the

likelihood of greater performance and project success (Engebø et al., 2020). Alliance research has been conducted with the aim of identifying the success factors in alliances (e.g. Jefferies et al., 2014), but according to Lahdenperä, 'the impact of the procedures followed in alliancing on the success of projects is not yet fully clear and undisputed' (Lahdenperä, 2017, p. 42).

3 Research Method

This chapter describes the research method and approach to the research. This includes an overview of the work carried out during the period of my doctoral research, 2016–2022, and the process of conducting the literature review. I used the 'research onion' as a framework (Saunders et al., 2019). Details of the methodology are illustrated in Figure 3-3 in Section 3.2. The research framework was modified from the work of Saunders et al. (2019), which from my point of view is a useful tool for thinking holistically about methodology, even though it may not give an entirely perfect picture. Each of the six layers of the onion are addressed with reference to the three papers in this dissertation, from Section 3.3 (on philosophy) to Section 3.8 (on techniques and procedures). The chapter ends with some reflections regarding the quality of my research and its limitations.

An overview of the research carried out during the research period is presented in Figure 3-1. The chronology of different parts of the research is illustrated by a timeline. The main data gathering and analyses for each paper are described above the timeline, while the main deliverables from the PhD project are shown below the timeline.

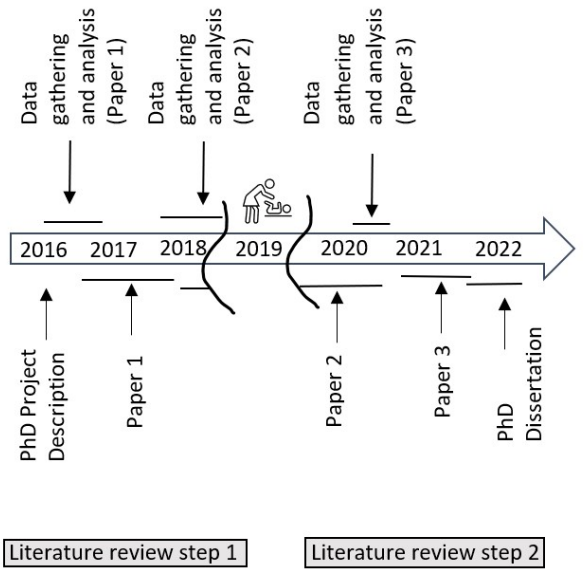

Figure 3-1: Overview of the research process

As illustrated in Figure 3-1, the PhD project description was the first to be decided and submitted for approval by an assessment committee appointed by NTNU. Following the approval of the project description, the next step was to gather and analyse data associated with Paper 1. That step overlapped with writing Paper 1. The process for both Paper 2 and Paper 3 was similar to that for Paper 1. The timeline in Figure 3-1 indicates that the literature review for this dissertation comprised two steps but there was continuous monitoring of literature through the entire PhD period, despite a period of maternity leave from December 2018 to September 2019. The timeline indicates a smooth transition between the different steps, with the exception of the maternity leave, when I was absent from work.

Although the research framework shown in Figure 3-3 describes the research choices for the dissertation, it does not describe how the literature searches were conducted. Since Saunders et al.'s 'research onion' (Saunders et al., 2019) does not include literature review, the review is described separately in the following Section.

3.1 Literature review

The process conducting of the literature review for this dissertation can be briefly outlined as comprising two steps, as shown in Figure 3-2.

Step 1 was mainly completed during first part of my work on the dissertation. The review provided an overview of the state of the art within the specific research field related to partnering, and identification of research gaps. Step 2 was similar to step 1, but focused on other CPDMs underlying this dissertation, specifically alliancing. A vast pool of relevant literature was generated through exploring Scopus, Google Scholar, and Emerald Insight, among other Internet sources.

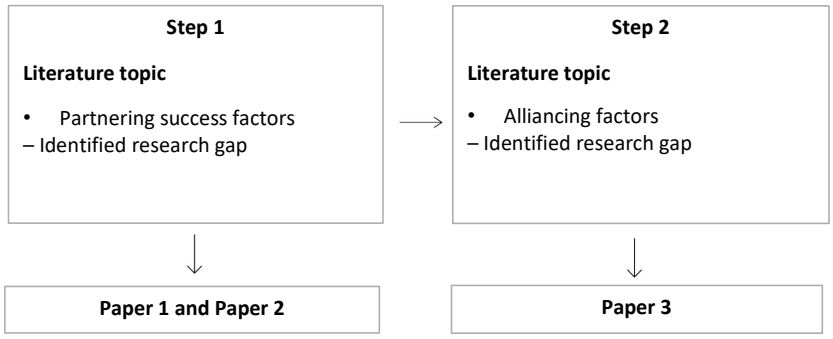

Figure 3-2: Summary of literature review process

Step 1. A literature review, consisting of several stages, was performed both before and after interviews were conducted, in order to gain insights into the phenomenon studied. Table 3-1 shows the results of the literature search in five high-ranking journals, in issues published in the period 1991 to 2022 inclusive. The reason for limiting the research to those journals was that they are highly recognized and considered as leading within the field of project management research (Aarseth et al., 2017). The initial search terms were 'project partnering' and closely associated concepts such as 'strategic partnering' and 'alliance partnering' (papers found in initial search). Thereafter, these were combined with the search terms 'succeed', 'success', and 'factors' (concerning how to succeed with partnering, which was relevant for Paper 1 and Paper 2). The total number of papers found in the initial search was 318 papers, the abstracts of the papers were reviewed to reduce the number of papers based on their relevance.

Table 3-1: Literature search results – step 1 (Paper 1 and Paper 2)

Journal	Papers found in initial search	Relevant for construction industry and research topic	How to succeed with partnering
Project Management Journal	76	3	3
International Journal of Project Management	179	29	8
International Journal of Managing Projects in Business	15	2	1
Engineering, Construction and Architectural Management	18	10	3
Journal of Management in Engineering	30	4	4
Total	**318**	**48**	**19**

The abstracts of the remaining papers were reviewed more carefully, and 48 papers were found relevant for the construction industry and research topic. Finally, 19 papers were found relevant for the research in Paper 1 and Paper 2. Most of the publicly available research findings focus on the challenges more than on how to do something about them. That only 19 papers have been published on this theme confirms that there is insufficient existing research on this topic. Based on the literature review, six additional papers were found published in the journal *Construction Management and Economics* that were relevant for my research. Table 2-4 (in Section 2.2.1) shows five groups of partnering success factors that researchers have found important to succeed with project partnering.

Step 2. The literature review process in step 2 is shown in Figure 3-2. The review was done before interviews were held. For project management, the literature distinguishes between hard and soft factors (Yeung et al., 2007; Fotopoulos & Psomas, 2009). Furthermore, claims have been made that it is possible to identify factors that appear to be key to an alliance (Young et al., 2018). Journal articles representing the most recent literature and containing comprehensive and very relevant articles on CPDMs were used to gain a broad perspective of the current views on the topic. A 'pre-scan' of factors relevant for the topic of my research, as well as factors identified by case study 2 (the oil company – an independent oil and gas company engaged in upstream operations) as key for the alliance performance, was conducted before preparing the interview guide. A list of factors identified in the literature formed the basis of a description of the alliance. Even though the literature has identified far more factors than is the case here, it was decided that a cut-off point of twelve factors was relevant for the study presented in Paper 3. Examples of factors that researchers have used in descriptions of alliances are listed in Table 2-6 (Section 2.2.2). The research methods used for the papers in this dissertation are summarized in Table 3-2.

Table 3-2: Summary of research methods for the papers in the dissertation

Author's dominant philosophical position	Critical realism		
	Paper 1: Understanding how to succeed with project partnering (Descriptive)	**Paper 2:** Linking partnering success factors to project performance (Descriptive)	**Paper 3:** How a project alliance influences project performance compared to traditional project practice (Descriptive)
Approach to theory development	Deduction	Deduction	Deduction
Methodological choice	Qualitative	Quantitative	Mixed methods
Sampling strategy	Case study/ narrative inquiry	Surveys	Case study/ narrative inquiry and Survey
Time horizon	Cross-sectional	Cross-sectional	Cross-sectional
Data collection	54 semi-structured interviews (Norway)	Data from 124 engineering consultancies (Norway and Denmark)	13 semi-structured interviews Data from 13 experienced persons (the same interviewees who answered the survey) (Norway)

3.2 The research framework

The research framework is shown in Figure 3-3. In the following Sections, I start with the outer layer of the 'research onion' (philosophy) and develop the discussion towards the inner layer (techniques and procedures), in order for benefits of the framework, and each of the three papers is discussed in detail.

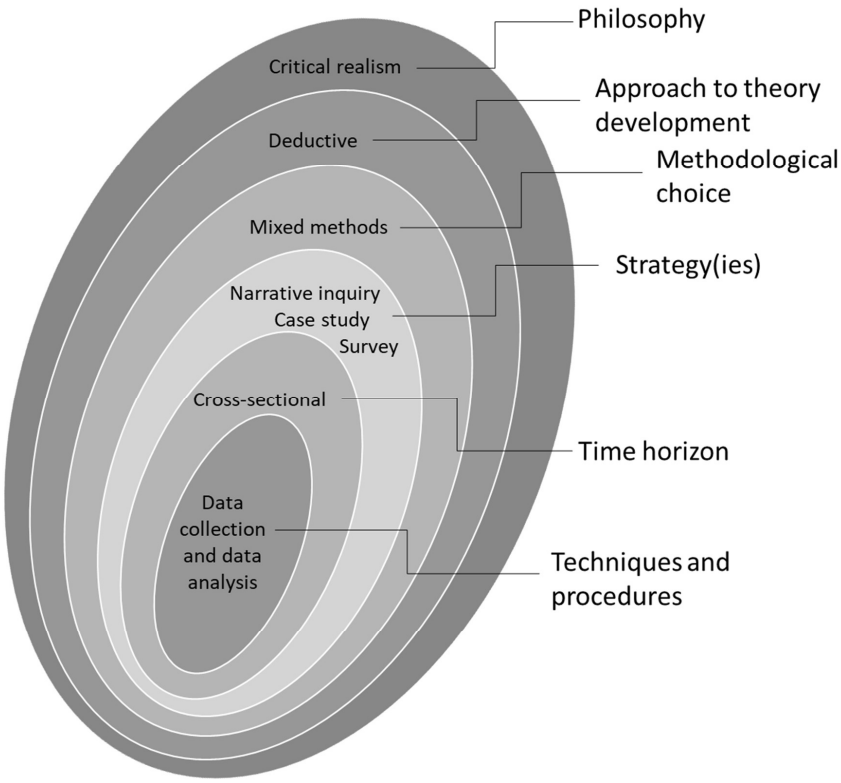

Figure 3-3: The research framework (modified from Saunders et al., 2019)

3.3 Outermost layer of the research framework – philosophy

The research philosophy makes up the outermost layer in Figure 3-3. The term 'research philosophy' refer to a system of belief and assumptions about the development of knowledge (Saunders et al., 2019). It is important that the researcher is self-aware of his or her own philosophical position in order to design a good research strategy (Klakegg, 2016), and to make the reader aware of what the researcher's beliefs and assumptions were when they conducted their research (Bryman, 2016). These *ontological*, *epistemological*, and *axiology* assumptions have considerable influence on how the research is conducted, which in turn creates the need to discuss their implications.

To enable suitable approaches to answering the three research questions, RQ1–3 (Section 1.3), the philosophical approach to the research undertaken for this dissertation should be clarified. The philosophical approach critical realism was adopted in order to fulfil the research objectives. The RQs cover a variety of aspects and thus pluralism was required in the approaches and methods. Hence, critical realism was considered a suitable paradigm as a platform for the research strategy (Saunders et al., 2019).

In general, three sets of assumptions influence the research process: *ontology* assumptions, *epistemology* assumptions, and *axiology* assumptions (Saunders et al., 2019). A paradigm can be defined as 'the basic belief system or worldview that guides the investigator, not only in choices of method but in ontologically and epistemologically fundamental ways' (Guba & Lincoln, 1994, p. 105). I consider that my philosophical position as a researcher is dominated by critical realism, and that the reality is crucial. The paradigm described by Saunders et al. (2019) is shown in Table 3-3.

Table 3-3: The critical realist philosophical position (modified from Saunders et al., 2019)

Critical realism			
Ontology	**Epistemology**	**Axiology**	**Typical methods**
Stratified/ layered (the empirical, the actual, and the real) External, independent Intransient Objective structures Causal mechanisms	Epistemological relativism Knowledge historically situated and transient Facts are social constructions Historical causal explanation as contribution	Value-laden research Researcher acknowledges bias due to worldview, cultural experience, and upbringing Researcher tries to minimize bias and errors Researcher is as objective as possible	Retroductive, in-depth, historically situated analysis of pre-existing structures and emerging agency Range of methods and data types to fit subject matter

The *ontology*, *epistemology*, and *axiology* assumptions that are typical of a critical realist (Table 3-3) are outlined in further detail in the following subchapter.

3.3.1 Ontology, epistemology, and axiology

According to Saunders et al. (2019), *ontology* describes what a researcher considers about the nature of the world and reality. The critical realist considers ontological assumptions as particularly important (Fleetwood, 2005; Reed, 2009). Figure 3-4 shows three overlapping

layers, which represent how critical realists aim to understand and explain what we experience and observe in a reality (Saunders et al., 2019). The innermost layer, 'the empirical', is what is actually observed or experienced. Nevertheless, only a small fraction of the 'the actual' (middle layer) events occur. In the outermost layer, 'the real' of a situation, represents the underlying causes of the events. Regarding to these three overlapping layers (Figure 3-4), a critical realist will look for the bigger picture, the underlying mechanisms causing the events that we experience, and accept that there is a real world out there. but he or she will highlight that our understanding of it will always be limited (Saunders et al., 2019).

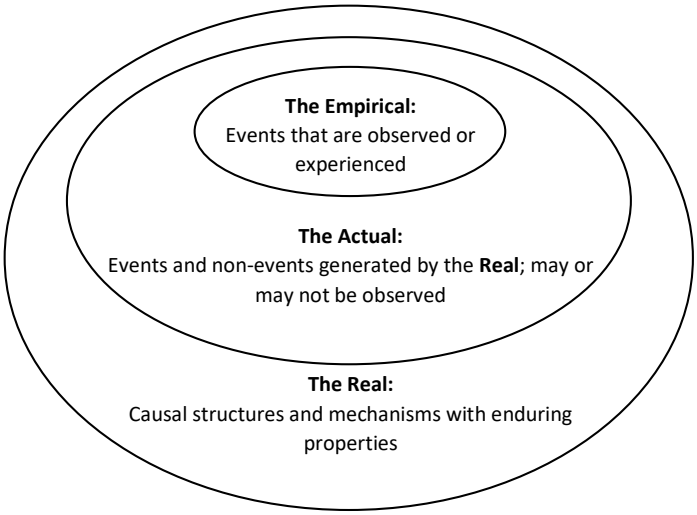

Figure 3-4: Critical realist ontology (modified from Saunders et al., 2019 p. 148)

According to Saunders et al. (2019), *epistemology* looks at the relation between the inquirer and the established/known (i.e. what constitutes acceptable, valid, and legitimate knowledge). For critical realists, knowledge is historically situated and transient. Therefore, an event that is observed or experienced must be analysed within the context of when it happened (Reed, 2009; Saunders et al., 2019). In order to know a complex reality and to gain a deeper understanding of it, a critical realist researcher normally prefers a combination of strategies (Reed, 2009; Saunders et al., 2019).

According to Saunders et al. (2019), the third and final set of assumptions that influences the research process is *axiology*. Axiology refers to the role of values and ethics. A critical realist acknowledges that research will be influenced by the researcher to a certain degree (Saunders et al., 2019). Therefore, the researcher's worldview and cultural understanding, as well as how they might have affected their research, must be considered when presenting the findings of that research. Nevertheless, a critical realist tries to be as objective as possible and minimize such bias and errors.

3.4 Research approach

The research approach – represented by the second outermost layer in Figure 3-3 – can be divided into two groups: *inductive* and *deductive*. The different approaches to theory development are shown in Figure 3-5. In a *deductive* approach (moving from theory to data), the researcher develops a hypothesis based on theory and then designs a research strategy to test that theory. By contrast, in an *inductive* approach (moving from data to theory), the researcher collects data to explore a phenomenon and then generate or build a theory. In an *abductive* approach (moves back and forth), the research typically begins with an observation of a 'surprising fact'. The approach is used by researchers who apply a combination of deduction and induction (Saunders et al., 2019).

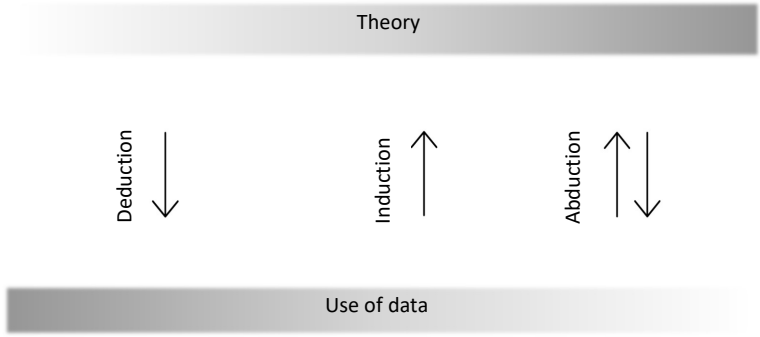

Figure 3-5: Three approaches to theory development (modified from Saunders et al., 2019)

A researcher's dominant philosophical position will influence their choice of approach to theory development. Critical realists often incline towards abduction. Due to the flexibility of the abduction approach, it can be applied by researchers with different philosophies (e.g. postmodernists and pragmatists) (Saunders et al., 2019).

Paper 1 identifies three main dimensions that are vital for project partnering success. The purpose of the paper is to present new findings for organizations that acknowledge difficulties in implementing and succeeding with project partnering. The central point of departure for Paper 1 is five partnering success factors (Section 2.2.1). The partnering success factors in the literature were compared with findings from interviews. The third main dimension *Way* in relation to partnering means served to confirm the findings of earlier research. A *deductive* approach is used in Paper 1. However, the approach include elements of *abduction*, as the literature review did not take account of either who should be involved in partnering projects (*Who* – participant selection) or a common understanding (*What* – task clarification), which are two new dimensions that emerged from the findings.

With regard to *Paper 2*, most the presented findings support previous research findings that improved collaboration has a positive effect on performance in projects. Paper 2 links partnering success factors to project performance. The purpose of the paper is to determine which partnering success factors influence whether the multi-partner project (MPP) meets project performance in its most classic and measurable sense of being on time, within budget, and to technical specifications. Data were collected and analysed to test whether there is such relationship. Hence, the 'research onion' approach used in Paper 2 is *deductive*.

Paper 3 presents findings from a study focusing on how a project alliance might influence project performance compared with the practices of traditional projects. Previous research has basically confirmed that through better relational attitudes and teamworking quality, partnering/alliance projects are likely to perform better than a traditional project. The purpose of the paper is to look how the two different project types, traditional and more collaborative, influence project performance. Accordingly, a *deductive* approach is used in Paper 3.

Various approaches have influenced the research design of this dissertation, and there are no clear-cut designs that explain the entire process. The research design described the plan for how the RQs were to be addressed (Saunders et al., 2019). According to Saunders et al. (2019), a research design should say something about the choice of method, data source and research strategy, time horizon, and techniques and procedures for data collection and analysis. These aspects are described in further detail in the following subchapters (Sections 3.5–3.8).

3.5 Research choice

Research choices form the third layer in the research framework shown in Figure 3-3, and they relate to the choices of methods available to the researcher. Research methods can be divided into two groups: *qualitative methods* and *quantitative methods* (Bryman, 2016). A research choice that uses quantitative methods typically focuses on the numbers related to the data

collection and analysis (i.e. a survey), whereas a research choice that uses qualitative methods will place more emphasis on the words than on the numbers (e.g. words spoken in an interview) (Bryman, 2016). Saunders et al. (2019) mention that a research choice can consist of both qualitative and quantitative data collection methods. Both methods have strengths and weaknesses. Using both methods for data collection is known as a *mixed-methods approach* and is commonly described as *triangulation* (Bryman, 2016; Saunders et al., 2019).

In mixed methods, qualitative and quantitative techniques are combined in a range of ways. Table 3-4 shows a variety of ways that range from concurrent forms to more complex and sequential forms (Saunders et al., 2019).

Table 3-4: Mixed-methods research design (modified from Saunders et al., 2019)

Research design	Method
Concurrent	Quantitative
	Qualitative
Sequential exploratory	Qualitative followed by quantitative
Sequential explanatory	Quantitative followed by qualitative
Sequential multiphase	Qualitative followed by quantitative, then by a further phase of qualitative

As shown in Table 3-4, using a *concurrent mixed-methods* research design signifies separate use of quantitative and qualitative methods within a single phase of data collection and analysis (a single-phase research design). Further, *sequential mixed methods*, as shown in Table 3-4, involves several phases of data collection and analysis to elaborate or expand on the initial set of findings (a two-phase research design). The latter leads to two alternative mixed-methods research strategies, either a *sequential exploratory research design* or a *sequential explanatory research design*. Finally, a more complex *sequential multiphase design* will signify multiple phases of data collection and analysis (Saunders et al., 2019).

It is often favourable to combine both quantitative and qualitative methods in order to provide a better understanding of a research problem than to a use a standalone approach. The use of mixed-methods approaches reflects the pluralist view of research methodology (Saunders et al., 2019). For the research for this dissertation, a combination of qualitative and quantitative methods (triangulation) was used. Qualitative methods were used for Paper 1, quantitative methods for Paper 2, and qualitative methods followed by quantitative methods (sequential

exploratory research design) for Paper 3. The triangulation of a combination of qualitative and quantitative methods enabled me to investigate the research objective of the dissertation from different angles and in turn might have provided a more robust set of results.

3.6 Sampling strategies

The fourth layer in the research framework shown in Figure 3-3 looks at different strategies that may be used to collect data. In the literature, the terms to describe data collection vary from, for example, *sample strategies* (Saunders et al., 2019) to *research design* (Bryman 2016), for which Yin (2014) uses the collective term *research methods*. In this dissertation the term *sample strategies* as used by Saunders et al. (2019) is used. Different sampling strategies are reported in the literature, including the following (Saunders et al., 2019):

- Experiment
- Survey
- Archival and documentary research
- Case study
- Ethnography
- Action research
- Grounded theory
- Narrative inquiry.

Table 3-5 lists the sampling strategies *narrative inquiry*, *case study*, and *survey*, which were applied in the studies on which Papers 1–3 are based.

Table 3-5: Research sample strategies relevant for the papers in the dissertation (modified from Saunders et al., 2019)

Sampling strategy	Short description	Relevance
Narrative inquiry	Story that involves the experiences of a participant or a small group Usually an interview The researcher writes his or her findings, then reviews and analyses them.	Qualitative methods Used to answer 'how' and 'why' questions
Case study (single case or multiple cases)	In-depth inquiry of one person, group, or event, with regard to a phenomenon within its real-life setting	Quantitative methods Qualitative methods (used separately or in combination with quantitative methods) Used to answer 'how' and 'why' questions Used for exploratory/descriptive/explanatory research
Survey	Collect data that can be used in statistical analyses Usually questionnaires, structured observations, and structured interviews	Quantitative methods Used to answer 'what', 'who', 'where', 'how much', and 'how many' questions Used for exploratory/descriptive research

The sampling strategies applied for each of the three papers are explained in more detail in the following subchapters (Sections 3.6.1–3.6.3).

3.6.1 Paper 1 (narrative inquiry and case study)

A narrative inquiry and a case study was used for Paper 1. A case study approach was used to address the overall RQ, and the qualitative data were collected using narrative inquiry. According to Yin (2014), using a case study is an appropriate approach when seeking to understanding a phenomenon, and is particularly appropriate when the RQ starts with 'How'. The research objective for Paper 1 meant it was important to obtain comprehensive information on the entire studied organization and value chain, as the aim was to identify factors and understand a phenomenon, rather than numbers. This was the primary reason for choosing the narrative inquiry strategy instead of another strategy, such as a survey strategy. Using a survey

strategy would have given limited insights into the reasons behind the answers from the interview subjects (Bryman, 2016). By contrast, narrative inquiry gives a researcher access to deeper organisational realities that can be collected as complete stories rather than collecting them as fragmentary data that flow from predefined fragmented interview questions (Saunders et al., 2019).

Case study 1 – 'CaseCo'

'CaseCo', a leading expert in infrastructure construction, with six years of experience of partnering projects and with more than 30% of the contracts in its particular USD 3.6 billion market, requested to be unnamed and anonymous, and that request was honoured. Project partnering was introduced to CaseCo in 2010, with three specific partnering goals of improving the basis for good relationships between client and contractor (the parties), to create trust between the parties, and to inspire the technical development of projects. The goals related to the basic principles of partnering that are designed to protect the interests of all parties at all levels – commitment, trust, respect, communication, and equality (Cowan et al., 1992; Chan et al., 2003b). CaseCo is a project-based organization concentrating its attention exclusively on the relationship between client and contractor, and it excludes internal and external stakeholders in the value chain from partnering activities. Internal departments and external stakeholders are just some of the organization's departments and employees who are mutually dependent on delivering the agreed products and services at the right cost, time, and quality. On this basis, CaseCo requested research-based insights into how to succeed with project partnering. Hence, a case study approach was the logical choice of method. More detailed information about the investigated case can be found in Paper 1 (Part II).

3.6.2 Paper 2 (survey)

A quantitative method (De Vaus, 2014) was used to conduct surveys. The quantitative data were collected through two nationwide surveys, one carried out in the Danish engineering consultancy industry and one in the Norwegian engineering consultancy industry. The paper is intentionally descriptive, and the related RQ was formulated as a 'how' question. The research objective of Paper 2 meant it was important to obtain information about ongoing MPPs measuring individual-level perceptions of collaborative behaviour. Despite the mentions of MPP in literature (Dietrich et al., 2010), there is no generally accepted definition of the concept. In line with the definition of multi-partner alliances provided by Lavie et al. (2007), as well as the definition given in a paper by Aagaard et al. (2012), I define a multi-partner project as follows: *a project in which employees from two or more independent firms work together to attract, plan, and execute a common time-bounded and resource-constrained task of a certain complexity for a client in order to create value for the firms and client involved*.

With regard to the ability to generalize findings to a larger population, the survey strategy is more suited than, for example, case studies and narrative inquiries (Bryman, 2016). A survey strategy was used for the study presented in Paper 2, due to the sample size. In the case of Paper 2, the purpose was to describe the current situation in numbers and measurements, by exploring the link between partnering success factors and project performance in terms of being on time, within budget, and to technical specifications. The survey strategy permits the researcher to collect data that can be used in statistical analyses, and described with reference to relationships and correlations (Saunders et al., 2019). A survey strategy was well suited to the objective of Paper 2, hence the reason it was chosen.

3.6.3 Paper 3 (narrative inquiry, case study, and survey)

A narrative inquiry, case study, and survey were used for the study presented in Paper 3. A case study was used to address the overall RQ. A single case study with a single unit of analysis (Yin, 2008) was used. The single case unit referred to the alliance in a case company (the oil company) and was restricted to the boundaries within that alliance. Paper 3 has descriptive purpose and the specific RQ is formulated as a 'how' question. Sequential mixed-methods were used in the study presented in Paper 3. The collected data were both quantitative and qualitative, and complemented each other. Sequential mixed-methods research involves more than one phase of data collection and analysis in order to elaborate or expand on the initial set of findings (Saunders et al., 2019).

The qualitative data were collected using narrative inquiry. According to Patton (1990), the goal of a qualitative research method is to gather extensive data on a specified subject. Instead of using a randomized selection to generalize the data, the participants with the most extensive knowledge about the research subject are selected. The research objective for Paper 3 made it important to gain a rich and comprehensive understanding, as the aim was to study factors relevant for alliances, as well as factors identified by the oil company as key for the alliance performance. This was the main reason for choosing the narrative inquiry. The survey was conducted using a quantitative method. The survey strategy allows the researcher to collect data that can be used in statistical analyses (Saunders et al., 2019). Regarding the survey strategy, the interviewees were able to rate their experience of the performance of the project alliance and any relatable traditional procurement forms for several variables. The extra dimension provided by the quantitative results were the means of measurement and comparison.

Case study 2 – The project alliance

The studied oil company, which was an independent oil company engaged in upstream operations, requested to be unnamed and anonymous, and that request was honoured. The

responsibility of the company, the investigated case (one project alliance within the Norwegian oil and gas industry), was to deliver facilities such as platforms and simple process units for the oil company. Hereafter, the alliance is referred to as a project alliance, and projects with the traditional offshore contractual model, EPCI contracts (i.e. engineering, procurement, construction, and installation), are referred to as traditional projects. Under an EPCI contract, the contractor carries the project risk for schedule and the budget in return for a fixed price, known a 'lump sum contract' (Loots & Henchie, 2007). The studied oil company used a common governing model for all its alliances. Each contractor entered into a separate frame agreement with the oil company. The alliance agreement and its appendixes then governed the alliance as a whole. The agreement regulated different terms regarding the project alliance, such as key principles, alliance organization, execution of work, and dispute resolution, as well as other regulatory terms within the project alliance. The compensation model of the project alliance was built on a target cost for projects, the Most Likely Cost. In the model, there were far fewer downsides for the contractors compared with in traditional projects. Still, they only stood to be liable for their share of the 20% of the overrun for the whole project. This was in contrast to traditional projects, in which contractors agree on a single compensation sum and are then liable for the total of any overrun of the compensation. Thus, from the compensation model, it can be seen that the oil company in the project alliance have taken on significant responsibility for potential overruns. The actors involved in the alliance were three Norwegian companies and one international company. The four companies were specialists in their fields and represented both the client (customer) and the contractor (supplier) in the project alliance. More detailed information about the investigated case can be found in Paper 3 (Part II).

3.7 Time horizon

The fifth layer in the research framework shown in Figure 3-3 is the time horizon. Time horizons are needed for a research design independent of the chosen methodology. Saunders et al. (2019) uses the terms *snapshot* and *diary* when describing time horizons in research designs. There are two types of time horizons: *longitudinal* and *cross-sectional*. Cross-sectional studies are limited to a specific time frame, whereas longitudinal studies are repeated over an extended period, and they are like diaries in that they offer a description of how a phenomenon or events develop over time. Longitudinal studies also require that sufficient time is available to the research or researchers (Bryman, 2016; Saunders et al., 2019).

The research for this dissertation was limited to a specific time and not undertaken as longitudinal study due to available data sources and time constraints. Therefore, a cross-sectional time horizon was used. For Paper 1, the data were collected over a period of four month. Furthermore, the dataset used for Paper 2 were not designed to address the RQ in Paper

2 specifically. Instead, an existing dataset (Aagaard et al., 2012) was reviewed, followed by linking the questions from existing dataset to the partnering success factors. Finally, for Paper 3, the data were collected over a period of two months.

3.8 Innermost layer of the research framework – techniques and procedures

The last and innermost layer of the research framework shown in Figure 3-3 concerns how the data are collected and analysed (Saunders et al., 2019). The following Sections (3.8.1–3.8.3) describe the detailed procedure for data collection and analysis for Papers 1–3, respectively.

In Paper 1, the phenomenon investigated was project partnering. The RQ – *How to succeed with project partnering in a project-based organization?* – is answered with reference to the findings from semi-structured interviews (Mason, 2018). In Paper 2, the RQ – *How do partnering success factors influence multi-partner projects' performance in terms of being on time, within budget, and to technical specifications?* – is answered with reference to the results of the statistical analysis and to both a Danish and a Norwegian dataset within the engineering consultancy. According to Bryman (2016), when a researcher conducts analysis using a dataset in which the central data were collected by someone else, the method is called *secondary analysis*. In Paper 3, the phenomenon investigated was project alliancing. The RQ – *How does a project alliance, as an example of a CPDM, influence project performance compared to traditional project practice?* – is answered with reference to semi-structured interviews and statistical analysis, which complemented each other.

3.8.1 Semi-structured interviews (Paper 1)

The interviews were conducted in a research project in one organization and there was only access to interview subjects from the organization. In total, 54 semi-structured interviews, conducted with 54 interviewees, were the sole source of information from which to gain comprehensive information for the entire organization and value chain. Experienced persons representing the entire company value chain were interviewed about project partnering in the company (Table 3-6).

Table 3-6: List of interviewees – Paper 1

Interviewees	Years of experience	Region	Department	Role
54	< 10 years: 27 10–20 years: 11 20+ years: 16	X: 35 Y: 19	A: 3 B: 4 C: 25 D: 6 E: 5 F: 11	construction manager: 20 project manager: 13 department manager: 7 controller: 4 planner: 4 adviser: 3 HR: 1 lawyer: 1 economist: 1

Among the interviewees, 35% were women, and all interviewees were employed in two of the five CaseCo regions. A total of 25 of interviewees worked in department C (one of two departments in charge of project implementation in CaseCo).

The interviewees were asked to participate in an interview lasting 45–60 minutes, after having reflected on the following two questions:

1. What specific partnering challenges does one face in CaseCo?
2. What factors do you consider important to succeed with project partnering?

Pattern matching for data analysis was used (Yin, 1994). The data were transferred to Microsoft Excel sheets to enable additional counting and comparison. The first 11 interviews were analysed to determine whether the interviews revealed a repeated pattern of specific factors. After that initial round, various success factors were identified and assigned to a Who, What, or Way dimension by the 11 first interviewees. It was found that four success factors constituted subdimensions of the *Way* dimension. When all the data had been analysed, there were still three main dimensions that had been emphasized by the vast majority of the 54 interviewees. The data were reviewed again to ensure that no important aspects had been missed. Finally, the findings were systematized in a three-dimensional model along the main dimensions of Who, What, and Way. The main dimensions and subdimensions were communicated to all interviewees by e-mail, with links to the interview report. With a few exceptions, all interviewees approved the e-mailed content. A few interviewees offered minor comments, which are included in the discussion section relating to Paper 1 (Section 4.1).

The dimensions were tested on relevant audiences to get feedback and to make sure the findings were consistent with how the employees of CaseCo perceived them (Table 3-6). This was done first for the management in region X and Y, then three times in region X, once in department F, and twice in connection with major company gatherings of CaseCo's employees.

3.8.2 Secondary analysis (Paper 2)

Central data are intended to enhance theoretical understandings of how organizations involved in temporary interorganizational activities can successfully collaborate, and how those organizations may improve their performance and competitiveness through the participation in national or international MPPs (Aagaard et al., 2012).

The empirical case for my research was engineering consultancies, as they are often involved in MPPs, often highly complex ones. Furthermore, engineering consultancies often act in international markets and have significant influence on the productivity and growth of other industries because they act as facilitators in the business-to-business market. Therefore, a study of MPPs involving engineering consultancies has the potential to be of significant value to research as well as to practice in different industries. Danish engineering consultancies are almost entirely either micro-enterprises or small and medium-sized enterprises (SMEs). It is well known that such SMEs play an important role in growth, innovation, and development in many industries (Lu & Beamish, 2006; OECD, 2009), an effect that has also been demonstrated in Denmark (Madsen et al., 2006) and Norway (Steinmo & Rasmussen, 2016; Azari et al., 2017). In sum, engineering consultancies provide a highly appropriate setting for research, as their main business model is MPPs in which the participants are specialized in different knowledge areas. Therefore, the engineering industry was selected as the empirical base for my doctoral research.

Description of the Danish dataset

The study population was defined as engineering consultancies within the NACE codes 71.12.10 (building and infrastructure) and 71.12.20 (production and machinery). In Denmark, firms were selected from the database 'Navne & Numre' ('Names & Numbers'), which registers information about all ongoing Danish firms.

For the study, all identified firms with more than two employees were included. The decision to use a cut-off point of two employees was made to ensure that only true MPPs of a certain size were included.

The final study population was 352 firms. The number was quality-checked by contacting the Danish Association of Consulting Engineers (FRI, Foreningen av Rådgivende Ingeniører). As the Association comprised approximately 300 firms at the time of the survey, the number was deemed reasonable. Each firm was then contacted by telephone to detect any incorrect registration details, to identify a relevant informant, and to invite the firm to participate in the survey.

No information about the number of MPPs in the firms was available prior to the study. The focus was on ongoing MPPs and therefore the companies were asked to identify ongoing MPPs that involved most man-hours and to use that information as the basis when responding to the survey questionnaire. The reason for this selection criterion was to examine MPPs of high importance for the responding firm, and MPPs in which the firm was highly involved. I anticipated that the number of man-hours would represent the best proxy for the criteria.

The participating firms received a cover letter, as well as a questionnaire that was sent to the contact person through SurveyXact. This resulted in 76 responses from 352 firms (i.e. a response rate of 22%).

Description of the Norwegian dataset

The Norwegian study population was identified in a similar way. In line with the approach used in the study relating to Denmark, the selection of an empirical base in Norway was based on members of RIF in Norway (Rådgivende Ingeniørers Forening), an association of consulting engineers in Norway. This was done to ensure the robustness of the research, as the same method was applied for the selection of the study populations in Denmark and Norway.

The data collection in Norway was undertaken as follows. Initially, the university in Denmark contacted the university in Norway to ask whether a similar study of MPPs could be conducted in Norway. The data from Denmark were then compared with the data from Norway. Then, the Norwegian university contacted RIF (Norway) to ask if it would be interested in participating in the survey. RIF (Norway) agreed to let the Norwegian university contact all its members and ask them to answer the questionnaire about MPPs.

The 201 firms were contacted by email. Some of the email addresses had to be updated. A letter describing the purpose of the survey was included in the invitation to participate and the link to the survey from SurveyXact. The first email revealed that several firms were too small or did not engage in MPPs, thus reducing the population of the study. Some firms answered quickly, and some declined to participate in the survey, mainly because of lack of time and unwillingness to participate in surveys.

Two reminders were sent. First, firms who had not replied received a reminder. This was sent to non-respondents as well as to respondents that had not answered the whole questionnaire after a certain amount of time. Second, all firms that had not answered the whole questionnaire were contacted one last time by telephone or were sent a final reminder. The latter included firms that were contacted in a more extended form, namely those that explicitly had promised to answer the questionnaire but had failed to do so. The efforts led to an increase in the number

of respondents. In sum, the study population (all members of RIF in Norway) was 201 firms, of which 48 answered the questionnaire (i.e. 24%).

In addition to the understanding of the core concepts generated by the literature review (step 1 in Figure 3-2), the questions in the questionnaire were formulated directly based on questions from similar previous studies in order to draw on existing knowledge (see Appendix A-2 for the development of the questionnaire).

Data analysis

A series of statistical analyses (a correlation analysis and regression analyses) were performed using the program Statistical Product and Service Solutions (SPSS), which is widely used by researchers to analyse quantitative data (Bryman, 2016). Methods of data analysis in the common survey were cross-tabulation, regression analyses, and analyses of variance, as the main interest was in testing whether different groups of firms or MPPs exhibited differences in characteristics, mindsets, behaviour, and results.

Correlation and regression analyses were carried out with three dependent variables and eight items indicating the five groups of partnering success factors. It was hypothesized that all independent variables were positively associated with each of the three dependent variables (see Appendix A-1 for more precise formulations of the independent and dependent variables): trust (trust know and trust interest), good communication, support, resources, and collaboration, as well as clear and accepted goals positively associated with meeting time schedule, budget, and technical specifications. To test these hypotheses, bivariate correlations between independent and dependent variables were first considered. Somewhat surprisingly, only slightly more than half of those simple correlations showed significant associations.

Bivariate correlations do not take multiple correlation into consideration. Therefore, three multiple regression analyses were performed to uncover the most influential independent variables when taking multicollinearity into consideration. A stepwise regression first picks up the independent variable with the highest association with the dependent variable. Subsequently, it picks up the second-best independent variable, given that the first variable is already included. The procedure stops when no further independent variables are significantly associated with the dependent variable.

3.8.3 Semi-structured interviews and survey (Paper 3)

For the case investigated, interviewees who had extensive knowledge about project alliances in combination with experience from more traditional projects were of interest. Personnel with these characteristics were found through the contact person in the oil company. In total, 14 experienced personnel confirmed that they were willing to participate in the study, but one had

to cancel later due to illness. Empirical data were collected by carrying out semi-structured interviews with 13 professionals within the Norwegian oil and gas industry. The strategy is known as the snowball method (Johannessen et al., 2011), and it proved an effective way of gathering the most appropriate people for the interview process. The respondents held varying management positions within the project alliance, and 2 were women (15%). An overview of the 13 respondents and their respective holding companies is provided in Table 3-7.

Table 3-7: List of interviewees – Paper 3

Interviewee	Organization	Alliance	Interview duration
TP*1	The technology provider	Project alliance	55 min.
OC 1**	The oil company	Project alliance	65 min.
OC 2	The oil company	Project alliance	50 min.
OC 3	The oil company	Project alliance	43 min.
OC 4	The oil company	Project alliance	55 min.
OC 5	The oil company	Project alliance	60 min.
O-SS 1	The oil service supplier	Project alliance	67 min.
O-SS 2	The oil service supplier	Project alliance	50 min.
O-SS 3	The oil service supplier	Project alliance	45 min.
EPCS 1	The EPC supplier	Project alliance	45 min.
EPCS 2	The EPC supplier	Project alliance	45 min.
EPCS 3	The EPC supplier	Project alliance	50 min.
EPCS 4	The EPC supplier	Project alliance	55 min.

*technology provider; **oil company

Extensive and detailed notes were taken during the interviews instead of using an audio recording device. The researchers' role in the interviews was consistent throughout the process, to ensure predictability in the collection of data. One of the authors was always responsible for conducting the interview, while other co-authors noted the main thoughts shared by the respondents.

With regard to the survey, the interviewees were asked to rate their experience of the performance of the project alliance and any relatable traditional projects for several variables. A scale of 1–10 was used in the survey.

Data analysis

To interpret and analyse the collected data, the data had to be processed into easily accessible codes and themes. The approach was based on the work by Creswell (2009) and his model of data analysis. The process used in the data analysis is explained in detail as follows.

The first step consisted of writing summaries of 11 hours and 19 minutes' worth of notes. As the native language of the interviewees was Norwegian, it seemed natural to conduct the interviews in the same language. The notes were written the same language to keep the data consistent with the respondents' wording. The transcriptions were made immediately after each interview, to minimize the risk of misunderstandings and misinterpretations. The second step consisted of reading the summaries. Various themes that might be of interest when discussing the research question were highlighted. The markings turned out to be very helpful when categorizing the data. In the third step, the main goal was to create codes to help categorize the data found in the summaries. MaxQDA – computer-assisted software used for qualitative data analysis – was used to manage, organize, and code the material. The fourth and final step in Creswell's model (Creswell, 2009) covers how coded data are interpreted. In this phase, the aim was to combine the knowledge of relevant literature with the interpretations derived from the empirical data. The comparison between recognized literature and newly collected data made it possible to establish whether the findings confirmed or diverged from earlier findings, as well as how the two different project types influenced project performance. This in turn prompted an in-depth study of subjects when considered necessary (Creswell, 2009).

The results from the case projects represent the experiences of practitioners and are thus limited by their memories. The interviewees provided answers to the best of their knowledge. The research process used for Papers 1–3 is summarized in Figure 3-6.

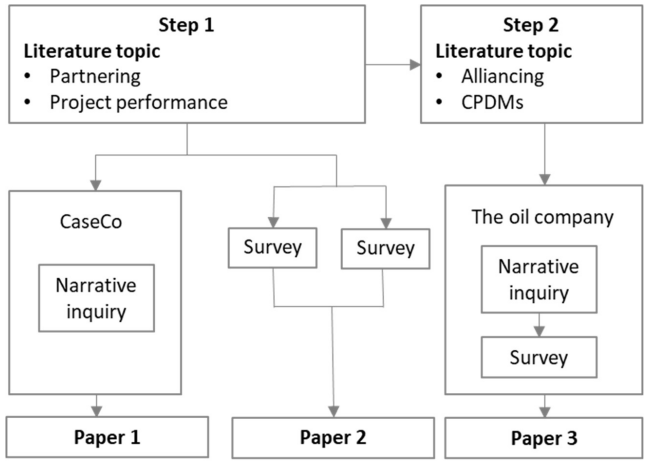

Figure 3-6: Summary of the research process for Papers 1–3 in the dissertation

3.9 Quality of research method and limitations

This section contains reflections and describes the limitations of the methods used in the research for this dissertation. In general, the quality of any research is assessed in terms of validity and reliability (Saunders et al., 2019). With regard to validity, the literature often distinguishes between internal and external validity (Saunders et al., 2019). External validity relates to a study's generalizability (Yin, 2014).

Reliability, the consistency, and repeatability of research procedures used in case studies (Yin, 2014) pertains to whether the information based on collected data would be reliable if the same findings were obtained in a replication study. Ensuring reliability is not necessarily easy. *Participant error*, *participant bias*, *researcher error*, and *researcher bias* are described as threats to reliability (Saunders et al., 2019, p. 214). A number of threats to reliability are listed in In Table 3-8.

Table 3-8: Threats to reliability (modified from Saunders et al., 2019, p. 214)

Threat	Definition and explanation
Participant error	'Any factor which adversely alters the way in which a participant performs. For example, asking a participate to complete a questionnaire just before a lunch break may affect the way they respond compared to choosing a less sensitive time.'
Participant bias	'Any factor which induces a false response. For example, conducting an interview in an open space may lead participants to provide falsely positive answers where they fear they are being overheard, rather than retaining their anonymity.'
Researcher error	'Any factor which alters the researcher's interpretation. For example, a researcher may be tired or not sufficiently prepared and misunderstand some of the more subtle meanings of his or her interviewees.'
Researcher bias	'Any factor which induces bias in the researcher's recording of responses. For example, a researcher may allow her or his own subjective view or disposition to get in the way of fairly and accurately recording and interpreting participants' responses.'

The quality of research depends also on its validity. Validity, which concerns the appropriateness of the measure used, depends on asking questions that will measure what we want to measure (Figure 3-7).

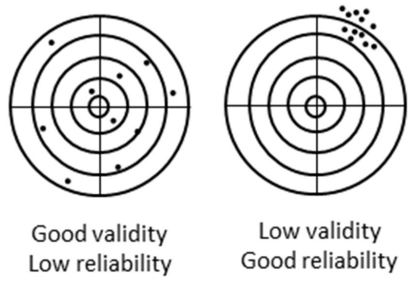

Figure 3-7: Validity and reliability (modified from Samset, 2008, p. 176)

The literature often distinguishes between internal and external validity (Saunders et al., 2019). External validity relates to a study's generalizability and says something about whether study findings are applicable outside the given context (Yin, 2014). Internal validity refers to whether a study's findings relate to interventions rather than to flaws in the research design (Saunders et al., 2019).

Several approaches were used for data collection during the research for this dissertation. With regard to Paper 1 and Paper 3, interviewees had extensive knowledge of the investigated topics (project partnering and project alliancing). For the study presented in Paper 3, interviewees had extensive knowledge about project alliances combined with experience from traditional procurement forms. To ensure the best possible reliability and validity of the study presented in Paper 2, the person within the engineering consultancy who was most knowledgeable about the MPP was asked to complete the questionnaire. In the following discussion (Sections 3.9.1–3.9.3), both the reliability and the validity of the research for this dissertation are considered further.

3.9.1 Validity, reliability, and limitations – Paper 1

The general context of the study presented in Paper 1 is a project-based organization in the construction industry. Within this context, project partnering assumes strong relevance as an attempt to improve project performance. For the study presented in Paper 1, there was special focus on how to succeed with project partnering. The research was aimed at clarifying the holistic view (in CaseCo) of succeeding with partnering in the complete organization and value chain, not merely in a single project. The empirical data originated from the client side; hence, the findings were limited to the client perspective. There might have been some benefits if the empirical data had included several perspectives beyond those of the client, as project partnering necessarily includes partners.

Even though the study was specific in terms of its context, the findings from the interviews should prove insightful for researchers and practitioners interested in CPDMs, and therefore may be relevant to project-based organizations outside the construction industry, and relevant to partnering projects outside Norway. The developed model can be adapted for project-based organizations such as CaseCo, to enable them to mature and achieve successful project partnering. It would have been beneficial for the research if the model could have been empirically tested in other companies and industries, as well as from an outside-in perspective. The developed model in the study needs to be tested in future studies and real projects in different contexts before it can be considered as generally accepted.

A commonly used approach to evaluate the generalizability of research is present the results to expert groups (Bryman, 2016). To address the external validity of the research, findings were presented in five separate forums, in which recognition of the findings was confirmed.

As shown in the overview of the research carried out during the period in which the doctoral research was conducted (Figure 3-1), the interviews for Paper 1 were held within the first 12 months of that period. Conducting the interviews at that early stage was beneficial, as I learned things from the interviews that opened my mind. The 54 interviews were conducted over a period of four months and followed the same two broad questions: (1) What specific partnering challenges does one face in CaseCo? and (2) What factors do you consider important to succeed with project partnering?

In each interview, the participant was asked to say something about the organization in which she/he was employed, what she/he was working on, and how long she/he had been employed by the organization. Each interviewee was encouraged to speak freely in response to the questions. If something was unclear, I asked control questions to confirm my understanding of each interviewee's meaning. In connection with each interview, a summary was written, which the interviewees were then asked to read to ensure consistency. With regard to reliability and researcher bias (Saunders et al., 2019), interviews can be a weakness in that they are carried out by a scholar. However, this risk was reduced by providing the interviewees with summaries and asking them to comment on those summaries. In order to reduce the risk of participant bias (Saunders et al., 2019*)*, the interviewees were informed that the information was treated confidentially, and data were secured in only aggregate form.

With regard to validity and reliability issues, it should be emphasized that the literature review was based on electronic searches in the English language only. Publications in other languages might have been overlooked.

3.9.2 Validity, reliability, and limitations – Paper 2

According to Bryman (2008), generalization is usually concerned with the ability to generalize research results beyond the constraints of the particular context under which the research has been conducted. When considering the generalizability of the findings form my doctoral research, a potential limitation regarding generalization issues should be noted. The sample consists of Norwegian and Danish project team members. The two countries were treated as one sample, which might have been a limitation. However, both countries are very similar in many respects and have certain unique characteristics that influence collaborations in teams. For instance, it has been said that Norwegian and Danish people have very open and honest communication. Given the sample used in the study presented in Paper 2, it is uncertain whether the results presented in this dissertation could be generalized to other samples, including to those in other countries.

The size of a dataset is important in order to generalize findings from research, as the larger the dataset that is investigated, the more likely it is that the findings can be generalized to a larger population (Bryman, 2016; Saunders et al., 2019). Despite the data being treated as one sample in my research, it could be argued that the findings could be generalized to other settings, at least to a certain degree.

There was special focus on how five partnering success factors influenced project performance. However, other partnering success factors that may influence project performance in MPPs might not have been included in the study. These aspects could be considered weaknesses (or limitations) but could be easily optimized in future research. Moreover, additional research is needed to determine whether the identified relationships are significant over time. It may be a weakness of the study that it was performed at a given point in time (cross-sectional) and did not follow the projects over time (longitudinal). Nevertheless, the results of the study presented in Paper 2 can provide a picture of the relationship between success factors and project performance.

The questions used in the dataset were not designed to address the RQ specifically. Instead, the questions in the questionnaire were reviewed (Aagaard et al., 2012) and relevant questions related to the RQ were identified. Thereafter, the questions were linked to the partnering success factors (Section 2.2.1). One must be careful to avoid biases and ensure that the data one uses is relevant to the specific questions. To compensate for this, the development of the questionnaire was preformed, and the development revealed how the partnering success factors were linked to the questions (for a detailed description of the development of the questionnaire see Appendix A-2).

As described in Section 2.3 (Project performance), some researchers perceive the 'iron triangle' concept as a poor definition of project success. However, as previously explained (Section 1.3), it was chosen to focus on time schedule, budget, and technical specifications because it was assumed that most project managers would be able to relate these criteria when responding to the survey. This might have been a bias or a limitation, and could easily be solved by including other elements in future studies.

Furthermore, it is known that being measured affects the behaviour of the subject in question (Spitzer, 2007), and therefore it can be argued that there is a risk of participant bias (Saunders et al., 2019). Many of the respondents in the case studies were to some extent responsible or accountable for the project performance and that might have influenced how they answered certain questions.

3.9.3 Validity, reliability, and limitations – Paper 3

The general context of the study presented in Paper 3 was a reasonably new alliance, with realistically just one project behind it. Thus, the data collected were heavily influenced by that project and did not allow for the formulation of a universal alliance theory. Future research should take the concepts developed in the study and apply them in research with a broader scope. It is also important to note that the study focused on managerial positions within the project alliance. Other members might have had other experiences, and this aspect should be given further consideration in future studies. Thus, a study involving members from all levels of the project alliance would be preferable.

A total of 13 interviews were conducted for the study presented in Paper 3. Several interviews were originally planned, but due to the COVID-19 pandemic, the collaboration with the oil company had to end. To improve the external validity of the interviews, it would have been beneficial if the total number of interviews had been larger. Given the sample size, it is uncertain whether the results presented in this dissertation could be generalized to other samples, including in other countries. However, the respondents held varying management positions within the project alliance. The actors involved in the alliance were three Norwegian companies and one international company. The four companies were specialized in their fields and represented both the client (customer) and contractor (supplier) in the project alliance. Therefore, it is fair to claim that the results presented in this dissertation would be relevant to other samples too, including in other countries.

With regard to reliability and researcher bias (Saunders et al., 2019), the researcher's role in the interviews was consistent throughout the process, to ensure predictability in the collected data and to reduce the risk of researcher bias. As the collected data were qualitative, their

interpretation was dependent on both the context and the understanding of the researchers conducting the interview. One of the researchers was always responsible for conducting the interview, while the other researchers took notes on the main thoughts shared by the interviewees. The risk of some influences was removed by having all researchers write their notes before collecting and summarizing all data in one document.

All interviewees were briefed before the interviews, during which the aim of the study was explained, and the interviewees were informed about their rights as informants. Each interviewee was encouraged to speak freely about the questions. If something was unclear, the interviewer asked control questions. To ensure informed consent, a summary was sent out after the interview for correction and confirmation, along with a summary of the researchers' strategy for handling sensitive data. This process ensured that the notes were representative of what the interviewees wanted to share, and they reduced the risk of any researcher bias. In order to reduce the risk of participant bias (Saunders et al., 2019) the interviewees were informed both pre-interview and post-interview that all information they shared would be handled confidentially and that nothing could be traced back to them personally.

When interviewing informants, some topics may present themselves as uncomfortable for those informants. However, it was important to not just focus on comfortable topics, but also to investigate possible downsides in the project alliance. Furthermore, it is known that being measured affects the behaviour of the subject in question (Spitzer, 2007), and therefore it could argue that there might have been some risk of participant bias, since the interviewees themselves had incentives to ensure that the project alliance performed well.

A mixed-methods research design following a sequential exploratory approach (Saunders et al., 2019) was used in the study presented in Paper 3. The same interviewees who answered the quantitative survey questionnaire were interviewed in the qualitative interviews. The extra dimension provided by the quantitative results served as the means for measurement and comparability.

3.9.4 Ethical aspects of the research

Study participants who are interviewed must be treated fairly (Bryman, 2016). The ethical aspects related to the research in this dissertation mainly related to the participants' privacy rights. One of the ethical challenges during the research for this dissertation was how to store the collected data. Formal consent for data collection and storage was obtained from the Norwegian Centre for Research Data (NSD). The research was conducted in accordance with the national standard guidelines for research ethics and the specific ethical guidelines for science and technology (National Committee for Research Ethics in Science and Technology, 2016). This

applied to all respondents in the two case studies investigated in this dissertation. The participants' identity and the name of their employer were anonymized to protect the privacy of the participants. In cases when respondents named specific clients or partners, or shared confidential information, the information was anonymized in direct quotation in Papers 1–3.

4 Findings Presented in Papers 1–3

The following Sections (4.1–4.3) describe the findings and discussions presented in Papers 1–3. The main findings from each paper are listed in Table 4-1.

Table 4-1: Main findings presented in Papers 1–3

Paper	Main finding
Paper 1	A project-based organization such as CaseCo must focus and work on all three main dimensions: *Who* related to participant selection; *What* related to task clarification; and *Way* related to partnering means.
Paper 2	Mutual project objectives and commitment are important for meeting time schedule, budget, and technical specifications. Trust and collaborative problem-solving are important for meeting time schedule and technical specifications. Communication is important for meeting technical specifications. The five partnering success factors are important for project performance.
Paper 3	A project alliance, as an example of a CPDM, contributes to better project performance by promoting a better working relationship between the partners compared with in traditional projects. This is achieved through closer cooperation, shorter decision path, transparent partners, and an overall culture tailored around collaboration.

For Paper 1, the aim was to investigate how to succeed with project partnering in a project-based organization. For Paper 2, the aim was to investigate how partnering success factors influence projects' performance in terms of being on time, within budget, and to technical specifications. For Paper 3, the aim was to investigate how a project alliance, as an example of a CPDM, influences project performance compared with in traditional project practice.

4.1 Findings and discussions in Paper 1

The purpose of Paper 1 was to present new findings to organizations that acknowledge difficulties in implementing and succeeding with project partnering. The objective was to understand how to succeed with project partnering in a project-based organization. The findings are based on a case study in which empirical data were collected from semi-structured interviews held with 54 experienced persons, who represented the entire value chain in CaseCo (a leading expert in infrastructure construction).

4.1.1 Three main dimensions and four subdimensions

Three main dimensions vital for project partnering success were identified. Each of these main dimensions is described further in detail in the following Sections.

Who – participant selection

The 'participant selection' dimension was emphasized by 44 of the 54 interviewees (81%) and was the second most frequently mentioned main dimension for successful partnering. In summary, the 'participant selection' dimension included the following:

(1) Involvement of:
    - internal departments: planning, design, external affairs, finance, and maintenance
    - external stakeholders: the Ministry of Transport and Communications, counties, municipalities, consultative bodies, subcontractors, the National Rail Administration, emergency response units
(2) Know your key stakeholders.

What – task clarification

The 'task clarification' dimension was emphasized by 43 of the 54 interviewees (80%). In summary, the 'task clarification' dimension included the following:

- common understanding of the task
- expectation clarification
- roles and responsibilities clarification
- clear and distinct goals and objectives.

Way – partnering means

The main dimension *Way* related to partnering means was found to consist of the four subdimensions: 3a. partnering attitude; 3b. a collaborative culture; 3c. a holistic perspective; and 3d. an accurate handover.

In total, 46 of the 54 interviewees (85%) expressed that the subdimension 'partnering attitude' was most important dimension. In summary, the subdimension 'partnering attitude' included the following:

- show respect
- proactive relationship building
- prevent opportunistic behaviour
- build trust
- partnering consistent throughout the project
- be solution-oriented
- practise formal two-way communication between the parties

- participate wholeheartedly
- create cohesion
- openness between the parties.

In total, 35 of the 54 interviewees (67%) denoted the subdimension 'a collaborative culture' as vital to successful partnering. In summary, the subdimension 'a collaborative culture' included the following:

- collaborate, not only coordinate
- use time and resources for partnering
- early involvement
- use collaboration tools and partnering models
- having acquired partnering competence – why and how
- acknowledge interdependence
- management, both by client and contractor, support of partnering.

The subdimension 'a holistic perspective' was expressed by 23 of the 54 interviewees (57%). In summary, the subdimension 'a holistic perspective' included the following:

- have an understanding of each other's subject areas/look beyond their own disciplines
- unified client
- understand the totality
- have people with partnering skills in all parts of the value chain in the organization.

Finally, 'an accurate handover' as a subdimension, was highlighted by 20 of the 54 interviewees (37%). In summary, the subdimension included the following:

- talk to people who have been involved earlier in value chain
- Secure ownership of the project
- maintain accurate and important information between phases in value chain
- use procedures and convey important and correct information.

Thus, the contribution of Paper 1 is the identification of the three main dimensions (Who, What, Way) as essential to success in project partnering.

The three main dimensions (Who, What, Way) can be linked to the following definition given by Børve et al. (2017, p. 694):

> Project Partnering is a relationship strategy whereby a project owner integrates contractors and other major contributors into the project. Through commitment to mutual project objectives, collaborative problem solving and a joint governance structure, partners pursue collaborative relationships, trust, and improved performance.

The dimensions relate respectively to the mentions of 'relationship strategy', 'collaborative problem solving', and 'collaborative relationship'. If CaseCo creates a relationship strategy and a partnering strategy that includes all three main dimensions from the interview findings, they will be more likely to succeed with project partnering.

4.2 Findings and discussions in Paper 2

The purpose of Paper 2 was to explore the relationship between project-based collaboration and project performance, and to determine which partnering success factors influence whether the multi-partner project (MPP) satisfies project performance in its most classic and measurable sense of being on time, within budget, and to technical specifications (i.e. within the 'iron triangle'). As stated in Section 3.6.2, in line with the definition of multi-partner alliances provided by Lavie et al. (2007), as well as the definition provided by Aagaard et al. (2012), I define a multi-partner project as *a project in which employees from two or more independent firms work together to attract, plan, and execute a common time-bounded and resource-constrained task of a certain complexity for a client in order to create value for the firms and client involved*. The findings presented in Paper 2 are based on an analysis of two nationwide surveys within the engineering consultancy industry in Denmark and Norway, which generated empirical data from 124 engineering consultancies.

4.2.1 How partnering success factors influence project performance

The findings presented in Paper 2 show that *trust*, *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives* are important for project performance, and that project managers must constantly ensure that those factors for success are present throughout the project. The performance outcome points to several benefits that can be obtained by working on the five partnering success factors, which should benefit both researchers and practitioners. This is explicitly explained in Table 4-2.

Table 4-2: Practical implications – how partnering success factors influence project performance (Paper 2)

Factor	Important for meeting	Explanation
Mutual project objectives and commitment	Time schedule, budget and technical specifications	To meet all three criteria, the project managers must know who their key stakeholders are and involve the appropriate internal parties (top management included) and external parties in an early phase. Furthermore, the project must ensure that goals for different project elements are accepted by all partners.
Trust and collaborative problem-solving	Time schedule and technical specifications	To meet the two criteria, the parties must keep each other mutually informed, based on respect and understanding, and have mechanisms in place for resolving disputes.
Communication	Technical specifications	To meet the criterion, the project managers must ensure that there is extensive communication between the participating partners, and the parties must have a mutual desire to collaborate, communicate, and build good relationships.

4.2.2 Correlation and regression analyses

Correlation and regression analyses were performed with three dependent variables (time, budget, and technical specifications) and eight items indicating the five groups of partnering success factors that were identified through a literature review (see Table 2-4).

It was hypothesized that all independent variables were positively associated with each of the three dependent variables (see Appendix A-1 for more precise formulations of independent and dependent variables). To test the hypothesis, bivariate correlations between independent and dependent variables were assessed. Somewhat surprisingly, only slightly more than half of these simple correlations show significant associations.

It appeared to be very important across all three dependent variables that goals for different project elements are accepted by all participating partners (*mutual project objectives*), and that all persons involved in the project actively support the project (*commitment*) (Table 4-3). These two indicators were significantly correlated with all three dependent variables. *Trust* seemed to be very important for meeting time schedule and technical specifications (both indicator items were significantly correlated).

Table 4-3: Results of the correlation analysis (Paper 2)

	MPP meets time schedule	MPP meets budget	MPP meets technical specifications
Trust know – *trust*	.225*	.141	.314**
Trust interest – *trust*	.206*	.124	.282**
Communication – *communication*	.069	-.146	.234*
Support – *commitment*	.297**	.230*	.367**
Resources – *commitment*	.204*	.094	.160
Overcome barriers – *collaborative problem-solving*	.219*	-.024	.232*
Goals clear – *mutual project objectives*	.008	-.077	-.006
Goals accepted – *mutual project objectives*	.286**	.421***	.347**

*significant at .05 level; **significant at .01 level; ***significant at .001 level; NS – not significant

One of the unexpected findings from the study was that *trust* was less important for meeting budgets. This can be interpreted from the fact that correlations between the two trust variables and the dependent variable 'MPP meets budget' was non-significant (Table 4-3). The latter result reflects that other variable are more influential for meeting budgets. Surprisingly, *communication* and collaboration to overcome barriers (*collaborative problem-solving*) had a negative (though not significant) correlation with the ability to meet budgets (Table 4-3). One explanation may be that such communication and collaboration will be most prevalent in projects that are difficult and perhaps already suffering from too high costs. Another explanation could be that collaborative problem-solving takes time, and time cost money.

With regard to *commitment* (Table 4-3), the results indicate that the allocation of resources (people and money) to the collaboration is only significantly associated with meeting the time schedule, whereas such commitments apparently do not meet budgets and technical specifications (correlations non-significant). In line with the arguments above, such resource allocations are perhaps confined to projects that are more complex and thus require further resources. By contrast, *commitment* in terms of actively supporting the project was positively and significantly associated with all three dependent variables (Table 4-3). Thus, as indicated in Table 4-3, *commitment* in terms of people's engagement seems to have more value than just pure allocation of resources. The results also strongly suggest that it is extremely important that goals are accepted (*mutual project objectives*) by all partners, and that this is far more important

than goals being clear (*mutual project objectives*). This may be due to the fact that MPP goals will be adapted along the way to some extent and that it is therefore very important that partners are involved in goal-setting processes so that they all accept the goals of the MPP, even if the goals change.

Bivariate correlations do not take multiple correlation into consideration. Therefore, three multiple regression analyses were performed to uncover the most influential independent variables when taking multicollinearity into consideration. The results of the analyses, using stepwise regression are presented in Table 4-4 (see Section 3.8.2 for further explanation).

Table 4-4: Results of stepwise multiple regression analyses (Paper 2)

	MPP meets time schedule	**MPP meets budget**	**MPP meets technical specifications**
Constant	1.264***	.83**	1.926***
Trust know – *trust*			.264**
Trust interest – *trust*			
Communication – *communication*		-.419**	
Support – *commitment*	.319**	.295**	
Resources – *commitment*			
Overcome barriers – *collaborative problem-solving*		-.362**	
Goals clear – *mutual project objectives*			
Goals accepted – *mutual project objectives*	.346**	.748**	.283**
R Square	.138	.327	.167
Adjusted R Square	.120	.297	.150
F-value	7.672***	10.589***	9.797***

*significant at .05 level; **significant at .01 level; ***significant at .001 level; NS – not significant

Table 4-4 lists the variables that remained significant in the analysis. Many significant bivariate correlations in Table 4-3 no longer seem insignificant, and they are not included in Table 4-4. The regression analyses (Table 4-4) showed that across all three dependent variables it remained very important that goals for different project elements should be accepted by all participating partners (*mutual project objectives*). In addition, in order to meet the time schedule of the project it remains important that all persons involved in the project actively support the project (*commitment*). However, to meet technical specifications, it appears to be important that the knowledge transferred to the project will not be misused by partners should they collaborate with competitors in the future *(trust*).

The regression analyses revealed higher complexity with regard to meeting budgets. 'Support' (*commitment*) and 'goals accepted' *(mutual project objectives)* were significantly positively associated with meeting budgets. However, the stepwise regression analyses revealed that the factors *communication* and *collaborative problem-solving* (collaboration to overcome barriers) had a significant and negative impact on the performance measure. Since the study was cross-sectional, the causal direction could have gone either way. Hence, this result was interpreted as indicating that when projects experience problems with meeting budgets, the partners will increase their efforts to communicate and collaborate with each other.

According to the findings listed in Table 4-2, *mutual project objectives* and *commitment* are important for meeting time schedule, budget, and technical specifications. In the literature, *mutual project objectives* are described with little variation in the wording; examples are 'mutual,' 'joint,' 'common or shared objectives', and 'common or shared goals.' The term 'objectives,' which are measurable, is used more frequently than the less tangible term 'goals'. The term 'measurable objectives' fits well with the terms 'continuous evaluation' and 'annual review of performance' emphasized by Bennett and Baird (2001). Bresnen (2007) emphasizes 'benchmarks', and the concept of partnering evaluation has been developed into 'performance measurement' by Meng (2012). That top management must be involved, is supported by the term 'top management support' (Larson, 1997; Cheng & Li, 2001; Suprapto et al., 2015b) as a kind of internal or external commitment, and top management must allocate time and resources to partnering activities. Cheung et al. (2003) support the use of the terms 'long-term commitment' and 'resource commitment'.

As shown in Table 4-2, *trust* and *collaborative problem-solving* were important for meeting time schedule and technical specifications. Several researchers support the use of the term *trust.* For example, trust is described as a prerequisite (Construction Industry Institute, 1991; Kaluarachchi & Jones, 2007; Aarseth, 2012), as a measure (Chan et al., 2004; Meng, 2012; Mesa et al., 2016), as an objective (Cheung et al., 2003; Construction Excellence, 2009). It also described as an outcome (Eriksson, 2010), and Kaluarachchi and Jones (2007) claim that trust between 'all stakeholders' is a requirement.

Finally, as shown in Table 4-3, *communication* was particularly important for meeting technical specifications. Factors pertaining to *communication* vary in the literature from just 'communication' (Cheung et al., 2003; Doloi, 2009 Meng, 2012) to 'effective communication' (Black et al., 2000) and 'open and honest communication' (Suprapto et al., 2015a).

4.3 Findings and discussions in Paper 3

The purpose of Paper 3 was to explore how the two different project types, a traditional project compared with a more collaborative one influence project performance. The findings were based on a case study of project alliance in which empirical data were collected from semi-structured interviews held with 13 professionals within the Norwegian oil and gas industry.

4.3.1 How a project alliance influences project performance compared with traditional project practice

Based on the case study, different areas were identified as critical to the project alliance's performance. Some of the most significant contributions are shown in Table 4-5.

Table 4-5: The project alliance, as an example of a CPDM, compared with traditional project practice (Paper 3)

The project alliance	Traditional projects
Low conflict level	***High conflict level***
(+)* Conflict of less several degree	(-)** Escalating conflict
Low degree of formal correspondence	***High degree of formal correspondence***
(+) Close to no formal letters sent	(-) Use formal letters to ensure legal rights and traceability
Quicker decision-making	***Long decision-making***
(+) Encourages discussion of disagreements that result in earlier decision-making	(-) Long discussion regarding responsibilities, extra work, and cost
Consensus oriented – flat structuring	***Less solidary/consensus-oriented***
(-) Lack of joint perspective on where the alliance is headed	(+) A distinct customer to lead the process
(+) A unique alliance culture	–
(+) Trust	–
(+) Incentives to open up and share information	–
(+) Prevent hidden agendas	–
Early involvement of parties – breakdown of 'silos'	***Late involvement of parties – 'silos'***
(+) The entire value chain works together	(-) Lack of collaboration across parties' responsibilities in value chain
(+) Understands the project as a whole	–
(+) Increased responsibility for the lifetime of the project	–
Co-location	–
(+) Closing the physical and organizational distance between companies and fields	–
(+) Parties share experiences with each other and between phases	–
(+) Enables a steady flow of communication between parties	–
(+) Strengthens the collaborative bonds between employees	–

(-) Lack of co-location	–
Risk share/reward	***Risk transfer***
Prevent double roles	***Mirrored roles***
(+) Delegated resources	(-) Ensuring control over other companies
More productive	***Less productive***
(+) Early information flow	(-) Lack of accurate and important information between phases in value chain
(-) Lack of innovative solutions	–
(+) Copying former solutions	–
(+) Innovative with products, documentation, lifetime, and procedures	–
A single IT system	–
(-) Lack of common IT system	–

*The + symbol indicates experienced persons who saw a favourable direction; ** The - symbol indicates experienced persons who saw an unfavourable direction

4.3.2 Findings from the interviews and discussions, and from the survey

Findings from interviews and discussions

Conflict level

Some interviewees explained that the project alliance had established platforms for exploring different solutions and opinions. The flat structuring of the project alliance, with teams consisting of people from the different companies, enabled earlier decision-making and better information flow. There were still conflicts in the project alliance, but they were resolved earlier and quicker compared with in traditional projects. One of the main topics brought up by the interviewees was the breakdown of 'silos' (departments that did not cooperate) in the project organization. There were still conflicts in the project alliance, but they were resolved earlier and quicker compared with in traditional projects. Some interviewees mentioned the lack of formal correspondence in the project alliance. In traditional projects, the partners send a lot of formal letters to each other to ensure legal rights and traceability. This was described by the interviewees as a tedious and time-consuming process with a negative impact on the operational performance. However, in the studied project alliance, almost no formal letters were sent. The low degree of formal correspondence shows how the project alliance opened up the collaboration.

With the compensation model focusing on the project as a whole, companies can openly discuss and collaborate. This process also reduces the pursuit of hidden agendas aimed at ensuring personal gain. The foundation of the alliance agreement is based on everyone working in the same team (Tadayon, 2018). In the agreement, a key factor is the development of a no-blame

culture (Tadayon, 2018; Young et al., 2018). A no-blame culture refers to the degree to which the parties take responsibility for problems as they arise, rather than avoiding them (Walker & Lloyd-Walker, 2015).

Trust, culture, and coinciding incentives

As stated by the interviewees, it was clear that trust, along with alliance culture was one of the major foci in the project alliance. Given the contractual model of the project alliance, the companies had incentives to open and share information, as they all shared potential upsides and downsides of the project. None of the interviewees believed there were any hidden agendas in the project alliance. This culture was based upon the contractual framework governing the project alliance. When creating the project alliance, culture was identified as a critical factor for success, thus making the project alliance in itself a contributor to creating shared incentives.

When establishing a project organization with a high degree of trust given to its suppliers, some degree of governance and direction may be lost. This shows how the very foundation of the alliance model – trust and culture – also causes some downsides. The interviewees noted that a vital role for the customer is to supervise and govern the process. Therefore, it is important that the involved companies understand what it means to work within the alliance model. In this respect, the education of the members working in the project alliance is vital. The overall impression of the empirical data points to trust and alliance culture as absolutely vital to the performance of an alliance. Cultural differences can easily occur when several companies work together (Biggs, 2004). In the studied case, alliance culture was a primary focus in the project alliance. In this regard, the oil company had been very successful when designing its alliance model, as there existed a unique culture in the project alliance. In the literature, single alliance culture is identified as a key factor of an alliance (Biggs, 2004; Tadayon, 2018; Young et al., 2018); all partners within a project alliance, regardless of their employer, are part of the same team (Tadayon, 2018).

Co-location

The co-location is, in many ways, the enabler for the other presented factors. On the basis of the interviews, it was clear that co-location was one of the most important factors in determining the project alliance's success. Conflict, trust, transparency, and coinciding incentives all rely on good communication and easy access to other members of the alliance organization. Thus, co-location must be viewed as a factor contributing to the performance of an alliance. Co-location can shorten the path to information and enable earlier decision-making and less work in 'silos'. One of the reasons why it was so crucial to the performance of the project alliance was that it contributed to closing the physical and organizational distance between the different fields in

the project. Co-location is identified as a key factor of an alliance in the literature (Jefferies et al., 2014; Tadayon, 2018; Young et al., 2018), and as a mechanism for realizing the full effects of an integrated project team (Tadayon, 2018).

Productivity versus innovation

The main goals of the project alliance were to create an organization that allowed for increased productivity compared with in traditional projects. The empirical data indicated that the project alliance was more productive than traditional projects. In the study, reference to innovation more often than not concerned new products or solutions. The empirical data seemed to suggest that a major contribution to the productivity of the project alliance's output was the lack of innovation. Furthermore, the data showed that productivity was closely linked to the standardization and copy effects. Another distinct advantage of the project alliance is the collaboration form itself (as presented in Section 3.6.3). Some of the interviewees pointed to the short decision paths and good workflow as major contributions to the project alliance's performance. The direct cost of correspondence and the indirect cost of waiting for information add up to a high and often neglected cost. Some interviewees pointed to the dynamic contractual model as a strength for productivity, since it removed some of the uncertainty experienced in traditional projects.

Interfaces between the companies

When asked to identify the biggest downsides of the project alliance, the interviewees pointed to interfaces as the most underachieving area in the project alliance. Most notably, IT systems had given rise to some issues in the alliance work. Problems with IT systems and the day-to-day communication tools, such as Skype for Business and Microsoft Outlook, had set back the productivity of the alliance. However, the largest problems arose with regard to communication. The IT system had proven difficult, as firewalls and different policies had made it difficult for company members to communicate. Additionally, some issues related to the handover of work between the different companies were noted by the interviewees. Communication and interaction between companies can function both as an enabler and a barrier. Thus, ensuring functional interfaces in the alliance model is a key factor for the performance of an alliance. Although questioned by Tadayon (2018), a single IT system is identified in literature as being a key factor in an alliance (Jefferies et al., 2014). In order for alliancing to be successful, significant interaction and communication is required between the partners.

Findings from the survey

According to the variables shown in Table 4-6 and Figure 4-1, there are notable differences between the experienced performance in traditional projects and in the project alliance. When

asked to quantify the difference in experienced performance between the two forms of collaboration, the informants showed strong support for the alliance model, as shown in Table 4-6 and Figure 4-1. The geometrical means and standard deviation are presented in Table 4-6, and the means are graphically presented in Figure 4-1.

Table 4-6: Results of the quantitative survey (Paper 3)

Variable	Traditional project		Alliance	
	Mean	SD	Mean	SD
Conflict level	6.0	1.5	8.3	1.3
Collaboration	5.6	0.9	8.4	1.0
Trust	6.0	1.1	8.5	0.8
Transparency	5.1	1.9	8.7	1.1
Co-location	5.0	1.8	7.5	1.2
Competence Increase	5.3	1.3	7.9	1.0
Double working	5.4	2.2	6.9	2.6
Productivity	5.9	1.4	8.4	0.7
Innovation	5.0	1.8	7.1	2.0
IT systems	5.4	1.7	5.7	1.7

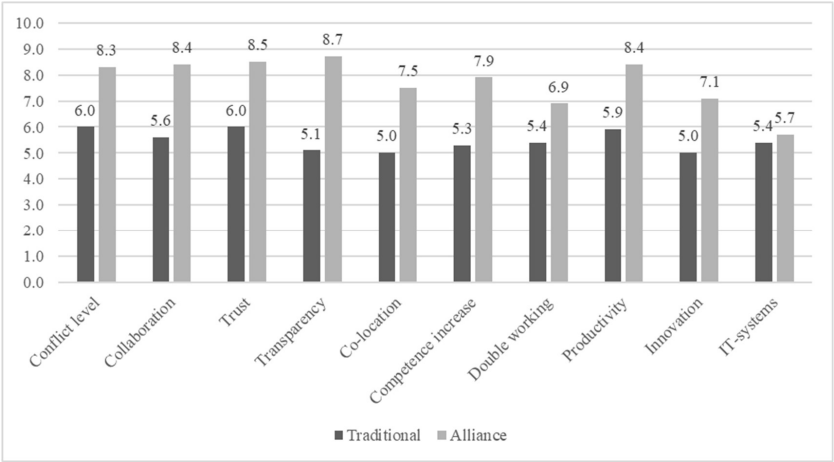

Figure 4-1: Graphic representation of project alliance versus any relatable traditional project (Paper 3)

On the basis of the data material, there is no doubt that the increased level of collaboration between involved actors is a major benefit to the performance of an alliance. According to the findings, this is achieved through closer cooperation, shorter decision paths, transparent partners, and an overall alliance culture tailored around collaboration. Furthermore, it was challenging to discover areas where the studied project alliance had not been performing as expected or had been performing worse than traditional projects.

5 Main Findings and Discussion

In this chapter, the findings related to each of the three research questions are presented and discussed. These are the main findings of the dissertation and provide a better understanding of how to succeed with the two CPDMs, of project partnering and project alliancing, by increasing the understanding of how factors in these CPDMs influence project performance to achieve better performing projects in the future. With reference to RQ1 (*What factors in extant literature describe partnering and alliancing?*), the factors describing partnering and alliancing were identified from existing literature. This in turn provided a foundation for further investigation, as they were seen as keys to finding solutions to challenge, first in relation to increasing the understanding of what factors describing the two CPDMs, and second in relation to understanding how factors in these CPDMs influence project performance. The research questions are answered in the following Sections (5.1–5.3).

5.1 Factors describing partnering and alliancing from extant literature

The aim in this dissertation was to gain a better understanding of partnering and alliancing, and to build a foundation for further investigation of how these CPDMs were practised in real-life settings by answering RQ1: *What factors in extant literature describe partnering and alliancing?*

To be able to answer the first research question and build a foundation for further investigation of how the CPDMs were practised in real-life settings, I drew on the results of previous research efforts. All three papers (Papers 1–3) contribute to answering the RQ1. Since the study presented in Paper 1 investigated how to succeed with project partnering, this section (Section 5.1) ends by presenting the factors that are important for successful project partnering, as identified from semi-structured interviews held with 54 professionals within the construction industry (case study 1, CaseCo). First, I present five groups of partnering success factors identified from the literature review (Step 1 in Figure 3-2). Thereafter, I present twelve factors describing an alliance, as identified from the literature review (Step 2 in Figure 3-2). Finally, the factors that are important for successful project partnering are presented.

As stated earlier in this dissertation (Section 2.2), each partnering project and alliancing project is formed by a set of hard and soft factors (Yeung et al., 2007; Fotopoulos & Psomas, 2009). There are many references in the literature to partnering. The research for this dissertation investigated the management and collaboration aspects of partnering. Groups of partnering success factors and references are listed in Table 2-4, and researchers have highlighted five key factors that contribute to a successful partnering project. The most important partnering success factor is *trust*, followed by *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives*, respectively (for details, see Section 2.2.1).

Furthermore, various authors have identified factors describing an alliance. Twelve examples of such factors are *collaborative problem solving*, *trust*, *co-location*, *pain/gain share*, *open book approach, commitment*, *single alliance culture*, *communication*, *workshops*, *a single IT system*, *no blame,* and *mutual goals and objectives* (see Table 2-6). Each of the twelve factors in project alliancing is explained in further detail in Section 2.2.2. A summary of the factors that researchers have found to describe partnering and alliancing is presented in Table 5-1.

Table 5-1: Examples of factors describing CPDMs

Factor	**Alliancing references**	**Partnering references**
Collaborative problem-solving	Biggs (2004), Jefferies et al. (2014), Young et al. (2016), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)	Sanders and Moore (1992), Bennett and Jayes (1995), Construction Industry Institute (1996), Cheng et al. (2000), DeVilbiss and Leonard (2000), Kumaraswamy and Matthews (2000), Cheung et al. (2003), Chan et al. (2004), Doloi (2009), Du et al. (2016), Raslim and Mustaffa (2017), Hosseini et al. (2018)
Trust	Biggs (2004), Lahdenperä (2012), Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Moradi and Kähkönen (2022)	Associated General Contractors of America (1991), Construction Industry Institute (1996), Cheng et al. (2000), DeVilbiss and Leonard (2000), Black et al. (2000), Kumaraswamy and Matthews (2000), Cheng and Li (2001), Cheung et al. (2003), P.S-P. Wong and Cheung (2004), P.S-P. Wong and Cheung (2005), Kaluarachchi and Jones (2007), Doloi (2009), Lau and Rowlinson (2009), Meng (2012), Suprapto et al. (2015a), Suprapto et al. (2016b), Du et al. (2016), Raslim and Mustaffa (2017), Hosseini et al. (2018), Moradi and Kähkönen (2022)
Co-location	Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)	–
Pain/gain share	Young et al. (2016), Tadayon (2018), Young et al. (2018)	–
Open-book approach	Jefferies et al. (2014), Young et al. (2016), Tadayon (2018)Young et al. (2018)	–

Commitment	Elmuti and Kathawala (2001), Biggs (2004), Lahdenperä (2012), Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Moradi and Kähkönen (2022)	Associated General Contractors of America (1991), Construction Industry Institute (1996), Larson (1997), Black et al. (2000), Cheng et al. (2000), Kumaraswamy and Matthews (2000), Cheung et al. (2003), Chan et al. (2004), Kaluarachchi and Jones (2007), Du et al. (2016), Smith and Thomasson (2016), Raslim and Mustaffa (2017)
Single alliance culture	Biggs (2004), Tadayon (2018), Young et al. (2018)	–
Communication	Elmuti and Kathawala (2001), Lahdenperä (2012), Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Moradi and Kähkönen (2022)	Associated General Contractors of America (1991), Sanders and Moore (1992), Bennett and Jayes (1995), Black et al. (2000), Cheng et al. (2000), Cheng and Li (2001), Cheung et al. (2003), Chan et al. (2004), P.S-P. Wong and Cheung (2004), P.S-P. Wong and Cheung (2005), Kaluarachchi and Jones (2007), Doloi (2009), Meng (2012), Suprapto et al. (2015b), Du et al. (2016), Smith and Thomasson (2016), Raslim and Mustaffa (2017), Moradi and Kähkönen (2022)
Workshops	Jefferies et al. (2014), Young et al. (2016), Raslim and Mustaffa (2017), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)	–
A single IT system	Jefferies et al. (2014), Young et al. (2016), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)	–
No blame	Young et al. (2018), Tadayon (2018)	–
Mutual goals and objectives	Lahdenperä (2012), Jefferies et al. (2014), Young et al. (2016), Tadayon (2018), Young et al. (2018), Moradi and Kähkönen (2022)	Associated General Contractors of America (1991), Sanders and Moore (1992), Bennett and Jayes (1995), Construction Industry Institute ((1996), Kumaraswamy and Matthews (2000), Cheung et al. (2003), Meng (2012), Suprapto et al. (2015a), Du et al. (2016), Smith and Thomasson (2016), Moradi and Kähkönen (2022)

Table 5-1 shows that the factors *trust*, *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives* are general prerequisites in both of the investigated types of CPDMs (i.e. project partnering and project alliancing). It could be argued that studies of these factors do not add to our knowledge of partnering/alliancing alone, as the factors are very general and could be considered common to all kinds of engineering and construction projects. For example, Haaskjold et al. (2019) identified the quality of communication and trust between parties as the two most important of five factors for project practitioners to prioritize in order to reduce transaction costs through improved collaboration. Thus, the partnering success factors may not be unique to partnering. While they specifically relate to partnering, they may also be highly relevant for other CPDMs, such as alliancing. It is important to mention that the identified common success factors have a situation-specific character, which implies that even if their presence is common, their degree/level in various CPDMs may differ. Furthermore, the terms used to describe the factors may vary. However, engineering and construction projects have many similarities and can therefore learn from each other. Experiences from the past can lead to increased skills level such that similar mistakes are not made in projects in the future, and learning from success and success factors in one project may be transferred to other projects (Aarseth et al., 2016).

Tadayon (2018) investigated the tangible components (hard factors) of partnering and alliancing. Apart from *single alliance culture*, *alliancing workshops*, and *no blame*, none of the factors listed in Table 5-1 are unique to alliancing. Therefore, it can be argued that some of the factors will be applicable to both types of CPDMs discussed this dissertation. This is in line with the common features of CPDM, such as trust-based relationships and open communication, presented by Moradi et al. (2022), as well as by Walker and Lloyd-Walker (2015, p. 118), who state that 'trust and commitment and the nature of co-learning through collaboration' are all linked elements at the core of CPDMs.

Shifting from a traditional procurement form to a more collaborative one will always create challenges. CPDMs such as partnering and alliancing need to be researched and documented, particularly with regard to success factors (Engebø et al., 2020). The terms critical success factors, success factors and elements are all used interchangeability in the literature. They are regarded as a tool for achieving success in projects. However, one should be aware that the list of factors that lead to success will change constantly (Aarseth et al., 2016). Not surprisingly, factors in project success in general (Pinto & Slevin, 1987) also apply to partnering projects and alliancing projects.

With regarding to partnering, the important factors for successful project partnering identified from the semi-structured interviews held with 54 professionals within the construction industry (case study 1, CaseCo) are as follows:

- Involvement of internal departments and external stakeholders
- Common understanding of the task
- Expectation clarification
- Roles and responsibilities clarification
- Clear and distinct goals and objectives
- Proactive relationship building
- Prevent opportunistic behaviour
- Build trust
- Partnering consistent throughout the project
- Be solution-oriented
- Practise formal two-way communication between the parties
- Participate wholeheartedly
- Create cohesion
- Openness between the parties
- Collaborate, not only coordinate
- Use time and resources for partnering
- Early involvement
- Use collaboration tools and partnering models
- Having acquired partnering competence – why and how
- Acknowledge interdependence
- Management, by both client and contractor, support of partnering
- Have an understanding of each other's subjects/look beyond one's own discipline
- Unified client
- Understand the totality
- Have people with partnering skills in all parts of the value chain in the organization
- Talk to people who have been involved earlier in the value chain
- Secure ownership of the project
- Maintain accurate and important information between phases in the value chain
- Use procedures and convey important and correct information.

The factors are included in the three main dimensions and the four subdimensions (Section 4.1.1), which make up 'The 3W model – How to succeed with project partnering'.

5.2 'The 3W model - How to succeed with project partnering'

The aim of the second research question (RQ2: *How to succeed with project partnering*) was to present new findings to organizations that acknowledge difficulties in implementing and succeeding with project partnering, as an example of a CPDM. In this section, I present the empirical findings related to the research question.

The second research question is mainly addressed in Paper 1. Three main dimensions and four subdimensions were found vital for project partnering success (for details, see Section 4.1.1). However, the research question is also to some extent addressed in Paper 2, as the partnering success factors identified through first sept in the literature review process (Step 1 in Figure 3-2) were included in one of the three main dimensions mentioned above. Based on the findings described in Paper 2, the five partnering success factors are considered important to project performance (for details, see Section 4.2.1).

The main dimension *Who* related to participant selection, includes wide involvement of the appropriate internal participants and external stakeholders in a project. The main dimension *What* relates to task clarification, which includes both achieving common understanding of the task for which each party is responsible and establishing a good basis for collaboration by first clarifying expectations, roles, and responsibilities. The third main dimension *Way* relates to partnering means and includes four subdimensions: 3a. partnering attitude, meaning a mutual desire to collaborate, communicate, and build good relationships; 3b. a collaborative culture, which denotes early involvement and acquiring partnering competence (why and how); 3c. a holistic perspective, which entails understanding the totality; and 3d. an accurate handover, as the history of the project is important in the planning period, during implementation, and afterwards. A project-based organization must focus and work on all three main dimensions to mature and to achieve successful project partnering. The findings described in Paper 1 show that also inadequate training of staff can be a major cause of breakdown in partnering.

The findings described in Paper 1 can be systematized in a three-dimensional model (Who, What, Way) for how to succeed with project partnering in the construction industry (Figure 5-1), where *Who* relates to participant selection, *What* relates to task clarification, and *Way* relates to partnering means. In addition, 3a. partnering attitude, 3b. a collaborative culture, 3c. a holistic perspective, and 3d. an accurate handover constitute subdimensions of the *Way* dimension of how to succeed with project partnering.

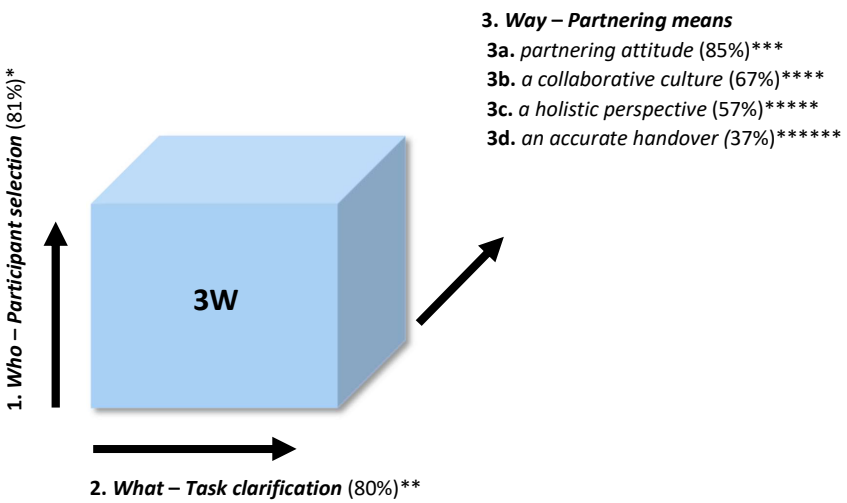

Figure 5-1: 'The 3W model – How to succeed with project partnering'

*81% indicates that the 'participant selection' dimension was emphasized by 44 of the 54 interviewees; ** 80% indicates that the 'task clarification' dimension was emphasized by 43 of the 54 interviewees; ***85% indicates that the subdimension 'partnering attitude' was emphasized by 46 of the 54 interviewees; ****67% indicates that the subdimension 'a collaborative culture' was emphasized by 35 of the 54 interviewees; *****57% indicates that the subdimension 'a holistic perspective' was emphasized by 23 of the 54 interviewees; ******37% indicates that the subdimension 'an accurate handover' was emphasized by 20 of the 54 interviewees

The three main dimensions and four subdimensions shown in Figure 5-1 must be seen in the context of each other. Changes made to one dimension will affect the other two dimensions. The aim is to work on all three main dimensions, where all participants involved in the project (*Who*) must have a common understanding of the task, must have clarified the expectations, roles, and responsibilities (*What*), and must engage and practise partnering activities (*Way*), in order to mature and succeed with project partnering. The success of partnering refers to how the involved parties perceive the effectiveness of partnering. If the parties perceive that partnering helps to obtain positive outcomes, the arrangement can be said to be successful (Cheng & Li, 2004).

Changing from a traditional procurement form to a more collaborative one is perceived as not easy, and organizations have acknowledged difficulties in implementing various CPDMs, such as project partnering (Alderman & Ivory, 2007; Aarseth et al., 2012; Hosseini et al., 2018). The

challenges of implementing such a change differ at the organization level from those at the project level (Migliaccio et al., 2008). 'The 3W model – How to succeed with project partnering' (Figure 5-1), adopts a holistic approach to modelling project partnering in a project-based organization at the project level. However, it should be mentioned that the model has some serious limitations. In this dissertation I only investigate partnering projects from the client's perspective, yet project partnering necessarily includes partners. Therefore, further research on how to succeed project partnering viewed from other perspectives would be very useful. Furthermore, the developed model needs to be tested in other companies, industries, and from an outside-in perspective.

The partnering success factors identified through the first step in the literature review (Step 1 in Figure 3-2) were compared with the findings from the case study (CaseCo). Table 5-2 shows the similarities between the partnering success factors and findings from interviews relating to the three main dimensions (Who, What, Way), which make up 'The 3W model – How to succeed with project partnering'. As shown in Table 5-2, success factors identified in the literature review did not take into account who should be involved in partnering projects (*Who*) or how to achieve a common understanding (*What*). However, the main dimension *Way* (related to partnering means) confirms findings from previous research.

Findings from step 1 in the literature review	**Trust**	**Communication**	**Commitment**	**Collaborative problem-solving**	**Mutual project objectives**
Findings from interviews (CaseCo)					
1. Who – participant selection	Not mentioned				
2. What – task clarification	Not mentioned				
3. Way – partnering means					
3a. Partnering attitude	X	X		X	
3b. A collaborative culture		X	X	X	
3c. A holistic perspective				X	
3d. An accurate handover		X			

Note: The X symbol indicates where the five partnering success factors were found included in the *Way* dimension

Table 5-2: Similarities between partnering success factors identified from the first step in the literature review and findings from interviews (Paper 1)

Way – Partnering means

Partnering attitude

According to the research findings, it was essential to build trust between the client's organization and the contractor's organization without hidden agendas. A good relationship can be fruitful, as knowledge exist on both sides. Partnering involves creating a system whereby knowledge can be used by not working against each other. The broader 'joint governance structure' (Walker & Lloyd-Walker, 2015) applies to both project risks and opportunities. Hence, a joint governance structure has the aim of value creation by capturing the value of opportunities and not merely avoiding conflict by mitigating risks by collaborative problem-solving. According to the findings, there has to be openness from both parties (client and contractor). Some researchers describe trust as a prerequisite for successful partnerships (Construction Industry Institute, 1991; Aarseth et al., 2012), and Kaluarachchi and Jones (2007) argue that trust is needed between all stakeholders. Factors pertaining to communication vary from just 'communication' (Cheung et al., 2003; Doloi, 2009; Meng, 2012) to 'effective communication' (Black et al., 2000; Raslim & Mustaffa, 2017) and 'open and honest communication' (Suprapto et al., 2015a; Moradi & Kähkönen, 2022). Good communication and chemistry constitute the foundation of partnering. The interviewees described two-way communication as important. In general, there must be a mutual desire to collaborate, communicate, and build good relationships, and this requires that the parties hold each other mutually informed based on respect and understanding. This is in agreement with the basic principles of partnering, namely commitment, trust, respect, communication, and equality, which are designed to protect the interests of all parties at all levels (Cowan et al., 1992; Chan et al., 2003b).

A collaborative culture

The interviewees highlighted early involvement as important for a collaborative culture. This findings supports the work of Kaluarachchi and Jones (2007) who use the term 'early contractor involvement' to explain 'effective communication'. The project managers must know who their key stakeholders are and involve the appropriate internal and external parties in an early phase. In particular, the interviewees considered it important to involve subcontractors early on, potentially to facilitate informal communication, in line with the findings of Aagaard et al. (2015). The finding that top management must be involved supports the mention of 'top management support' in the literature (Larson, 1997; Cheng & Li, 2001; Suprapto et al., 2015b; Moradi & Kähkönen, 2022) as a kind of internal or external commitment, and that top management must allocate time and resources to partnering activities. Cheung et al. (2003) argues for both long-term commitment and resource commitment. Lack of top-management

support may lead to inefficient partnering, which often results in conflicts and is both time-consuming and costly. According to findings, and considering that there may be disputes, it is important to have mechanisms in place for resolving disputes that could arise continuously as a part of partnering. According to Walker and Lloyd-Walker (2015), conflict should be avoided by mitigating risks through collaborative problem-solving .

A holistic perspective

The research results indicated that unsuccessful partnering will quickly become a reality in cases where there is a lack of employees with the necessary skills required for partnering approaches. Be willing to see the complexities (organizational) and having an overall picture is essential. Successful projects also depend on having an understanding of the importance of others' disciplines, keeping an open mind, and looking beyond one's own discipline.

An accurate handover

Project history was found important in the planning period, during implementation, and afterwards: first in relation to bringing forward experiences from past projects and gaining ownership of the project; second, in what was being safeguarded and handed over between the various phases of value chain processes in CaseCo, and ultimately in the final documentation. Communication is an important part of the subdimension 'an accurate handover'. Factors of communication include, for example, 'communication' (Cheung et al., 2003; Doloi, 2009; Meng, 2012) and 'effective communication' (Black et al., 2000; Raslim & Mustaffa, 2017). Walker and Lloyd-Walker (2015) described gain and pain sharing and early involvement as the two main dimensions of levels of relationship-based procurement. Early involvement was strongly emphasized as important by the interviewees.

The finding that the main dimension *Way* related to partnering means confirmed findings from previous research (Table 5-2). Figure 5-2 shows how in theory the findings described in Paper 1 and Paper 2 flow into and inform each other by linking partnering success factors to project performance via the *Way* dimension. Figure 5-2 is based on the finding that *commitment* was included in the subdimension 'a collaborative culture' (Table 5-2). It is further assumed that 'a collaborative culture' is important for meeting time schedule, budget, and technical specifications. For example, to meet all three criteria, the project managers must know who their key stakeholders are and involve the appropriate internal parties (top management included) and external parties in an early phase. Furthermore, the project must also ensure that goals for different project elements are accepted by all participating partners.

Partnering success factors from literature review process of step 1	**The 3W model** **Way** dimension Findings from interviews (Paper 1)		**Project performance** Findings from the survey (s) (Paper 2)
Mutual project objectives		→	Time schedule, budget and technical specifications
Commitment	3b. A collaborative culture		
Trust	3a. Partnering attitude	→	Time schedule and technical specifications
Collaborative problem-solving	3a. Partnering attitude 3b. A collaborative culture 3c. A holistic perspective		
Communication	3a. Partnering attitude 3b. A collaborative culture 3d. An accurate handover	→	Technical specifications

Figure 5-2: Summary of how the 'Way' dimension influences project performance

Furthermore, Figure 5-2 is based on the finding that *trust* was found included in the subdimension 'partnering attitude' and *collaborative problem-solving* was found included in the subdimensions 'partnering attitude', 'a collaborative culture', and 'a holistic perspective' (Table 5-2). It is further assumed that 'partnering attitude', 'a collaborative culture' and 'a holistic perspective' are important for meeting time schedule and technical specifications. For example, to meet the two criteria, the parties must keep each other mutually informed based on respect and understanding and have mechanisms in place for resolving disputes.

Finally, Figure 5-2 is based on the finding that *communication* was included in the subdimension 'partnering attitude', 'a collaborative culture', and 'an accurate handover' (Table 5-2). It is further assumed that 'partnering attitude', 'a collaborative culture', and 'an accurate handover' are important for meeting technical specifications. For example, to meet the criterion, the project managers must ensure that there is extensive communication between the participating partners, and the parties must have a mutual desire to collaborate, communicate, and build good relationships.

It should be mentioned that the findings do not inform anything about the significance of one or more of the five partnering success factors found included in the *Way* dimension (indicated by X in Table 5-2) (e.g. that *trust* and *commitment* were found in one subdimension, while *communication* and *collaborative problem-solving* were found in three subdimensions (Figure 5-2)). This calls for further investigation. Nevertheless, the findings show that the partnering

success factors are included in the *Way* dimension, and that the five partnering success factors are important for project performance (Table 4-2). To have a positive influence on project performance in a project comprising partners from independent firms, the project manager must aim to ensure the presence of the five identified partnering success factors throughout the project.

The purpose of Figure 5-2 is to show anticipated benefits for adopting 'The 3W model – How to succeed with project partnering', including the five partnering success factors, in construction projects. Based on the findings described in Paper 1, a project-based organization such as CaseCo must focus and work on all the three main dimensions in order to mature and achieve successful project partnering. Based on the findings described in Paper 2, the anticipated benefits of ensuring the presence of the five identified partnering success factors throughout the project include, but are not limited to, improved efficiency and cost-effectiveness, and improved quality of product. However, based on the finding described in Paper 1, the subdimension 'a collaborative culture' as vital to successful partnering included having acquired partnering competence (why and how). If employees or affiliates do not fully understand what the term partnering signifies, the organization will not be able to practise successful partnering. Inadequate training of staff can be a major cause of breakdown in partnering.

Partnering has been described as 'the most significant development to date as a means of improving project performance' (Wood & Ellis, 2005, p. 317). For partnering to be able to lead to positive outcomes, the partnering process must be achieved in a good manner. One of the challenges of implementing collaborative arrangements relates to the social level. According to Engebø et al. (2019) and to Aarseth et al. (2012), CPDMs create confusion related to roles, responsibility, structure, and process. Based on the findings described in Paper 1, the main dimension *What*, related to task clarification as vital to successful partnering, included clarification of expectations, roles, and responsibilities. It can therefore be argued that the findings described in Paper 1 provide solutions to this confusion, and by adopting 'The 3W model – How to succeed with project partnering', the ability to implement project partnering will be improved. This in turn could increase the ability to conduct successful partnering and achieve better performing projects in the future.

5.3 How CPDMs influence project performance

Improving the success of projects, particularly engineering and construction projects, is of interest to both practitioners and researchers. The third research question (*How do project partnering and project alliancing influence project performance?*) addressed the need for

research on CPDMs that lack empirical-based evidence regarding performance (Mesa et al., 2016; Lahdenperä, 2017; Engebø et al., 2020).

All three papers contribute to answering the third research question (RQ3). Thus, based on the findings and insights gained from the three studies on which Paper 1–3 are themselves based, this dissertation culminates with a summary model that aims to capture the description and explanation of the main findings in a holistic presentation. An illustrative conceptual model named *Project-based Collaboration for Future Performance*, hereafter abbreviated as the *PCFP model*, is presented in Figure 5-3.

Figure 5-3 shows a circle with three overlapping layers. In the inner-most layer of the circle, multiple partners are depicted sitting around a round table, to show that they are collaborating. To create this type of collaboration, a trust-based relationship between the actors involved must be established, and relationships and teamwork of this type can be accomplished through CPDMs such as alliancing and partnering (Lahdenperä, 2012; Moradi et al., 2022). CPDMs are more person-dependent than traditional delivery methods (Engebø et al., 2019), and collaborative arrangements have a significant difference compared with traditional ones. According to Moradi et al. (2022), the difference is related to changes in mindsets (the established sets of attitudes held by people). Several success factors influence the collaborative project process, and they are shown located between the project participants in Figure 5-3. The factors are also important for project performance. In addition, there are some influencing factors in the model (top left corner of Figure 5-3). The situation after partnering/alliance competence (*what*, *why* and *how*) has been acquired is shown in the outermost layer in the circle, and is illustrated in Figure 5-3 as a foundation comprising a round rug under the table around which the project participants sit. Education of the members is vital for successful implementation at the project level and for ensuring that the outcome of using the models is successful. All positive outcomes related to the collaboration between project participants that improves project success are shown at the bottom of Figure 5-3.

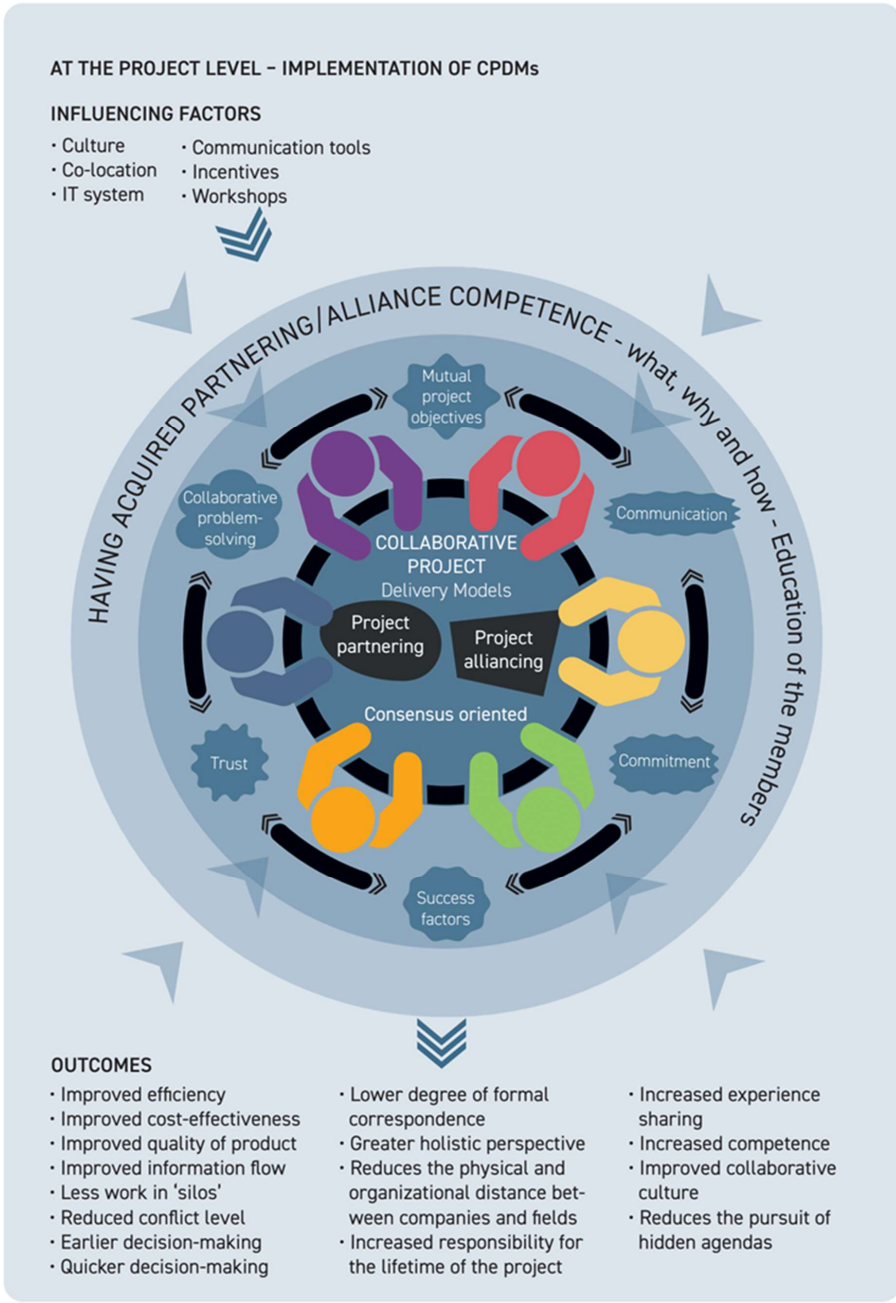

Figure 5-3: Project-based Collaboration for Future Performance (the PCFP model)

It is important to emphasize that collaboration has several benefits, and this is the primary reason that CPDMs are introduced in engineering and construction projects. Great optimism and positive expectations are associated with the PCFP model. It is expected that the PCFP model will contribute to increased project performance in engineering and construction projects. However, few results come without hard work, the appropriate education of the team members, and the right attitude, not just from individuals, but from everyone who participates in the engineering and construction projects. Even though the PCFP model only shows positive outcomes, the findings and discussion show the negative consequences of a possible lack of effort in relation to the various factors, as the factors can function both as enablers and barriers. In the following Sections, the three overlapping layers in the PCFP model are described further in detail, followed by an explanation of the influencing factors (upper left corner in Figure 3.5). Finally, the anticipated benefits of adopting the PCFP model are presented, namely the positive outcomes related to the collaboration between project participants that improve project success.

Three overlapping layers

In the innermost layer in Figure 5-3, multiple partners are shown sitting round a round table and collaborating. Both CPDMs in focus in this dissertation are shown placed on the table. Both project partnering and project alliancing can be defined as CPDMs in which the client and contractor usually collaborate through informal or formal agreements, together with the establishment of trusted-based relationships to achieve common objectives (Lahdenperä, 2012; Moradi et al., 2022). Some types of project procurement that focus on integrating project design and deliver teams may utilize CPDMs, where collaboration between internal participants and external stakeholders in the project is of prime importance (Moradi et al., 2020). Projects with extensive collaboration between the client and contractor experience less ambiguity, fewer errors and deviations, more often meet requirements, and more often have satisfied clients than projects with poor collaboration (Sarhan et al., 2017; Walker et al., 2017; Caniëls et al., 2019).

In the literature, researchers have argued that the contractual form does not directly affect project performance (Suprapto et al., 2016a). Hence, project partnering and project alliancing does not necessarily result directly in better project performance, but achievements are gained through relational attitudes and how they play out throughout the project in terms of actual teamworking behaviour (Suprapto et al., 2016a). According to the findings described in Paper 3, there is no doubt that the increased level of collaboration between involved actors is a major benefit for the performance outcomes. This result is achieved through closer cooperation, shorter decision paths, transparent partners, and an overall alliance culture tailored around collaboration.

Furthermore, according to the findings described in Paper 3, a project alliance is much more consensus-oriented than traditional projects. This may lead to a lack of common perspective on where an alliance is headed. Some concerns about consensus orientation in the project alliance were voiced by the interviewees in the case investigated in Paper 3. The alliance culture is based upon the contractual framework governing project alliances. Culture was identified by the company as a critical factor for success when creating a project alliance, thus making the project alliance itself a contributor to the creation of shared incentives. Some managers felt too much trust was given to the project alliance itself, and that the project lacked a distinct customer to lead the process. As the alliance model is inherently more solitary, the well-implemented structure of an overseeing customer is broken down to some extent. As reported in Paper 3, the interviewees noted that a vital role of the customer was to supervise and govern the process. Therefore, it is important that companies in volved in an alliance understand what it means to work in accordance with the alliance model. In this respect, the education of the team members working in the project alliance is vital.

Even though the alliance model lays the groundwork for a mindset with a common goal, some challenges still exist. The partners pointed expressly to the relationship between the partners as being most significant with regard to the project alliance's performance. When establishing a project organization with a high degree of trust given to its suppliers, some degree of governance and direction may be lost. This shows how the very foundation of the alliance model – trust and culture – also has some downsides. The overall impression of the empirical data is that it pointed to that the factors culture and trust is vital to the performance of an alliance.

Several success factors influence the success of a collaborative project, and these are illustrated in the middle layer of the circle in Figure 5-3, located between the project participants, and important to project performance. According to the findings described in Paper 2, *mutual project objectives* and *commitment* are important for meeting time schedule, budget, and technical specifications, *trust* and *collaborative problem-solving* are important for meeting time schedule and technical specifications, and *communication* is important for meeting technical specifications. The findings also showed that to have a positive influence on project performance in a project comprising partners from independent firms, the project manager must aim to ensure the presence of the five identified partnering success factors throughout the project.

The situation of having acquired partnering/alliance competence (*what*, *why*, and *how*) makes up the outer-most layer in the circle in Figure 5-3. The findings described in Paper 1 show that inadequate training of staff can be a major cause of breakdown in partnering. This in turn could be a key reason for variance in project outcomes, and a possible explanation for why project-

based organizations fail to succeed fully with project partnering. As mentioned earlier (Section 4.3.2), the findings described in Paper 3 show that it is important that involved companies understand what it means to work within the alliance model. In this regard, the education of the members working on the project alliance is vital. Difficulties in implementing new CPDMs will still occur, which will create uncertainty in relation to the outcome of using the models if project practitioners have not acquired partnering/alliancing competence. It would be highly appropriate to gain better insights into such CPDMs before they are used in practice and, through improved collaboration, achieve better performing projects in the future.

Education of project members is vital for the implementation of CPDMs at the project level. Increased understanding of CPDMs in project-based organizations and among project participants, particularly with regard to the barriers related to the lack of partnering/alliance competence, should increase the ability to implement CPDMs and thus achieve better performing project outcomes in the future. This in turn could provide savings for project-based organizations, which usually invest significant resources when shifting from a traditional approach to a more collaborative one. With regard to implementation of barriers related to partnering, barriers to collaboration among project participant show the potential for improvement (Mollaoglu et al., 2015). Alliancing and partnering require large investments in resources and it is therefore important to ensure that the outcomes of using the models are successful.

As project-based organizations without partnering/alliance experience and limited to no experience with collaborative arrangements begin to adopt CPDMs, they will no doubt face several challenges. Therefore, project-based organizations contemplating a shift from a traditional delivery method to a more collaborative one, such as project partnering or project alliancing, must increase project participants' understanding of CPDMs. First, in relation to understanding the concept (*what*), there is a need for some sort of innovation or conceptualization by using a practical description. Second, in relation to justification (*why*), whereby something has to be shown to be right or reasonable, a need for pioneers to be willing input effort has to be created. Third, and finally, new CPDMs need to be researched and documented, particularly concerning effect, barriers, and enablers, and the success factors within the context of CPDMs need to be used as a tool for achieving success in projects (*how*) (Engebø et al., 2020). Project practitioners will need to be educated in the factors that make such collaborative approaches successful (Young et al., 2016).

Influencing factors

In addition to the success factors that influence the collaborative project process described earlier in (Section 5.3), there are several other organizational factors that influence the

collaboration between project participants. In Figure 5-3, the part in the upper left corner outside the circle shows factors that might influence the collaborative project process, including *culture*, *co-location*, *IT system*, *communication tools*, *incentives,* and *workshops*. The influencing factors can function both as enablers and as barriers, and are regarded collectively as a tool for achieving success in project (Aarseth et al., 2016).

Culture is based up on the contractual framework governing the collaborative approach, and the findings described in Paper 3 point to the culture as vital to the project alliance's performance. In the literature, *single alliance culture* is identified as a key factor of an alliance (Biggs, 2004; Tadayon, 2018; Young et al., 2018); all partners within the project alliance, regardless of their employer, are part of the same team (Tadayon, 2018). Culture has been identified as a critical factor for success when creating an alliance. However, culture seems to be important regardless of which CPDM is used. As discussed earlier (Section 5.1), *single alliance culture* was found unique to alliancing. According to the findings described in Paper 1, an project-based organization should build a project partnering culture, both internally and externally. This entails having people who can master partnering, who understand the essence of partnering, who have a common understanding of the interdependence on each other, and who have a desire to cooperate and communicate. If targets do not take into account a holistic perspective and good attitudes, project managers with an operational focus, and with their mindset and success criteria focused on 'getting the job done', will work to achieve their own goals instead. Thus, the studied partnering projects could have benefited from a project partnering culture in the same way as in the case of an alliance. Therefore, culture is listed as an influencing factor, and applicable to both CPDMs in the PCFP model. The lack of culture will result in unsuccessful partnering.

Co-location must be viewed as a factor in project performance. In many ways, co-location is an enabler for the other presented factors to be influential. The findings described in Paper 3 show that one of the reasons why co-location is so crucial to the performance of the project alliance is that it contributes to closing the physical and organizational distance between companies and different fields in the project. Furthermore, co-location could shorten the path to information and enable earlier decision-making and less work in 'silos'. Co-location is identified as a key factor of an alliance in the literature (Jefferies et al., 2014; Tadayon, 2018; Young et al., 2018), and as a mechanism for realizing the full effects of an integrated project team (Tadayon, 2018). According to the findings described in Paper 3, co-location enables a steady flow of communication between parties and helps to strengthen collaborative bonds between employees. The studied project alliance was co-located in one of the largest cities in Norway, where employees and managers worked in the same office building. This allowed for swifter

and more precise flow of information and resources than might otherwise have been the case. The exception was the EPC (engineering, procurement, construction) supplier, as its yard was located c.600 km distant, which created some distance between the construction and the planning of the project. Although most of the interviewees were happy with how the project alliance handled co-location, some felt it could have been improved, especially by having the construction team located closer to the other project members in the engineering phase. Especially the EPC supplier found the situation challenging in terms of good collaboration. This shows how lack of co-location can have some downsides. For alliancing to be successful, more dynamic co-location in offices should be allowed for when needed.

With regard to *IT system* and *communication tools*, the findings described in Paper 3 show that problems with IT systems and everyday communication tools such as Skype for Business and Microsoft Outlook, can set back the productivity of an alliance. When asked to identify the biggest downsides of the project alliance, the interviewees pointed to interfaces as the most underachieving area in the project alliance. Most notably, IT systems had given rise to some issues in the alliance work, as firewalls and different policies had impeded the interaction between the different systems. The lack of governing guidelines initially seemed to have contributed to those issues, and this in turn had resulted in unnecessary costs that could otherwise have generated value in the project alliance. Interfaces between companies and other alliances are crucial elements in the alliance model. With regard to the benefits discussed earlier (Section 4.3.2), communication and interaction between companies can function both as enablers and as barriers. Thus, ensuring functional interfaces in the alliance model is a key factor in its performance. In the literature, *a single IT system* has been identified as a key factor in an alliance (Jefferies et al., 2014). For alliancing to be successful, significant interaction and communication is required between the partners.

With regard to *incentives*, and given the contractual model of the project alliance (described in Section 3.6.3), companies have incentives to be open and share information, as they all share potential upsides and downsides of the project. All members of an alliance share in the profits and losses of the alliance project and ensure that no single participant is held responsible for financial performance (Laan et al., 2011). The distribution of risk prompts coinciding incentives. As mentioned earlier (Section 4.3.2), with the compensation model focusing on the project as a whole, companies can openly discuss and collaborate. This process also reduces the pursuit of hidden agendas aimed at ensuring personal gain. The findings described in Paper 3 show that companies have incentives to open and share information as they all share potential upsides and downsides of the project in which they are involved. With the compensation model focusing on the project as a whole, companies could openly discuss and collaborate. This process would

also reduce the pursuit of hidden agendas aimed at ensuring personal gain. However, it is known that being measured affects behaviour of the subject in question (Spitzer, 2007), and it can therefore be argued that there might be a risk of some participant bias, since the interviewees themselves will have personal incentives for the project alliance to perform well.

Workshops are organized to develop and maintain the culture in the project alliance and the best-for-project mindset (Tadayon, 2018). Jefferies et al. (2014) identified the importance of pre-project and planning workshops and organizing early workshops for all members of the alliance prior to the client-focused workshops in order to build good working relationships. The success of projects is dependent on both management and collaboration, as well as the investments made early in the start-up phase in the application of CPDMs. Such investments pay off through ensuring that employees have a genuine wish to collaborate in order to achieve the best project outcomes.

The above-discussed influencing factors are some examples of organizational factors that influence the interaction between project participants. Only a few influencing factors have been found unique to an alliance (Tadayon, 2018). However, as stated earlier (Section 5.1), engineering and construction projects have many similarities and can therefore learn from each other. Moreover, learning from success and success factors in one project may be transferred to other projects (Aarseth et al., 2016).

Outcomes

Project partnering and project alliancing, as examples of CPDMs, can lead to improved project outcomes. A distinct advantage of using a more collaborative approach is the collaboration form itself. According to the findings described in Paper 3, the project alliance, as an example of a CPDM, has given rise to a new mindset due to its business model. This concept is, as previously stated (Section 1.1), a new concept, at least within the Norwegian oil and gas industry. In a project alliance, partners have greater responsibility for the project as a whole, compared with in a more traditional project. The strength of project alliances is transparent in how companies are able to rethink their role in the project. In traditional projects, a company will have strict roles and responsibilities. With the project alliance, the boundaries are shifted, and this in turn facilitates innovative and rewarding new ways of thinking. CPDMs foster collaboration, good communication, and easy access to other members of the project organization. The direct cost of correspondence and the indirect cost of waiting for information add up to a high and often neglected cost.

At the bottom of the PCFP model shown in Figure 5-3, the illustrated results are based on recent research. As stated earlier (Section 4.2.1), the findings described in Paper 2 show that the five

partnering success factors are important for project performance (i.e. with regard to the 'iron triangle'). The results indicate that a successful project outcome will become more likely as the degree of collaboration improves, which in turn is influenced by an increase in the level of *trust*, *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives* among partners. The implementation of the five partnering success factors could lead to major benefits in engineering and construction projects. The anticipated benefits of ensuring the presence of the five identified success factors throughout the project include the following, but are not limited to them:

- Improved efficiency
- Improved cost-effectiveness
- Improved quality of product.

To have a positive influence on project performance in a project compromising partners from independent firms, the project manager must aim to ensure the presence of the identified factors throughout the project. The remaining positive outcomes related to collaboration between the project participants that leads to improved project success are listed as follows (see also the bottom of Figure 5-3):

- Improved information flow
- Less work in 'silos'
- Reduced conflict level
- Earlier decision-making
- Quicker decision-making
- Lower degree of formal correspondence
- Greater holistic perspective
- Reduced physical and organizational distance between companies and fields
- Increased responsibility for the lifetime of the project
- Increased experience sharing
- Increased competence
- Improved collaborative culture
- Reduction in the pursuit of hidden agendas.

The positive outcomes point to several benefits that can be obtained by adopting a more collaborative approach. The project manager must aim to ensure the presence of the identified factors (success factors and influencing factors) listed in the PCFP model (Figure 5-3). Each of the factors affects the likelihood of success and should be a focal point throughout the project.

The sooner projects engage in actions such as practising formal two-way communication, building trust, and creating a collaborative culture, the better off they will be in the long term.

Research to date indicates that there are several potential positive outcomes of improved collaboration between project participants. Many of the outcomes shown in Figure 2-3 appear to correspond to outcomes that can be obtained by adopting a more collaborative approach. For example, increased collaboration will lead to improved change order and resolutions, and to an enhanced project culture (Børve, 2019).

Hopefully, project-organizations will find the PCFP model a useful tool for gaining better insights into collaborative arrangements. The PCFP model should help project-based organizations to gain insights into factors describing CPDMs that are important to project performance. This in turn would advance a general understanding, which would make it easier to gain better insights into collaborative arrangements before they are put into practice. This in turn could make implementation at the project level easier and ensure that the outcomes of using the models would be successful, and ultimately achieve better performing projects in the future.

The developed model needs to be tested in other companies and industries, and further research on how factors in these CPDMs influence project performance would be very useful.

6 Conclusions and Further Research

This chapter contains the main conclusions of the research presented in this dissertation. First, answers to the research questions are presented, followed by a description of the theoretical and practical implications. Finally, avenues for further research are presented.

Aligned with the objective of the doctoral research, the overall purpose of this dissertation is to establish a deeper understanding of two CPDMs, project partnering and project alliancing, by increasing the understanding of how factors in these CPDMs influence project performance to achieve better performing projects in the future. Factors within the context of the CPDMs are a valuable point of departure for providing the groundwork for a better understanding of these concepts and thus build a foundation for further investigation into how different CPDMs are practised. The work for this dissertation was guided by the following research questions regarding partnering and alliancing as examples of CPDMs:

RQ1: What factors in extant literature describe partnering and alliancing?

RQ2: How to succeed with project partnering?

RQ3: How do project partnering and project alliancing influence project performance?

6.1 Answers to the research questions

RQ1: What factors in extant literature describe partnering and alliancing?

The first research question (RQ1) is addressed in all three papers, where factors within the context of CPDMs were identified from extant literature. The findings presented in this dissertation highlight the factors that researchers have found in partnering and alliancing. In terms of partnering, the most important partnering success factor is *trust*, followed by *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives*, respectively. In terms of alliancing, a list of factors identified from extant literature formed the basis of the description of an alliance. Twelve examples of factors that describe an alliance are *collaborative problem solving*, *trust*, *co-location*, *pain/gain share*, *open-book approach*, *commitment*, *single alliance culture, communication*, *workshops*, *a single IT system*, *no blame*, and *mutual goals and objectives.* The five partnering success factors and the twelve examples of factors describing an alliance are listed in Table 6-1. The factors include 'critical success factors', 'success factors', and 'elements' as terms used interchangeably in the literature. The factors are reviewed in detail in Section 2.2.

Table 6-1: Factors describing partnering and alliancing, sourced from extant literature

CPDM/ Factor	Alliancing	Partnering
Collaborative problem-solving	X	X
Trust	X	X
Co-location	X	
Pain/gain share	X	
Open-book approach	X	
Commitment	X	X
Single alliance culture	X	
Communication	X	X
Workshops	X	
A single IT system	X	
No blame	X	
Mutual goals and objectives	X	X

Note: The X symbol indicates the factors that researchers have found to describe partnering and alliancing

RQ2: How to succeed with project partnering?

The second research question (RQ2) is mainly addressed in Paper 1. The findings are systematized in a three-dimensional model (Who, What, Way), called 'The 3W model – How to succeed with project partnering' (Figure 6-1). *Who* relates to participant selection, *What* relates to task clarification, and *Way* related to partnering means. The *Way* dimension consists of four subdimensions: 3a. partnering attitude, 3b. a collaborative culture, 3c. a holistic perspective, and 3d. an accurate handover. The three main dimensions and four subdimensions are reviewed in detail in Section 4.1.1.

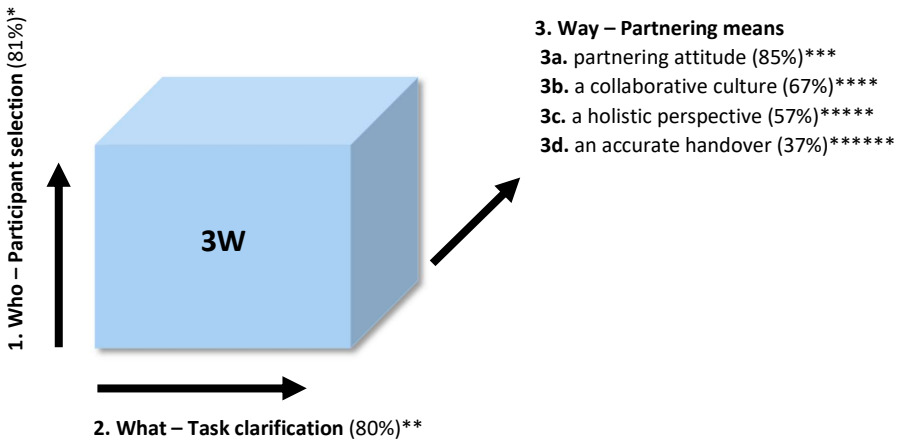

Figure 6-1: 'The 3W model – How to succeed with project partnering'

*81% indicates that the 'participant selection' dimension was emphasized by 44 of the 54 interviewees; ** 80% indicates that the 'task clarification' dimension was emphasized by 43 of the 54 interviewees; ***85% indicates that the subdimension 'partnering attitude' was emphasized by 46 of the 54 interviewees; ****67% indicates that the subdimension 'a collaborative culture' was emphasized by 35 of the 54 interviewees; *****57% indicates that the subdimension 'a holistic perspective' was emphasized by 23 of the 54 interviewees; ******37% indicates that the subdimension 'an accurate handover' was emphasized by 20 of the 54 interviewees

The three main dimensions and four subdimensions must be seen in the context of each other. Changes made to one dimension affect the other two dimensions. A project-based organization, such as CaseCo, must focus and work on all three main dimensions in order to mature and achieve successful project partnering, where all participants involved in the project (*Who*), must have a common understanding of the task and have clarified expectations, roles, and responsibilities (*What*), and engage and practise partnering activities (*Way*). 'The 3W model – How to succeed with project partnering' adopts a holistic approach to modelling project partnering in a project-based organization at the project level. The anticipated benefits of adopting 'The 3W model – How to succeed with project partnering' in construction projects, include (but are not limited to) improved efficiency, cost-effectiveness, and improved quality of product.

RQ3: How do project partnering and project alliancing influence project performance?

Papers 1–3 all contribute to answering the third research question (RQ3). Thus, based on the findings and insights gained from the three studies, this dissertation culminates in a summary model that is intended as a holistic presentation of the main findings. An illustrative conceptual model called 'Project-based Collaboration for Future Performance' (the PCFP-model) is presented in Figure 6-2. The positive outcomes point to several benefits that can be obtained by adopting a more collaborative approach, including both project partnering and project alliancing.

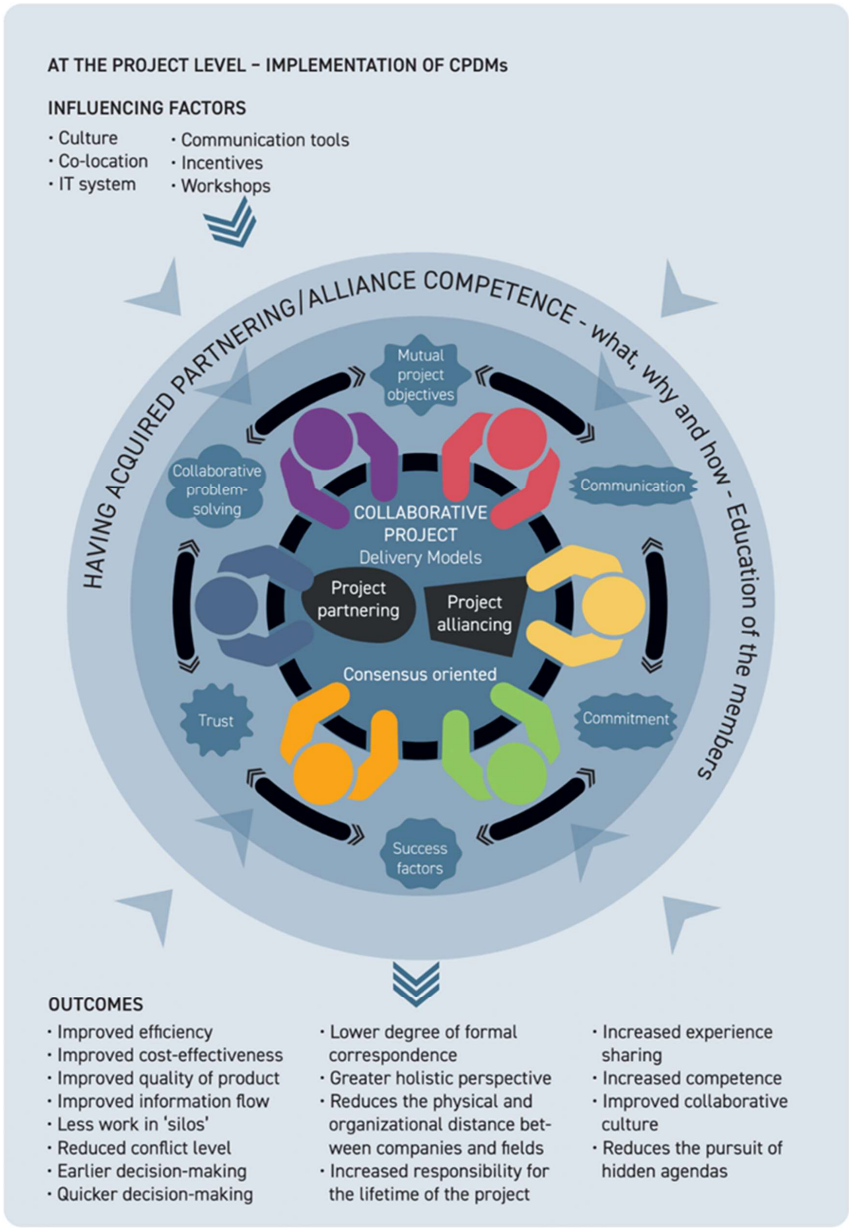

Figure 6-2: Project-based Collaboration for Future Performance (the PCFP model)

The PCFP model in Figure 6-2 consists of a circle with three overlapping layers. In the innermost layer of the circle, multiple partners sit around a round table, which serves to show that involved parties are collaborating. Several success factors influence the collaborative project process, and these success factors are depicted in the middle layer of the circle, located between the project participants, and have been found important for project performance. In addition, outside the circle, in the upper left corner of Figure 6-2, there are factors that might influence the collaborative project process. The situation of having acquired partnering/alliance competence (*what, why*, and *how*) makes up the outermost layer in the circle. This is illustrated as a foundation in the form of a round rug under the table in Figure 6-2.

Education of project members is vital for successful implementation at the project level and for ensuring that the outcome of using the models is successful. The positive outcomes point to several benefits that can be obtained by adopting a more collaborative approach. The project manager must aim to ensure the presence of the identified factors (success factors and influencing factors) listed in the PCFP model (Figure 6-2). Each of the factors affects the likelihood of success and can function both as an enabler and as a barrier, and thus each factor should be in focus throughout the project. The earlier projects that engage in these actions, the better off they will be in the long term. There is no valid list of challenges faced by projects and new challenges always crop up. Therefore, the list of factors that lead to success will change constantly. Acquisition of partnering/alliancing competence can reduce any inability to implement collaborative arrangements, such as project partnering and project alliancing.

The anticipated benefits of adopting the PCFP model are shown at the bottom of Figure 6-2 as the positive outcomes related to the collaboration between project participants that improve project success.

6.2 Theoretical implications

Several authors have called for more research exploring the link between project-based collaboration and project performance (Meng & Gallagher, 2012; Bond-Barnard et al., 2018; Silva & Harper, 2018). The theoretical contribution of my research narrows the research gap in relation to project-based collaboration (i.e. the relationship between project participants' collaboration and project performance) by providing relevant insights into factors in CPDMs and insights that are important to project performance. This advances general understandings, which will make it easier to gain better insights into CPDMs before they are used in practice.

The research undertaken for this dissertation looked at research gaps in relation to CPDMs at a more detailed level, pertaining to the understanding of relations and interactions among projects participants. This was done by exploring collaboration through factors describing

CPDMs, specifically social and human aspects that are important in CPDMs that are more person-dependent than traditional models.

For an owner organization, adopting a new approach may need comprehensive changes in both its work processes and existing organizational structures. Information about how such changes should be implemented is limited (Migliaccio et al., 2008). Conclusions drawn from the two case studies in this dissertation suggest that gaining better insights into collaborative arrangements before they are implemented should be given much more attention in future project management research. This in turn could make the implementation of CPDMs at project level easier and ensure that the outcomes of using the models are successful.

6.3 Practical implications

In terms of practical implications, the findings presented and discussed in this dissertation can be insightful and value adding for practitioners. The research was conducted in real-life case projects to understand how project partnering and project alliancing are actually practised in different industries. The discussed approaches are aimed at project-based organizations contemplating a shift from a traditional delivery method to a more collaborative one, such as project partnering or project alliancing, in order to achieve better performing projects in the future.

The construction industry and the oil and gas industry should be able to apply the research findings presented in this dissertation by implementing the models in their projects. In turn, that could reduce some of the challenges that project-based organizations experience when implementing new CPDMs at the project level.

The following recommendations are intended for project-based organizations contemplating a shift from a traditional delivery method to a more collaborative one in order to achieve better performing projects in the future:

- Start with the appropriate education of the members. Increase the understanding in the project-based organization and among project participants about the CPDM, particularly by having acquired partnering/alliancing competence (*what, why*, and *how)*.
- Establish courses for project members to learn more and to gain better insights (*what*, *why*, and *how*): first, in relation to understanding the concept (*what*), by using a practical description; second, in relation to justification (*why*), to create a need for pioneers willing to input effort; and third and finally, to use the success factors within the context of CPDMs as a tool for achieving success in projects (*how*). Having acquired partnering/alliancing competence can reduce the inability to implement collaborative arrangements, such as project partnering and project alliancing.

- In partnering projects, apply 'The 3W model – How to succeed with project partnering'.
- In engineering and construction projects, apply the PCFP model; 'Project-based Collaboration for Future Performance'.

Hopefully, project-based organizations will find 'The 3W model – How to succeed with project partnering' and the PCFP model useful as tools for gaining better insights into CPDMs. 'The 3W model – How to succeed with project partnering' should help project-based organizations to mature and achieve successful project partnering. The PCFP model should help project-based organizations to gain better insights into factors in these CPDMs that are important for project performance. This, in turn, would advance general understanding, which would make it easier to gain better insights into collaborative arrangements before they are used in practice. Subsequently, implementation of such arrangements at the project level would be easier and ensure that the outcomes of using the models would be successful, and thus ultimately lead to better performing projects. However, difficulties in implementing new collaborative approaches will still occur, which will create uncertainty in relation to the outcome of using the models if project practitioners do not acquire partnering/alliancing competence by gaining better insights into the collaborative arrangements before they are used in practice.

The results of the research presented and discussed in this dissertation may also provide insights into teaching and learning in tertiary education. During the time in which I carried out my doctoral research, I had a period of leave from my permanent position at NTNU. An agreement to teach during part of that period, on a subject close to the scope of the dissertation, was made between me and the head of my department. This agreement was outside the required duties stipulated for PhD candidates. I created a new course subject (BYGA2020 Partnering and project management) in autumn 2020, for which I was both the course coordinator and teacher (52 students took the course in spring semester 2021 and 54 students in spring semester 2022). This meant that some of my research was applied in teaching and the findings might ultimately prove useful in practice.

6.4 Further research

This dissertation provides an enhanced understanding of how to succeed with CPDMs in order to achieve better performing projects in the future. However, the findings presented and discussed in this dissertation represent only a small and preliminary step.

Case study 1 (CaseCo) addressed the management and collaboration aspects of partnering, and this led to the introduction of a model for organizations that acknowledge difficulties in implementing and succeeding with project partnering. However, there remains the question of

how generic a model developed for the construction industry really is, and further studies using similar models for other companies, industries, and from an outside-in perspective are needed in order to answer this question. Furthermore, 'The 3W model – How to succeed with project partnering' needs to be tested in other settings to determine its relevance for other industries. All findings from the study presented in Paper 1 (CaseCo) were based on interviews held only with Norwegians. Further research should determine whether these findings are applicable in countries other than Norway. The findings might also be applicable to industries other than the construction industry, but this need to be studied further. Since the case study focused on partnering from the owner's view only, further research recommendations presented in Paper 1 include several perspectives beyond those of the client, since project partnering necessarily includes partners.

Case study 2, the project alliance, highlighted how a traditional project compared with a more collaborative one influenced project performance. Only one alliance within the Norwegian oil and gas industry was investigated. Further research should investigate the concept developed in that study and apply them in a study with a broader scope. It is also important to note that the study only focused on marginal positions within the project alliance. Other project members might have had other experiences, and this possibility should be explored further. Thus, a study involving members from all levels of the project alliance would be preferable. The findings might also be applicable to industries other than the oil and gas industry, but this would need to be verified by further research.

Hopefully, the discussion of how combined factors in the context of CPDMs can influence project performance will inspire other scholars specializing in project management to build and expand on potential factors in the relationship between project participants' collaboration and project performance. Overall, with regard to the impact of CPDMs on project performance presented in this dissertation, further research should investigate other potential elements that that were not included in my research but might influence project performance in terms of the relationship between success factors and project performance. Moreover, additional research is needed to determine whether these relationships are significant over time.

In acknowledging that many projects cannot be accomplished without the efforts of several partners working together, it seems logical that a performance measurement of projects implementing various CPDMs must include measurement of how smoothly the collaboration among the project partners unfolds. In practice, the various success factors' influence on project performance can be used by project-based organizations and project managers when selecting and measuring the various success factors they find most suitable to improve their project performance. If put into active use (by picking up the early warning signs of project problems),

this should help to improve the project performance of future engineering and construction projects.

References

AAGAARD, A., ESKEROD, P., KNUDSEN, M.H, MADSEN, J.K., MADSEN, T.K., PETERSEN, B. & ROSENBAUM, S.M. 2012. *Collaboration and Performance in Multi-Partner Projects: The Case of Engineering Consultancies. Research Methodology*. University of Southern Denmark, Working Papers in Marketing & Management 32, 1-72.

AAGAARD, A., ESKEROD, P. & MADSEN, E.S. 2015. Key drivers for informal project coordination among sub-contractors: A case study of the offshore wind energy sector. *International Journal of Managing Projects in Business,* 8, 222–240.

AARSETH, W. 2012. *An Empirical Study of Organizational Cooperation in Large Traditional and Global Projects Execution.* PhD thesis. Norwegian University of Science and Technology, Trondheim.

AARSETH, W. 2014. *Project Management – A New Mindset for Success: Collaborative Business and Global Mindset.* Bergen: Fagbokforlaget.

AARSETH, W., ANDERSEN, B., AHOLA, T. & JERGEAS, G. 2012. Practical difficulties encountered in attempting to implement a partnering approach. *International Journal of Managing Projects in Business,* 5, 266–284.

AARSETH, W., ROLSTADÅS, A. & KLEV, R. 2016. *Project Leadership Challenges : Their Nature and How They Are Managed.* Bergen: Fagbokforlaget.

AARSETH, W., AHOLA, T., AALTONEN, K., ØKLAND, A. & ANDERSEN, B. 2017. Project sustainability strategies: A systematic literature review. *International Journal of Project Management,* 35, 1071–1083.

ABUDAYYEH, O. 1994. Partnering: A team building approach to quality construction management. *Journal of Management in Engineering,* 10, 26–29.

ALDERMAN, N. & IVORY, C. 2007. Partnering in major contracts: Paradox and metaphor. *International Journal of Project Management,* 25, 386–393.

ANDERSEN, E. & JESSEN, S.A. 2000. Project evaluation scheme: A tool for evaluating project status and predicting project results. *Project Management,* 6, 61–69.

ANDERSON, L.L. & POLKINGHORN, B.D. 2011. Efficacy of partnering on the Woodrow Wilson bridge project: Empirical evidence of collaborative problem-solving benefits. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction,* 3, 17–27.

ASSOCIATED GENERAL CONTRACTORS OF AMERICA. 1991. *Partnering: A Concept for Success*. Washington DC: Associated General Contractors of America.

AUGIER, M. & SARASVATHY, S.D. 2004. Integrating evolution, cognition and design: Extending Simonian perspectives to strategic organization. *Strategic Organization,* 2, 169–204.

AZARI, M.J., MADSEN, T.K. & MOEN, Ø. 2017. Antecedent and outcomes of innovation-based growth strategies for exporting SMEs. *Journal of Small Business and Enterprise Development*, 24, 733–752.

BAYLISS, R., CHEUNG, S.-O., SUEN, H.C.H. & WONG, S.-P. 2004. Effective partnering tools in construction: a case study on MTRC TKE contract 604 in Hong Kong. *International Journal of Project Management,* 22, 253–263.

BENNETT, J. & JAYES, S. 1995. *Trusting the Team: The Best Practice Guide to Partnering in Construction*. London: Thomas Telford.

BENNETT, J. & BAIRD, A. 2001. *NEC and Partnering: The Guide to Building Winning Teams*. London: Thomas Telford.

BIGGS, C.P. 2004. *Managing Cultural Differences in Alliances*. Pittsford: Altreya Consulting LLC.

BIONG, H., LANSENG, E., ENERGIFORSYNINGENS, F. & EFFEN, M. 1994. *Selgers og leverandørens oppførsel i energimarkedet: Selgers og energileverandørs rolle med hensyn til å skape langsiktig kunderelasjoner i energimarkedet. Rapport*. Sandvika: Norsk institutt for markedsforskning.

BLACK, C., AKINTOYE, A. & FITZGERALD, E. 2000. An analysis of success factors and benefits of partnering in construction. *International Journal of Project Management,* 18, 423–434.
BOND-BARNARD, T.J., FLETCHER, L. & STEYN, H. 2018. Linking trust and collaboration in project teams to project management success. *International Journal of Managing Projects in Business,* 11, 432–457.
BRESNEN, M. 2007. Deconstructing partnering in project-based organisation: Seven pillars, seven paradoxes and seven deadly sins. *International Journal of Project Management,* 25, 365–374.
BRETTEL, M., MAUER, R., ENGELEN, A. & KÜPPER, D. 2012. Corporate effectuation: Entrepreneurial action and its impact on R&D project performance. *Journal of Business Venturing,* 27, 167–184.
BRYMAN, A. 2008. *Social Research Methods*. 3rd. ed. Oxford: Oxford University Press.
BRYMAN, A. 2016. *Social Research Methods*. 5th ed. Oxford: Oxford University Press.
BYGBALLE, L.E., JAHRE, M. & SWARD, A. 2010. Partnering relationships in construction: A literature review. *Journal of Purchasing and Supply Management,* 16, 239–253.
BYGBALLE, L.E. & SWÄRD, A. 2019. Collaborative project delivery models and the role of routines in institutionalizing partnering. *Project Management Journal,* 50, 161–176.
BØRVE, S. 2019. *Project Partnering Defined and Implications Thereof.* PhD thesis 2019:308, Norwegian University of Science and Technology, Faculty of Engineering, Department of Mechanical and Industrial Engineering, Trondheim.
BØRVE, S., ROLSTADÅS, A., ANDERSEN, B. & AARSETH, W. 2017. Defining project partnering. *International Journal of Managing Projects in Business,* 10, 666–699.
CANIËLS, M. C., CHIOCCHIO, F. & VAN LOON, N. P. 2019. Collaboration in project teams: The role of mastery and performance climates. *International Journal of Project Management,* 37**,** 1–13.
CHAN, A.P., CHAN, D.W. & HO, K.S. 2003a. An empirical study of the benefits of construction partnering in Hong Kong. *Construction Management and Economics,* 21, 523–533.
CHAN, A.P., CHAN, D.W. & HO, K.S. 2003b. Partnering in construction: Critical study of problems for implementation. *Journal of Management in Engineering,* 19, 126–135.
CHAN, A.P.C., CHAN, D.W.M., CHIANG, Y.H., TANG, B.S., CHAN, E.H. W. & HO, K.S.K. 2004. Exploring critical success factors for partnering in construction projects. *Journal of Construction Engineering and Management,* 130, 188–198.
CHANG, A., CHIH, Y.-Y., CHEW, E. & PISARSKI, A. 2013. Reconceptualising mega project success in Australian defence: Recognising the importance of value co-creation. *International Journal of Project Management,* 31, 1139–1153.
CHE IBRAHIM, C.K.I., COSTELLO, S.B. & WILKINSON, S. 2018. Making sense of team integration practice through the 'lived experience' of alliance project teams. *Engineering, Construction, and Architectural Management,* 25, 598–622.
CHEN, W.T. & CHEN, T.-T. 2007. Critical success factors for construction partnering in Taiwan. *International Journal of Project Management,* 25, 475–484.
CHENG, E.W. & LI, H. 2001. Development of a conceptual model of construction partnering. *Engineering, Construction and Architectural Management,* 8, 292–303.
CHENG, E.W. & LI, H. 2004. Development of a practical model of partnering for construction projects. *Journal of Construction Engineering and Management,* 130, 790–798.
CHENG, E.W., LI, H. & LOVE, P. 2000. Establishment of critical success factors for construction partnering. *Journal of Management in Engineering,* 16, 84–92.
CHEUNG, S.-O., NG, T.S., WONG, S.-P. & SUEN, H.C. 2003. Behavioral aspects in construction partnering. *International Journal of Project Management,* 21, 333–343.
CONSTRUCTION EXCELLENCE 2009. *Collaborative Procurement Guide*. London: Construction Excellence.
CONSTRUCTION INDUSTRY INSTITUTE 1991. *In Search of Partnering Excellence*. Special Publication 17-1. Austin, TX: Construction Industry Institute).

CONSTRUCTION INDUSTRY INSTITUTE 1996. *Model for Partnering Excellence, Research Summary 102-1*. University of Texas at Austin, Construction Industry Institute Partnering II Research Team. https://classes.engineering.wustl.edu/2009/spring/jme4900/Articles/RS102-1ModelforPartnering.pdf8 (accessed 7 September 2022).

COOKE-DAVIES, T. 2002. The real success factors on projects. *International Journal of Project Management,* 20, 185–190.

COWAN, C., GRAY, C. & LARSON, E. 1992. Project partnering. *Project Management Journal,* 23, 5–11.

CRANE, T.G., FELDER, J.P., THOMPSON, P.J., THOMPSON, M.G. & SANDERS, S.R. 1997. Partnering process model. *Journal of Management in Engineering,* 13, 57–63.

CRESPIN-MAZET, F., INGEMANSSON HAVENVID, M. & LINNÉ, Å. 2015. Antecedents of project partnering in the construction industry—The impact of relationship history. *Industrial Marketing Management,* 50, 4–15.

CRESWELL, J.W. 2009. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* 3rd ed. Los Angeles, CA: SAGE.

CROWLEY, L.G. & KARIM, M.A. 1995. Conceptual model of partnering. *Journal of Management in Engineering,* 11, 33–39.

DAS, T. & TENG, B.-S. 2001. A risk perception model of alliance structuring. *Journal of International Management,* 7, 1–29.

DEPARTMENT OF TREASURY AND FINANCE, VICTORIA. 2010. *The Practitioners' Guide to Alliance Contracting*. State of Victoria, Australia: Department of Treasury and Finance.

DE VAUS, D. 2014. *Surveys in Social Research.* London: Routledge.

de WIT, A. 1988. Measurement of project success. *International Journal of Project Management,* 6, 164–170.

DEVILBISS, C.E. & LEONARD, P. 2000. Partnering is the foundation of a learning organization. *Journal of Management in Engineering,* 16, 47–57.

DEW, N., SARASVATHY, S.D. & VENKATARAMAN, S. 2004. The economic implications of exaptation. *Journal of Evolutionary Economics,* 14, 69–84.

DIETRICH, P., ESKEROD, P., DALCHER, D. & SANDHAWALIA, B. 2010. The dynamics of collaboration in multipartner projects. *Project Management Journal,* 41, 59–78.

DIREKTORATET FOR HØGARE UTDANNING OG KOMPETANSE. n.d. *Register over vitenskapelige publiseringskanaler*. https://kanalregister.hkdir.no/publiseringskanaler/KanalTreffliste.action?a=true&tv=true (accessed 30 March 2022.

DOLOI, H. 2009. Relational partnerships: the importance of communication, trust and confidence and joint risk management in achieving project success. *Construction Management and Economics,* 27**,** 1099–1109.

DU, L., TANG, W., LIU, C., WANG, S., WANG, T., SHEN, W., HUANG, M. & ZHOU, Y. 2016. Enhancing engineer–procure–construct project performance by partnering in international markets: Perspective from Chinese construction companies. *International Journal of Project Management,* 34, 30–43.

DVIR, D. & LECHLER, T. 2004. Plans are nothing, changing plans is everything: The impact of changes on project success. *Research Policy,* 33, 1–15.

ELMUTI, D. & KATHAWALA, Y. 2001. An overview of strategic alliances. *Management Decision,* 39, 205–218.

ENGEBØ, A., SKATVEDT, Å. & TORP, O. 2019. *Soft Elements in Collaborative Project Delivery Methods*. International Group for Lean Construction. https://iglcstorage.blob.core.windows.net/presentations/presentation-d9accbb1-0e50-48d5-b5f5-a2b9d62ad7af.pdf (accessed 7 September 2022).

ENGEBØ, A., LÆDRE, O., YOUNG, B., LARSSEN, P.F., LOHNE, J. & KLAKEGG, O.J. 2020. Collaborative project delivery methods: A scoping review. *Journal of Civil Engineering and Management,* 26, 278–303.

ERIKSSON, P.E. 2010. Partnering: What is it, when should it be used, and how should it be implemented? *Construction Management and Economics,* 28, 905–917.

ERIKSSON, P.E. & WESTERBERG, M. 2011. Effects of cooperative procurement procedures on construction project performance: A conceptual framework. *International Journal of Project Management,* 29, 197–208.

FLEETWOOD, S. 2005. Ontology in organization and management studies: A critical realist perspective. *Organization,* 12, 197–222.

FORTUNE, J. & WHITE, D. 2006. Framing of project critical success factors by a systems model. *International Journal of Project Management,* 24, 53–65.

FOTOPOULOS, C.B. & PSOMAS, E.L. 2009. The impact of 'soft' and 'hard' TQM elements on quality management results. *International Journal of Quality & Reliability Management,* 26, 150–163.

GADDE, L.E. & DUBOIS, A. 2010. Partnering in the construction industry-problems and opportunities. *Journal of Purchasing and Supply Management,* 16, 254–263.

GUBA, E.G. & LINCOLN, Y.S. 1994. Competing paradigms in qualitative research. In: Denzin, N.K. & Lincoln, Y.S. (eds.) *Handbook of Qualitative Research,* pp. 105–117. London: SAGE.

HAASKJOLD, H., ANDERSEN, B., LÆDRE, O. & AARSETH, W. 2019. Factors affecting transaction costs and collaboration in projects. *International Journal of Managing Projects in Business,* 13. https://www.emerald.com/insight/content/doi/10.1108/IJMPB-09-2018-0197/full/html (accessed 7 September 2022).

HAASKJOLD, H., ANDERSEN, B.S. & LANGLO, J. A. 2020. In search of empirical evidence for the relationship between collaboration and project performance. *Journal of Modern Project Management,* 7(4). https://journalmodernpm.com/index.php/jmpm/article/view/JMPM02207 (accessed 7 September 2022).

HAASKJOLD, H., AARSETH, W.K., RØKKE, T.A. & IVARSON, M. 2021. Spinning the IPD wheels – Moving towards frictionless project delivery. *Journal of Modern Project Management,* 9(2). https://doi.org/10.19255/JMPM02705 (accessed 7 September 2022).

HANISCH, B. & WALD, A. 2011. A project management research framework integrating multiple theoretical perspectives and influencing factors. *Project Management Journal,* 42, 4–22.

HAUCK, A.J., WALKER, D.H.T., HAMPSON, K.D. & PETERS, R.J. 2004. Project alliancing at National Museum of Australia—Collaborative process. *Journal of Construction Engineering and Management,* 130, 143–152.

HENDERSON, L.S., STACKMAN, R.W. & LINDEKILDE, R. 2016. The centrality of communication norm alignment, role clarity, and trust in global project teams. *International Journal of Project Management,* 34, 1717–1730.

HIETAJÄRVI, A.-M., AALTONEN, K. & HAAPASALO, H. 2017. Managing integration in infrastructure alliance projects: Dynamics of integration mechanisms. *International Journal of Managing Projects in Business,* 10, 5–31.

HOBBS, B. & ANDERSEN, B. 2001. Different alliance relationships for project design and execution. *International Journal of Project Management,* 19, 465–469.

HOEGL, M. & GEMUENDEN, H.G. 2001. Teamwork quality and the success of innovative projects: A theoretical concept and empirical evidence. *Organization science,* 12, 435–449.

HOSSEINI, A., WONDIMU, P.A., BELLINI, A., HENRIKTUNE, HAUGSETH, N., ANDERSEN, B. & LÆDRE, O. 2016. Project partnering in Norwegian construction industry. *Energy Procedia,* 96, 241–252.

HOSSEINI, A., WONDIMU, P. A., KLAKEGG, O.J., ANDERSEN, B. & LAEDRE, O. 2018. Project partnering in the construction industry: Theory vs. practice. *Engineering Project Organization Journal,* 8, 2–24.

HÄLLSTRÖM, A. af, BOSCH-SIJTSEMA, P., POBLETE, L., REMPLING, R. & KARLSSON, M. 2021. The role of social ties in collaborative project networks: A tale of two construction cases. *Construction Management and Economics,* 39, 723–738.

INGIRIGE, B. & SEXTON, M. 2006. Alliances in construction: Investigating initiatives and barriers for long-term collaboration. *Engineering, Construction, and Architectural Management,* 13, 521–535.

JACOBSSON, M. & ROTH, P. 2014. Towards a shift in mindset: Partnering projects as engagement platforms. *Construction Management and Economics,* 32, 419–432.

JEFFERIES, M., BREWER, G.J. & GAJENDRAN, T. 2014. Using a case study approach to identify critical success factors for alliance contracting. *Engineering, Construction and Architectural Management,* 21, 465–480.

JOHANNESSEN, A., CHRISTOFFERSEN, L. & TUFTE, P. 2011. *Forskningsmetode for økonomisk-administrative fag*. 3. utg. Oslo: Abstrakt.

JULIEN, P., JANE, H. & DANIEL, A. 2018. What is the Iron Triangle, and how has it changed? *International Journal of Managing Projects in Business,* 11, 527–547.

KADEFORS, A. 2004. Trust in project relationships—Inside the black box. *International Journal of Project Management,* 22, 175–182.

KALUARACHCHI, Y.D. & JONES, K. 2007. Monitoring of a strategic partnering process: The Amphion experience. *Construction Management and Economics,* 25, 1053–1061.

KLAKEGG, O.J. 2016. Ontology and epistemology. In: Pasian, B. (ed.) *Designs, Methods and Practices for Research on Project Management*, pp. 57–67. New York: Routledge.

KLAKEGG, O.J., WILLIAMS, T., WALKER, D., ANDERSEN, B. & MAGNUSSEN, O.M. 2010. *Early Warning Signs in Complex Projects*. United States of America: Project Management Institute.

KUMARASWAMY, M.M. & MATTHEWS, J.D. 2000. Improved subcontractor selection employing partnering principles. *Journal of Management in Engineering,* 16, 47–57.

LAAN, A., VOORDIJK, H. & DEWULF, G. 2011. Reducing opportunistic behaviour through a project alliance. *International Journal of Managing Projects in Business,* 4, 660–679.

LAHDENPERÄ, P. 2012. Making sense of the multi-party contractual arrangements of project partnering, project alliancing and integrated project delivery. *Construction Management and Economics,* 30, 57–79.

LAHDENPERÄ, P. 2017. Towards a coherent theory of project alliancing: Discovering the system's complex mechanisms yielding value for money. *Construction Economics and Building,* 17, 41–61.

LARSEN, A.S.A., KARLSEN, A.T., ANDERSEN, B. & OLSSON, N.O.E. 2021. Exploring collaboration in hospital projects' front-end phase. *International Journal of Project Management*, 39, 557–569.

LARSON, E. 1997. Partnering on construction projects: A study of the relationship between partnering activities and project success. *IEEE Transactions on Engineering Management,* 44, 188–195.

LATHAM, S.M. 1994. *Constructing the Team: Final Report of the Government/Industry Review of Procurement and Contractual Arrangements in the UK Construction Industry*. London: HMSO.

LAU, E. & ROWLINSON, S. 2009. Interpersonal trust and inter-firm trust in construction projects. *Construction Management and Economics,* 27, 539–554.

LAVIE, D., LECHNER, C. & SINGH, H. 2007. The performance implications of timing of entry and involvement in multipartner alliances. *Academy of Management Journal,* 50, 578–604.

LING, F.Y.Y., RAHMAN, M.M. & NG, T.L. 2006. Incorporating contractual incentives to facilitate relational contracting. *Journal of Professional Issues in Engineering Education and Practice,* 132, 57–66.
LING, F.Y., TAN, P. C., NING, Y., TEO, A. & GUNAWANSA, A. 2015. Effect of adoption of relational contracting practices on relationship quality in public projects in Singapore. *Engineering, Construction and Architectural Management*, 22, 169–189.
LOOTS, P. & HENCHIE, N. 2007. Worlds apart: EPC and EPCM contracts: Risk issues and allocation. *International Construction Law Review,* 24, 1–18.
LOVE, P.E.D., MISTRY, D. & DAVIS, P.R. 2010. Price competitive alliance projects: identification of success factors for public clients. *Journal of Construction Engineering and Management,* 136, 947–956.
LU, J. W. & BEAMISH, P.W. 2006. SME internationalization and performance: Growth vs. profitability. *Journal of International Entrepreneurship,* 4, 27–48.
MADSEN, T.K., RASMUSSEN, E.S., SERVAIS, P., SØRENSEN, H.E. & CEDERQUIST, N. 2006. *Muligheder for vækst i dansk eksport*. København: Danmarks Eksportråd.
MALVIK, T.O. & ENGEBØ, A. 2022. Experiences with Partnering: A case study on the development phase. *Procedia Computer Science,* 196, 1044–1052.
MALVIK, T.O., WONDIMU, P., KALSAAS, B.T. & JOHANSEN, A. 2021. Various approaches to early contractor involvement in relational contracts. *Procedia Computer Science,* 181, 1162–1170.
MASON, J. 2018. *Qualitative Researching.* Los Angeles, CA: SAGE.
MATTHEWS, O. & HOWELL, G.A. 2005. Integrated project delivery: An example of relational contracting. *Lean Construction Journal,* 2, 46–61.
MENG, X. 2012. The effect of relationship management on project performance in construction. *International Journal of Project Management,* 30, 188–198.
MENG, X. & GALLAGHER, B. 2012. The impact of incentive mechanisms on project performance. *International Journal of Project Management,* 30, 352–362.
MESA, H.A., MOLENAAR, K.R. & ALARCÓN, L.F. 2016. Exploring performance of the integrated project delivery process on complex building projects. *International Journal of Project Management,* 34, 1089–1101.
MIGLIACCIO, G.C., GIBSON, G.E. & O'CONNOR, J.T. 2008. Changing project delivery strategy: An implementation framework. *Public Works Management & Policy,* 12, 483–502.
MILLER, J.B., GARVIN, M.J., IBBS, C.W. & MAHONEY, S.E. 2000. Toward a new paradigm: Simultaneous use of multiple project delivery methods. *Journal of Management in Engineering,* 16, 58–67.
MOLLAOGLU, S., SPARKLING, A. & THOMAS, S. 2015. An inquiry to move an underutilized best practice forward: Barriers to partnering in the architecture, engineering, and construction industry. *Project Management Journal,* 46, 69–83.
MORADI, S. & KÄHKÖNEN, K. 2022. Success in collaborative construction through the lens of project delivery elements. *Built Environment Project and Asset Management*. https://doi.org/10.1108/BEPAM-09-2021-0118
MORADI, S., KÄHKÖNEN, K. & AALTONEN, K. 2020. Project managers' competencies in collaborative construction projects. *Buildings,* 10: Article 50.
MORADI, S., KÄHKÖNEN, K. & SORMUNEN, P. 2022. Analytical and conceptual perspectives toward behavioral elements of collaborative delivery models in construction projects. *Buildings,* 12: Article 316.
MORGAN, R.M. & HUNT, S.D. 1994. The commitment-trust theory of relationship marketing. *Journal of Marketing,* 58, 20–38.
MORRIS, P.W.G. & PINTO, J.K. (eds.) 2007. *The Wiley Guide to Project Technology Management, Supply Chain & Procurement Management*. Hoboken, NJ: John Wiley & Sons.

MÜLLER, R. & JUGDEV, K. 2012. Critical success factors in projects: Pinto, Slevin, and Prescott – The elucidation of project success. *International Journal of Managing Projects in Business,* 5, 757–775.

NATIONAL COMMITTEE FOR RESEARCH ETHICS IN SCIENCE AND TECHNOLOGY 2016. *Guidelines for Research Ethics in Science and Technology*. Oslo: Norwegian National Research Ethics Committee.

NAOUM, S. 2003. An overview into the concept of partnering. *International Journal of Project Management,* 21, 71–76.

NEVSTAD, K., Børve, S., Karlsen, A.T. & Aarseth, W. 2018. Understanding how to succeed with project partnering. *International Journal of Managing Projects in Business*, 11(4), 1044–1065.

NEVSTAD, K., Madsen, T.K., Eskerod, P., Aarseth, W.K., Karlsen, A.S.T. & Andersen, B. 2021. Linking partnering success factors to project performance – Findings from two nation-wide surveys. *Project Leadership and Society*, 2: Article 100009.

NEVSTAD, K., Karlsen, A.S.T., Aarseth, W.K. & Andersen, B. 2022. How a project alliance influences project performance compared to traditional project practice – Findings from a case study in the Norwegian oil and gas industry. *Journal of Modern Project Management*, 9(3). https://doi.org/10.19255/JMPM02809 (accessed 7 September 2022)

NG, S.T., ROSE, T.M., MAK, M. & CHEN, S.E. 2002. Problematic issues associated with project partnering—the contractor perspective. *International Journal of Project Management,* 20, 437–449.

NYAGA, G.N., WHIPPLE, J.M. & LYNCH, D.F. 2010. Examining supply chain relationships: Do buyer and supplier perspectives on collaborative relationships differ? *Journal of Operations Management,* 28, 101–114.

NYSTRÖM, J. 2005. The definition of partnering as a Wittgenstein family-resemblance concept. *Construction Management and Economics,* 23, 473–481.

OECD. 2009. *The Impact of the Global Crisis on SME and Entrepreneurship Financing and Policy Responses*. https://www.oecd.org/cfe/smes/theimpactoftheglobalcrisisonsmeandentrepreneurshipfinancingandpolicyresponses.htm (accessed 22 September 2022).

PATTON, M.Q. 1990. *Qualitative Evaluation and Research Methods.* 2nd ed. Newbury Park, CA: SAGE.

PINTO, J.K. & SLEVIN, D.P. 1987. Critical factors in successful project implementation. *IEEE Transactions on Engineering Management*, 34(1), 22–27.

RAHMAN, M.M. & KUMARASWAMY, M.M. 2004. Contracting relationship trends and transitions. *Journal of Management in Engineering,* 20, 147–161.

RAISBECK, P., MILLIE, R. & MAHER, A. 2010. Assessing integrated project delivery: A comparative analysis of IPD and alliance contracting procurement routes. In: Egbu, C. (ed.) *Proceedings 26th Annual ARCOM Conference: 6–8 September 2010, Leeds, UK,* pp. 1019–1028. https://www.tib.eu/en/search/id/TIBKAT:1002892597/ (accessed 22 September 2022).

RASLIM, F. & MUSTAFFA, N. 2017. The success factors of relationship-based procurement (RBP) in Malaysia. *International Journal of Civil Engineering and Technology,* 8, 1616–1625.

RATAJCZAK, J., SCHIMANSKI, C.P., MARCHER, C., RIEDL, M. & MATT, D.T. Collaborative tool for the construction site to enhance lean project delivery. In: Luo, Y. (ed.) *Cooperative Design, Visualization and Engineering*. CDVE 2018 Lecture Notes in Computer Science Vol. 11151, 192–199. Cham: Springer.

READ, S., DEW, N., SARASVATHY, S.D., SONG, M. & WILTBANK, R. 2009. Marketing under uncertainty: The logic of an effectual approach. *Journal of Marketing,* 73, 1–18.

REED, M.I. 2009. Critical realism: Philosophy, method, or philosophy in search of a method. In: Buchanan, D.A. & Bryman, A. (eds.) *The SAGE Handbook of Organizational Research Methods*, pp. 430–448. 1st ed. Los Angeles, CA: SAGE.

REZVANI, A. & KHOSRAVI, P. 2018. A comprehensive assessment of project success within various large projects. *Journal of Modern Project Management,* 6. https://journalmodernpm.com/index.php/jmpm/article/view/JMPM01613 (accessed 7 September 2022).
ROLSTADÅS, A., PINTO, J.K., FALSTER, P. & VENKATARAMAN, R. 2014. *Decision Making in Project Management*. Trondheim: NTNU, Faculty of Engineering Science and Technology.
SAMSET, K.F. 2008. *Prosjekt i tidligfasen : valg av konsept.* Trondheim: Tapir akademisk forlaget.
SANDERS, S.R. & MOORE, M.M. 1992. Perceptions on partnering in the public sector. *Project Management Journal,* 23, 13–19.
SARASVATHY, S.D. 2001. Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. *Academy of Management Review,* 26, 243–263.
SARASVATHY, S.D. 2004. Making it happen: Beyond theories of the firm to theories of firm design. *Entrepreneurship Theory and practice,* 28, 519–531.
SARHAN, S., PASQUIRE, C., MANU, E. & KING, A. 2017. Contractual governance as a source of institutionalised waste in construction: A review, implications, and road map for future research directions. *International Journal of Managing Projects in Business,* 10**,** 550–577.
SAUNDERS, M.N.K., LEWIS, P. & THORNHILL, A. 2019. *Research Methods for Business Students.* 8th ed. New York: Pearson.
SHENHAR, A.J., DVIR, D., LEVY, O. & MALTZ, A.C. 2001. Project success: A multidimensional strategic concept. *Long Range Planning,* 34**,** 699–725.
SILVA, A. & HARPER, C. *Using Project Team Integration to Predict Cost and Schedule Performance in Public Transportation Projects*. Construction Research Congress 2018, New Orleans, Louisiana. https://ascelibrary.org/doi/10.1061/9780784481295.068 (accessed 7 September 2022).
SMITH, E.M. & THOMASSON, A. 2016. The use of the partnering concept for public–private collaboration: How well does it really work? *Public Organization Review,* 18, 191–206.
SPITZER, D.R. 2007. *Transforming Performance Measurement: Rethinking the Way We Measure and Drive Organizational Success*. New York: American Management Association.
STEINMO, M. & RASMUSSEN, E. 2016. How firms collaborate with public research organizations: The evolution of proximity dimensions in successful innovation projects. *Journal of Business Research,* 69, 1250–1259.
SULLIVAN, J., ASMAR, M.E., CHALHOUB, J. & OBEID, H. 2017. Two decades of performance comparisons for design-build, construction manager at risk, and design-bid-build: Quantitative analysis of the state of knowledge on project cost, schedule, and quality. *Journal of Construction Engineering and Management,* 143: Article 4017009.
SUPRAPTO, M., BAKKER, H.L., MOOI, H.G. & HERTOGH, M.J. 2016a. How do contract types and incentive matter to project performance? *International Journal of Project Management,* 34, 1071–1087.
SUPRAPTO, M., BAKKER, H.L. M. & MOOI, H.G. 2015a. Relational factors in owner–contractor collaboration: The mediating role of teamworking. *International Journal of Project Management,* 33**,** 1347–1363.
SUPRAPTO, M., BAKKER, H.L.M., MOOI, H.G. & MOREE, W. 2015b. Sorting out the essence of owner–contractor collaboration in capital project delivery. *International Journal of Project Management,* 33, 664–683.
TADAYON, A. 2018. *A New Look Towards Relational Project Delivery Models.* Doctoral Theses at NTNU, 2018:372. Norwegian University of Science and Technology, Faculty of Engineering, Department of Civil and Environmental Engineering.
TADAYON, A. & ANDERESEN, B. 2021. Characteristics of a project that are suitable for a relational PDM. *Procedia Computer Science,* 181, 1089–1096.

TADEU DE OLIVEIRA LACERDA, R., ENSSLIN, L. & ROLIM ENSSLIN, S. 2011. A performance measurement view of IT project management. *International Journal of Productivity and Performance Management,* 60, 132–151.
THOMPSON, P. & SANDERS, R. 1998. Partnering continuum. *Journal of Management in Engineering,* 14, 73–78.
TURNER, J.R. 2008. *The Handbook of Project-Based Management*. 3rd ed. New York: McGraw-Hill Professional Publishing.
TURNER, J.R. & MÜLLER, R. 2004. Communication and co-operation on projects between the project owner as principal and the project manager as agent. *European Management Journal,* 22, 327–336.
WALKER, D.H., HAMPSON, K. & PETERS, R. 2002. Project alliancing vs project partnering: A case study of the Australian National Museum Project. *Supply Chain Management,* 7, 83–91.
WALKER, D.H.T. & LLOYD-WALKER, B.M. 2015. *Collaborative Project Procurement Arrangements.* Newton Square, PA: Project Management Institute.
WALKER, D.H.T. & LLOYD-WALKER, B.M. 2016. Understanding the motivation and context for alliancing in the Australian construction industry. *International Journal of Managing Projects in Business,* 9, 74–93.
WALKER, D.H.T., DAVIS, P.R. & STEVENSON, A. 2017. Coping with uncertainty and ambiguity through team collaboration in infrastructure projects. *International Journal of Project Management,* 35, 180–190.
WILLIAMS, T. 2005. Assessing and moving on from the dominant project management discourse in the light of project overruns. *IEEE Transactions on Engineering Management,* 52, 497–508.
WILLIAMS, T. 2016. Identifying success factors in construction projects: A case study. *Project Management Journal,* 47, 97–112.
WILLIAMS, T. & SAMSET, K. 2010. Issues in front-end decision making on projects. *Project Management Journal,* 41, 38–49.
WILLIAMSON, O.E. 1975. *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.
WONG, P.S.-P. & CHEUNG, S.-O. 2004. Trust in construction partnering: Views from parties of the partnering dance. *International Journal of Project Management,* 22, 437–446.
WONG, P.S.P. & CHEUNG, S.O. 2005. Structural equation model of trust and partnering success. *Journal of Management in Engineering,* 21**,** 70–80.
WONG, W.K., CHEUNG, S.O., YIU, T.W. & PANG, H. Y. 2008. A framework for trust in construction contracting. *International Journal of Project Management,* 26, 821–829.
WOOD, G., MCDERMOTT, P. & SWAN, W. 2002. The ethical benefits of trust-based partnering: The example of the construction industry. *Business Ethics: A European Review,* 11, 4–13.
WOOD, G.D. & ELLIS, R.C.T. 2005. Main contractor experiences of partnering relationships on UK construction projects. *Construction Management and Economics,* 23, 317–325.
YEUNG, J.F.Y., CHAN, A.P.C. & CHAN, D.W.M. 2007. The definition of alliancing in construction as a Wittgenstein family-resemblance concept. *International Journal of Project Management,* 25, 219–231.
YIN, R. 1994. Discovering the future of the case-study method in evaluation research. *Evaluation Practice,* 15, 283–290.
YIN, R.K. 2008. *Case Study Research Design and Methods*. 4th ed. Thousand Oaks, CA: SAGE.
YIN, R.K. 2014. *Case Study Research: Design and Methods.* Los Angeles, CA: SAGE.
YIU, T.W., KEUNG, C.W. & WONG, K.L. 2011. Application of equity sensitivity theory to problem-solving approaches in construction dispute negotiation. *Journal of Management in Engineering,* 27, 40–47.
YOUNG, B., HOSSEINI, A., KLAKEGG, O.J. & LÆDRE, O. 2018. What makes an alliance an alliance: Experiences from Australian infrastructure projects. *Journal of Modern Project Management,* 6, 18–29.

YOUNG, B., HOSSEINI, A. & LÆDRE, O. 2016. The characteristics of Australian infrastructure alliance projects. *Energy Procedia,* 96, 833–844.

Appendices

Appendix A-1 Formulations of independent and dependent variables (Paper 2)

Dependent variables

- The project so far follows the planned time schedule
- The project is so far within budget
- The project so far meets the agreed technical specifications

Independent variables

Please note that the specific questions to which the variables relate are presented in the section on questionnaire development.

- Trust know – indicator for *trust*
- Trust interest – indicator for *trust*
- Communication – indicator for *communication*
- Support – indicator for *commitment*
- Resources – indicator for *commitment*
- Overcome barrier – indicator for *collaborative problem-solving*
- Goals clear – indicator for *mutual project objectives*
- Goal accepted – indicator for *mutual project objectives*

Appendix A-2 Development of the questionnaire (Paper 2)

Trust

Relational norms refer to norms of reciprocity and trust that develop during the course of an inter-firm relationship (Morgan & Hunt, 1994). The stronger the relational norms, the more protection the partners have against opportunistic behaviour without having to rely on explicit formal contracts as safeguarding mechanisms (Das & Teng, 2001). Two questions related to trust were developed (the variable name of the indicators used in the quantitative analysis included in square brackets):

- *We trust that the knowledge we transfer to the project will not be misused by our partner should they collaborate with our competitors in the future*. [Trust know]
- *We trust that our partner shows consideration for our interests.* [Trust interest]

Communication

The question about communication corresponds to a survey question reported by Hoegl and Gemuenden (2001), which suggests that communication between partners is important to project success:

- *There is often communication happening between the participating partners.* [Communication]

Commitment

Commitment relates both to support by project representatives and to allocation/investment of resources.

The first question on commitment is adapted from Andersen and Jessen (2000). The survey underlying the article by Andersen and Jessen (2000) was conducted in the Norwegian language and therefore the original question was already in Norwegian (which is easily adaptable to Danish).

- *All persons involved in the project (project manager, project owner, steering groups, top management, etc.) are actively supporting the project.* [Support]

Relation-specific assets refer to investments that a firm makes with a partner and that are specific to that relation ('idiosyncratic') and have only salvage value outside the focal relation (Williamson, 1975). Investments can be in, for example, human resources (e.g. dedicated personnel) or physical capital resources (e.g. locating a production site adjacent to a partner's production site). With regard to transaction cost, it is argued in the literature in the field of

economics that the more a firm invests in relation-specific assets, the higher will be its switching costs, and thus the higher the risk that it will fall victim to a 'hold-up' by a partner trying to extract ex post rents (Williamson, 1975). The next question was inspired by two statements by Nyaga et al. (2010) – 'We have dedicated significant investments (e.g. equipment, personnel) to partner relationships', and 'We needed to dedicate a lot of resources (human, capital) to our relationships with our partners' – and linked to commitment:

- *We allocate many resources (people, money) to the collaboration with partners.* [Resources]

Collaborative problem-solving

Effectuation has been suggested as a viable theoretical frame for the analysis of individual behaviour in environments characterized by high uncertainty (Sarasvathy, 2001). In entrepreneurship research, effectuation relates to the view that the process of decision-making involves a person's prior beliefs about themself, as well as prior knowledge and networks, thereby placing the entrepreneur centre stage (Sarasvathy, 2004). Although the theory has attracted strong interest among researchers in related fields, such as marketing (Read et al., 2009), economics (Dew et al., 2004), management (Augier & Sarasvathy, 2004) and R&D management (Brettel et al., 2012), effectuation has yet to be employed in the study of how managers in consulting engineering firms engage in multi-partner projects. Inspired by the questionnaire and the scales developed by the work of Brettel et al. (2012) on R&D management and effectuation, and to contribute to the understanding of how key managers engage in collaboration in MPPs, the following question related to collaborative problem-solving was developed:

- *We try to overcome barriers to project completion through continuous collaboration with customers and partners.* [Overcome barrier]

Mutual project objectives

With regard to mutual project objectives, two questions included in the analysis corresponded to survey questions used by Hogel and Gemuenden (2001) in their empirical study of mutual project objectives:

- *Goals for different project elements are clear and well understood across partner organizations.* [Goals clear]
- *Goals for different project elements are accepted across partner organizations.* [Goal accepted]

Project performance

The respondents were asked how the MPP was currently evaluated in terms of whether it was meeting its time schedule, budget, and technical specifications (i.e. the dependent variables). Scales were inspired by Andersen and Jessen (2000) and Brettel et al. (2012). Questions linked to project performance were as follows:

- *The project so far follows the planned time schedule.* [Meets time schedule]
- *The project is so far within budget.* [Meets budget]
- *The project so far meets the agreed technical specifications.* [Meets technical specifications]

PART II
INDIVIDUAL PUBLICATIONS

PAPER 1

PAPER 2

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Empirical Research Paper

Linking partnering success factors to project performance - Findings from two nation-wide surveys

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ABSTRACT

In this article we present findings from an investigation into the influence of partnering success factors on multi-partner projects' abilities to meet time schedule, budget, and technical specifications. Our findings are based on the analysis of nation-wide surveys within the engineering consultancy industry in Denmark and Norway, and the research includes empirical data from 124 engineering consultancies. A main conclusion is that in order to meet all three criteria in the project performance measure, i.e. time schedule, budget, and technical specifications, *mutual project objectives* and *commitment are* important. To fulfil the two criteria time schedule and technical specifications, *trust* and *collaborative problem-solving* are important. To meet the criterion technical specifications, *communication* is the important partnering success factor. We also find that to positively influence project performance in a project comprising partners from independent firms, the project manager must aim to ensure the presence of the five identified partnering success factors throughout the project.

1. Introduction

In several industries it is common for companies to create value through projects (Turner et al., 2012; Söderlund, 2008; Crawford, 2006; Brady and Davies, 2004). In some domains, attracting and accomplishing projects requires that several partners work together. For example, this is typically the case in shipbuilding (Ahola, 2009), in oil and gas (Olsen et al., 2005), in construction (Bresnen, 2007), and in sports event projects (Larson and Wikström, 2007). When it comes to infrastructure projects and other large engineering projects, the long-term, integrated construction process requiring multiple services in an increasingly global world has led to widespread recognition of engineering consultancies and construction companies entering into various kinds of cooperation arrangements in order to create value together (Dyer and Nobeoka, 2000; Eskerod and Damgaard, 1998).

In many countries there is an increasing interest in collaborative relationships, also referred to as partnering (Bresnen and Marshall, 2000; Chan et al., 2003; Ng et al., 2002). Partnering is the most frequently discussed institutional form of cooperative relationship in the building and construction industry (Eriksson, 2010; Wood et al., 2002). Each partnering project is formed by a set of hard and soft elements (Fotopoulos and Psomas, 2009; Yeung et al., 2007). Elements that are directly regulated by the project contract or have their basis in the procurement process are considered hard elements (such as a formal contract and gain-share/pain-share), whereas soft elements contribute to the relationship between the project participants (such as trust, communication, and commitment) (Yeung et al., 2007). A study (Nevstad et al., 2018) focusing on the management and collaboration aspects of partnering has identified *trust*, *communication*, *commitment*, *collaborative problem-solving*, and *mutual project objectives* to be the most frequently stated partnering success factors.

Despite the mentioning of multi-partner projects (MPP) in literature (Dietrich et al., 2010), there is no generally accepted definition of the concept. In line with the definition of multi-partner alliances provided by Lavie, Lechner et al. (Lavie et al., 2007) as well as the definition in (Aagaard et al., 2012), we define a multi-partner project as *a project in which employees from two or more independent firms work together to attract, plan and execute a common time-bounded and resource-constrained task of a*

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certain complexity for a client in order to create value for the firms and client involved. A multi-partner project can be seen as a knowledge collective, which is characterized by cross-disciplinary, loosely coupled groups with a minimal common knowledge base (Lindkvist, 2005). Multi-partner projects involve highly complicated knowledge-sharing processes and collaborative arrangements and are therefore highly relevant to study.

Project-based collaboration, often spanning national borders and organizations, is challenging due to a multitude of reasons, including the temporary nature of alliances that are formed to deliver new output together. Several complex projects experience substantial cost overruns and delays in completion as well as failure in delivering what was agreed upon (Chang et al., 2013; Williams and Samset, 2010). However, partnering (in terms of both hard and soft elements) has been documented to contribute positively to construction projects (Suprapto et al., 2016; Tabish and Jha, 2011; Xue et al., 2010; Jacobson and Ok Choi, 2008; Chan et al., 2004; Bayramoglu, 2001; Cheng et al., 2000; Larson, 1997).

In recent years, researchers have increasingly turned their focus from hard elements to social and human aspects, i.e. soft elements related to working in project-based collaboration (Jacobsson and Roth, 2014; Hanisch and Wald, 2011). Several authors state that improved collaboration has a positive effect on performance in construction projects (Caniëls et al., 2019; Sarhan et al., 2017; Walker et al., 2017). Generally, there is a need for more research investigating the link between collaboration and project performance (Silva and Harper, 2018; Bond-Barnard et al., 2018; Meng and Gallagher, 2012). This investigation responds to the call to collect data from a large number of projects to test that there is a positive relationship between collaboration and project performance (Eriksson and Westerberg, 2011).

Several studies have been carried out to identify factors responsible for successful partnering (Chan et al., 2004; Cheng et al., 2000; Ling et al., 2015; Black et al., 2000; Doloi, 2009; Chen and Chen, 2007). Furthermore, studies on human project success factors, in the context of the project team, have been explored to some extent (Eriksson and Westerberg, 2011) in literature, but these have been investigated in relative isolation from the other factors (Bond-Barnard et al., 2018). Even though research has been conducted, several existing studies are based on surveys with limited empirical support (Silva and Harper, 2018; Bond-Barnard et al., 2018; Meng and Gallagher, 2012; Haaskjold et al., 2020) and therefore testify to a gap in the existing literature. In order to explore the relationship between project-based collaboration and project performance further, it is apparent that more empirical research is needed.

In this investigation, we focus on collaboration between multiple partners within the engineering consultancy industry. Based on the argumentation above, our research question is:

> RQ. How do partnering success factors influence multi-partner projects' performance in terms of being on time, within budget, and to technical specifications?

This article is organized as follows: Section 2 describes the theoretical background for partnering success, including subsections on project performance and partnering success factors. This is followed by section 3, in which a description of the chosen research methodology is presented. In section 4, findings are summarized and central aspects of our findings are discussed. Finally, in section 5, conclusions, practical implications and further research are presented.

2. Theoretical background

In this section, we discuss the two core concepts in the research underlying this article.

2.1. Project performance

The literature distinguishes between project success (measured against the purpose and the overall objectives of the project) and project management success (measured against the widespread and classic measures of performance, i.e. cost, time, and quality) (De Wit, 1988; Cooke-Davies, 2002). Traditionally, projects were perceived as successful when they met time, budget, and performance goals (Shenhar et al., 2001). Performance in terms of cost, time and quality is commonly known as "The Iron Triangle" (Rezvani and Khosravi, 2018). This concept is a fundamental aspect of how we understand success in projects. It is a representation of the most basic and classic criteria by which project success is measured, specifically whether the project is delivered by the due date, within budget, and to some agreed level of quality, performance or scope (Julien et al., 2018).

Several researchers perceive "The Iron Triangle" concept as a poor definition of project success, as it does not take into account fulfillment of the project's purpose about bringing value (Müller and Jugdev, 2012). However, most project managers in the construction industry have an operational focus, and their mindset and success criteria are focused on "getting the job done". While other success criteria have emerged, such as environmental impact, societal value, etc., industries still put heavy emphasis on finishing projects on time, within budget, and to specifications (Shenhar et al., 2001), implicitly implying that this is the first step towards fulfilling the other success criteria. In addition, it is easier to measure than other performance measures. Thus, we have chosen this classic project performance construct (time schedule, budget, and technical specifications) for our empirical study. The scope of this study is limited to performance measures pertaining to the concept "The Iron Triangle" only.

2.2. Partnering success factors

Project partnering is not easy to define, since researchers have been unable to develop a widely accepted description of project partnering. While (Larson, 1995) formulated a definition of partnering that includes a list of success elements, such as collaboration, trust, openness, and mutual respect, other authors have emphasized that a partnering definition cannot be separated from the presented elements (Chan et al., 2003; Yeung et al., 2007; Naoum, 2003; Nyström, 2005; Lu and Yan, 2007). We use the definition by Børve, Rolstadås et al. (Børve et al., 2017): "Project Partnering is a relationship strategy whereby a project owner integrates contractors and other major contributors into the project. Through commitment to mutual project objectives, collaborative problem solving and a joint governance structure, partners pursue collaborative relationships, trust and improved performance" [57, p. 694].

Partnering elements, such as trust, common understanding, and conflict resolution mechanisms, are in literature identified by a majority of the authors as important elements of partnering (Hosseini et al., 2018). As mentioned in the introduction, Nevstad, Børve et al. (Nevstad et al., 2018) found five groups of partnering success factors. The most important partnering success factor was *trust*, the second most important was *communication*, *commitment* was the third most important, *collaborative problem-solving* was listed as number four, and finally *mutual project objectives.* Inspired by Nevstad, Børve et al. (Nevstad et al., 2018), Table 1 shows groups of factors responsible for successful partnering described in literature and references. Each of the five partnering success factors, mentioned above, will be described in further detail.

Trust is a broad term (Wong et al., 2008; Kadefors, 2004) and varies in literature from "mutual trust" (Cheung et al., 2003) to the more specific "System-based trust" (Wong and Cheung, 2005). The factors of trust refer to involved partners (Cheung et al., 2003; Wong and Cheung, 2005; Lau and Rowlinson, 2009; Meng, 2012). Kaluarachchi and Jones (2007), adopting a broader view, require trust between "all stakeholders". Furthermore, trust is in literature described as an outcome (Eriksson, 2010), as an objective (Cheung et al., 2003; Construction Excellence, 2009), a measure (Mesa et al., 2016; Meng, 2012; Chan et al., 2004) or as a prerequisite (Aarseth et al., 2012; Kaluarachchi and Jones, 2007; Construction Industry Institute (CII) and C, 1991).

Table 1
Groups of factors responsible for successful partnering described in literature and references (adapted from Nevstad, Børve et al. (Nevstad et al., 2018)).

Partnering success factors	Formulations used to describe the factor	References
Trust	"Mutual trust"	Cheung, Ng et al. (Cheung et al., 2003)
	"System-based trust" (satisfactory terms, alignment, adoption of alternative dispute resolution)	Wong and Cheung (Wong and Cheung, 2005)
	"Inter-firm trust"	Lau and Rowlinson (Lau and Rowlinson, 2009)
	Described as a prerequisite	Aarseth, Andersen et al. (Aarseth et al., 2012) Kaluarachchi and Jones (Kaluarachchi and Jones, 2007) Construction Industry Institute (CII) (Construction Industry Institute (CII) and C, 1991)
	Described as a measure	Mesa, Molenaar et al. (Mesa et al., 2016) Meng (Meng, 2012) Chan, Chan et al. (Chan et al., 2004)
	Described as an objective	Construction Excellence (Construction Excellence, 2009) Cheung, Ng et al. (Cheung et al., 2003)
	Described as an outcome	Eriksson (Eriksson, 2010)
	Implicitly, the factors of trust refer to involved partners	Meng (Meng, 2012) Lau and Rowlinson (Lau and Rowlinson, 2009) Wong and Cheung (Wong and Cheung, 2005) Cheung, Ng et al. (Cheung et al., 2003)
	Require trust between "all stakeholders"	Kaluarachchi and Jones (Kaluarachchi and Jones, 2007)
	Related to the no-blame factors	Suprapto, Bakker et al. (Suprapto et al., 2015) Meng (Meng, 2012)
	Trust-control balance	Walker and Lloyd-Walker (Walker and Lloyd-Walker, 2015)
Communication	Just "communication"	Meng (Meng, 2012) Doloi (Doloi, 2009) Cheung, Ng et al. (Cheung et al., 2003)
	"Effective communication"	Black, Akintoye et al. (Black et al., 2000)
	"Open and honest communication"	Suprapto, Bakker et al. (Suprapto et al., 2015)
	"Permeability of partners" comprising communication, information flow and openness	Wong and Cheung (Wong and Cheung, 2005)
	"Early contractor involvement" to explain "effective communication"	Kaluarachchi and Jones (Kaluarachchi and Jones, 2007)
Commitment	"Commitment to teamwork"	Larson (Larson, 1997)
	"Commitment from senior management"	Black, Akintoye et al. (Black et al., 2000)
	"Long-term-" and "resource commitment"	Cheung, Ng et al. (Cheung et al., 2003)
	"Top management support" (as a kind of internal or external commitment)	Suprapto, Bakker et al. (Suprapto et al., 2015) Cheng and Li (Cheng and Li, 2001) Larson (Larson, 1997)
	"Equity" (to have something to lose)	Du, Tang et al. (Du et al., 2016)
	"Joint risks"	Doloi (Doloi, 2009)
Collaborative problem-solving	"Conflicts"	Cheng, Li et al. (Cheng et al., 2000)
	"Problems"	Du, Tang et al. (Du et al., 2016) Meng (Meng, 2012) Kaluarachchi and Jones (Kaluarachchi and Jones, 2007) Cheung, Ng et al. (Cheung et al., 2003) Bennett and Jayes (Bennett and Jayes, 1995)
	"Joint governance structure" (applies to both project risks and opportunities)	Walker and Lloyd-Walker (Walker and Lloyd-Walker, 2015)
Mutual project objectives	"Measurable objectives" fits well with the "continuous evaluation" and "annual review of performance"	Bennett and Baird (Bennett and Baird, 2001)
	"Benchmarks"	Bresnen (Bresnen, 2007)
	"Performance measurement"	Meng (Meng, 2012)

In literature, the wording of *communication* varies, with examples ranging from just "communication" (Doloi, 2009; Cheung et al., 2003; Meng, 2012) to, "effective communication" (Black et al., 2000) and, "open and honest communication" (Suprapto et al., 2015), whereas (Kaluarachchi and Jones, 2007) utilized the term "early contractor involvement" to explain "effective communication".

Commitment is the third most frequent factor. Formulations used to describe this factor vary from "commitment to teamwork" (Larson, 1997), and "commitment from senior management" (Black et al., 2000) to "long-term-" and "resource commitment" (Cheung et al., 2003). Furthermore, commitment is related to "top management support" (Larson, 1997; Suprapto et al., 2015; Cheng and Li, 2001) as a kind of internal or external commitment.

Collaborative problem-solving varies in literature from "joint risks" (Doloi, 2009) and "conflicts" (Cheng et al., 2000) to the broader "problems" (Cheung et al., 2003; Kaluarachchi and Jones, 2007; Meng, 2012; Du et al., 2016; Bennett and Jayes, 1995) and "joint governance structure" (Walker and Lloyd-Walker, 2015).

As to, *mutual project objectives*, examples used to describe this factor with exhibit little variation in wording and include "mutual", "joint", "common or shared objectives" or "goals". The concept of partnering evaluation has been developed into "performance measurement" by Meng (2012). "Benchmarks" are highlighted by (Bresnen, 2007). The term "measurable objectives" fits well with the terms "continuous evaluation" and "annual review of performance" emphasized by Bennett and Baird (2001).

Not surprisingly, success factors for projects in general (Pinto and. Slevin, 1987) also apply to partnering projects. For example, Haaskjold, Andersen et al. (Haaskjold et al., 2019) identified the quality of communication and trust between the parties to be the two out of five most important factors for project practitioners to prioritize in order to reduce transaction costs through improved collaboration.

3. Research methodology

In this section, we present our choice of industry as empirical base. Further, we describe in detail how we conducted two nation-wide surveys in the engineering consultancy industry, including both a Danish and a Norwegian dataset. In addition, we present how we developed the questionnaire and conducted the data analysis. The section is finalized by a thorough assessement of our research method.

3.1. Selection of industry as empirical base

Engineering consultancies are often involved in multi-partner projects of high complexity. Furthermore, engineering consultancies often act in international markets and have significant influence on the productivity and growth of other industries because they act as facilitators in the business-to-business market. Therefore, a study of multi-partner projects involving engineering consultancies has the potential to bring significant value to research as well as to practice in different industries. Danish engineering consultancies are almost entirely micro or small and medium-sized enterprises (SMEs). It is well known that such SMEs play an important role in growth, innovation and development in many industries (OECD, 2009; Lu and. Beamish, 2006), an effect that has also been demonstrated in Denmark (Madsen et al., 2006) and Norway (Azari and Madsen, 2017; Steinmo and Rasmussen, 2016). In sum, the engineering consultancies provide a highly appropriate setting, as their main business model is multi-partner projects in which the participants are specialized in different knowledge areas. Thus, this industry has been selected as the research's empirical base.

The surveys were conducted using a quantitative method (Vaus and D.A, 2014). Our quantitative data were collected through two nation-wide surveys, one carried out in the Danish and one in the Norwegian engineering consultancy industry. Our interest was in on-going multi-partner projects measuring individual-level perceptions of collaborative behaviors. The surveys were carried out in the respective native languages (which are very similar).

3.2. Two nation-wide surveys in the engineering consultancy industry

The two nationwide surveys were conducted as described below

3.2.1. The Danish dataset

The population of the study was defined as engineering consultancies in the NACE codes 71.12.10 (building and infrastructure) and 71.12.20 (production and machinery). In Denmark, firms were selected from the database 'Navne & Numre' ('Names & Numbers'), which registers information about all on-going Danish firms.

For the purpose of this study, all identified firms with more than two employees were included. The cut-off point of two employees was decided to ensure that only truly multi-partner projects of a certain size were included.

This population of the study ended up being 352 firms. This number was quality-checked by contacting The Association for Consulting Engineers in Denmark (FRI). As the association comprised approximately 300 firms at the time of the survey, the number seemed reasonable.

Each firm was contacted by telephone in order to detect wrong registration, to identify a relevant informant, and to invite the firm to participate in the survey.

There was no prior information about the number of multi-partner projects in these firms. As mentioned, our interest focused on on-going multi-partner projects. We asked the firms to identify the on-going multi-partner project which involved most man-hours and use this as the basis when responding to the survey questionnaire. The reason for this selection criterion was that we wished to examine multi-partner projects of high importance for the responding firm, and multi-partner projects in which the firm was highly involved. The number of man-hours was thought to represent the best proxy for these criteria.

The participating firms received a cover letter as well as a questionnaire that was sent to the contact person through SurveyXact. This resulted in 76 responses out of the population of 352 firms, i.e. a response rate of 22 percent.

3.2.2. The Norwegian dataset

The Norwegian population was identified in a similar way. In line with the approach used in Denmark, the selection of empirical base in Norway was based on members of RIF Norway (Norwegian engineering consultancies). This was done to ensure the robustness of the research - that the same method was applied to the selection of both populations.

The data collection in Norway was undertaken as follows: Initially, the university in Norway was contacted by the university in Denmark and asked to do a similar study about multi-partner projects in Norway. The data from Denmark would then be compared to the data from Norway. Then, the Norwegian university contacted RIF Norway to ask if they would be interested in participating in the survey. RIF Norway agreed to let the Norwegian university contact all their members and ask them to answer the questionnaire about multi-partner projects.

The 201 firms in the population were contacted by email. Some of the email addresses bounced and had to be updated. Attached to the invitation to participate and the link to the survey from SurveyXact was a letter, describing the purpose of the survey. The first email revealed that several firms were too small or did not engage in multi-partner projects, thus reducing the population of the study. Some firms answered right away, and some declined to participate in the survey, mainly because of lack of time and an unwillingness to participate in surveys.

A total of two reminders were sent. First, firms who had not replied received a reminder. This was sent to non-respondents as well as to respondents that had not answered the whole questionnaire after a certain amount of time. Finally, all firms that had not answered the whole questionnaire were contacted a last time by telephone or were sent a final reminder. The latter included firms that were contacted in a more extended form, namely those who explicitly had promised to answer the questionnaire but had failed to do so. These efforts raised the total number of respondents to 48.

In sum, the population (the members of RIF Norway) was 201 firms, of which 48 answered the questionnaire, i.e. 24 percent.

3.3. The questionnaire development

In addition to the understanding of the core concepts generated by the literature review by Nevstad, Børve et al. (Nevstad et al., 2018) mentioned above, the questions in the questionnaire were formulated directly on the basis of previous questions from similar studies in order to draw on existing knowledge.

3.3.1. Trust

Relational norms refer to norms of reciprocity and trust that develop during the course of an inter-firm relationship (Morgan and Hunt, 1994). The stronger the relational norms, the more protection the partners have against opportunistic behavior without having to rely on explicit formal contracts as safeguarding mechanisms (Das and Teng, 2001). This made us develop these two questions linked to trust (with the variable name for the indicators used in the quantitative analysis included in hard brackets):

"*We trust that the knowledge we transfer to the project will not be misused by our partner should they collaborate with our competitors in the future*" [Trust know]

"*We trust that our partner shows consideration for our interests*" [Trust interest]

3.3.2. Communication

The question about communication corresponds to a survey question presented in Hoegl and Gemuenden (2001) that suggests that communication between partners is important to project success:

"*There is often communication happening between the participating partners*" [Communication]

3.3.3. Commitment

In our research, commitment relates both to support by project representatives and to allocation/investment of resources.

The first question on commitment is adapted from Andersen and Jessen (2000). The survey underlying the article by Andersen and Jessen (2000) was conducted in the Norwegian language, thus the original question was already in Norwegian (which is easily adaptable to Danish).

"*All persons involved in the project (project manager, project owner, steering groups, top management, etc.) are actively supporting the project*" [Support]

Relation-specific assets refer to investments that a firm undertakes with a partner that are specific to that relation ("idiosyncratic") and have only salvage value outside the focal relation (Williamson, 1975). Investments can e.g. be in human resources (e.g. dedicated personnel) or in physical capital resources (e.g. locating a production site adjacent to a partner's). As to transaction cost, literature in the field of economics argues that the more a firm invests in relation-specific assets, the higher its switching costs, and thus the higher the risk that it will fall victim to a "hold-up" by a partner trying to extract ex post rents (Williamson, 1975). Inspired by Nyaga, Whipple et al. (Nyaga et al., 2010): "We have dedicated significant investments (e.g. equipment, personnel) to partner relationships", and "We needed to dedicate a lot of resources (human, capital) to our relationships with our partners". This caused us to develop the second question linked to commitment:

"*We allocate many resources (people, money) to the collaboration with partners*" [Resources]

3.3.4. Collaborative problem-solving

Effectuation has been suggested as a viable theoretical frame for the analysis of individual behavior in environments characterized by high uncertainty (Sarasvathy, 2001). In entrepreneurship research, effectuation adopts the view that the process of decision-making involves both prior beliefs about ourselves and prior knowledge and networks, bringing the entrepreneur to the center of the stage (Sarasvathy, 2004). Although the theory has found a strong interest from related fields such as marketing (Read et al., 2009), economics (Dew et al., 2004), management (Augier and Sarasvathy, 2004) and R&D management (Brettel et al., 2012), effectuation has yet to be employed in the study of how managers in consulting engineering firms engage in multi-partner projects. Inspired by the questionnaire and the scales developed by Brettel, Mauer et al. (Brettel et al., 2012)'s work on R&D management and effectuation, we aimed to contribute to the understanding of how key managers engage in collaboration in MPPs by posing a question related to collaborative problem-solving:

"*We try to overcome barriers to project completion through continuous collaboration with customers and partners*" [Overcome barrier]

3.3.5. Mutual project objectives

With regard to mutual project objectives, two questions included in the analysis correspond with survey questions presented in Hogel and Gemuenden (2001) on their empirical study of mutual project objectives:

"Goals for different project elements are clear and well understood across partner organizations" [Goals clear]

"Goals for different project elements are accepted across partner organizations" [Goal accept]

3.3.6. Project performance

The respondents were asked how the multi-partner project is presently evaluated in terms of whether it meets its time schedule, budget, and technical specifications (i.e. the dependent variables). Scales were inspired by Andersen and Jessen (2000) and Brettel, Mauer et al. (Brettel et al., 2012). Questions linked to project performance:

"The project so far follows the planned time schedule" [meets time schedule]

"The project is so far within budget" [meets budget]

"The project so far meets the agreed technical specifications" [meetstechnical specifications]

3.4. Data analysis

A series of statistical analysis was made using the Statistical Products and Services Solution (SPSS). Methods of data analysis in the common survey were cross tabulation, regression analysis, and analyses of variance, as the main interest was in testing whether different groups of firms or multi-partner projects exhibited differences in characteristics, mindsets, behaviors, and results.

3.5. Method assessment

Our study opens several avenues for limitations. First, when considering the generalizability of our findings, a potential limitation should be noted. Our sample consists of Norwegian and Danish project team members. We have treated the two countries as one sample, which may be a limitation. However, on the other hand, both countries are very similar and have certain unique characteristics that influence collaborations in teams, for instance it is said that Norwegian and Danish people have a very open and honest communication. Given this sample, it is uncertain whether the results reported here could be generalized to other samples as well, including other countries.

We especially focused on how five partnering success factors influence project performance. There are other partnering success factors that may influence project performance in multi-partner projects and that have not been included in this study. For instance, it may be interesting to investigate how "project uncertainty" or "change orders", two out of the five most frequently found factors, influence both project transaction costs and collaboration level (Haaskjold et al., 2019).

Validity refers to something about asking questions that measure what we want to measure. We have not designed the questions used in this dataset to specifically address the research question of this article. Instead, we have reviewed an existing dataset (Aagaard et al., 2012) and linked the questions from two existing datasets to the partnering success factors described in (Nevstad et al., 2018). We must be careful to avoid bias and to ensure that the data we use is relevant for our specific questions. To compensate for this, we have performed a questionnaire development and linked the questions to the partnering success factors, this is described in detail in the section on questionnaire development. To ensure the best possible reliability and validity of our study, the person within the engineering consultancy most knowledgeable about the multi-partner project was asked to complete the questionnaire.

As described in our theoretical background section, some researchers perceive "The Iron Triangle" concept as a poor definition of project success. As previously explained, we chose to focus on these dimensions - time schedule, budget, technical specifications - since these are critieria that most project managers would be able to relate to when responding to the survey. This may be a bias or a limitation, and can easily be solved by including other elements in future studies.

Furthermore, we know that being measured does effect behavior (Spitzer, 2007), and one can, therefore, argue that there is a risk of respondent bias as many of the respondents to some extent are responsible or accountable for the project performance and that this may have influenced how they have answered certain questions.

In the next section, we have carried out a correlation and regression analysis with three dependent variables and eight items indicating the five groups of partnering success factors mentioned previously. We hypothesize that all independent variables are positively associated with each of the three dependent variables (see Appendix for more precise formulations of independent and dependent variables): trust (trust know and trust interest), good communication, support, resources, collaboration as well as clear and accepted goals are positively associated with meeting time schedule, budget and technical specifications. To test these hypotheses, we initially considered bivariate correlations between independent and dependent variables. Somewhat surprisingly, only slightly more than half of these simple correlations show significant associations.

4. Findings and discussion

The following section reports how partnering success factors influence time schedule, budget, and technical specifications (RQ). As Table 2 shows, it appears to be very important across all three dependent variables that goals for different project elements are accepted by all participating partners (*mutual project objectives*), and that all persons involved in the project (project manager, project owner, steering groups, top management, etc.) are actively supporting the project (*commitment*). These two indicators are significantly correlated with all three dependent variables. *Trust* seems to be very important for meeting time schedule and technical specifications (both indicator items are significantly correlated).

One of the unexpected findings from the study was that *trust* is less important for meeting budgets. This can be interpreted from the fact that correlations between the two trust variables and the dependent variable "MPP meets budget" are non-significant. The latter result reflects that other variables are more influential for meeting budgets. Surprisingly, *communication* and collaboration to overcome barriers (*collaborative problem-solving*) have a negative (though not significant) correlation with the ability to meet budgets. One explanation may be that such communication and collaboration will be most prevalent in projects that are difficult and perhaps already suffering from too high costs. Another explanation could be that collaborative problem-solving takes time, and time is money. It is expensive to spend time dealing with arguing and disagreements internally and externally, with consultants, contractors, or others.

With regard to *commitment*, our results indicate that the allocation of resources (people and money) to the collaboration is only significantly associated with meeting the time schedule, whereas such commitments apparently do not meet budgets and technical specifications (correlations non significant). In line with the arguments above, such resource allocations are perhaps confined to projects that are more complex and thus require further resources. *Commitment* in terms of actively supporting the project, on the other hand, is positively and significantly associated with all three dependent variables. *Commitment* in terms of people's engagement thus seem to be more valuable than just pure allocation of resources. Our results also strongly suggest that it is extremely important that goals are accepted (*mutual project objectives*) by all partners - by far more important than goals being clear (*mutual project objectives*). This may be due to the fact that multi-partner project goals will be adapted along the way to some extent and that it is therefore very important that partners are involved in goal setting processes so that all of them accept (perhaps changing) goals of the multi-partner project.

Bivariate correlations do not take multicorrelation into consideration. For example, there may be a positive correlation, so that if we trust that the knowledge we transfer to the project will not be misused by our partner, then we also actively support the project. In a bivariate analysis, both independent variables have a positive association with meeting the time schedule. But, as we see below, when analyzing them together in a multiple regression analysis, only the commitment variable is significant because it (so to speak) incorporates also the trust aspect. Thus, we have carried out three multiple regression analyses in order to uncover the most influential independent variables when taking multicollinearity into consideration.

Table 3 provides the results of the analysis, using stepwise regression. A stepwise regression first picks up the independent variable with the highest association with the dependent variable. It subsequently picks up the second best independent variable, given that the first variable is already included. The procedure stops when no further independent variables are significantly associated with the dependent variable.

Table 3 reports the variables that remain significant in this analysis. As it appears many significant bivariate correlations in Table 2 are now insignificant, they are not included in Table 3. This is due to multicollinarity, as mentioned above. For example, when meeting time schedule is the dependent variable, then only "support" (*commitment*) and "goals accept" *(mutual project objectives)* remain significantly positively associated with "MPP meets time schedule". The *trust* and "resource" *(commitment)* variables that were significant in the bivariate correlation analysis are no longer significant because they are strongly correlated with "support" (*commitment*) and "goal acceptance" (*mutual project objectives*). Accordingly, the effect of these independent variables is shared among them, but in this case "support" (*commitment*) and goal acceptance (*mutual project objectives*) are most strongly associated with meeting time schedule.

The regression analysis shows that it remains very important across

Table 2
Results of correlation analysis.

	MPP meets time schedule	MPP meets budget	MPP meets technical specifications
Trust know - *trust*	.225*	.141	.314**
Trust interest - *trust*	.206*	.124	.282**
Communications - *communication*	.069	-.146	.234*
Support - *commitment*	.297**	.230*	.367**
Resources - *commitment*	.204*	.094	.160
Overcome barrier - *collaborative problem-solving*	.219*	-.024	.232*
Goals clear - *mutual project objectives*	.008	-.077	-.006
Goals accept - *mutual project objectives*	.286**	.421***	.347**

* = significant at 0.05 level; ** = significant at 0.01 level; *** = significant at 0.001 level; NS = not significant.

Table 3
Results of stepwise multiple regression analysis.

	MPP meets time schedule	MPP meets budget	MPP meets technical specifications
Constant	1.264***	.83**	1.926***
Trust know - *trust*			.264**
Trust interest - *trust*			
Communications - *communication*		-.419**	
Support - *commitment*	.319**	.295**	
Resources - *commitment*			
Overcome barrier - *collaborative problem-solving*		-.362**	
Goals clear - *mutual project objectives*			
Goals accept - *mutual project objectives*	.346**	.748**	.283**
R Square	.138	.327	.167
Adjusted R Square	.120	.297	.150
F-value	7.672***	10.589***	9.797***

* = significant at 0.05 level; ** = significant at 0.01 level; *** = significant at 0.001 level; NS = not significant.

all three dependent variables that goals for different project elements are accepted by all participating partners (*mutual project objectives*). In addition to this, in order to meet the time schedule of the project it remains important that all persons involved in the project (project manager, project owner, steering groups, top management, etc.) are actively supporting the project (*commitment*). For meeting technical specifications, however, it appears to be important that the knowledge transferred to the project will not be misused by partners should they collaborate with competitors in the future *(trust*).

The regression analysis reveals higher complexity when it comes to meeting budgets. "Support" (*commitment*) and "goals accept" *(mutual project objectives)* are significantly positively associated with meeting budgets. The stepwise regression analysis reveals, however, that the factors *communication* and collaboration to overcome barriers (*collaborative problem-solving*) have a significant and negative impact on this performance measure. Since our study is cross-sectional, the causal direction may go either way. We therefore interpret this result to indicate that when projects experience problems with meeting budgets, then the partners will increase their effforts to communicate and collaborate with each other. Table 4 shows the influence of partnering success factors on multi-partner projects' abilities to meet time schedule, budget, and technical specifications.

A summary of the findings is shown in Table 4. We found that *mutual project objectives* and *commitment* are important for meeting time schedule, budget and technical specifications. In literature, *mutual project objectives* are described using little variation in wording. Examples are "mutual," "joint," "common or shared objectives" or "goals." The term "objectives," which are measurable, is used more frequently than the more intangible "goals." The term "measurable objectives" fits well with the "continuous evaluation" and "annual review of performance" emphasized by Bennett and Baird (2001). Benchmarks are highlighted by Bresnen (2007), and the concept of partnering evaluation has been developed into "performance measurement" by Meng (2012). That top management must be involved, was supported by "top management support" (Larson, 1997; Suprapto et al., 2015; Cheng and Li, 2001) as a kind of internal or external commitment, and top management must allocate time and resources to partnering activities. Cheung, Ng et al. (Cheung et al., 2003) supported "Long-term-" and "resource commitment."

As shown in Table 4, *trust* and *collaborative problem-solving* are found to be important for meeting time schedule and technical specifications. Several support *trust*, e.g. trust is described as a prerequisite (Kaluarachchi and Jones, 2007; Construction Industry Institute (CII) and C, 1991; Aarseth, 2012), as a measure (Mesa et al., 2016; Meng, 2012; Chan et al., 2004), as an objective (Cheung et al., 2003; Construction Excellence, 2009), trust is described as an outcome (Eriksson, 2010), and Kaluarachchi and Jones (2007) require trust between "all stakeholders".

Finally, as Table 4 shows, we found that *communication* was particularly important for meeting technical specifications. Factors pertaining to *communication* vary in literature from just "communication," (Doloi, 2009; Cheung et al., 2003; Meng, 2012) via "effective communication" (Black et al., 2000) to "open and honest communication" (Suprapto et al., 2015).

Table 4
Partnering success factors' abilities to meet time schedule, budget, and technical specifications

Partnering success factors	MPP meets time schedule	MPP meets budget	MPP meets technical specifications
Trust	✓		✓
Communication			✓
Commitment	✓	✓	✓
Collaborative problem-solving	✓		✓
Mutual project objectives	✓	✓	✓

According to our findings, the expected benefits of implementing the five partnering success factors in construction projects include improved efficiency and cost-effectiveness, as well as improved quality of product, if successful partnership is achieved. Earlier research confirms this, for example partnering was documented to contribute positively to construction projects (Tabish and Jha, 2011; Xue et al., 2010; Jacobson and Ok Choi, 2008; Chan et al., 2004; Bayramoglu, 2001; Cheng et al., 2000; Larson, 1997). Further, Haaskjold, Andersen et al. (Haaskjold et al., 2020) report that there is a strong positive relationship between collaboration and project quality performance. There were fewer errors and deviations in projects with good collaboration, and deliverables more often delivered according to requirements and client expectations than projects with poor collaboration.

5. Conclusion, practical implications and further research

5.1. Theoretical implications

In this study, success was gauged according to the traditional criteria of time schedule, budget, and technical specifications. The key contribution of this study is the influence of partnering success factors on a multi-partner project's abilities to meet project performance. The overall review of the key findings has provided an interesting insight into human aspects in projects.

Addressing our research question (RQ), as shown in Fig. 1, we found that *mutual project objectives* and *commitment* influence all three dependent variables. To elaborate on this, *mutual project objectives* and *commitment* are important for meeting time schedule, budget and technical specifications. Additionally, *trust* and *collaborative problem-solving* are found to be important to meet time schedule and technical specifications. Finally, we concluded that *communication* was particularly important for meeting technical specifications.

Our findings confirm earlier research, as we have provided more empirical support in a field where several authors have highlighted the need for more empirical research into the relationship between project participants' collaboration and project performance (Silva and Harper, 2018; Bond-Barnard et al., 2018; Meng and Gallagher, 2012).

5.2. Practical implications

The five partnering success factors are important to project performance, and project managers must constantly ensure that they are present throughout the project. The performance outcome points to several benefits that can be obtained by working on the five partnering success factors, which should benefit both researchers and practitioners. This is explicitly explained in the bullet points below:

- *Mutual project objectives* and *commitment* are important for meeting time schedule, budget and technical specifications, i.e. to meet all three criteria, the project must know who their key stakeholders are and involve the appropriate internal (top management included) and external parties in an early phase, further the project must also ensure that goals for different project elements are accepted by all participating partners.
- *Trust* and *collaborative problem-solving* are important for meeting time schedule and technical specifications, i.e. to meet the two criteria, the parties must hold each other mutually informed based on respect and understanding, and have mechanisms in place for resolving disputes.
- *Communication* is important for meeting technical specifications, i.e. to meet the criterium, the project must ensure that there is extensive communication between the participating partners, and the parties must have a mutual desire to collaborate, communicate and build good relationships.

The implementation of the five partnering success factors could lead to major benefits in construction projects: Anticipated benefits of

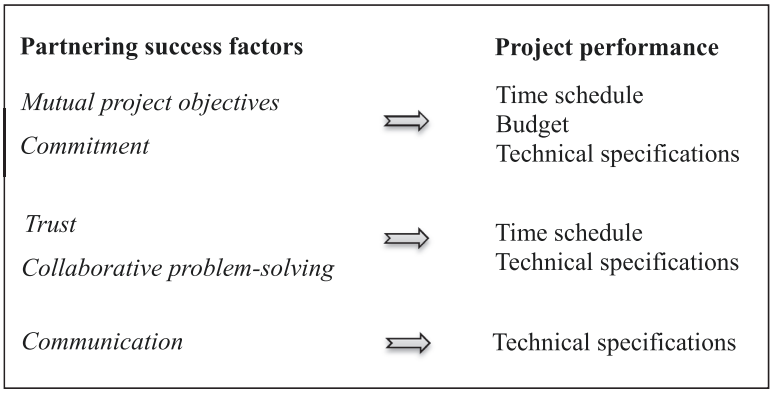

Fig. 1. How partnering success factors influence project performance.

ensuring the presence of the five identified partnering success factors throughout the project include improved efficiency and cost-effectiveness, and improved quality of product.

5.3. Further research

The survey is limited to engineering consultancies in Norway and Denmark. This aspect could be considered as a weakness or limitation but can also be easily improved in further research. Our research would benefit from further similar research in other industries and countries. Moreover, additional research is needed to determine whether these relationships are significant over time. It may be a weakness of the study that it is performed at a given point in time and does not follow the projects over time. The study can nevertheless provide a picture of a relationship between partnering success factors and project performance. Also, future research should investigate other potential elements in the relationship between collaboration and project performance in multi-partner projects.

Acknowledging that many projects cannot be accomplished without the efforts of several partners working together, it seems logical that a performance measurement of multi-partner projects must include measuring how smoothly the collaboration among the project partners unfolds. In practice, the various partnering success factors' influence on project performance can be utilized by project-based organizations and project managers to select and measure the various partnering success factors they find most suitable to improve their project performance. If put actively to use (by picking up the early warning signs of project problems), this should help improve the project performance of future multi-partner projects.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix

Dependent variables

- The project so far follows the planned time schedule
- The project is so far within budget
- The project so far meets the agreed technical specifications

Independent variables

Please notice that the specific questions are presented in the section on questionnaire development.

- Trust know - indicator for *trust*
- Trust interest - indicator for *trust*
- Communication - indicator for *communication*
- Support - indicator for *commitment*
- Resources - indicator for *commitment*
- Overcome barrier - indicator for *collaborative problem-solving*
- Goals clear - indicator for *mutual project objectives*
- Goal accept - indicator for *mutual project objectives*

References

Aagaard, A., et al., 2012. Collaboration and performance in multi-partner projects: the case of engineering consultancies. research methodology. In: Working Papers in Marketing & Management, pp. 1–72.
Aarseth, W., 2012. An empirical study of organizational cooperation in large traditional and global projects execution. In: Department of Production and Quality Engineering. Norwegian University of Science and Technology, Trondheim, Norway.
Aarseth, W., et al., 2012. Practical difficulties encountered in attempting to implement a partnering approach. Int. J. Manag. Proj. Bus. 5 (2), 266–284.
Ahola, T., 2009. Efficiency in Project Networks: the Role of Inter-Organizational Relationships in Project Implementation. Doctoral PhD Thesis. Helsinki University of Technology.
Andersen, E., Jessen, S.A., 2000. Project evaluation scheme: a tool for evaluating project status and predicting project results. Proj. Manag. 6 (1), 61–69.
Augier, M., Sarasvathy, S.D., 2004. *Integrating evolution, cognition and design: extending Simonian perspectives to strategic organization.* Strategic Organization, 2 (2), 169–204.
Azari, M.J., Madsen, T.K., 2017. Antecedent and outcomes of innovation-based growth strategies for exporting SMEs. J. Small Bus. Enterprise Dev. 24 (4), 733–752.
Bayramoglu, S., 2001. Partnering in construction: improvement through integration and collaboration. Leader. Manag. Eng. 1 (3), 39–43.
Bennett, J., Baird, A., 2001. NEC and Partnering : the Guide to Building Winning Teams. Thomas Telford, London.
Bennett, J., Jayes, S., 1995. Trusting the Team: the Best Practice Guide to Partnering in Construction. Thomas Telford, , London.
Black, C., Akintoye, A., Fitzgerald, E., 2000. An analysis of success factors and benefits of partnering in construction. Int. J. Proj. Manag. 18 (6), 423–434.
Bond-Barnard, T.J., Fletcher, L., Steyn, H., 2018. Linking trust and collaboration in project teams to project management success. Int. J. Manag. Proj. Bus. 11 (2), 432–457.
Børve, S., et al., 2017. Defining project partnering. Int. J. Manag. Proj. Bus. 10 (4), 666–699.
Brady, T., Davies, A., 2004. *Building project capabilities: from Exploratory to exploitative learning.* Organization studies, 25 (9), 1601–1621.
Bresnen, M., 2007. Deconstructing partnering in project-based organisation: seven pillars, seven paradoxes and seven deadly sins. International Journal of Project Management, 25 (4), 365–374.
Bresnen, M., Marshall, N., 2000. Building Partnerships: Case Studies of Client–Contractor Collaboration in the UK Construction Industry. Construction Management and Economics, vol. 18, pp. 819–832, 7.

Brettel, M., et al., 2012. Corporate effectuation: entrepreneurial action and its impact on R&D project performance. J. Bus. Ventur. 27 (2), 167–184.
Caniëls, M.C., Chiocchio, F., van Loon, N.P., 2019. Collaboration in project teams: the role of mastery and performance climates. Int. J. Proj. Manag. 37 (1), 1–13.
Chan, A.P., Chan, D.W., Ho, K.S., 2003. An empirical study of the benefits of construction partnering in Hong Kong. Construct. Manag. Econ. 21 (5), 523–533.
Chan, A.P.C., et al., 2004. Exploring critical success factors for partnering in construction projects. Journal of Construction Engineering and Management-Asce 130 (2), 188–198.
Chang, A., et al., 2013. Reconceptualising mega project success in Australian Defence: recognising the importance of value co-creation. Int. J. Proj. Manag. 31 (8), 1139–1153.
Chen, W.T., Chen, T.-T., 2007. Critical success factors for construction partnering in Taiwan. Int. J. Proj. Manag. 25 (5), 475–484.
Cheng, E.W.L., Li, H., 2001. Development of a conceptual model of construction partnering. Engineering. Construction and Architectural Management 8 (4), 292–303.
Cheng, E.W., Li, H., Love, P., 2000. Establishment of critical success factors for construction partnering. J. Manag. Eng. 16 (2), 84–92.
Cheung, S.-O., et al., 2003. Behavioral aspects in construction partnering. Int. J. Proj. Manag. 21 (5), 333–343.
Construction Excellence, Collaborative Procurement Guide, 2009. Construction Excellence: London.
Construction Industry Institute (Cii), 1991. In search of partnering excellence. In: C II, P.T.F.o. (Ed.), Special Publication 17-1. Construction Industry Institute (CII): Austin, Texas.
Cooke-Davies, T., 2002. The "real" success factors on projects. Int. J. Proj. Manag. 20 (3), 185–190.
Crawford, L., 2006. Developing organizational project management capability: theory and practice. (Author abstract). Proj. Manag. J. 37 (3), 74.
Das, T., Teng, B.-S., 2001. A risk perception model of alliance structuring. J. Int. Manag. 7 (1), 1–29.
De Wit, A., 1988. Measurement of project success. Int. J. Proj. Manag. 6 (3), 164–170.
Dew, N., Sarasvathy, S.D., Venkataraman, S., 2004. The economic implications of exaptation. J. Evol. Econ. 14 (1), 69–84.
Dietrich, P., et al., 2010. The dynamics of collaboration in multipartner projects. Proj. Manag. J. 41 (4), 59–78.
Doloi, H., 2009. Relational partnerships: the importance of communication, trust and confidence and joint risk management in achieving project success. Construct. Manag. Econ. 27 (11), 1099–1109.
Du, L., et al., 2016. Enhancing engineer–procure–construct project performance by partnering in international markets: perspective from Chinese construction companies. Int. J. Proj. Manag. 34 (1), 30–43.
Dyer, J.H., Nobeoka, K., 2000. Creating and managing a high-performance knowledge-sharing network: the Toyota case. Strat. Manag. J. 345–367.
Eriksson, P.E., 2010. Partnering: what is it, when should it be used, and how should it be implemented? Construct. Manag. Econ. 28 (9), 905–917.
Eriksson, P.E., Westerberg, M., 2011. Effects of cooperative procurement procedures on construction project performance: a conceptual framework. Int. J. Proj. Manag. 29 (2), 197–208.
Eskerod, P., Damgaard, T., 1998. Enhancing the competencies in SME's through networking YYYY No org found YYY. Proceedings til konferencen "RENT XII: Research in Entrepreneurship and Small Business" (pp. (20 sider)).
Fotopoulos, C.B., Psomas, E.L., 2009. The impact of "soft" and "hard" TQM elements on quality management results. Int. J. Qual. Reliab. Manag. 26 (2), 150–163.
Haaskjold, H., Andersen, B., Lædre, O., Aarseth, W., 2019. Factors affecting transaction costs and collaboration in projects. Int. J. Manag. Proj. Bus. 13 (1), 197–230.
Haaskjold, H., Andersen, B.S., Langlo, J.A., 2020. In search of empirical evidence for the relationship between collaboration and project performance. Journal of Modern Project Management 7 (4), 1–33.
Hanisch, B., Wald, A., 2011. A project management research framework integrating multiple theoretical perspectives and influencing factors. Proj. Manag. J. 42 (3), 4–22.
Hoegl, M., Gemuenden, H.G., 2001. Teamwork quality and the success of innovative projects: a theoretical concept and empirical evidence. Organ. Sci. 12 (4), 435–449.
Hogel, M., Gemuenden, H., 2001. Teamwork quality and the success of innovation projects. Organ. Sci. 12 (4), 435–449.
Hosseini, A., et al., 2018. Project partnering in the construction industry: theory vs. practice. Eng. Proj. Organ. J. 8 (1), 2–24.
Jacobson, C., Ok Choi, S., 2008. Success factors: public works and public-private partnerships. Int. J. Public Sect. Manag. 21 (6), 637–657.
Jacobsson, M., Roth, P., 2014. Towards a shift in mindset: partnering projects as engagement platforms. Construct. Manag. Econ. 32 (5), 419–432.
Julien, P., Jane, H., Daniel, A., 2018. What is the Iron Triangle, and how has it changed? Int. J. Manag. Proj. Bus. 11 (2), 527–547.
Kadefors, A., 2004. Trust in project relationships—inside the black box. Int. J. Proj. Manag. *22* (3), *175–182*.
Kaluarachchi, Y.D., Jones, K., 2007. Monitoring of a strategic partnering process: the Amphion experience. Construct. Manag. Econ. 25 (10), 1053–1061.
Larson, E., 1995. Project partnering - results of study of 280 construction projects. J. Manag. Eng. 11 (2), 30–35.
Larson, E., 1997. Partnering on construction projects: a study of the relationship between partnering activities and project success. IEEE Trans. Eng. Manag. 44 (2), 188–195.
Larson, M., Wikström, E., 2007. Relational interaction processes in project networks: the consent and negotiation perspectives. Scandinavian Journal of Management, 23 (3), 327–352.
Lau, E., Rowlinson, S., 2009. Interpersonal trust and inter-firm trust in construction projects. Construct. Manag. Econ. 27 (6), 539–554.
Lavie, D., Lechner, C., Singh, H., 2007. The performance implications of timing of entry and involvement in multipartner alliances. The academy of management journal, 50 (3), 578–604.
Lindkvist, L., 2005. Knowledge communities and knowledge collectivities: a typology of knowledge work in groups. J. Manag. Stud. 42 (6), 1189–1210.
Ling, F.Y., et al., 2015. Effect of adoption of relational contracting practices on relationship quality in public projects in Singapore. Eng. Construct. Architect. Manag. 22 (2), 169–189.
Lu, J.W., Beamish, P.W., 2006. SME internationalization and performance: growth vs. profitability. J. Int. Enterpren. vol. 4 (1), 27–48.
Lu, S., Yan, H., 2007. A model for evaluating the applicability of partnering in construction. Int. J. Proj. Manag. 25 (2), 164–170.
Madsen, T.K., et al., 2006. Muligheder for Vækst I Dansk Eksport, in Danmarks Eksportråd. Danmarks Eksportråd.
Meng, X., 2012. The effect of relationship management on project performance in construction. Int. J. Proj. Manag. 30 (2), 188–198.
Meng, X., Gallagher, B., 2012. The impact of incentive mechanisms on project performance. Int. J. Proj. Manag. 30 (3), 352–362.
Mesa, H.A., Molenaar, K.R., Alarcón, L.F., 2016. Exploring performance of the integrated project delivery process on complex building projects. Int. J. Proj. Manag. 34 (7), 1089–1101.
Morgan, R.M., Hunt, S.D., 1994. The commitment-trust theory of relationship marketing. J. Market. 58 (3), 20–38.
Müller, R., Jugdev, K., 2012. Critical success factors in projects: pinto, Slevin, and Prescott-the elucidation of project success. Int. J. Manag. Proj. Bus. 5 (4), 757–775.
Naoum, S., 2003. An overview into the concept of partnering. Int. J. Proj. Manag. 21 (1), 71–76.
Nevstad, K., et al., 2018. Understanding how to succeed with project partnering. Int. J. Manag. Proj. Bus. 11 (4), 1044–1065.
Ng, S.T., et al., 2002. Problematic issues associated with project partnering — the contractor perspective. Int. J. Proj. Manag. 20 (6), 437–449.
Nyaga, G.N., Whipple, J.M., Lynch, D.F., 2010. Examining supply chain relationships: do buyer and supplier perspectives on collaborative relationships differ? J. Oper. Manag. 28 (2), 101–114.
Nyström, J., 2005. The definition of partnering as a Wittgenstein family-resemblance concept. Construct. Manag. Econ. 23 (5), 473–481.
Oecd, 2009. P., Technical Report. Author, Paris report.
Olsen, B.E., et al., 2005. Governance of complex procurements in the oil and gas industry. Journal of Purchasing and Supply management, 11 (1), 1–13.
Pinto, J.K. and D.P. Slevin, Critical factors in successful project implementation. Engineering Management, IEEE Transactions on, vol. 1987(1): p. 22–27.
Read, S., et al., 2009. Marketing under uncertainty: the logic of an effectual approach. J. Market. 73 (3), 1–18.
Rezvani, A., Khosravi, P., 2018. A comprehensive assessment of project success within various large projects. The Journal of Modern Project Management 6 (1).
Sarasvathy, S.D., 2001. Causation and effectuation: Toward a theoretical shift from economic inevitability to entrepreneurial contingency. Acad. Manag. Rev. 26 (2), 243–263.
Sarasvathy, S.D., 2004. Making it happen: Beyond theories of the firm to theories of firm design. Enterpren. Theor. Pract. 28 (6), 519–531.
Sarhan, S., et al., 2017. Contractual governance as a source of institutionalised waste in construction: a review, implications, and road map for future research directions. Int. J. Manag. Proj. Bus. 10 (3).
Shenhar, A.J., et al., 2001. Project success: a multidimensional strategic concept. Long. Range Plan. 34 (6), 699–725.
Silva, A., Harper, C., 2018. Using project team integration to predict cost and schedule performance in public transportation projects. Construction Research Congress 2018.
Söderlund, J., 2008. Competence dynamics and learning processes in project-based firms: shifting, adapting and leveraging. International Journal of Innovation Management, 12 (1), 41–67.
Spitzer, D.R., 2007. Transforming Performance Measurement: Rethinking the Way We Measure and Drive Organizational Success (Amacom Books).
Steinmo, M., Rasmussen, E., 2016. How firms collaborate with public research organizations: the evolution of proximity dimensions in successful innovation projects. J. Bus. Res. 69 (3), 1250–1259.
Suprapto, M., et al., 2015. Sorting out the essence of owner–contractor collaboration in capital project delivery. Int. J. Proj. Manag. 33 (3), 664–683.
Suprapto, M., Bakker, H.L.M., Mooi, H.G., 2015. Relational factors in owner–contractor collaboration: the mediating role of teamworking. Int. J. Proj. Manag. 33 (6), 1347–1363.
Suprapto, M., et al., 2016. How do contract types and incentives matter to project performance? Int. J. Proj. Manag. 34 (6), 1071–1087.
Tabish, S.Z.S., Jha, K.N., 2011. Identification and evaluation of success factors for public construction projects. Construct. Manag. Econ. 29 (8), 809–823.
Turner, R., Ledwith, A., Kelly, J., 2012. Project management in small to medium-sized enterprises: tailoring the practices to the size of company. Manag. Decis. 50 (5), 942–957.
De Vaus, D.A., 2014. Surveys in Social Research. 6th Ed. Ed. Social Research Today (Sydney, N.S.W.). Routledge, , London.
Walker, D.H.T., Lloyd-Walker, B.M., 2015. Collaborative Project Procurement Arrangements. Pennsylvania, USA: PMI, Philadelphia.
Walker, D.H., Davis, P.R., Stevenson, A., 2017. Coping with uncertainty and ambiguity through team collaboration in infrastructure projects. Int. J. Proj. Manag. 35 (2), 180–190.

Williams, T., Samset, K., 2010. Issues in front-end decision making on projects. Proj. Manag. J. 41 (2), 38–49.
Williamson, O.E., 1975. *Markets And Hierarchies.* New York, p. 2630.
Wong, P.S.P., Cheung, S.O., 2005. Structural equation model of trust and partnering success. J. Manag. Eng. 21 (2), 70–80.
Wong, W.K., et al., 2008. A framework for trust in construction contracting. Int. J. Proj. Manag. 26 (8), 821–829.
Wood, G., McDermott, P., Swan, W., 2002. The ethical benefits of trust-based partnering: the example of the construction industry. Bus. Ethics Eur. Rev. 11 (1), 4–13.
Xue, X., Shen, Q., Ren, Z., 2010. Critical review of collaborative working in construction projects: business environment and human behaviors. J. Manag. Eng. 26 (4), 196–208.
Yeung, J.F., Chan, A.P., Chan, D.W., 2007. The definition of alliancing in construction as a Wittgenstein family-resemblance concept. Int. J. Proj. Manag. 25 (3), 219–231.

PAPER 3

HOW A PROJECT ALLIANCE INFLUENCES PROJECT PERFORMANCE COMPARED TO TRADITIONAL PROJECT PRACTICE

– FINDINGS FROM A CASE STUDY IN THE NORWEGIAN OIL AND GAS INDUSTRY

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Abstract: Practitioners and researchers have turned their attention toward collaborative arrangements and new Collaborative Project Delivery Models (CPDMs). In this paper, we present findings from a study focusing on the impact of a project alliance on project performance, as an example of a CPDM compared to traditional project practice. Findings are based on a case study where empirical data has been collected by carrying out semi-structured interviews with thirteen professionals within the Norwegian oil and gas industry. A main finding is that a project alliance contributes to better project performance by promoting a better working relationship between the partners compared to traditional projects. This result is achieved through closer cooperation, shorter decision paths, transparent partners, and an overall alliance culture tailored around collaboration. It is challenging to discover areas where the investigated project alliance has not been performing as expected or has performed worse than traditional projects. Findings also show some barriers related to the co-location and the interfaces between the companies, the project alliance, and the partner organizations. Conclusions drawn should be of interest to both researchers and practitioners contemplating to shift from a traditional project practice to a more collaborative one.

Keywords: Alliancing, Collaborative Project Delivery Model, Project performance

1. INTRODUCTION

Today, there is broad acknowledgment that engineering and construction projects face certain problems. Practitioners and researchers suggest, among other things, productivity problems, opportunistic behavior, and sub-optimization (Laan, Voordijk, & Dewulf, 2011; Matthews & Howell, 2005). One strategy for addressing these concerns is the development of Collaborative Project Delivery Models (CPDMs) (Lahdenperä, 2012; Malvik, Wondimu, Kalsaas, & Johansen, 2021; Tadayon, 2018; Tadayon & Anderesen, 2021; Young, Hosseini, Klakegg, & Lædre, 2018). A major goal of a CPDM is to avoid conflicting objects and problems that have characterized the industry for a long period (Ling, Rahman, & Ng, 2006). Collaborative models, such as alliancing, early contractor involvement, and partnering are known under the umbrella terms relational contracting or CPDMs (Af Hällström, Bosch-Sijtsema, Poblete, Rempling, & Karlsson, 2021; Bygballe & Swärd, 2019; Lahdenperä, 2012; Rahman & Kumaraswamy, 2004).

The project alliance can be defined as a CPDM in which the client and contractor usually collaborate through informal or formal agreements, together with the establishment of trust-based relationships to achieve common objectives (Lahdenperä, 2012). Researchers and practitioners have turned their attention toward collaborative arrangements and new CPDMs (Lahdenperä, 2012) to achieve better-performing projects by promoting a better working relationship between the parties (Suprapto, Bakker, Mooi, & Hertogh, 2016).

Attracting and accomplishing projects require that several partners work together; this is typically the case in the oil and gas industry, which started to use alliancing in the mid-1990s (Olsen, Haugland, Karlsen, & Johan Husøy, 2005). A suitable approach is chosen to inspire the parties to work rationally together to achieve the best outcomes in accordance with their common objectives and within the expected risk level (Morris & Pinto, 2007).

Generally, there is a need for more research exploring the link between collaboration and project performance (Bond-Barnard, Fletcher, & Steyn, 2018; Meng & Gallagher, 2012; Silva & Harper, 2018). We focus on how a project alliance might influence project performance as compared to traditional projects. The classic project performance constructs in terms of time, cost, and quality (“The Iron Triangle”) is considered to be outside the scope of this study.

2 ALLIANCING AS AN EXAMPLE OF A COLLABORATIVE PROJECT DELIVERY MODEL (CPDM)

The project alliance is a relatively new CPDM that has started becoming popular as an alternative to traditional contracts (Young et al., 2018). According to Suprapto et al. (2016), an alliance project is likely to be more collaborative than a traditional project (also known as a lump sum contract).

To clarify the use of the term PDM, we use the definition by Miller, Garvin, Ibbs, and Mahoney (2000), i.e., “a system for organizing and financing design, construction, operations and maintenance activities that facilitates the delivery of a goods or service”. Alliancing, as an example of a collaborative PDM, for short CPDM, can lead to improved outcomes in projects and value for money. This is in part due to the increased level of integration and collaboration between the players involved (customer and suppliers) (Love, Mistry, & Davis, 2010). The project alliance does not necessarily result directly in better project performance, but achievements are gained through relational attitudes and how they play out throughout the project in terms of actual teamworking behavior (Suprapto et al., 2016).

2.1 Alliancing factors

Deciding what alliancing is by means of a literature search might be confusing, however, the literature claims that it is possible to identify factors that appear to be key in an alliance. Hence, alliancing can be identified by factors, and the combination of factors makes the alliance model a unique CPDM (Young et al., 2018).

A project alliance is formed by a set of hard and soft factors (Fotopoulos & Psomas, 2009; Yeung, Chan, & Chan, 2007). Factors that are directly regulated by the project contract or have their basis in the procurement process are considered hard factors (such as a formal contract, and pain share/gain share), whereas soft elements contribute to the relationship between the project participants (such as trust,

communication, and commitment) (Yeung et al., 2007).

Various authors have identified factors within the context of an alliance. A summary of factors *(1)* researchers have found for describing an alliance is presented in **Table 1**. Each of the following will be outlined in further detail: Collaborative problem solving, trust, co-location, pain/gain share, open book approach, commitment, single alliance culture, communication, workshops, a single IT system, no blame, mutual goals and objectives.

Collaborative problem solving emphasizes that all members of the project alliance work together to overcome problems that arise (Tadayon, 2018).

Trust is especially important to fully realize the potential of the project alliance. Examples of formulations used to describe the factor are “trust between parties” (Jefferies et al., 2014) and “mutual trust” (Biggs, 2004).

Co-location of the project alliance is a mechanism for realizing the effect of an integrated project team (Tadayon, 2018). A central alliance office combining all alliance partners (Jefferies et al., 2014) is often identified in the literature as a key factor (Laan et al., 2011).

Pain/gain share. All members of the alliance share in the profits and losses of the alliance project and ensure that no single participant is held responsible for financial performance (Laan et al., 2011).

Open book approach. A key factor for the project alliance is the open book approach (Tadayon, 2018), allowing the individual alliance partners to have an open and trusting relationship with one another (Jefferies et al., 2014).

Commitment to the project alliance is a key factor by having a dedicated client and stakeholders showing commitment to the project through participation at a senior level (Jefferies et al., 2014). This is important not only to ensure that the alliances receive the necessary resources, but also to convince others throughout the organization of the importance of the alliance (Elmuti & Kathawala, 2001).

Single alliance culture. The project alliance can be seen as being established to unite culturally different partners in pursuit of a common objective (Biggs, 2004). All members of the alliance, regardless of their holding company, are part of the team (Tadayon, 2018).

Communication. Effective communication between the partners is a vital factor for the project alliance to be successful (Elmuti & Kathawala, 2001).

Workshops are organized to develop and maintain the culture in the project alliance and the best-for-project mindset (Tadayon, 2018). Jefferies et al. (2014) identified pre-project and planning workshops by organizing early workshops for all members of the alliance prior to the client-focused workshops in order to build good working relationships.

TABLE 1. EXAMPLES OF FACTORS DESCRIBING AN ALLIANCE

Factor	Reference
Collaborative problem solving	Jefferies, Brewer, and Gajendran (2014), Young et al. (2018), Biggs (2004), Tadayon (2018)
Trust	Jefferies et al. (2014), Biggs (2004), Lahdenperä (2012)
Co-location	Young et al. (2018), Jefferies et al. (2014), Tadayon (2018)
Pain/gain share	Young et al. (2018), Tadayon (2018)
Open book approach	Young et al. (2018), Jefferies et al. (2014), Tadayon (2018)
Commitment	Jefferies et al. (2014), Biggs (2004) Elmuti and Kathawala (2001), Lahdenperä (2012)
Single alliance culture	Biggs (2004), Tadayon (2018), Young et al. (2018)
Communication	Jefferies et al. (2014), Elmuti and Kathawala (2001), Lahdenperä (2012)
Workshops	Jefferies et al. (2014), Young et al. (2018), Tadayon (2018)
A single IT system	Young et al. (2018) Jefferies et al. (2014), Tadayon (2018)
No blame	Young et al. (2018), Tadayon (2018)
Mutual goals and objectives	Jefferies et al. (2014), Young et al. (2018), Lahdenperä (2012), Tadayon (2018)

1. WE USE THE TERM FACTOR. HERE, FACTORS INCLUDE CRITICAL SUCCESS FACTORS, SUCCESS FACTORS AND ELEMENTS, AS TERMS ARE USED INTERCHANGEABLY IN THE LITERATURE.

No blame. The foundation of the alliance agreement is based on everyone working in the same team (Tadayon, 2018). In this agreement, a key factor is the development of a no-blame culture. No blame culture refers to the degree to which the parties take responsibility for problems as they arise rather than avoid them (Walker and Lloyd-Walker, 2015).

A single IT system can be seen as a tool used by an alliance (Young et al., 2018), ensuring that every member of the alliance has access to the same programs and files (Tadayon, 2018) and allowing the individual alliance partners to manage resources and share knowledge (Jefferies et al., 2014).

Mutual goals and objectives. Examples of formulations used to describe this factor are “common goals” (Young et al., 2018), “shared objectives” (Biggs, 2004), and “common goals and objectives” (Lahdenperä, 2012).

Existing research describes what is being done in CPDMs (Malvik et al., 2021; Tadayon, 2018; Tadayon & Anderesen, 2021; Young et al., 2018), but there is a lack of studies looking at how the two different project types, a traditional project as compared to a more collaborative one, influence project performance (Suprapto et al., 2016). Let us proceed to the methodology.

3 RESEARCH METHODOLOGY

We have chosen a case study approach to address our research question, stated as:

- RQ1: How does a project alliance, as an example of a CPDM, influence project performance compared to traditional project practice?

We utilize a single case study with a single unit of analysis (Robert K Yin, 2008). In this research, the single case unit refers to the alliance in a case company (the oil company) and is restricted to the boundaries within this alliance.

3.1 Case – project alliance within the Norwegian oil and gas industry

The oil company, an independent oil and gas company engaged in upstream operations, requested to be unnamed and anonymous, a request which we honored. The responsibility of the investigated case is to deliver smaller

The oil company uses a common governing model for all its alliances. Each contractor enters into a separate frame agreement with the oil company. The alliance agreement and its appendixes then govern the alliance as a whole. This agreement regulates different terms regarding the project alliance, such as key principles, alliance organization, execution of work, dispute resolution, and other regulatory terms within the project alliance.

The compensation model of the project alliance is built upon a target cost for projects, Most Likely Cost. In this model, there is far less downside for the contractors as compared to traditional projects. In any case, they only stand to be liable for their share of the 20 percent of the overrun for the whole project. This is in contrast to traditional projects, where they agree on one compensation sum and are then liable for the total of the potential overrun of the compensation. Thus, from this compensation model, we see that the oil company in the project alliance takes on significant responsibility for potential overruns.

We have limited the scope of research to one alliance within the Norwegian oil and gas industry, as we are collaborating with the oil company on this study.

3.2 Literature review about factors of an alliance

A literature review was done before the interviews were held. We used the CPDM as a framework. Furthermore, the literature claims it is possible to identify factors that appear to be key to an alliance (Young et al., 2018). For project management, the literature distinguishes between hard and soft factors in literature (Fotopoulos & Psomas, 2009; Yeung et al., 2007). Journal articles representing the most recent literature and containing comprehensive and very relevant literature on CPDMs, were used to gain a broad perspective of the current views on this topic. A pre-scan of factors relevant for this topic, as well as factors identified by the oil company as key for the alliance performance, was conducted before making the interview guide. A list of factors identified by the literature formed the basis that defines alliancing. We concluded on a number that was of interest to this study. Table 1 shows examples of factors (both soft and hard) describing an alliance, as an example of a CPDM.

3.3 Data collection

The data collection includes both quantitative and qualitative data, complementing each other.

The case was researched using a qualitative method, and we conducted semi-structured interviews (Mason, 2018). According to Patton (1990), the goal of qualitative research methodology is to gather extensive data on a specified subject. Instead of using a randomized selection to generalize the data, one chooses the participants with the most extensive knowledge about the research subject. In our case, this meant that we had to find interviewees who had extensive knowledge about project alliances in combination with experience from more traditional projects. We asked our contact in the oil company to find personnel with these characteristics and had him communicate the message to his contacts.

The survey was conducted using a quantitative method (De Vaus, 2014). The interviewees were asked to rate their experience performance of the project alliance and any relatable traditional projects for several variables. For this survey, a 1-10 scale was used. The findings from the quantitative survey are also presented in the findings section. We emphasize that it is the same interviewees answering the quantitative survey who were interviewed in the qualitative interviews. The extra dimension provided by the quantitative results is the means of measurement and comparability.

Through our contact with the oil company, we reached out to fourteen experienced persons, who all confirmed that they were willing to participate. Of these fourteen, one had to cancel due to illness. This left us with thirteen interviewees, which was a number we felt satisfied with. This strategy is referred to as the snowball method (Johannessen, Christoffersen, & Tufte, 2011), and it proved an effective way of gathering the correct people for our interview process. Our respondents held varying management positions within the project alliance, and 15 percent were women. An overview of the thirteen respondents in question and their respective holding companies can be seen in **Table 2**.

All interviews were conducted over a period of two months. We made sure the roles of the researcher in the interviews were consistent throughout the process, as it created a predictable collection of data. One of the authors was always responsible for conducting the interview, with the remaining authors noting down the main thoughts shared by the respondents. We did not make any recordings of the interviews, something which required extensive and detailed notes.

TABLE 2. OVERVIEW OF THE INTERVIEWEES

Interviewee	Organization	Alliance	Duration
TP1	The technology provider	Project alliance	55 min
OC 1	The oil company	Project alliance	65 min
OC 2	The oil company	Project alliance	50 min
OC 3	The oil company	Project alliance	43 min
OC 4	The oil company	Project alliance	55 min
OC 5	The oil company	Project alliance	60 min
O-S S 1	The oilservice supplier	Project alliance	67 min
O-S S 2	The oilservice supplier	Project alliance	50 min
O-S S 3	The oilservice supplier	Project alliance	45 min
EPC S 1	The EPC supplier	Project alliance	45 min
EPC S 2	The EPC supplier	Project alliance	45 min
EPC S 3	The EPC supplier	Project alliance	50 min
EPC S 4	The EPC supplier	Project alliance	55 min

3.4 Data analysis

To interpret and analyze the data collected in our study, we had to process it into easily accessible codes and themes. This approach is based on the work by Creswell (2009) and his model of data analysis. The process is explained in detail below.

The first step consisted of writing up summaries of the 685 minutes' worth of notes. With Norwegian being the native language of the interviewees, it seemed natural to interview in this language. The notes were written the same language to keep the data consistent with the wording of the respondents. Furthermore, it is important to specify that the citations presented in Findings were translated from Norwegian into English. The transcriptions were made right after each interview to minimize the risk of misunderstandings and misinterpretations. Step two consisted of reading through the summaries, providing us with a general sense of the data and its meaning. We decided to mark different themes that could be of interest when discussing the research question at hand. These markings turned out to be very helpful when categorizing the data. In step three, the main goal was to create codes to help categorize the data found in the summaries. We utilized MaxQDA to manage, organize, and code the material, a computer-assisted software used for qualitative data analysis. The fourth and final step in Creswell's model (Creswell, 2009) covers how the coded data is interpreted. In this phase, we sought to combine our knowledge of relevant literature with the interpretations derived from the empirical data. This comparison between recognized literature and newly collected data made it possible for us to establish whether our findings confirmed or diverged from earlier findings, how the two different project types influence project performance, thus prompting us to dive deeper into the subjects that required it (Creswell, 2009).

All respondents were briefed before the interviews, whereby we explained what the goal of the study was, as well as informed them about their rights as informants. Each interviewee was encouraged to speak freely on the questions. If something was unclear, the interviewer asked control questions. To further ensure informed consent, a summary was sent out post-interview for correction and confirmation, along with a summary of our strategy for handling sensitive data. We informed the respondents both pre-interview and post-interview that everything shared would be handled confidentially and that nothing could be traced back to them personally. Formal consent to data collection and storing was obtained from the Norwegian Centre for Research Data. The research was conducted in accordance with the national standard guidelines for research ethics and the specific ethical guidelines for science and technology (Technology, 2016).

The result from the case projects represents the experiences of practitioners and is limited by their memories. The interviewees provided us with answers to the best of their knowledge.

3.5 Method assessment

External validity says something about whether the findings of the study can be said to be relevant outside the given context (Robert K. Yin, 2014). Only one alliance was examined. The project alliance was also a reasonably new alliance, with realistically only one project behind them. Thus, the data collected would be heavily influenced by this one project and by the fact that they are in the start-up phase of the alliance. Alliances with more experience might display different views and perspectives. These aspects could be considered as weaknesses (or limitations) but can also be easily optimized in further research.

Reliability, the consistency and repeatability of the research procedures used in case studies (Robert K. Yin, 2014), refers to whether we can believe the information that the data collection provides us with. We made sure the roles of the researcher in the interviews were consistent throughout the process, as it created a predictable collection of data. As it is qualitative, the data collected is dependent on both the context and the understanding of the researchers conducting the interview. We sought to remove some of this influence by having all researchers present write down their notes, before collecting and summarizing everything into one document. The summary was then sent to the respondents post-interview for correction and confirmation. This process ensured that our notes were, in fact, representative of what

the respondents wanted to share, as well as reducing the effect of the researchers' potential bias.

4 FINDINGS FROM THE INTERVIEWS AND THE SURVEY

This section presents the empirical findings pertaining to the research question RQ1: How does a project alliance, as an example of a CPDM, influence project performance compared to traditional project practice? Based on our case study, we identified different areas of importance as critical to the project alliance's performance. Some of the most significant contributions are shown in **Table 3**. In this table, a (+) symbol indicates where experienced persons see a favorable direction, as opposed to a (-) symbol indicating the opposite.

4.1 Findings from the interviews

4.1.1 Conflict level

Going into the interviews, the degree of conflict between partners in the project alliance created the biggest interest. Several interviewees explained that the project alliance establishes platforms for exploring different solutions and opinions. The flat structuring of the project alliance, with teams consisting of people from the different companies, enabled earlier decision making and better information flow. One of the main topics brought up by the interviewees was the breakdown of "silos" in the project organization. "Silos" refers to departments not cooperating. There were still conflicts in the project alliance, but they were resolved earlier and quicker compared to traditional projects. The conflicts were also of a less severe degree. A manager from the EPC supplier had this to say about the conflict level:

"In the alliance, we experience the level of conflict as lower than in traditional projects. The alliance encourages discussion of disagreements, and we can find solutions. In traditional projects, we often experience that those conflicts do not limit themselves over time". (EPC S2).

This statement is particularly impressive when considering the context: that the interviewee represents the construction contractor (the EPC supplier). Construction is a big part of the project and generates a significant contribution to the costs. This is naturally prone to promote both discussions and conflicts. Collaborative problem-solving takes time, and time is money. It is expensive to spend time dealing with arguing and disagreements with consultants, contractors, or others. Another manager from the EPC supplier explained:

"There have been tough discussions in the project alliance, but we have managed to conclude and move forward. The traditional long discussions regarding responsibilities, extra work, and cost we often see in traditional projects have been absent in the alliance model." (EPC S3).

When asked about the conflict level in the project alliance, several interviewees mentioned the lack of formal correspondence. In traditional projects, the partners send a lot of formal letters to each other to ensure legal rights and traceability. In this case, formal letters refer to a process conducted when two or more parties are in disagreement, and they are not able to decide the issue without involving an objective third party, often higher up in the company hierarchy. This was described by the interviewees as a tedious and time-consuming process with a negative impact on the operational performance. In the project alliance, however, there were close to no formal letters sent. An interviewee from the technology provider explained:

"There has only been sent one formal letter during the [….] project. In traditional projects, we would lose count of the number of formal letters sent between partners." (TP1).

The low degree of formal correspondence shows how the project alliance opens up the collaboration. The risk distribution prompts coinciding incentives. With the compensation model focusing on the project as a whole, companies can openly discuss and collaborate. This process also reduces the pursuit of hidden agendas aimed at ensuring personal gain.

Even though almost every interviewee was quite eager to express how low the conflict

level was, there seemed to exist some bias among the respondents due to consensus orientation within the project

The project alliance	Traditional projects
Low conflict level	***High conflict level***
(+) Conflict of less several degree	(-) Escalating conflict
Low degree of formal correspondence	***High degree of formal correspondence***
(+) Close to no formal letters sent	(-) Use formal letters to ensure legal rights and traceability
Quicker decision making	***Long decision making***
(+) Encourages discussion of disagreements that result in earlier decision making	(-) Long discussion regarding responsibilities, extra work, and cost
Consensus oriented - flat structuring	***Less solidary/consensus oriented***
(-) Lack of joint perspective on where the alliance is headed	(+) A distinct customer to lead the process
(+) A unique alliance culture	
(+) Trust	
(+) Incentives to open up and share information	
(+) Prevent hidden agendas	
Early involvement of parties - breakdown of "silos"	***Late involvement of parties – "silos"***
(+) The entire value chain works together	(-) Lack of collaboration across their responsibilities in value chain
(+) Understands the project as a whole	
(+) Increased responsibility for the lifetime of the project	
Co-location	
(+) Closing the physical and organizational distance between companies and fields	
(+) Parties share experiences between each other and between phases	
(+) Enables a steady flow of communication between parties	
(+) Strengthens the collaborative bonds between employees	
(-) Lack of co-location	
Risk share/reward	***Risk transfer***
Prevent double roles	***Mirrored roles***
(+) Delegated resources	(-) Ensuring control over other companies
More productive	***Less productive***
(+) Early information flow	(-) Lack of accurate and important information between phases in value chain
(-) Lack of innovative solutions	
(+) Copying former solutions	
(+) Innovative with products, documentation, lifetime, and procedures	
A single IT system	
(-) Lack of common IT system	

TABLE 3. THE PROJECT ALLIANCE, AS AN EXAMPLE OF A CPDM, COMPARED TO TRADITIONAL PROJECT PRACTICE

alliance. Alliance culture was a primary focus going into the project alliance, and after our initial interviews, it was evident that there existed a unique culture in the project alliance. Several interviewees claimed it would be difficult to identify the employer of a randomly selected member of the project alliance. Informants also spoke about their employer holding companies in the third person, referring to the project alliance as "we" and the employer holding firm as "they". There might also be some bias in the data since the interviewees themselves have incentives for the project alliance performing well. When applying the conflict level to this context, it was evident that there existed strong incentives for consensus within the project alliance. A manager from the oil company explained:

“Building an alliance culture takes time, and we should perhaps have used even more time than we did. Even though we underestimated the potential for conflict, I believe it will be reduced once the alliance model is fully realized. The project alliance is much more consensus-oriented.” (OC1).

4.1.2 Trust, culture, and coinciding incentives

As stated by the interviewees, it is clear that trust, along with alliance culture, had been one of the major foci going into the project alliance. Given the contractual model of the project alliance, the companies have incentives to open and share information as they all share potential upsides and downsides of the project. The different companies and members within the project alliance felt that they were working towards a common goal with shared incentives. None of the interviewees believed there existed any hidden agendas in the project alliance. There were some conflicting statements, but the majority pointed to trust and the unique culture as the most crucial contributor to creating shared incentives.

“I think the majority of the members of the alliance do not know the compensation model of the alliance, and that trust between the companies is the main driver for creating coinciding incentives.” (O-S S 3).

“Trust has been a critical factor from day one. Without it, the alliance model would not have worked. I have not encountered any situations where we did not comply with this. There have been disagreements but never breach of trust. Everyone has played their part and contributed to building trust. The majority of people I meet wants the alliance to succeed.” (OC 2).

Even though the interviewees pointed to the alliance culture as being the most important, this culture is based upon the contractual framework governing the project alliance. When creating the project alliance, culture was identified as a critical factor for success, thus making the project alliance in itself a contributor to creating shared incentives. When establishing a project organization with a high degree of trust given to its suppliers, one may lose some degree of governance and direction. This shows how the very foundation of the alliance model, trust and culture, also causes some downsides. The overall impression of the empirical data points to trust and alliance culture as absolutely vital to the alliance’s performance.

There were some concerns regarding the consensus orientation in the project alliance. Some managers felt too much trust was given to the project alliance itself, and that the project lacked a distinct customer to lead the process:

“We experience that (the oil company) gives the project alliance too much responsibility and there is no joint perspective on where the project alliance is headed and what the goals of the project alliance are.” (O-S S 2).

As the alliance model is inherently more solitary, the well-implemented structure of an overseeing customer is, to some degree, broken down. Interviewees noted that a vital role for the customer is to supervise and govern the process. It is, therefore, important that the involved companies understand what it means to work within the alliance model. Here, the education of the members working in the project alliance is vital.

4.1.3 Co-location

The co-location is, in many ways, the enabler for the other

presented factors to happen. On the basis of the interviews, it is clear that co-location was one of the most important factors determining the project alliance's success. Conflict, trust, transparency, and coinciding incentives all rely on good communication and easy access to other members of the alliance organization. Thus, co-location must be viewed as a factor contributing to the alliance's performance. Co-location can shorten the path to information and enable earlier decision-making and less work in silos. One of the reasons why it was so crucial to the performance of the project alliance was that it contributed to closing the physical and organizational distance between the different fields in the project. For example, the oil company, being responsible for engineering and design, more or less left the project after the design phase of the project. The EPC supplier, being responsible for construction, would essentially not be involved until after the design phase was finished. Now, every partner is present throughout the whole project's lifetime. This, of course, is a major benefit as the parties share experiences between each other and between phases.

Co-location enables a steady flow of communication between parties and helps strengthen the collaborative bonds between employees. The project alliance is currently co-located in one of the largest cities in Norway, where employees and managers are located in the same office building. This creates a swifter and more precise flow of information and resources. The exception was the EPC supplier, as the yard was located some 600km away. This created some distance between the construction and the planning of the project. Especially the EPC supplier found this challenging:

"The majority of planning and engineering in the project alliance is situated in (one of the largest cities in Norway), while the execution happens (some 600km away). In certain periods we could have been more co-located, especially in engineering and procurement. When co-locating, you have a better collaboration than one does through Skype or e-mail." (EPC S2).

Going forward, the project alliance should allow for more dynamic co-location at other offices when needed.

The project alliance created cross-organizational teams that involved people from different partners. Involved members were then able to share knowledge to a high degree. The most significant contribution mentioned by the interviewees was how the entire value chain worked together. Several respondents pointed to a notable increase in "process competence". "Process competence" refers to competence relating to the processes and organization within the project organization. A manager from the technology provider had this to say:

"The collaboration in the alliance makes us able to experience more than just a small part of the work process. We get to take part in the whole picture. I am certain that the alliance contributes to increasing competence. It seems like a majority of the co-workers feel more responsible in the alliance, which in turn increases the understanding of the project as a whole. This increases their competence as well." (TP1).

In the project alliance, there had been a focus on removing so-called double roles in the project. In a traditional project, the different companies often had mirrored roles that served as governing and controlling functions, ensuring control over what the other companies were doing. There were some conflicting experiences as to the degree of double roles in traditional projects, but most interviewees agreed that they traditionally experienced some dual functionality. The interviewees agreed that the project alliance removed some of this by having delegated resources. A manager from the oil-service supplier had this to say about double roles:

"The avoidance of double working is one of the most positive aspects of the alliance. Co-location has been central in avoiding double working." (O-S s 2).

4.1.4 Productivity versus innovation

The main goals of the project alliance were to create an organization that allowed for increased productivity when compared to traditional projects. The empirical data points to the project alliance as indeed being more productive than traditional projects. A manager from the EPC supplier said the following about the productivity:

"The productivity was on par with the ambitions of the projects, even though the bar was raised going into [the

project alliance], with higher goals and ambitions compared to more traditional projects." (EPC S 1).

In the alliance framework, it is stated that innovation should be used as a tool to increase productivity. Although innovation is stated as a goal in the governance documentation, the interviewees illustrated some clear conflicting interests. In our study, when talking about innovation, it is more often than not related to new products or solutions. The empirical data seemed to suggest that a major contribution to the productivity of the project alliance's output was, in fact, the lack of innovation. Furthermore, the data showed that productivity was closely linked to the standardization and copy effects. A manager from the EPC supplier explained further:

"... Another example is that it is typical for the industry that the projects have a high degree of tailored solutions, even though there are intentions of copying former solutions. Thus, it is innovative in itself that the project alliance manages to increase the degree of copying." (EPC S 1).

Another distinct advantage of the alliance is the collaboration form in itself, as presented earlier. Several of the interviewees pointed to the short decision paths and good workflow as major contributions to the project alliance performance. The direct cost of correspondence and the indirect cost of waiting for information add up to a high and often neglected cost. Some also pointed to the dynamic contractual model as a strength for productivity as it removed some of the uncertainty experienced in traditional projects. A manager from the oil-service supplier stated the following about the productivity of the alliance:

"In engineering, we have experienced excellent productivity compared to more traditional projects. The information flow was already a priority in the FEED stage. In a traditional project, this focus would come at a much later stage." (O-S S 2).

In traditional projects, members of the different parts of the projects would not necessarily collaborate across their responsibilities. For instance, the engineering and design team would be more or less finished with the project when the handover to the construction was completed. In the project alliance, the different companies follow the project and have more responsibility for the whole lifetime of the installation. A manager from the EPC supplier had this to say about how the alliance model enabled a change in their approach:

"The alliance will have a greater responsibility for the lifetime of the projects compared to traditional projects." (EPC S 3).

As a whole, the factor of innovation was one of the most splitting factors in the study. Some interviewees indicated that the project alliance was very good at promoting and achieving innovation. Others claimed that the project alliance tried but failed to achieve an edge in innovation over traditional projects. A manager from the oil-service supplier had this to say about innovation:

"I do not think that the alliance model has contributed to innovation. I fail to see how the model is a major advantage. The alliance model in itself is supposed to be more efficient and contribute to the work being done faster, but I cannot say I have seen particularly innovative solutions." (O-S S 3).

This view backs up the notion that the alliance business model itself stands for most of the increase in innovation. A manager from the EPC supplier also pointed to other areas of the business model that he thought of as innovative:

"The alliance in itself is an innovative business model within the industry. The alliance has also been innovative with products, documentation, lifetime, and procurement." (EPC S 1).

When asked to identify the biggest downsides of the project alliance, the interviewees pointed to interfaces as the most underachieving area in the project alliance. Most notably, IT systems had given rise to some issues in the alliance work. The largest problems, however, arose with regard to communication. A manager from the technology provider said:

"It is the everyday processes that have been challenging. This has set back productivity, but it has been somewhat mitigated by co-location. For instance, (the EPC supplier) stopped using Skype and started using Teams." (TP1).

A manager from the oil company had the following to say about the interfaces:

"The use of a common IT system has not worked well. These areas were a big black hole when starting up the project alliance. The governance model should have been more specific on the matter of establishing a functioning system structure. There have been done extensive work to fix the systems, and we have achieved an acceptable solution, but there is still a lot missing." (OC1).

Some issues related to the handover of work between the different companies were also noted.

4.2 Findings from the survey

For this survey, a 1-10 scale was used. The geometrical means and standard deviation are presented in **Table 4**, and the means are graphically presented in **Figure 1**.

According to the variables shown in **Figure 1** and **Table 4**, one can see a notable difference between the experienced performance in traditional projects versus in the project alliance.

When asked to quantify the difference in experienced performance between the two collaboration forms, the informants showed strong support for the alliance model, as shown in **Table 4** and **Figure 1**. It is challenging to discover areas where the project alliance has not been performing as expected, or worse, than traditional projects. Some consensus orientation and strong incentives for the project alliance to perform well were also noted. This, in turn, makes it even more challenging to identify areas that are not performing, as it is not in the informants' interest to identify them. The most notable differences are related to the variables trust, transparency, and collaboration. The data also indicated that the conflict level is reduced in the alliance model. The least significant difference can be found in the variable IT systems. As discussed in earlier sections, one of the few issues directly identified by the interviewees was interfaces between the companies, the project alliance, and the partner organizations. The IT system had proven to be difficult, as firewalls and different policies made it difficult to communicate. The IT system variable in **Table 4** and **Figure 1** illustrates how the project alliance has failed to work out the technical issues. Thus, this phenomenon was expected to be illustrated in the quantitative data as well.

Variable	Traditional		Alliance	
	Mean	SD	Mean	SD
Conflict level	6.0	1.5	8.3	1.3
Collaboration	5.6	0.9	8.4	1.0
Trust	6.0	1.1	8.5	0.8
Transparency	5.1	1.9	8.7	1.1
Co-location	5.0	1.8	7.5	1.2
Competence Increase	5.3	1.3	7.9	1.0
Double Working	5.4	2.2	6.9	2.6
Productivity	5.9	1.4	8.4	0.7
Innovation	5.0	1.8	7.1	2.0
IT-systems	5.4	1.7	5.7	1.7

TABLE 4. RESULTS FROM THE QUANTITATIVE SURVEY

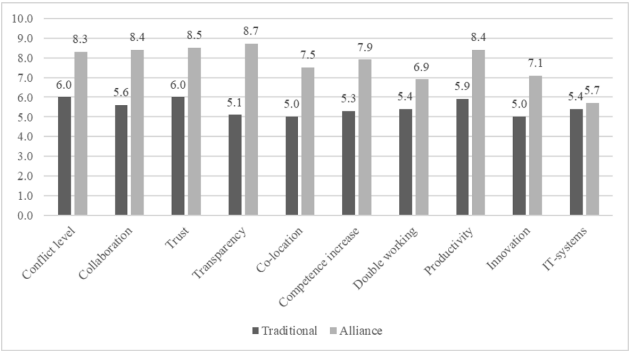

FIGURE 2. GRAPHICAL REPRESENTATION OF PROJECT ALLIANCE VERSUS ANY RELATABLE TRADITIONAL PROJECT

5 DISCUSSION

The empirical results indicate that there exists a much lower degree of conflict within the project alliance, compared to more traditional projects. This result is, according to our findings, achieved through closer cooperation, shorter decision paths, transparent partners, and a single alliance culture tailored around collaboration. What is interesting in this respect is how the oil company has managed to keep all partners in the project alliance satisfied with the alliance model, regardless of the role they play in the value chain. Some interviewees expressed that they often forgot that some of their colleagues belonged to different companies when working together in the project alliance.

Cultural differences can easily occur when several companies work together (Biggs, 2004). Alliance culture was a primary focus going into the project alliance. In this regard, the oil company has been very successful when designing their alliance model, as there existed a unique culture in the project alliance. In literature, a single alliance culture is identified as a key factor of an alliance (Biggs, 2004; Tadayon, 2018; Young et al., 2018); all partners within the project alliance, regardless of their employer, are part of the same team (Tadayon, 2018).

It was evident that the oil company invested both time and resources into creating a trusting environment when establishing the project alliance, and the findings indicate that they have been mostly successful. The interviewees in our study were satisfied with the level of transparency between partners in the alliance, and many were convinced that it was one of the main drivers behind the alliance's success.

Even though the alliance model lays the groundwork for a common goal mindset, some challenges still exist. The partners pointed expressly to the relationship between the partners as most significant in regard to the project alliance's performance. When establishing a project organization with a high degree of trust given to its suppliers, one may lose some degree of governance and direction. This shows how the very foundation of the alliance model, trust and culture, also causes some downsides. The overall impression of the empirical data points to trust and alliance culture is vital to the project alliance's performance.

As presented by our findings, one of the main topics brought up when discussing the level of conflict in the project alliance was how conflicts were resolved earlier and more efficiently compared to traditional projects. Several interviewees stated that when an issue arose, there seemed to exist a consensus orientation of some sort in the project alliance. This consensus could stem from the team-building investments the oil company made early on when initiating the project alliance, which paid off through developing employees with a genuine wish to resolve the issue as fast and as efficiently as possible. Based on our findings, the consensus was that while working in the alliance, the need to send formal letters was significantly reduced, which in hand boosted the alliance performance, as well as created a more collaborative workforce in the long run. The foundation of the alliance agreement is based on everyone working in the same team (Tadayon, 2018). In this agreement, a key factor is the development of no-blame culture (Tadayon, 2018; Young et al., 2018). No blame culture refers to the degree to which the parties take responsibility for problems as they arise, rather than avoiding them (Walker & Lloyd-Walker, 2015).

The oil company identified co-location as one of the key factors contributing to the performance of the project alliance. Interestingly, this was also the consensus of the respondents in our case study. According to one interviewee, the close distance between different fields in the project contributed significantly to the performance of the alliance, due to closer collaboration and a lower degree of conflict. This aligns with what the oil company wanted to achieve with their co-location, which points towards a successful implementation. Although most of the interviewees were happy with how the project alliance handled co-location, some felt it could improve, more specifically by having the construction team located closer in the engineering phase. Co-location is identified as a key factor of an alliance in literature (Jefferies et al., 2014; Tadayon, 2018; Young et al., 2018), and as a mechanism for realizing the full effects of an integrated project team (Tadayon, 2018).

Interfaces between the partners have been an issue. Problems with IT systems and the day-to-day communication tools such as Skype for Business and Microsoft Outlook have set back the productivity of the alliance. Firewalls and different policies impede the different systems from interacting with each other. The lack of governing guidelines initially seems to have contributed to this issue. Interfaces between companies and other alliances are crucial elements in the alliance model. With regard to the benefits discussed earlier, the communication and interaction between companies can function both as an enabler and as a barrier. Thus, ensuring functional interfaces in the alliance model is a key factor for its performance. Although questioned by Tadayon (2018), a single IT system is in literature identified as being a key factor in an alliance (Jefferies et al., 2014). In order for alliancing to be successful, significant interaction and communication is required between the partners.

6 CONCLUSION

On the basis of the data material, there is no doubt that the increased level of collaboration between the involved players is a major benefit to the alliance's performance. This result is, according to our findings, achieved through closer cooperation, shorter decision paths, transparent partners, and an overall alliance culture tailored around collaboration.

It is challenging to discover areas where the project alliance has not been performing as expected, or worse than traditional projects. The results were reviewed in detail in the 4.1 Findings from the interviews chapter. The findings show some barriers related to the co-location and the interfaces between the companies, the project alliance, and the partner organizations. Getting four independent companies to communicate and collaborate without problems occurring is difficult. The interfaces between the alliance partners, mainly the day-to-day communication, were found to be challenging. This results in unnecessary costs that could otherwise have generated value in the project alliance. There were also some barriers related to how the project alliance handled co-location; some felt this could improve.

The project alliance, as an example of a CPDM, has given rise to a new mindset as a result of its business model. This concept is, as previously stated, a new concept, at least within the Norwegian oil and gas industry. In this project alliance, the partners have a greater responsibility for the project as a whole, compared to a more traditional project. The strength of the project alliance is transparent in how companies are able to rethink their role in the project. In traditional projects, the firm will have strict roles and responsibilities. With the project alliance, the boundaries are shifted, and this, in turn, makes for innovative and rewarding new ways of thinking.

We limited the case study to one alliance within the Norwegian oil and gas industry. Future research should take the concepts developed in this study and apply them to a broader scope. It is also important to note that this study only focused on managerial positions within the project alliance. Other members might have other experiences, and this should be explored further. Thus, a study involving members from all levels of the project alliance would be preferable.

REFERENCES

AF HÄLLSTRÖM, A., BOSCH-SIJTSEMA, P., POBLETE, L., REMPLING, R., & KARLSSON, M. (2021). THE ROLE OF SOCIAL TIES IN COLLABORATIVE PROJECT NETWORKS: A TALE OF TWO CONSTRUCTION CASES. CONSTRUCTION MANAGEMENT AND ECONOMICS, 39(9), 723-738. DOI:10.1080/01446193.2021.1949740

BIGGS, C. P. (2004). MANAGING CULTURAL DIFFERENCES IN ALLIANCES. ALTREYA CONSULTING LLC.

BOND-BARNARD, T. J., FLETCHER, L., & STEYN, H. (2018). LINKING TRUST AND COLLABORATION IN PROJECT TEAMS TO PROJECT MANAGEMENT SUCCESS. INTERNATIONAL JOURNAL OF MANAGING PROJECTS IN BUSINESS, 11(2), 432-457. DOI:10.1108/IJMPB-06-2017-0068

BYGBALLE, L. E., & SWÄRD, A. (2019). COLLABORATIVE PROJECT DELIVERY MODELS AND THE ROLE OF ROUTINES IN INSTITUTIONALIZING PARTNERING. PROJECT MANAGEMENT JOURNAL, 50(2), 16. DOI:10.1177/8756972818820213

CRESWELL, J. W. (2009). RESEARCH DESIGN : QUALITATIVE, QUANTITATIVE, AND MIXED METHODS APPROACHES (3RD ED. ED.). LOS ANGELES: SAGE.

DE VAUS, D. (2014). SURVEYS IN SOCIAL RESEARCH.

ELMUTI, D., & KATHAWALA, Y. (2001). AN OVERVIEW OF STRATEGIC ALLIANCES. MANAGEMENT DECISION, 39(3), 205-218. DOI:10.1108/EUM0000000005452

FOTOPOULOS, C. B., & PSOMAS, E. L. (2009). THE IMPACT OF "SOFT" AND "HARD" TQM ELEMENTS ON QUALITY MANAGEMENT RESULTS. INTERNATIONAL JOURNAL OF QUALITY & RELIABILITY MANAGEMENT, 26(2), 150-163. DOI:10.1108/02656710910928798

JEFFERIES, M., BREWER, G. J., & GAJENDRAN, T. (2014). USING A CASE STUDY APPROACH TO IDENTIFY CRITICAL SUCCESS FACTORS FOR ALLIANCE CONTRACTING. ENGINEERING, CONSTRUCTION AND ARCHITECTURAL MANAGEMENT, 21(5), 465-480. DOI:10.1108/ECAM-01-2012-0007

JOHANNESSEN, A., CHRISTOFFERSEN, L., & TUFTE, P. (2011). FORSKNINGSMETODE FOR ØKONOMISK-ADMINISTRATIVE FAG. NOR. 3. UTG. OSLO: ABSTRAKT FORL. ISBN: 9788279353195.

LAHDENPERÄ, P. (2012). MAKING SENSE OF THE MULTI-PARTY CONTRACTUAL ARRANGEMENTS OF PROJECT PARTNERING, PROJECT ALLIANCING AND INTEGRATED PROJECT DELIVERY. CONSTRUCTION MANAGEMENT AND ECONOMICS, 30(1), 57-79. DOI:10.1080/01446193.2011.648947

LING, F. Y. Y., RAHMAN, M. M., & NG, T. L. (2006). INCORPORATING CONTRACTUAL INCENTIVES TO FACILITATE RELATIONAL CONTRACTING. JOURNAL OF PROFESSIONAL ISSUES IN ENGINEERING EDUCATION AND PRACTICE, 132(1), 57-66. DOI:10.1061/(ASCE)1052-3928(2006)132:1(57)

LOOTS, P., & HENCHIE, N. (2007). WORLDS APART: EPC AND EPCM CONTRACTS: RISK ISSUES AND ALLOCATION. INTERNATIONAL CONSTRUCTION LAW REVIEW, 24(1/4), 252.

LOVE, P. E. D., MISTRY, D., & DAVIS, P. R. (2010). PRICE COMPETITIVE ALLIANCE PROJECTS: IDENTIFICATION OF SUCCESS FACTORS FOR PUBLIC CLIENTS. JOURNAL OF CONSTRUCTION ENGINEERING AND MANAGEMENT, 136(9), 947-956. DOI:10.1061/(ASCE)CO.1943-7862.0000208

LAAN, A., VOORDIJK, H., & DEWULF, G. (2011). REDUCING OPPORTUNISTIC BEHAVIOUR THROUGH A PROJECT ALLIANCE. INTERNATIONAL JOURNAL OF MANAGING PROJECTS IN BUSINESS, 4(4), 660-679. DOI:10.1108/17538371111164065

MALVIK, T. O., WONDIMU, P., KALSAAS, B. T., & JOHANSEN, A. (2021). VARIOUS APPROACHES TO EARLY CONTRACTOR INVOLVEMENT IN RELATIONAL CONTRACTS. PROCEDIA COMPUTER SCIENCE, 181, 1162-1170. DOI:10.1016/J.PROCS.2021.01.313

MASON, J. (2018). QUALITATIVE RESEARCHING (THIRD EDITION. ED.). LOS ANGELES, CALIFORNIA: SAGE.

MATTHEWS, O., & HOWELL, G. A. (2005). INTEGRATED PROJECT DELIVERY AN EXAMPLE OF RELATIONAL CONTRACTING. LEAN CONSTRUCTION JOURNAL, 2(1), 46-61.

MENG, X., & GALLAGHER, B. (2012). THE IMPACT OF INCENTIVE MECHANISMS ON PROJECT PERFORMANCE. INTERNATIONAL JOURNAL OF PROJECT MANAGEMENT, 30(3), 352-362. DOI:10.1016/J.IJPROMAN.2011.08.006

MILLER, J. B., GARVIN, M. J., IBBS, C. W., & MAHONEY, S. E. (2000). TOWARD A NEW PARADIGM: SIMULTANEOUS USE OF MULTIPLE PROJECT DELIVERY METHODS. JOURNAL OF MANAGEMENT IN ENGINEERING, 16(3), 58-67. DOI:10.1061/(ASCE)0742-597X(2000)16:3(58)

MORRIS, P. W. G., & PINTO, J. K. (2007). THE WILEY GUIDE TO PROJECT TECHNOLOGY MANAGEMENT, SUPPLY CHAIN & PROCUREMENT MANAGEMENT.

OLSEN, B. E., HAUGLAND, S. A., KARLSEN, E., & JOHAN HUSØY, G. (2005). GOVERNANCE OF COMPLEX PROCUREMENTS IN THE OIL AND GAS INDUSTRY. JOURNAL OF PURCHASING AND SUPPLY MANAGEMENT, 11(1), 1-13. DOI:10.1016/J.PURSUP.2005.03.003

PATTON, M. Q. (1990). QUALITATIVE EVALUATION AND RESEARCH METHODS: SAGE PUBLICATIONS, INC.

RAHMAN, M. M., & KUMARASWAMY, M. M. (2004). CONTRACTING RELATIONSHIP TRENDS AND TRANSITIONS. JOURNAL OF MANAGEMENT IN ENGINEERING, 20(4), 147-161. DOI:10.1061/(ASCE)0742-597X(2004)20:4(147)

SILVA, A., & HARPER, C. (2018). USING PROJECT TEAM INTEGRATION TO PREDICT COST AND SCHEDULE PERFORMANCE IN PUBLIC TRANSPORTATION PROJECTS. PAPER PRESENTED AT THE CONSTRUCTION RESEARCH CONGRESS 2018.

SUPRAPTO, M., BAKKER, H. L., MOOI, H. G., & HERTOGH, M. J. (2016). HOW DO CONTRACT TYPES AND INCENTIVE MATTER TO PROJECT PERFORMANCE? INTERNATIONAL JOURNAL OF PROJECT MANAGEMENT, 34(6), 1071-1087. DOI:10.1016/J.IJPROMAN.2015.08.003

TADAYON, A. (2018). A NEW LOOK TOWARDS RELATIONAL PROJECT DELIVERY MODELS. (2018:372). NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY, FACULTY OF ENGINEERING, DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING, TRONDHEIM.

Tadayon, A., & Anderesen, B. (2021). Characteristics of a project that are suitable for a relational PDM. Procedia computer science, 181, 1089-1096. doi:10.1016/j.procs.2021.01.305

Technology, T. N. C. f. R. E. i. S. a. (2016). Guidelines for Research Ethics in Science and Technology. Retrieved from Oslo: https://www.forskningsetikk.no/globalassets/dokumenter/4-publikasjoner-som-pdf/60126_fek_guidelines_nent_digital.pdf

Walker, D. H. T., & Lloyd-Walker, B. M. (2015). Collaborative Project Procurement Arrangements. Philadelphia, Pennsylvania, USA: PMI.

Yeung, J. F. Y., Chan, A. P. C., & Chan, D. W. M. (2007). The definition of alliancing in construction as a Wittgenstein family-resemblance concept. International Journal of Project Management, 25(3), 219-231. doi:10.1016/j.ijproman.2006.10.003

Yin, R. K. (2008). Case Study Research Design and Methods 4th Revised Edition. In: Thousand Oaks: Sage Publications.

Yin, R. K. (2014). Case study research : design and methods (5th ed. ed.). Los Angeles, California: SAGE.

Young, B., Hosseini, A., Klakegg, O. J., & Lædre, O. (2018). What Makes an Alliance an Alliance – Experiences from Australian Infrastructure Projects. Journal of Modern Project Management, 6(1). doi:10.19255/JMPM01603

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