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Factors affecting transaction costs and collaboration in projects

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Abstract:

Purpose:

Transaction costs in projects can be reduced through improved collaboration between contractors and clients. The purpose with this paper is to respond to the call for further research on the framework suggested by Li et al. (2015) who presented 26 factors that determine project transaction costs. The objective is to empirically test the framework to identify which factors that have the greatest influence on project collaboration so that practitioners can prioritize their efforts on the most salient factors that will improve collaboration and reduce transaction costs.

Design/methodology/approach:

Interviews with 38 project practitioners from three different industries in Norway. The respondents had in average 20 years of professional experience.

Findings:

Quality of communication, project uncertainty, owner's organizational efficiency, change orders and *trust* were the five most frequently found factors that influence both project transaction costs and collaboration level. When we compared findings between different industries we found that *quality of communication* was important for all industries. The owner's *organizational efficiency* was also highly important in oil & gas and ICT projects. *Trust* was particularly important in oil& gas projects while *frequency of claims* was particularly important in construction projects.

Originality/value

This paper identifies the five most important factors for project practitioners to prioritize in order to reduce transaction costs through improved collaboration. The paper contributes to the conceptual theory of transaction costs and collaboration as it empirically tests and extend the framework developed by Li et al. (2015).

Keywords: Transaction costs, Collaboration, Project management

Paper type: Research paper

1 Introduction

On 19 May 2007, Chelsea footballer Didier Drogba scored the winning goal in the first FA cup final played at the new Wembley stadium in London. If every one of the 90,000 spectators

watching the game that day had donated £10 each, it would not be enough to even cover the cost of photocopying the legal documents of what became a notorious dispute between the main contractor responsible for building the stadium and its subcontractor. The case was finally settled in September 2008 after more than two years of hearings. At this point, the photocopying bill alone for printing case documents was £ 1 million, and the total legal costs paid by the involved parties had risen to £22 million. In the concluding section, Justice Jackson expresses his concern about the amount of resources spent.

"*The final result of this litigation is such that, when costs are taken into account, neither party has gained any significant financial benefit. Instead large sums of costs and a large amount of management time have been expended on both sides for no useful purpose"* (Jackson, 2008, p. 220).

This is a reminder that the cost of taking disputes to court can be high, as the parties invest significant resources in preparations for the hearings. The aim should be to prevent disputes, and to resolve disagreement as soon as possible. The potential for reaching an agreement quickly is reduced proportionally to the amount of resources the parties invest in the dispute (CII, 1995). Money spent on dispute resolution is an example of transaction costs that do not add value and should be avoided (Lu et al., 2015, Rajeh et al., 2015, Lumineau and Quélin, 2012). *Transaction costs* are the "*costs of running the economic system*"(Arrow, 1969, p. 48) and Williamson describes this with the following illustration:

"In mechanical systems, we look for frictions: do the gears mesh, are the parts lubricated, is there needless slippage or other loss of energy? The economic counterpart of friction is transaction cost: do the parties to the exchange operate harmoniously, or are there frequent misunderstandings and conflicts that lead to delays, breakdowns and other malfunctions?" (Williamson, 1981, p. 552)

The ability to prevent and resolve potential conflicts efficiently is related to the level of collaboration between the actors in the project (Dietrich et al., 2010). The term *collaboration* has been defined by the Institute for Collaborative Working (ICW, 2017, p. 29): *"Collaboration is a commitment between two or more parties to create value by striving to achieve shared competitive goals and operational benefit through a spirit of mutual trust and openness*".

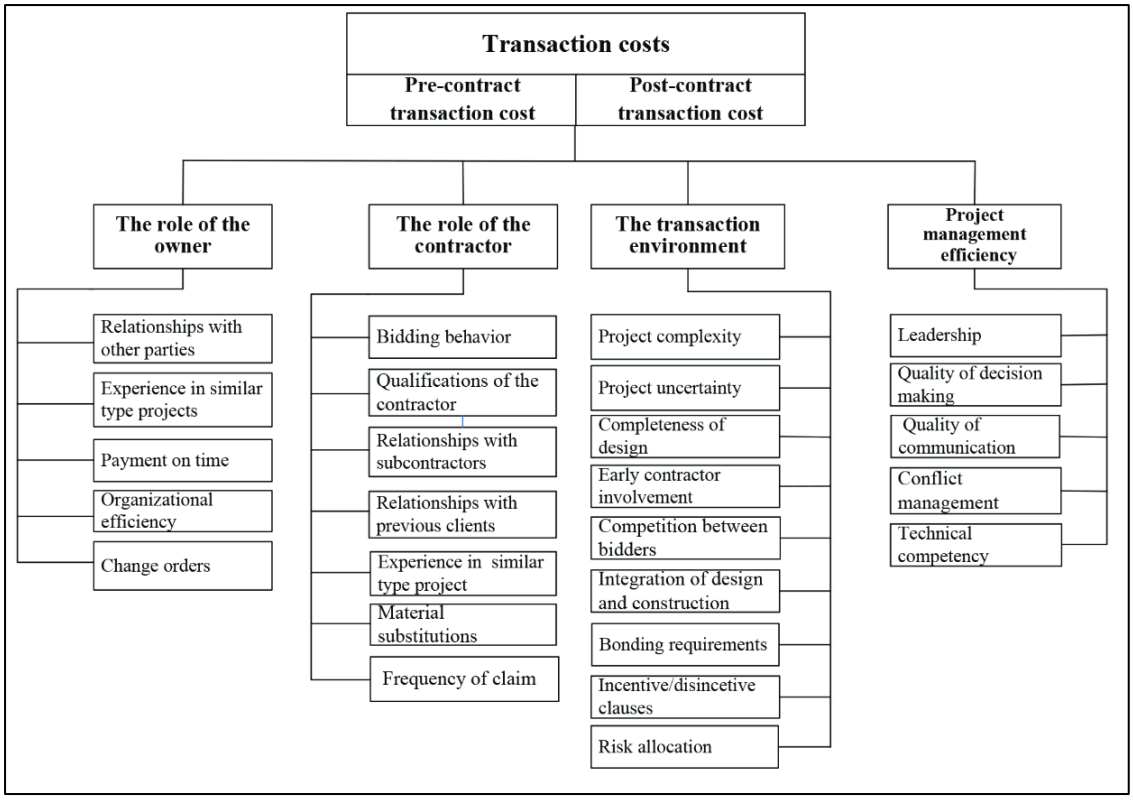

Fig. 1: Determinants of transaction costs in construction projects (Li et al., 2015, p. 550)

The purpose of this paper is to respond to the call for further research on the existing framework published by Li et al. (2015) of factors that determine transaction costs. The reason for using this framework is that it is based on a comprehensive literature review of existing project transaction cost research. Within this framework, shown in **Fig. 1**, we will identify which of the 26 factors that determine transaction costs have the greatest influence on collaboration. This will help project practitioners to prioritize their efforts on factors that they can expect to have the most significant effect on collaboration leading to reduced transaction costs.

Through interviews with experienced project practitioners we address the three research questions listed below. We have chosen respondents from three different industries. Hence, we follow the recommendation given by von Danwitz (2018), who has identified the need for more cross-industry research in future project management research.

RQ1: Which of the 26 transaction cost factors presented by Li et al. (2015) have the largest influence on collaboration in projects?

RQ2: What are the differences and similarities in the findings from projects in the construction industry, the ICT industry and oil and gas industry?

RQ3: What are the differences and similarities of the findings between the contractor perspective and the client perspective?

The research objective is to empirically test the framework developed by Li et al. (2015) to identify which factors that have the greatest influence on project collaboration so that practitioners can prioritize their efforts on the most salient factors that will improve collaboration and reduce transaction costs.

In the following sections of the paper we present the theoretical background followed by a description of the research method. Furthermore, we report, analyse and discuss findings followed by a conclusion where we describe implications and contributions from the research.

2 Theoretical background and literature review

The following section summarizes existing research on *transaction cost theory* and *collaboration*. Existing research on transaction costs in projects is limited and we identify a specific research gap related to factors that affect both transaction costs and collaboration.

2.1 Transaction costs

The term *transaction cost* was introduced by Robert Coase in *The Nature of the Firm* (Coase, 1937) as the reason for why firms exists, and it is a foundation of the "New Institutional Economics" paradigm (Rindfleisch and Heide, 1997, Shelanski and Klein, 1995, Simon, 1991). Transaction cost theory was later expanded by Williamson (1971), who pointed out that people are sometimes opportunistic and will perform actions that are only in their own interest. Opportunism leads to transaction costs when it is combined with bounded rationality, uncertainty or high asset specificity (Williamson, 1985). Although transaction costs theory has had some critics, it has later been validated by strong empirical evidence (Macher and Richman, 2008, Lafontaine and Slade, 2007, Geyskens et al., 2006, David and Han, 2004, Rindfleisch and Heide, 1997, Shelanski and Klein, 1995). In 2009 Oliver Williamson received the Nobel Prize in Economics for his work on the transaction cost theory (Kunglege-vetenskaps-akademien, 2009).

The transaction cost framework, shown in **Fig**. **2**, is based on a set of human factors and a set of environmental factors which are referred to as *behavioural assumptions* and *transaction dimensions* (Rindfleisch and Heide, 1997, Williamson, 1985).

Asset specificity describes the uniqueness, i.e. to which extent investments are locked and specific to a certain transaction (Williamson, 1981, Klein et al., 1978). Bounded rationality relates to the limited capacity the human mind has to process information and solve complex problems (Simon, 1957) and opportunism is defined as *"…Self-interest seeking with guile: agents who are skilled at dissembling realize transactional advantages*." (Williamson, 1971, p. 255)

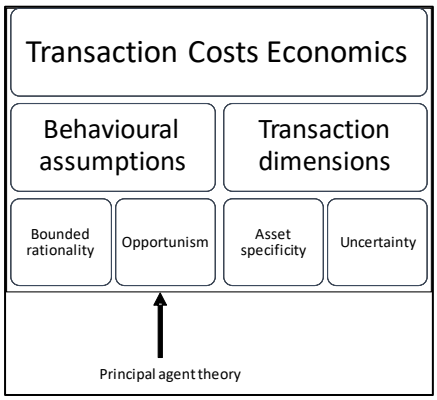

Fig. **2**: Transaction cost framework

If bounded rationality and uncertainty are linked with opportunism, problems occur. Opportunistic agents can then exploit uncertainty to deceive others while pursuing their own interest (Williamson, 1996, 1985, 1975) by:

- Provide incomplete information
- Disclosure of information
- Calculated efforts to mislead, distort or confuse

One should safeguard transactions against the threats from opportunism, and Williamson (1996) clarifies the assumption of opportunistic behaviour by stating that:

"*To assume, moreover, that human agents are opportunistic does not mean that all are continually given to opportunism. Rather, the assumption is that some individuals are opportunistic some of the time and that it is costly to ascertain differential trustworthiness ex ante*" (Williamson, 1996, p. 48)

A summary of identified research on opportunistic behaviour in projects after 1990 is presented in **Table 1**. Opportunistic behaviour has a negative effect on collaboration (Ning, 2018) and cause transaction costs (Ho et al., 2015). Some contractors may choose to prepare opportunistic bids to win a job only to file a high number of claims to the client later (Mohamed et al., 2011, Rooke et al., 2004).

A low level of trust was found by Kadefors (2004) in client-contractor relationships in Swedish construction projects. These contractors were often found to be opportunistic and took advantage of mistakes, changes and omissions in contract documents in order to claim additional payment from the client. To prevent contractor opportunism, clients prepared detailed specifications in contract documents and closely monitored contractors during the execution of the project. This lead to high transaction costs for the client. Similar findings are also presented by Pinto et al. (2009) who performed an empirical study of large construction projects in Canada and found that trust between actors contributes to reduced transaction costs.

Table 1: Research published after 1990 on opportunistic behaviour in client-contractor relations in projects

Opportunistic behaviour	Discussed by
Opportunistic bidding reduce margins in bids and seek profit recovery by claims submit unbalanced bids by exploiting information asymmetry	(Nyström, 2015) (Mohamed et al., 2011) (Arditi and Chotibhongs, 2009) (Tan et al., 2008) (Lo et al., 2007) (Ho and Liu, 2004) (Rooke et al., 2004) (Ngai et al., 2002) (Crowley and Hancher, 1995) (Zack, 1993)
Take advantage of uncertainty or mistakes by others Search for mistakes and omissions in principal's documentation to build claim Take advantage of changes and variations to scope	(You et al., 2018) (Ho et al., 2015) (Manu et al., 2015) (Mandell and Nyström, 2013) (Pinto et al., 2009) (Kadefors, 2004)
Strategic misrepresentation Use of false or misleading information to get acceptance for project Withhold information on purpose	(Andersen et al., 2016) (Pinto, 2013) (Flyvbjerg, 2009) (Flyvbjerg, 2005) (Flyvbjerg et al., 2002)

With reference to the principal-agent theory, the term *adverse selection* is commonly used to describe the situation where information asymmetry between a principal and its agent leads to decisions that do not give the optimal result (Akerlof, 1970, Arrow, 1969). Such information asymmetry in a project may lead the client (principal) to choose a contractor (agent) that may in fact not turn out to be the best contractor for the job (Forsythe et al., 2015, Müller and Turner,

2005). Often the contractor offering the lowest price is not the most favourable contractor for the client to choose in the long run (Lædre, 2014). In order to select the best contractor, both the organizational culture and the trustworthiness of potential bidders must be considered (Kadefors et al., 2007). Another example of a situation where the client may need to safeguard its interests is *small number bargaining.* If the number of alternative contractors is low, a contractor may choose to utilise its bargaining power to claim a superior price, (Levy, 1985, Klein et al., 1978). Once a relationship between two parties exist, *hold up-problems* can occur as the contractor may try to hold up the client and re-negotiate a better deal (Klein et al., 1978). Goldberg (1976) illustrates this with the mechanic who takes apart your car and then demand three times the agreed price to put it back together. Furthermore, incomplete contracts where the principal is not able to specify all details may lead to *haggling problems* with the contractor (Williamson, 1996). To safeguard its interest against a contactor that underperform or conduct work with poor quality, the client may need to monitor the execution of the contractor's work closely. This leads to *shirking costs* (Alchian and Demsetz, 1972).

Based on a review of existing literature, Li et al. (2015) synthesize factors that determine potential project transaction costs that the project owner may have to bear. These factors are grouped in four categories which are *the role of the owner*, *the role of the contractor*, *the transaction environment* and *project management efficiency*. In total, 26 determinants of transaction costs in projects are shown in **Fig. 1.**

The owner's behaviour affects the direct transaction costs but also has an indirect effect, as it has an impact on the uncertainty in the transaction environment. By involving contractors early, clearly defining the work scope, harmonizing relationships and making sure that risk allocation is fair between the parties, transaction costs borne by the owner can be reduced (Guo et al., 2016, Li et al., 2013). The contractor's behaviour when bidding and executing the work is also found to impact the transaction costs borne by the owner (Li et al., 2013).

Furthermore, high project management efficiency through leadership, good decision making, effective communication, proper conflict management and a high degree of technical competence helps to reduce these transaction costs, (Li et al., 2013).

2.2 Collaboration

Project performance is positively related to collaboration (Um and Kim, 2018). Projects more often fail due to conflicts and cooperation issues rather than due to technical issues (Aarseth,

2014). The importance of organizational relations in projects has also been identified by others, such as (Ning and Ling, 2015, Young, 2015, Pinto, 2010, Davies et al., 2009, Winter et al., 2006).

Collaboration should create win-win situations and ensure that all parties gain economic advantages by participating. According to the synergy model by Bititci et al. (2007), the collaborating parties need to have a sufficient maturity level in order to be able to collaborate successfully and achieve such win-win situations.

The importance of carrying out self-assessment to verify an organization's readiness for collaboration is also recognized in the ISO 44001 Collaborative Business Relationships Management Systems standard, which was launched in 2017. This is the first international standard that addresses collaborative business relationships, and it supersedes the previous British standard "BS 11000 Collaborative Business Relations" (ICW, 2017). Empirical research presented by Chakkol et al. (2018) reveal how using such collaborative standards is useful to formalize the collaboration practises between clients and contractors in complex projects.

Collaborative project approaches include several types of relationship-based procurement methods such as *partnering, integrated project delivery (IPD),* and *alliancing.* Among these approaches, *alliancing* is the highest order of relational contracting, and has a high level of both pain-share/gain-share incentives and *early contractor involvement*. (Walker and Lloyd-Walker, 2015, Lahdenperä, 2012). In addition, soft elements such as *trust, long-term commitment, cooperation* and *communication* are also important to achieve a high extent of collaboration (Yeung et al., 2007).

Relational aspects play an important role in the cooperation level between project actors (Benítez-Ávila et al., 2018) and contractors are more willing to cooperate if they perceive the contract as fair (Song et al., 2018). Recent research on client-contractor relations has found that success factors are cooperation, sharing of knowledge, mutual ability to adapt and learn, openness and trust, (Biong et al., 2016).

Contracts should be designed so that the interest of the client and the contractor is aligned in order to prevent opportunism (Eisenhardt, 1985). Contracts with fixed-price or cost-plus mechanism often has a negative impact on project collaboration between a principal and its agent, (Müller and Turner, 2005). To foster cooperative behaviour from its contractor(s), the

client should use contract mechanisms that also take into account what contractors need and not only focus on what is best for themselves, (Zhang et al., 2018a).

The *collaborative tool model* follows the principle that information should be shared between parties, to better manage organizational complexity (Aarseth, 2014). Formal barriers that hinder parties from communicating can lead to conflicts (Vaaland and Håkansson, 2003), and proper communications is critical for project success, (PMI, 2017, Kerzner, 1995).

2.3 Research gap - Transaction costs and collaboration in projects

Empirical research on transaction costs in projects is limited, as shown in **Table *2***. The number of studies is small and more research is needed (Guo et al., 2016, De Schepper et al., 2015, Li et al., 2015, Rajeh et al., 2015).

Table 2: Empirical research on transaction costs in projects

Transaction costs in projects	Discussed by
Factors influencing transaction costs in projects	(Guo et al., 2016) (Li et al., 2015, Li et al., 2013) (Ho and Tsui, 2009) (Lu et al., 2015)
Quantification of transaction costs in projects	(Rajeh et al., 2015) (De Schepper et al., 2015) (Li et al., 2014) (Dudkin and Välilä, 2006) (Antinori and Sathaye, 2007) (Farajian, 2010) (Halvorsen and Andersen, 2015)

Pinto et al. (2009) encourage researchers to further investigate the relationship between *trust* and *project transaction costs* and Li et al. (2015) call for further empirical research on the framework which contains factors that determine *project transaction costs.*

While there exists a fair amount of research on the various collaborative approaches (Eriksson, 2010, Yeung et al., 2007), we have identified a research gap related to the relationship between *collaboration* and *transaction costs* in projects. We have not identified any existing research investigating which *transaction cost* factors in projects that influence *collaboration* the most.

In addition, von Danwitz (2018), who performed an extensive literature review of existing project management research, identified the need for more cross-industry research in the future, as most studies today are industry-specific. Therefore, we believe it would be particularly useful to perform the study from a cross-industry perspective.

3 Methodology

The point of departure for our research is based on theory as we investigate an existing framework published by Li et al. (2015). We collect empirical data to explore and validate this framework through deduction (Bryman, 2016, Alvesson and Sköldberg, 2009).

In this paper, we explore the research questions through semi-structured interviews. Interviews allows the researcher to explore the research question in depth (Cassell, 2009). The reason for choosing a qualitative strategy using interviews instead of a quantitative strategy using a survey is that the interview gives us greater insight in the reason why the various respondents consider different factors important for collaboration. Through follow up questions we can explore the argumentation of the respondents and get a more meaningful understanding of the reason for their responses. Qualitative interviews are well-suited to explore experience of practice when opinions and experience are important for the research question (Bryman, 2016, Shepherd, 2015, Cassell, 2009). Interviews also gives us the opportunity to identify if there are other factors that are important outside the 26 factors in the existing framework by Li et al. (2015). In a study of recent published articles on project management von Danwitz (2018) found that both qualitative and quantitative methods are commonly used as 49% of the contributions were qualitative, 31% quantitative, 15% conceptual, 4% mixed methods and 1% other used other methods.

3.1 Respondents

Recruitment of respondents was mainly performed using purposive sampling (Bryman, 2016). The reason for using purposive sampling is to identify respondents that are relevant for our research questions rather than to recruit respondents on a random basis (Bryman, 2016). In addition, we used elements of snowball sampling (Bryman, 2016) as some respondents

suggested names of other potential respondents that they claim have experience that is relevant to the research.

We searched for experienced practitioners that can explain matters comprehensively based on their own experience from many projects. From a total of 38 respondents, 34 held a role as a project manager or a project director. The respondents had on average 20 years of professional experience. All respondents were currently located in Norway, but several had international experience and most of the companies where respondents work operate in an international market.

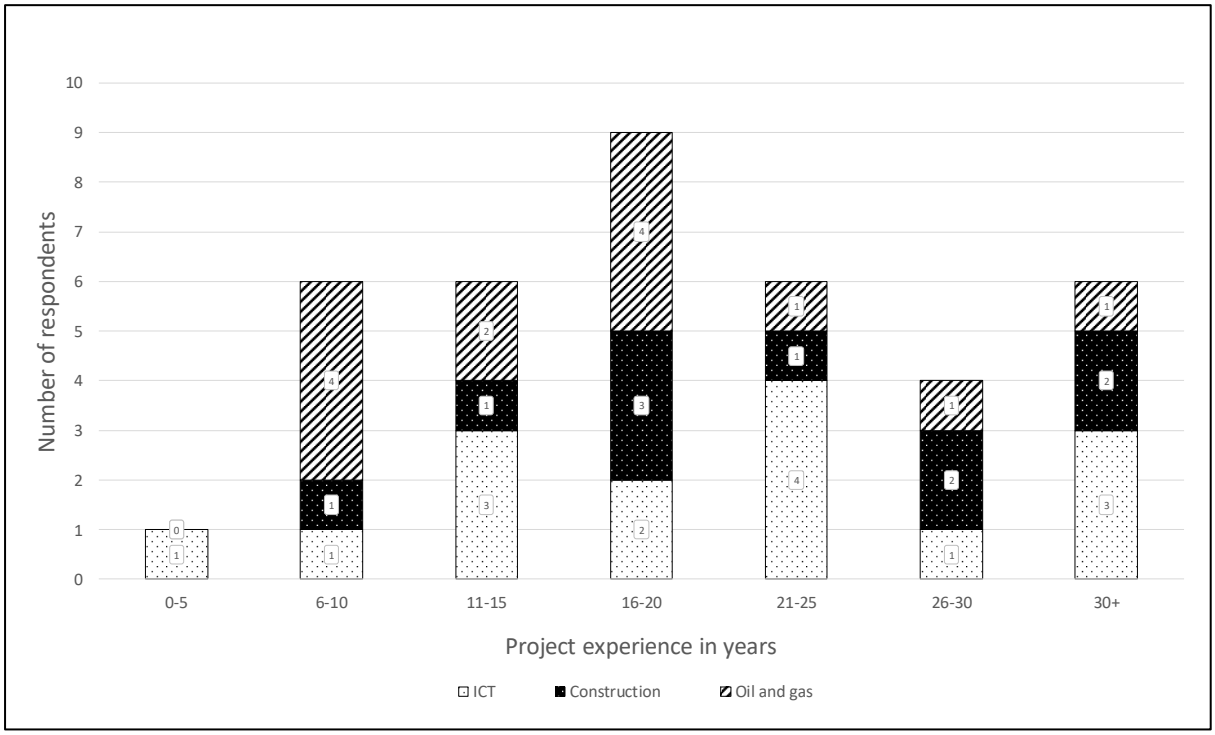

Fig. 3: Demographic distribution of respondents

In order to find answers to our second research question, we ensured that we recruited respondents from three different industries (**Fig. 3**). We also ensured that we recruited respondents from both contractors and clients, thus making it possible to investigate both perspectives to find answers to our third research question. The respondents came from thirteen different companies in Norway and worked in *ICT* projects, *construction* projects or *oil and gas* projects. From the total of 38 respondents, 29 worked for seven different companies categorized as contractors while nine respondents worked for six different companies categorized as clients.

3.2 Saturation

Following the idea of theoretical saturation by Glaser and Strauss (1967) we should perform interviews until we see that additional interviews do not provide any significant new theoretical understanding, (Bryman, 2016). In an experiment performed by Guest et al. (2006), it was found that saturation occurred after only 12 interviews and Crouch and McKenzie (2006) argue that a small number of cases (fewer than 20) is often sufficient. In a sample of 560 studies that used qualitative interviews, the average number of interviews was 31 (Mason, 2010).

In **Fig.** ***4*** we present how our results saturated as the number of interview increased. Each line in the plot shows the development of one of the 26 factors. The vertical scale indicate percentage of interviews where factor was found. The purpose with this plot is not to show the results for all the 26 factors (detailed results are presented in section 4 of this paper), but rather to show how saturation occurred. Most results start to stabilise after the first 10-15 interviews. After 30 interviews, we have reached a point where it is fair to claim that most results are saturated. In total, we carried out interviews with 38 respondents.

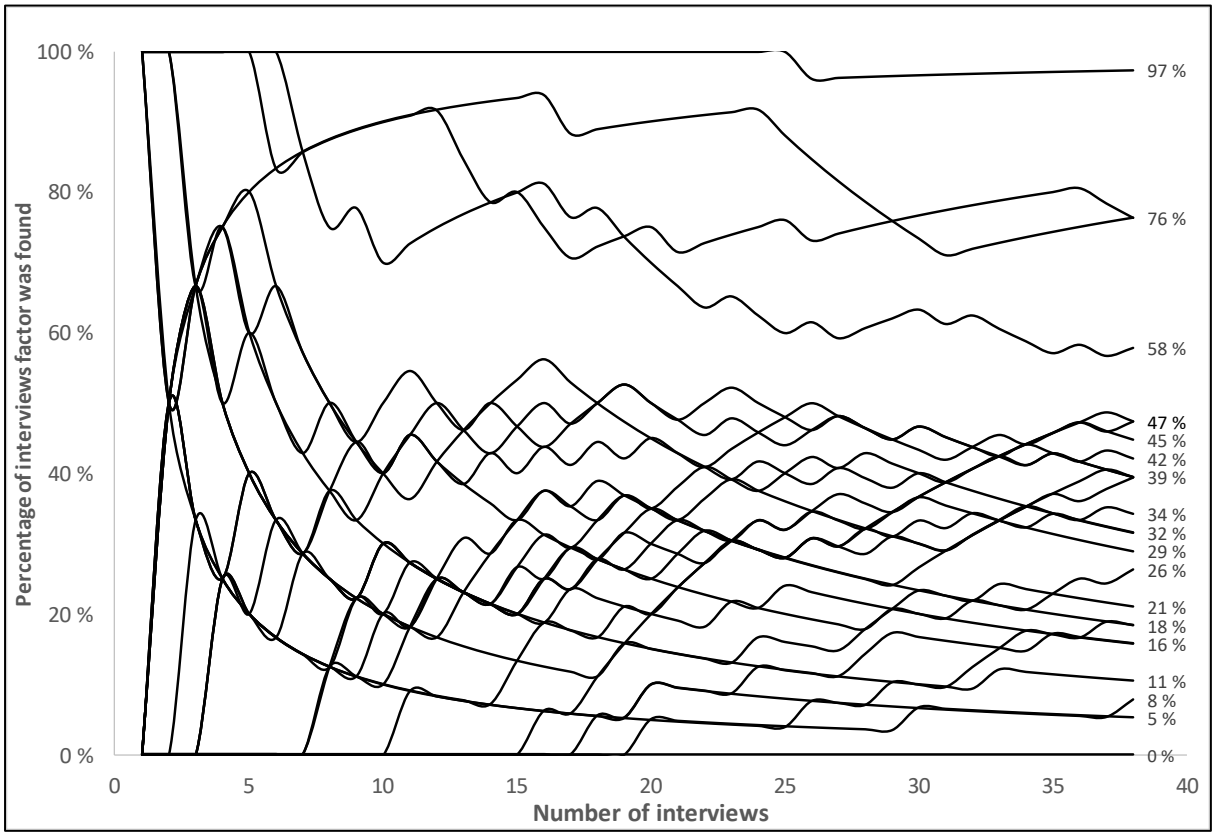

Fig. 4: How the results saturated as number of interviews increased. Each line shows the development of one factor.

3.3 Interview method

An interview guide was established and two pilot interviews were conducted with colleagues to pre-test the questions in the interview guide (Bryman, 2016) as well as to practise interview skills (Buchanan and Bryman, 2009). Based on lessons learned from the pilot interviews, the interview guide was revised before interviews were initiated with the 38 respondents in this study.

The interviews were conducted as face-to-face meetings in order to get a more comprehensive impression (Bryman, 2016) and more accurate answers (Shuy, 2002) than what one could achieve through telephone or video calls. The location of the interview can affect the balance between the interviewer and the respondent (Herzog, 2005). Reluctant respondents may be more willing to share information if they are interviewed in an environment where they feel comfortable (Adler and Adler, 2001). Most of the interviews were therefore conducted in meeting rooms at the location where the respondents work.

Each interview lasted between 60 and 90 minutes. No audio-recording device was used and the interviewer took handwritten notes during the interview. Based on these notes, the interviewer wrote a summary of the interview and sent it to the respondent for verification the same day. All interviews were conducted by the same person in the period between October 2017 and January 2018.

There are many good reasons to audio-record interviews when performing qualitative research. Audio-recorded interviewing allows the researcher to examine the interviews in more detail. It also provides high accuracy and reduces the risk of bias from the interviewer. Furthermore, audio-recorded interviews allow other researchers to conduct secondary analysis later (Bryman, 2016). On the other hand, audio recording may cause respondents to be less willing to share information during the interview (Saunders et al., 2009, Warren, 2002). Ultimately, the importance of interviewing respondents in a context where they were comfortable about sharing information was the main reason for choosing not to audio-record the interviews.

3.4 Ethical awareness and privacy

Respondents who participate in interviews must be treated fairly (Bryman, 2016, Jonasson and Ingason, 2015). To protect the privacy of the participants, their identity and the name of their employer were anonymized. In addition, if respondents named specific clients, partners or shared confidential information, the interviewer ensured that such information was

anonymized when writing the summary from the interview. This summary was submitted to the respondent for review and approval.

In Norway, the NSD Data Protection Official for Research is an agency that ensures that research is conducted according to Norwegian laws related to protection of the individual's right to privacy. The interview guide was therefore sent to the NSD *Data Protection Official for Research* for approval.

A one-page document with key information was sent to each participant prior to the interview. This document contained information about the purpose of the interview, details about the interview method and how anonymity would be ensured. Each respondent gave their written consent to participate in the interview based on these terms.

3.5 Data analysis and coding

A written summary of each of the 38 interviews was stored in a database. These summaries were then imported into computer-assisted qualitative data analysis software (NVivo 11). Such software is useful when coding data from a larger number of interviews. However, using such software may increase the risk of fragmentation and one should therefore have high awareness of the context when analysing the data (Bryman, 2016). The process starts with basic coding by topic. We then then look for patterns and group codes across the interviews (Alvesson and Sköldberg, 2009, Ely et al., 1997).

The 26 factors (**Fig. 1**) for transaction costs established by Li et al. (2015) were used for the coding. This framework was developed for determining transaction costs. In order to justify why these factors can be used for coding our interviews about collaboration we searched existing literature for factors affecting collaboration. As shown in **Table *3***, we found that 25 of the 26 factors is discussed in existing literature. The only factor we could not find any supporting literature for was *bonding requirements.* Hence, we argue that the framework presented by Li et al. (2015) is suited for coding the interviews to study factors that affect collaboration.

Table 3: Literature where factors are found to influence collaboration

	Literature describing collaboration factors	(Bond-Barnard et al., 2018)	(Hietajärvi and Aaltonen, 2018)	(Hosseini et al., 2018)	(Ahola et al., 2017)	(Eriksson et al., 2017)	(Hanna, 2016)	(Suprapto et al., 2015)	(Walker and Lloyd-Walker, 2015)	(Boukendour and Hughes, 2014)	(Fulford and Standing, 2014)	(Jefferies et al., 2014)	(Bond-Barnard et al., 2013)	(Fellows and Liu, 2012)	(Patel et al., 2012)	(Cho and Ballard, 2011)	(Love et al., 2011)	(Dietrich et al., 2010)	(Eriksson, 2010)	(Bresnen, 2007)	(Kadefors et al., 2007)	(Bayliss et al., 2004)	(Kadefors, 2004)	(Duarte and Davies, 2003)	(Tjosvold et al., 2003)	(Hoegl and Gemuenden, 2001)
Factors from Li et al. (2015)																										
The role of the owner																										
Relationships with other parties		✓							✓						✓					✓						
Experience in similar type projects									✓						✓					✓			✓			
Payment on time																	✓									
Organizational efficiency			✓		✓										✓					✓						
Change orders									✓	✓	✓						✓						✓			
The role of the contractor																										
Bidding behaviour										✓				✓					✓		✓					
Qualifications of the contractor				✓											✓					✓						
Relationships with subcontractors									✓		✓				✓				✓	✓						
Relationships with previous clients			✓						✓						✓					✓						
Experience in similar type project												✓			✓					✓						
Material substitutions				✓					✓						✓											
Frequency of claims									✓	✓												✓	✓			
The transaction environment																										
Project complexity			✓			✓			✓						✓											
Project uncertainty									✓	✓			✓		✓								✓			
Completeness of design									✓	✓	✓												✓			
Early contractor involvement				✓					✓																	
Competition between bidders										✓										✓						
Integration of design and construction									✓		✓					✓			✓							
Bonding requirements																										
Incentive / disincentive clauses		✓							✓	✓					✓		✓		✓	✓		✓				
Risk allocation									✓	✓					✓		✓			✓						
Project management efficiency																										
Leadership			✓					✓	✓						✓											✓
Quality of decision making			✓				✓		✓						✓											
Quality of communication			✓					✓	✓				✓		✓			✓								✓
Conflict management		✓						✓	✓						✓			✓							✓	✓	
Technical competency					✓				✓		✓				✓					✓						

This framework with 26 factors was not presented to the respondents before or during the interviews. The respondents were simply asked to describe factors that they regarded as influencing collaboration in their project(s), and what they did to protect their own interests from potential opportunistic behaviour by others. Summaries from the interviews were then analysed to identify sections where the respondents described factors influencing collaboration

that corresponded with any of the 26 factors that determine transaction costs. Sections where such factors were found were then coded accordingly and we counted, for each code, the number of interviews in which each code occurred. For example, the code *relationships with other parties* occurred in 16 of the 38 interviews. This means that 16 of the 38 respondents discussed matters that fit this code when they described factors affecting collaboration in their projects.

3.6 Criticism of the research method

With regard to validity and reliability, one can argue that the approach of analysis used has a potential for some source of error. There is a risk of misinterpretation since the researcher subjectively analysed the interviews in a framework that was not presented to the respondents during the interview. On the other hand, if the framework had been presented to the respondents in the interview, and they had been asked to specifically rate each factor, for example by using a Likert scale, there is a risk that the respondents would have been influenced by this framework. Without the framework, and by answering open questions, respondents were more likely to describe factors that affected collaboration in their projects without being constrained by the existing framework. As a result of this, one new factor (that was not part of the existing framework) emerged from the interviews. Even though a subjective analysis creates a risk of misinterpretation, this approach was considered the best. Finally, to mitigate this potential source of error, findings from the interviews were later presented to two different groups of project managers. The first group consisted of 40 project managers working for an IT consulting company. The second group consisted of 18 project managers working for an oil company. Although we did not present the results for a specific group of construction project managers, some of the project managers in the two above mentioned groups had previously worked in the construction industry. The consensus from the feedback from the two groups was that the findings corresponded well with their experience as project practitioners, something that further validates our findings.

Quotations from the interviews have been used in the discussion section of this paper to underline important findings. Since no audio recording was used and the interviews were conducted in the Norwegian language, there are potential sources of error when presenting quotations from respondents.

Since the interviews were not audio-recorded, there is increased risk of bias from the interviewer as well as potential lack of accuracy and misunderstandings. To mitigate this

weakness, the interviewer wrote a summary of the interview on the same day and returned it to the respondent for approval. Each respondent was asked to review the summary and correct mistakes or clarify misunderstandings.

The ratio of approximately 3:1 between respondents from the contractor perspective and the client perspective gives reason to expect that findings from this study are influenced more by contractors than by clients.

With regard to external validity, the study was only performed on Norwegian projects. However, several respondents had international experience and many of the companies where the respondent work operate in an international market.

4 Findings

The following section reports how frequently the 26 different factors, from the framework proposed by Li et al. (2015), are found in the interviews. In ***Table 4*** we show the detailed finding from each interview.

Table 4: Detailed findings from interviews (RQ1/RQ2/RQ3)

Respondents			Factors found in interview																										
Respondent ID	Respondent - Industry	Respondent - Role	Relationships with other parties	Experience in similar type projects	Payment on time	Organizational efficiency	Change orders	Bidding behaviour	Qualifications of the contractor	Relationships with subcontractors	Relationships with previous clients	Experience in similar type project	Material substitutions	Frequency of claims	Project complexity	Project uncertainty	Completeness of design	Early contractor involvement	Competition between bidders	Integration of design and construction	Bonding requirements	Incentive / disincentive clauses	Risk allocation	Leadership	Quality of decision making	Quality of communication	Conflict management	Technical competency	Trust
1	ICT	Contractor				✓	✓							✓		✓	✓			✓				✓		✓			
2	ICT	Contractor	✓				✓	✓	✓	✓				✓	✓	✓	✓						✓		✓	✓			
3	ICT	Contractor	✓			✓	✓	✓		✓						✓		✓					✓	✓		✓			
4	ICT	Contractor				✓	✓				✓					✓	✓						✓	✓		✓	✓	✓	
5	ICT	Contractor				✓	✓	✓	✓						✓	✓								✓		✓			
6	ICT	Contractor				✓	✓										✓									✓	✓		
7	ICT	Contractor				✓										✓		✓								✓			✓
8	ICT	Contractor		✓		✓			✓			✓			✓	✓							✓			✓			
9	ICT	Contractor				✓	✓		✓		✓	✓				✓										✓			
10	Oil&Gas	Client				✓		✓						✓		✓		✓						✓	✓	✓	✓		✓
11	Oil&Gas	Client				✓	✓	✓	✓			✓				✓			✓	✓			✓	✓		✓			✓
12	Oil&Gas	Contractor				✓	✓	✓			✓					✓	✓			✓					✓	✓			✓
13	Oil&Gas	Contractor	✓			✓	✓										✓								✓	✓			✓
14	Oil&Gas	Contractor	✓			✓	✓		✓								✓							✓		✓			✓
15	Oil&Gas	Contractor	✓	✓		✓	✓	✓								✓	✓	✓		✓					✓	✓			✓

16	ICT	Client	✓	✓		✓	✓	✓	✓		✓			✓	✓		✓			✓		✓	✓			✓			✓
17	ICT	Client									✓							✓			✓				✓		✓	✓		✓
18	Construct.	Client				✓	✓	✓	✓				✓	✓	✓	✓				✓		✓	✓	✓		✓			
19	Construct.	Contractor	✓	✓		✓		✓		✓	✓			✓		✓				✓		✓		✓		✓			✓
20	Construct.	Client			✓	✓			✓				✓	✓	✓	✓						✓				✓		✓	
21	ICT	Contractor		✓		✓									✓			✓		✓						✓			
22	ICT	Contractor		✓		✓									✓			✓		✓		✓		✓		✓			
23	ICT	Contractor		✓		✓	✓	✓			✓				✓	✓				✓		✓		✓		✓	✓		
24	ICT	Contractor	✓	✓		✓			✓	✓			✓			✓	✓									✓			✓
25	Construct.	Contractor														✓	✓			✓					✓	✓			
26	Construct.	Contractor	✓	✓			✓	✓			✓			✓			✓	✓	✓	✓									✓
27	Construct.	Contractor	✓					✓	✓							✓								✓		✓			
28	Construct.	Contractor					✓			✓		✓			✓			✓		✓						✓			
29	Construct.	Contractor		✓			✓			✓	✓	✓			✓			✓	✓							✓	✓		✓
30	Construct.	Contractor	✓	✓	✓		✓	✓	✓	✓				✓		✓	✓	✓				✓				✓			✓
31	Construct.	Contractor	✓													✓		✓				✓				✓			✓
32	Oil&Gas	Contractor	✓			✓	✓				✓			✓		✓		✓	✓	✓		✓	✓	✓	✓	✓			✓
33	Oil&Gas	Contractor	✓			✓				✓	✓		✓			✓		✓	✓	✓		✓	✓	✓		✓			✓
34	Oil&Gas	Contractor				✓		✓			✓					✓		✓	✓	✓		✓	✓			✓			✓
35	Oil&Gas	Client	✓			✓					✓	✓		✓		✓	✓	✓		✓		✓		✓	✓	✓			✓
36	Oil&Gas	Client				✓	✓				✓					✓		✓		✓				✓	✓	✓			✓
37	Oil&Gas	Client	✓			✓					✓								✓	✓		✓	✓			✓			
38	Oil&Gas	Contractor				✓	✓															✓		✓	✓	✓		✓	✓
RQ 1 - All respondents																													
All respondents (38)			16	11	2	29	23	15	12	8	15	6	4	12	7	29	15	17	7	18	0	15	13	18	10	37	6	3	21
RQ 2 – Industry specific																													
ICT respondents (15)			4	6	0	13	9	5	6	3	5	2	1	3	5	11	7	5	0	4	0	4	7	7	1	15	4	1	4
Construction respondents (10)			5	4	2	3	5	5	4	4	3	2	2	6	2	9	3	5	2	5	0	5	1	3	1	9	1	1	5
Oil&Gas respondents (13)			7	1	0	13	8	5	2	1	7	2	1	3	0	9	5	7	5	9	0	6	5	8	8	13	1	1	12
RQ 3 – Role specific																													
Contractor respondents (29)			13	10	1	21	18	11	8	8	10	4	2	7	4	23	13	13	5	12	0	10	9	12	7	28	4	2	15
Client respondents (9)			3	1	1	8	4	4	4	0	5	2	2	5	3	6	2	4	2	6	0	5	4	6	3	9	2	1	6

We sort the results in ***Table 4*** as we in section 4.1 through 4.4 present detailed findings for each of the factors that describes *the role of the owner* (**Fig. 5**), *the role of the contractor* (**Fig. 6**), *the transaction environment* (**Fig. 7**) and *project management efficiency* (**Fig. 8**). Each of the above mentioned four figures contains three plots. The left bar chart shows the percentage from all 38 respondents that identified each factor (RQ1), while the two other charts separate the findings by industry (RQ2) and role (RQ3). In section 4.5, we provide a summary of the findings as well as describing how one new factor emerged from the interviews.

4.1 The role of the owner

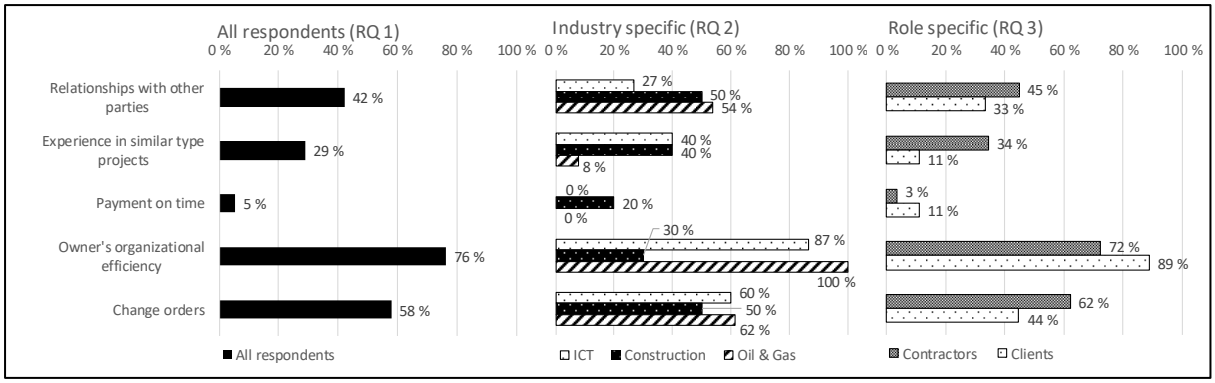

Fig. 5: The role of the owner – Percentage of interviews where factor was found

Relationship with other parties describes the level of stability that the owner has in his/her relationship with other third parties (Li et al., 2015). Sections found in 16 of the 38 interviews described this. It was most frequently identified in interviews with respondents from the oil and gas industry (54%). From respondents working in construction projects and ICT projects the numbers were 50% and 27% respectively. For the contractor perspective, the number was 45%, and the number was 33% for the client perspective.

Experience in similar type projects relates to the ability the project owner has to implement lessons learned from previous projects, (Li et al., 2015) and it was found in 11 of the 38 interviews. It was only identified in one of the 13 interviews with respondents from oil and gas projects, while it was identified in 40% of interviews related to ICT respondents. For construction projects, the number was also 40%. It was identified in 34% of the interviews with contractors and in 11% of the interviews with clients.

Payment on time is related to the owner's ability to pay contractors on time, (Li et al., 2015). This was not identified in any interviews with respondents in ICT or oil and gas projects, while it was found in two interviews with respondents from the construction industry. Consequently, only 5% of the 38 interviews included this factor, making it one of the least frequently found factors for collaboration. It was found in 3% of interviews with contractors and 11% of the interviews with clients.

Organizational efficiency describes the stability in the owner's organizations (Li et al., 2015). In total, it was identified in 29 of the 38 interviews and it is one of the three factors most frequently found in the interviews. It was identified in all of the 13 interviews with respondents working in oil and gas projects, but only in 30% for construction projects. For ICT projects, it was found in 13 of 15 interviews. The number from the contractor perspective was 72% vs 89% from the client perspective.

Change orders will be issued more frequently by the owner if the scope of work is not clearly specified, (Li et al., 2015). This was identified in 58% of all the interviews. The variation between the respondents from ICT projects, construction projects and oil and gas projects was low as the numbers were respectively 60%, 50% and 62%. From the contractor side, 62% of interviews included this, while the corresponding number was 44% for the clients.

4.2 The role of the contractor

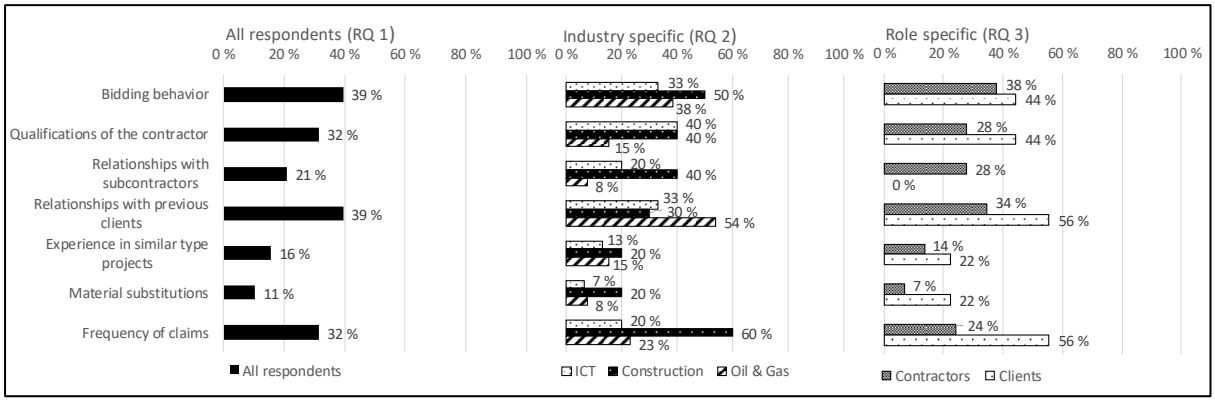

Fig. 6: The role of the contractor – Percentage of interviews where factor was found

Bidding behaviour is related to the issue if contractors speculate in bidding below cost to win a job (Li et al., 2015) and it was discussed in 39% of all the interviews. There was some variation between the respondents from the three different industries. It was identified in 50% of construction projects, 33% of ICT projects and in 38% of the interviews with respondents working with oil and gas projects. The difference between the contractor perspective and the client perspective was small, 38% vs 44%.

Qualifications of the contractor describe the contractors' capability to do the work without the need for close monitoring by the owner (Li et al., 2015). It was identified in 12 of the 38 interviews. However, it was only found in 15% of the interviews from oil and gas projects, as opposed to ICT projects and construction projects where this number was 40%. From the contractor perspective, the number was 28% while it was found in 44% of the interviews with respondents holding a client role.

Relationships with subcontractors refer to the question if the contractor has a long and stable relationship with its preferred subcontractors (Li et al., 2015). This factor was identified in only eight of the 38 interviews. It was most frequently found for construction projects (40%) followed by ICT projects (20%) and least frequently for oil and gas projects with only 8%. It

was identified in 28% of the interviews with respondents working for contractor companies, but in none of the interviews with clients.

Relationships with previous clients refer to the track record for the contractor and how satisfied other clients have been when they used the contractor in the past (Li et al., 2015). This factor was identified in 15 of the 38 interviews. It was most frequently found in oil and gas projects (54%). In comparison, this number was 33% for ICT projects and 30% for construction projects. It was identified in 34% of the interviews with contractors and in 56% of the interviews with clients.

Material substitutions refer to the flexibility the client gives to the contractor to identify its own solutions rather than what is specified by the client (Li et al., 2015). This factor was only found in four of the 38 interviews. It was least frequently found in interviews with respondents from ICT projects (7%) and oil and gas projects (8%). For construction projects, the corresponding number was 20%. It was identified in 7% of interviews with contractors and in 22% of interviews with clients.

Frequency of claims refers to how often contractors claim extra payment from the client, (Li et al., 2015). This was identified in 32% of the interviews. The majority of these were found in interviews with respondents working in construction projects (60%). This is far more frequent than in the interviews with respondents in ICT projects or oil and gas projects where the corresponding numbers were 20% and 23%. From the contractor perspective, it was identified in 24% of the interviews while it was found in 56% of the interviews with clients.

4.3 The transaction environment

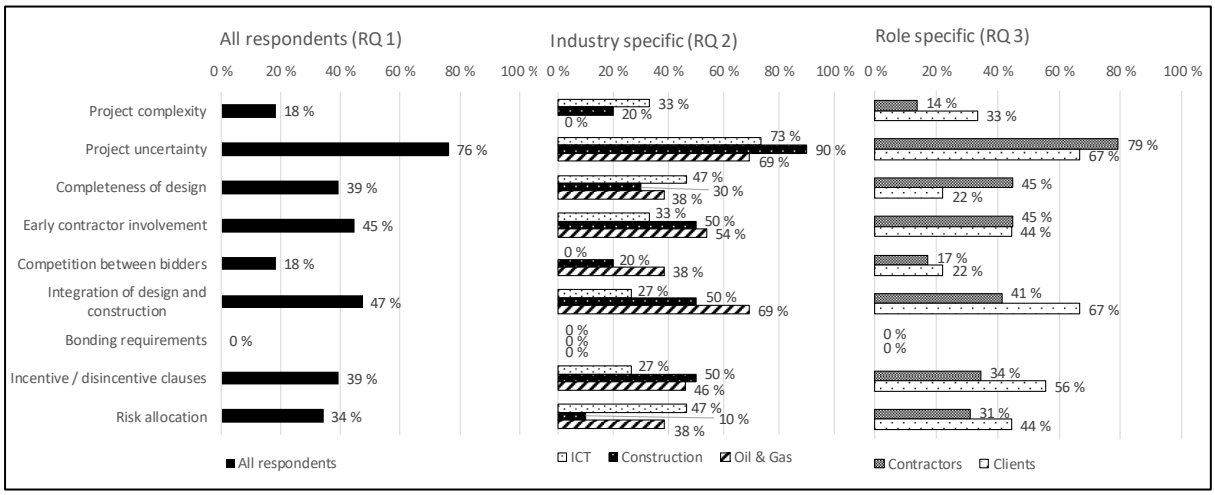

Fig. 7: The transaction environment – Percentage of interviews where factor was found

Project complexity refers to whether the environment in which the project is conducted is stable or not, (Li et al., 2015) and it was identified in only 18% of all the interviews. While it was not identified in any of the interviews with respondents from oil and gas projects, it was found in one third of the interviews with respondents from ICT projects and in 20% of the construction projects. It was identified in 14% of the interviews with contractors and in 33% of the interviews with clients.

Project uncertainty relates to the amount of information, such as drawings and specifications, that is available to perform the task, (Li et al., 2015). It was found in 29 of the 38 interviews there was some variation in frequency between the three industries. For respondents working in construction projects the number was 90%, compared to 73% for ICT projects and 69% for oil and gas projects. The number for contractors was 79% while the corresponding number for clients was 67%.

Completeness of design describes how well the client has defined the project (Li et al., 2015). This was identified in 39% of the interviews. It occurred most frequently in interviews with respondents from ICT projects (47%). In oil and gas projects, this number was 38% and it was 30% in construction projects. This factor was identified in 45% of the interviews with contractors and in 22% of the interviews with clients.

Early contractor involvement relates to if the client includes the contractor at the design stage (Li et al., 2015), and it was found in 45% of the interviews. It was identified in 54% of the interviews with respondents working with oil and gas projects and in 50% of the interviews with respondents from construction projects. For ICT projects, this number was 33%. There was only a minor difference between the contractor perspective and the client perspective on this matter, 45% vs 44%.

Competition between bidders describes whether there are several contractors bidding for the job or whether there are few or only one potential candidates (Li et al., 2015). This factor was identified in seven of the 38 interviews. It was not identified in any of the 15 interviews with people working with ICT projects as opposed to oil and gas projects, where this number was 38%. The corresponding number for construction projects was 20%. It was identified in 17% of the interviews with contractors and in 22% of the interviews with clients.

Integration of design and construction relates to how integrated the interface between design and construction is in a project, (Li et al., 2015). This topic was discussed in 47% of the interviews. It was found in 69% of the interviews with people working in oil and gas projects,

while the corresponding number for ICT projects was less than half of this (27%). For construction projects, the number was 50%. It was identified in 41% of the interviews with contractors and in 67% of the interviews with client.

Bonding requirements refer to situations where the client uses financial instruments (third party guarantee) to buy protection against opportunistic behaviour from contractors (Li et al., 2015). This was not identified as a factor that influence collaboration in any of the 38 interviews.

Incentive / disincentive clauses relate to the use of contract clauses to encourage contractors to deliver as agreed (Li et al., 2015). This was identified in 39% of the interviews. The variation between oil and gas projects and construction projects was small, 46% vs 50%. For respondents working with ICT projects this number was 27%. This factor was found in 34% of the interviews with contractors and in 56% of the interviews with clients.

Risk allocation relates to how risk is allocated between client and contractor (Li et al., 2015). This factor was identified for one third of the 38 interviews. It was found in 47% of the interviews from ICT projects and in 38% of the oil and gas projects. However, for respondents working in construction projects it was only found in one of the 10 interviews. The factor was found in 31% of the interviews with contractors and in 44% of the interviews with clients.

4.4 Project management efficiency

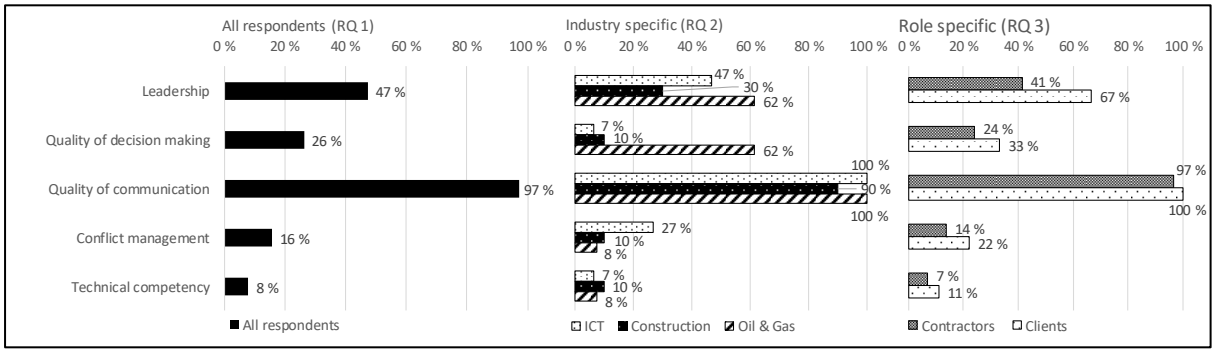

Fig. 8: Project management efficiency – Percentage of interviews where factor was found

Leadership refers to the skills of the project manager (Li et al., 2015). This was identified in 47% of the interviews. The highest frequency was found in oil and gas projects (62%). In construction projects, the number was 30%, compared to 47% for ICT projects. It was found in 41% of interviews with contractors and in 67% of the interviews with clients.

Quality of decision making is related to the process of making good decisions in projects (Li et al., 2015). It was mentioned in less than one third of the interviews (26%). It occurred in only

one of the 15 interviews from ICT projects and in only one of the 10 interviews from construction projects. However, in interviews with respondents working in oil and gas projects it was identified in 62% of the interviews. The factor was found in 24% of the interviews with contractors and in 33% of the client interviews.

Quality of communication is the factor that was most frequently found, as it was identified in 37 of the 38 interviews. It was found in all the interviews with respondents working in oil and gas- or ICT projects, and in 90% of the interviews with respondents working in construction projects. The factor was identified in 97% of the interviews with contractors and in in all of the interviews with clients.

Conflict management describes the organization's capability of preventing and resolving conflicts (Li et al., 2015). It was only identified in 16% of all the interviews. For construction projects the number was only 10% and for oil and gas projects, this number was even lower (8%). For ICT projects this number was approximately three times higher, as the factor was identified in 27% of the interviews. It was found in only 14% of the interviews with contractors and in 22% of the interviews with clients.

Technical competency is related to the technology and equipment available to the contractor (Li et al., 2015). This was only identified in three of the 38 interviews and was the third least frequent factor found.

4.5 Summary of findings

A summary of the findings is presented in **Fig. 9** and in more detail in **Table 4**. We see that 25 of the 26 factors from (Li et al., 2015) was identified by two or more respondents. However, none of the respondents identified *bonding requirements* as a factor that influence collaboration. During the interviews, *trust* appeared as a factor although is not listed as an explicit factor in the framework by (Li et al., 2015). In fact, 21 of our 38 respondents emphasised the importance trust has on collaboration.

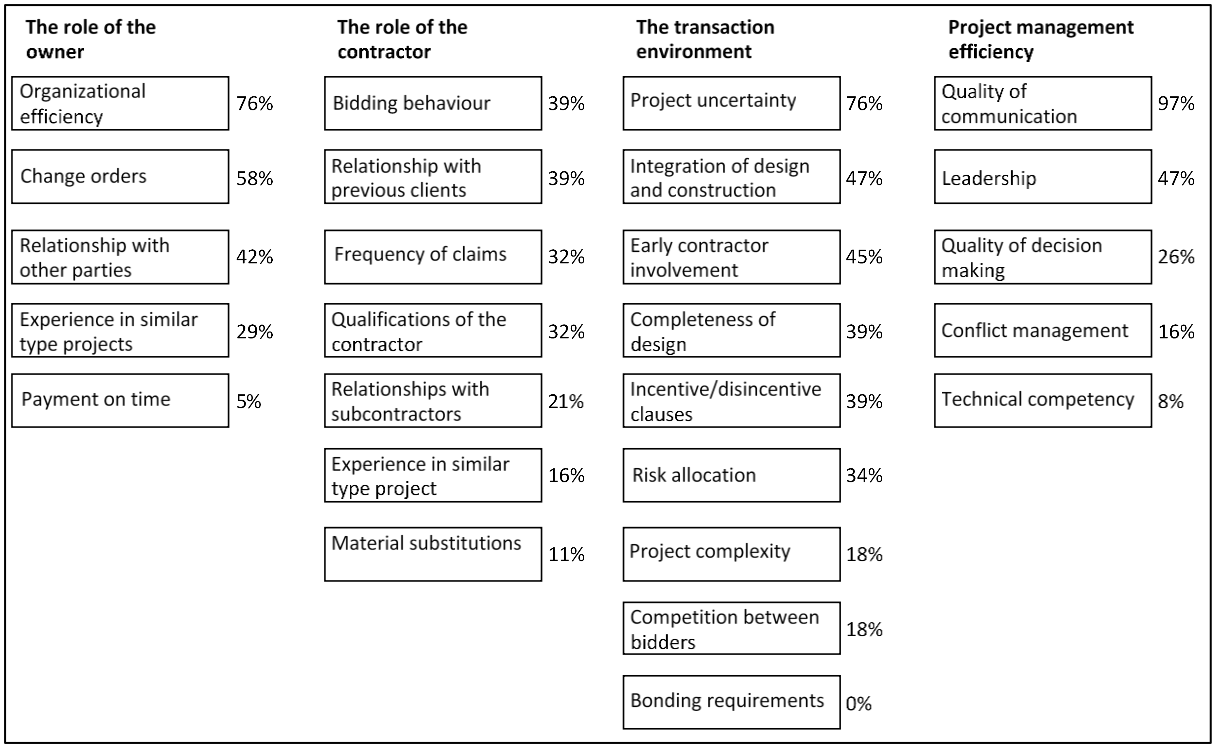

Fig. 9: RQ1 - The percentage of interviews in which each factor from (Li et al., 2015, p. 550) was found to influence project collaboration

5 Analysis and discussion

The purpose of conducting the interviews was to identify which factors that determine transaction costs that has the largest influence on collaboration. We analysed 38 interviews and searched for sections where the respondents discussed topics that correspond with factors that, according to Li et al. (2015), determine transaction costs. In the following section we will first discuss briefly one factor (*bonding requirements*) that vanished during the coding and the appearance of a new factor *(trust)* that was not in the original framework. We will then discuss findings related to each of the three research questions.

Bonding requirements was the only of the factors in the framework that did not occur in any of our interviews (***Table 4***). Li et al. (2015) *describe bonding requirements* as the use of financial instruments to purchase protection to secure own interests against opportunism. Costs associated with this are examples of transaction costs. From ***Table 3*** we also see that we failed to find existing literature where other researchers have identified such *bonding requirements* as a factor affecting collaboration. Hence, it is not surprising that this factor vanished when we used a framework with transaction cost factors to investigate collaboration.

One can argue that *trust* is an underlying element of several of the factors in the framework shown in **Fig. 1**. However, it is not considered as a separate factor by Li et al. (2015). The impact of trust in the relationship between clients and contractors has been established by others such as Pinto et al. (2009) and Kadefors (2004). We found that 21 of 38 interviewees in our study suggested *trust* as a factor that influences project collaboration. This is also in line with findings from previous research, which have found a strong relationship between trust and collaboration (Bond-Barnard et al., 2018, Izam et al., 2015).

5.1 RQ1: Most important factors

The Pareto principle describes how only a few (of many) elements account for a large proportion of the effect. This is often referred to as the 80/20 principle, where 20 percent of the variables cause 80 percent of the results (Nisonger, 2008, Koch, 1997). This phenomenon is "universal" and is transferable to management planning and control (PMI, 2017, Juran, 1954). Based on the 80/20 principle, we present, in **Fig. 10**, the five factors most frequently found from **Table *4***, as five factors corresponds to 20 percent of the 26 factors we investigated (0.2x26=5.2)

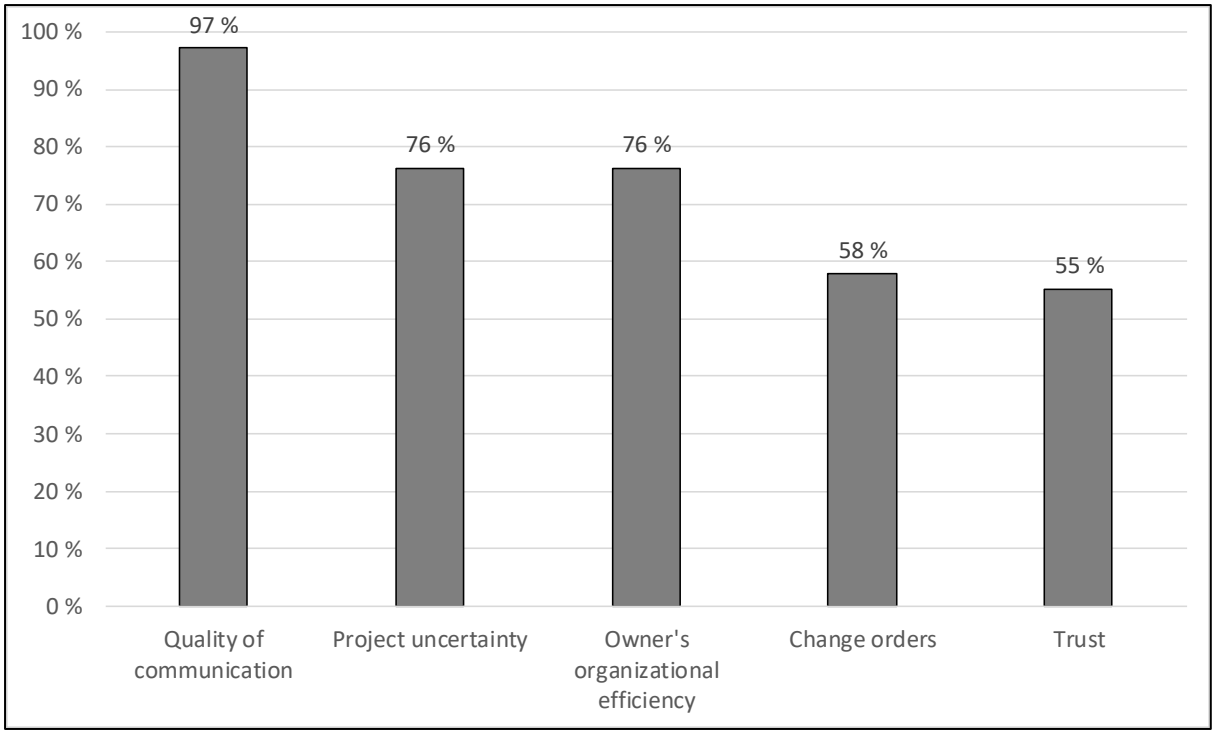

Fig. 10: RQ1 –Five most salient factors that influence collaboration

Among the factors that determine transaction costs in projects, we found that *quality of communication* is the one that has the highest influence on project collaboration. This is in line with existing research, where effective communication has been identified as a factor which influence collaboration quality (Aliakbarlou et al., 2018, Nevstad et al., 2018, Yap et al., 2017, Dietrich et al., 2010). Incomplete or poor communication may cause misunderstandings and lead to potential conflicts (Lædre, 2009).

"*We make a lot of assumptions. We even assume that the client is happy. And then when we receive the final evaluation report from the client when the project is complete we are criticized for not involving the client. Why do we wait until the end of the project to find out that the client preferred to be involved? We need to clarify expectations continuously but we are afraid to wake up the troll. We are afraid to ask!"*

–contractor, construction project–

High communication willingness and formal project communication contribute to trust (Costa e Silva et al., 2012) and project success (Wu et al., 2017). Informal communication can be an effective manner to discuss and find solutions (Christensen, 2008). Turner and Müller (2004) argue that the best results occur by balancing formal and informal communication. This is in

line with our findings where interviewees described how frequent use of telephone and face-to-face meetings was often the preferred solution for resolving problems. The agreed solution was formalised through use of formal project communication (i.e. e-mail, letter, memo) after the solution was found.

It is not surprising that *project uncertainty* affects project collaboration, as it is critical to have a clear understanding of the scope of work to achieve success in a project, (PMI, 2017). High uncertainty increases the need to collaborate in order to prevent project actors from becoming opportunistic (Um and Kim, 2018, You et al., 2018). In fact, several of the interviewees in our study gave examples of how uncertainty and unclear scope of work caused misunderstandings and extra work.

"Out of 1,000 hours spent on the project so far, 300 of these are wasted caused by an unclear scope."

–contractor, ICT project–

In the early phase of a project, there is a lot of information that is not available. It was therefore particularly interesting to find that those of the interviewees who worked in projects with pain-share / gain-share models reported that such models helped to reduce information asymmetry and uncertainty, as they experienced a high level of openness and willingness to share information between the parties.

Another important finding was related to the owner's *organizational efficiency*. The need for the client to be actively involved in the project was highlighted by several respondents, and in particular by those working in agile projects. One of the requirements for success in agile project management is to have dedicated clients on site that work closely with the contractor (Azanha et al., 2017, Lappi and Aaltonen, 2017). Several of the interviewees confirmed this, as they reported how lack of active involvement from the client had a negative effect on the collaboration in their project.

"*The sprint process requires the client to take important decisions on a daily basis in the projects. For this to work, persons with sufficient authority to make these decisions must be released from other tasks in the client's organization and participate full time in the project*"

–contractor, ICT project–

The client's representative must have the right mandate within his/her organization in order to allow the contractor to perform their task efficiently. Several of the contractor-respondents in the interviews described situations where they were in agreement with the representative from the client, only to find out later that this person did not have the mandate or authority within his or her own organization to make such decisions. Other examples of low organizational efficiency included examples of internal conflicts in the client's organization.

"*In this project we learned that there were internal conflicts in the client's organization which was split between two cities. This was challenging as we were depending on a good relationship with the client in order to deliver a good solution. For example, some people in the client's organization requested that we should not work with specific persons in their organization located in another city, even though these persons had the key competence required in order to get a good result."*

–contractor, ICT project–

Opportunistic contractors may choose to lower their margins and reduce their price in order to increase their chances of winning the contract with a client (Mohamed et al., 2011, Arditi and Chotibhongs, 2009, Tan et al., 2008) and thus speculate that they will recover the loss later through change orders and claims (Lo et al., 2007, Crowley and Hancher, 1995, Zack, 1993). Contractors with more detailed information and knowledge than the client may exploit this situation of asymmetric information (Mandell and Nyström, 2013) and issue many change orders during the project. Our findings are in line with existing research as we found that opportunistic change orders have a negative effect on the collaboration level in the contractor-client relationship.

"*Some contractors take advantage of our lack of detailed knowledge about their field of expertise in order to earn extra money through change orders*"

–client, construction project–

5.2 RQ2: Different industries

From **Table *4*** we extract the three most frequently found factor for each industry and present this as a joint figure (**Fig. 11**). For ICT projects these were *quality of communication, owner's organizational efficiency* and *project uncertainty.* The three most frequent factors found for

construction projects were *quality of communication, project uncertainty* and *frequency of claims.* For oil and gas projects these were *quality of communication, owner's organizational efficiency* and *trust.* While there seems to be a consensus between interviewees from all three industries that *quality of communication* is an important factor that influence collaboration, we will discuss further three findings where we found some interesting differences between the industries.

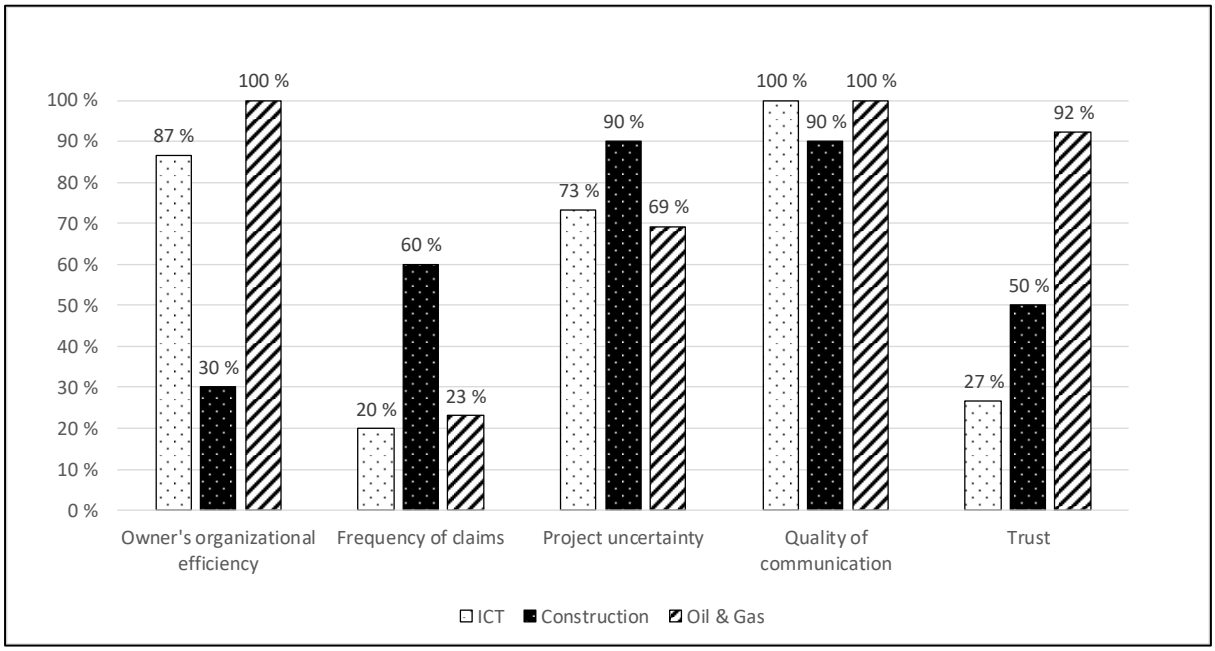

Fig. 11: RQ2 – Top three most frequent factors that influence collaboration in each industry

First, one can see that interviewees in the construction industry do not consider the *owner's organizational efficiency* a particularly important factor that influences project collaboration. In contrast, this factor was among the top three most frequently found factors in the other two industries. For example, respondents who worked in *ICT projects* frequently described how their agile project models required efficient clients. If the owner did not allocate the right resources from its own organization to participate in these processes on a daily basis, it was difficult to be truly agile. The importance of the owner's behaviour in order to achieve collaboration in construction projects has been presented by (Davies et al., 2009, Eriksson et al., 2009). We are therefore a little surprised that the owner's *organizational efficiency* was identified in so few of the interviews with our respondents in construction projects.

Secondly, we see that *trust* is considered a very important factor for collaboration in oil and gas projects, while it seems to be in particular less salient in ICT projects. In this discussion,

we will emphasize that many of the interviewees from the oil and gas industry worked in projects with alliance collaboration models. Such models require trust and openness (Hietajärvi et al., 2017, Walker and Lloyd-Walker, 2015, Hauck et al., 2004) something several respondents underlined.

"In the alliance we share all our commercial details with the client and our partners. We really have to trust each other"

–contractor, oil and gas project

Respondents described how the alliance acts as a unity and is jointly responsible for the execution of the project. If the alliance fails, all members fail, if the alliance succeeds, all members succeed. Moving away from traditional procurement arrangements to alliancing often foster improved innovation (Che Ibrahim et al., 2017) and productivity (Sarhan et al., 2017). A project manager from the client perspective gave an example of how the turnaround time for handling change requests had been reduced from 30 days to 10 days when working in an alliance with the contractors. Another example of waste reduction is here described from the contractor perspective.

"Another saving is that we save a lot of hours by having the same team in all phases of the project. Furthermore, we have a much more efficient organization without double functions. There is less waste than before. We are running the project much more efficient than previously"

–contractor, oil and gas project –

Third, we see that *frequency of claims* is found to be the third most important factor in construction projects, while this factor is significantly less salient in the two other industries. The conflict level in the Norwegian construction industry is high (Kvålshaugen and Sward, 2018) and this may be the reason why *frequency of claims* was found to be in particular important for projects in this industry. Opportunistic claims often have a negative effect on the client-contractor relationship (Mohamed et al., 2011) and several of the interviewees from the construction industry gave examples of relations with a low level of *trust*.

"*This time, we shall fool <u>them</u> since these guys fooled us last time*"

–contractor, construction project–

5.3 RQ3: Different perspectives

We will now discuss further how the five factors most frequently found for RQ1 (see **Fig. *10***) vary between the *client perspective* and the *contractor perspective*. The result from this analysis is presented in **Fig. 12**. Our findings do not suggest that there are any large differences between the contractor and the client perspective in how they view which factors influence collaboration in projects. In general, there seems to be a consensus between the contractor and client perspective about the importance of the various factors.

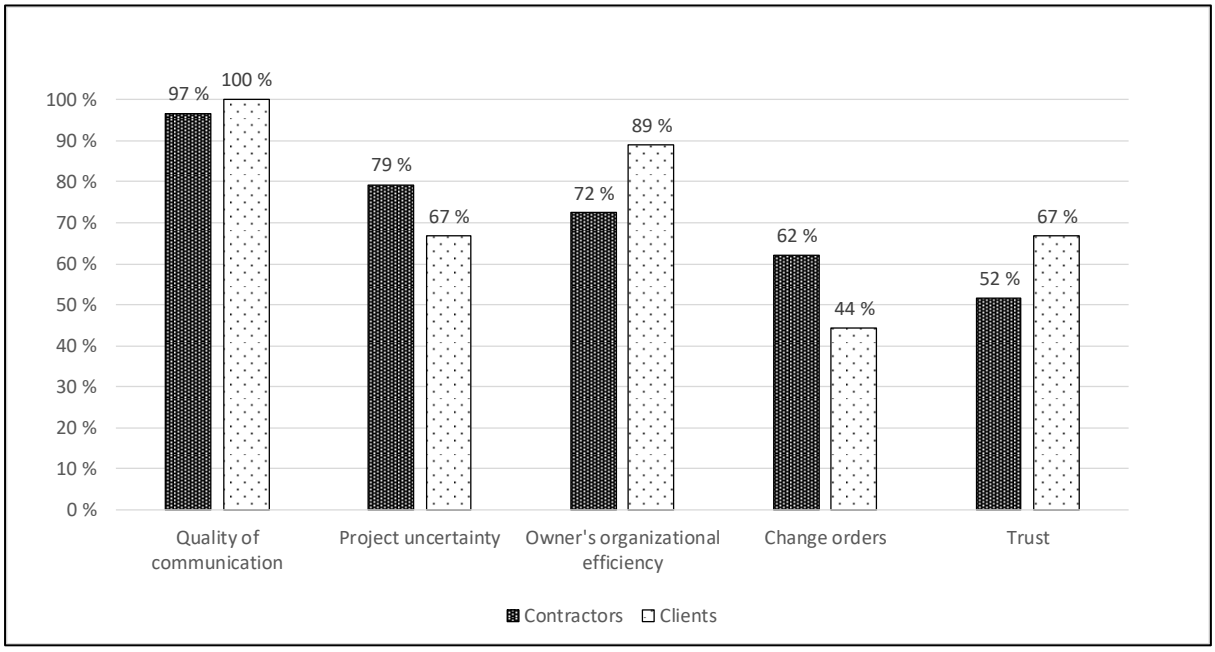

Fig. 12: RQ3 –Five most salient factors that influence collaboration separated by roles

Keeping in mind that the number of interviewees from the contractor side is approximately three times the number of interviewees from the client side, this does not seem to have any significant impact on our findings related to RQ1 and RQ2. If large differences had been found between the contractor and client perspective, one could have argued that our findings for RQ1 and RQ2 would be less valid.

As seen from **Fig. 12**, both contractors and clients consider *quality of communication* to be the most salient factor that influence the collaboration level. The largest relative difference between the two perspectives is related to *change orders*. Contractors seem to consider issues related to *change orders* to be a somewhat more important factor on the collaboration level in the project than clients do. We also see that contractors, in particular, stress the importance of reducing *uncertainty* in order to collaborate better. Clients seem to be aware of the importance

of their own role in projects, as they acknowledge that their own *organizational efficiency* is an important factor that influences collaboration.

"We can contribute by removing uncertainty and suggest solutions that are favourable also for the contractor "

–client, construction project–

6 Conclusion, implications, and avenues for further research

This paper answers the call from Li et al. (2015), who encouraged researchers to perform further empirical research within their framework of factors that determine transaction costs. In particular, this paper expands this existing framework by exploring the relationship between transaction costs and collaboration as well as introducing *trust*.

Moreover, we have highlighted which factors that determine transaction costs in a project that has the largest influence on the level of collaboration in projects. Project practitioners should prioritize addressing these factors to achieve reduced transaction costs through improved collaboration. We have conducted the study in a cross-industry context that allows for increased learning for practitioners.

Through interviews with 38 experienced project practitioners from three different industries, we have answered the following research questions:

RQ1: Which of the 26 transaction cost factors presented by Li et al. (2015) have the largest influence on collaboration in projects?

Conclusion: We found that the five most important factors are *quality of communication, project uncertainty*, *organizational efficiency* in the owner's organization, *change orders* and *trust*. Trust is not listed an explicit factor by Li et al. (2015) but emerged as a factor when coding the interviews.

RQ2: What are the differences and similarities in the findings from projects in the construction industry, the ICT industry and oil and gas industry?

Conclusion: Q*uality of communication* was found to be important across the industries. The owner's *organizational efficiency* was also highly important in oil & gas and ICT projects.

Trust was particularly important in oil& gas projects while *frequency of claims* was particularly important in construction projects.

RQ3: What are the differences and similarities of the findings between the contractor perspective and the client perspective?

Conclusion: We found no major differences between the contractor perspective and the client perspective.

6.1 Contribution to body of knowledge

The main contribution to the body of knowledge is that we have explored Li et al. (2015)'s framework of factors that affect transaction costs and empirically tested how these factors influence project collaboration. Hence we make a contribution to theory connecting transaction costs and collaboration. From the 26 transaction cost factors presented by Li et al. (2015) we found that 25 of these to various degree influence collaboration. The only factor we found not to influence collaboration was *bonding requirements*. Even though *trust* is not listed an explicit transaction cost factor by Li et al. (2015), we found that *trust* was an important factor for collaboration. *Trust* should therefore be included in the discussion when connecting transaction cost factors with collaboration.

6.2 Practical implications

The example given in the introduction of this paper reminds us about how conflicts can lead to significant transaction costs. The ability to prevent and resolve such conflicts increases with improved collaboration, (Dietrich et al., 2010). Our research identify the top five factors that should have the most important effect on collaboration. Hence, project managers can expect to get the most effective impact on collaboration in their projects if they prioritise to work with the following five factors: (1) Improve the quality of communication, (2) reduce uncertainty, (3) have the right level of client involvement, (4) handle change orders properly and (5) build trust in the relationship. Practitioners should then expect to experience improved collaboration and hopefully avoid disputes that lead to extensive transaction costs for all parties.

Kadefors (2004) describes the client-contractor relationship in construction projects as a "black box". In the search for the key to unlock this "black box" we believe that our findings related to RQ2 in this paper are particularly interesting from a cross-industry perspective. We see that *trust* is considered as a less important factor by those working in ICT- and construction projects

compared with respondents from oil and gas projects. *Frequency of claims* appear to be a much more salient factor in the construction industry compared to other industries. This is particular interesting when we keep in mind that the construction industry has received some criticism for lagging behind other industries in terms of productivity (Zhang et al., 2018b, Fulford and Standing, 2014). An interesting point to note for practitioners may therefore be that the respondents in oil & gas projects, where most of the respondents worked in alliance arrangements, rated *trust* very high and *frequency of claims* low. High-order collaborative approaches, such as partnering or alliancing, were in 2010, less common in the Nordic construction industry compared to the UK and South-East Asian contexts (Bygballe et al., 2010). Our findings does not give any indication that this has changed. In fact, none of the interviewees from construction projects utilised high-order collaboration models.

Clients in ICT projects may want to be aware of that it appear to be particular important that they make enough resources available so that they can effectively work together with the contractor. To achieve effective collaboration in agile projects the client need to allocate personnel with sufficient authority to take decisions and make sure that these people have sufficient time available.

6.3 Limitations and avenues for further research

The study is somewhat more influenced by the contractor perspective than the client perspective as 29 of the 38 respondents held a role as contractor. The study has been performed in Norway, but many of the companies operate in an international market and several respondents had international experience.

We found that respondents from the construction industry consider the owner's *organizational efficiency* significantly less important than what is the case for the two other industries studied, as they consider *frequency of claims* to be much more significant. It would be particularly interesting to study if there is a relationship between these findings and the productivity level in construction projects.

Furthermore we echo the call for more empirical research on transaction costs as suggested by (Guo et al., 2016, , De Schepper et al., 2015, Pinto et al., 2009). It would be particularly

interesting to study transaction costs and trust in projects that use collaborative execution models.

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