Pre-contract phase efficiency by applying Transaction Cost Economics (TCE): A contractors' perspective

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22 June 2021

Abstract

Construction practitioners experience difficulties in managing contracts, because of the dynamics between formal contracts and informal relationships. Reasoning that it is better to be safe than sorry, the premature phase of projects is key. Therefore, efficiency of the (pre-)contract phase is analyzed, by considering transaction costs. From a contractors' perspective, fifteen semi-structured interviews with practitioners are coded by 26 determinants of transaction costs, derived from Transaction Cost Economics (TCE). Analysis reveals quality of communication, quality of decision making, risk allocation and relationships between parties as important determinants for efficiency. Also, contract managers emphasized experience of clients and contractors in similar type projects. Intense and physical collaboration between contract managers and project managers are key in drawing up contracts, since alignment between risk allocation, requirements and clauses can only be obtained by both contractual and construction engineering expertise. The two complement each other in the dynamics between contract and relationship.

Keywords: (Pre-)contract phase, Transaction Cost Economics (TCE), contractual and relational governance, risk allocation, project team competencies

1. Introduction

The construction industry is known for its project-based approach, where temporary coalitions between client and contractor are usual (Winch, 1989). To run through a project with success, contracts are signed to clarify obligations of parties (Chao-Duivis, Koning, Ubink, & Bruggeman, 2018), such that expectations are aligned. Though, the interplay between informal relations and formal contracts (Poppo & Zenger, 2002) often leads to conflicts, because of complexity (Tijhuis, 1996).

Clients and contractors, benefit from completion of projects with success, which contradicts the 'daily routine' of conflicts and disputes, resulting in higher costs and disturbed relations. However, struggling with the interplay of formal contracts and informal relations represents how the construction industry is characterized: inefficient (Dubois & Gadde, 2002). Which is supported by Winch (1989) who indicates high and often unforeseen transaction costs of the industry.

Increased efficiency and alignment of expectations between parties can be obtained by intensifying the premature phase of projects, where relations are born, and contracts are drawn up. The research presented in this paper contributes to increased efficiency of this premature phase, defined as the (pre-)contract phase.

1.1. Problem statement and research objective

Practitioners experience the (pre-)contract phase as inefficient. In particular, by unsuitable order of procedures, unequal risk allocation, and the interplay between formal contracts and informal relationships. Where project managers tend to steer on practical issues and relationships, lawyers and contract managers steer from the perspective of formal agreements and risk management. In the environment of construction conglomerates, subsidiaries are largely responsible for managing projects, where contract managers and lawyers only fly in if needed. This rather independent way of working creates tensions between the two. However, disputes as a result of different ways of working or culture are common in construction (Tijhuis, 1996).

The research aims for tailored contracts based on client relation and project characteristics, by increasing efficiency of the (pre-)contract phase, such that projects develop fluidly, and with minimal transaction costs. The field of

Transaction Cost Economics (TCE) is applied to indicate what kind of transaction costs are of importance and which can be minimized. To achieve this objective, the following research question is drawn up:

How to obtain a more efficient (pre-)contract phase by minimizing transaction costs, such that procedures in this phase are logical and alignment between contract and project increases?

1.2. Scope of the study

The research evaluates contract management of construction projects, by focusing on the (pre-)contract phase. Relationships and contracts between client and (main) contractor play a central role during the research, where the research is conducted from the contractors' perspective.

By focusing on the premature phase of projects, contractual governance (CG) and relational governance (RG), and their interplay are evaluated. Efficiency of contracts and the pre-contract phase is exposed from a Transaction Cost Economics (TCE) approach.

1.3. Research approach

To increase efficiency by means of minimizing transaction costs, the relation between formal contracts and informal relationships is analyzed.

The research is conducted from the perspective of Dutch contractor, Goossen Te Pas Bouw (GTP). They operate as a subsidiary of a large, decentralized construction conglomerate, VolkerWessels (VW). Within this organization, they are classified in the department of 'building construction and real estate' (VW-BVGO). Daily execution of projects is up to GTP. However, contract management is a general part of VW-BVGO, also if project complexity increases the managing board of VW-BVGO needs to give approval for decision in addition to managing director(s) of subsidiaries.

A mixed-method approach is applied, which largely relies on semi-structured interviews with contract managers, managing directors, and project managers of GTP, VW-BVGO, and five other subsidiaries.

1.4. Managerial relevance

The problem as defined (section 1.2), is emphasized by GTP. They experience inefficiency of the (pre-)contract phase in three ways. Respectively, (1) unsuitable order of processes executed, (2) difficulties in estimating equality of risk allocation, and (3) since contract management is centralized and project teams decentralized, communication is limited and rather formal. The problem is recognized by VW-BVGO, and other subsidiaries.

Besides, it can be assumed that the problem of VW-BVGO and its subsidiaries is not on its own, since construction is known for its complex interrelationship between formal contracts and informal relationships (Poppo & Zenger, 2002; Musawir, Abd-Karim, & Mohd-Danuri, 2020; Yan & Zhang, 2020) leading to conflicts (Tijhuis, 1996).

1.5. Structure of the paper

The thesis' problem statement and research objective, scope, methods, and managerial relevance are introduced above. The literature review starts by elaborating on CG and RG. To better understand these mechanisms, reviewed literature is not limited to construction management only. Contractual functions, and contracts in buyer-supplier relationships in organizations as a whole are reviewed. TCE, introduced by Williamson (1981) and applied in construction management by Winch (1989), provides a foundation to indicate process related (transaction) costs, which are applied to code collected data. Eventually, the theoretical framework brings together CG and RG, and TCE.

The research design (chapter 3) further elaborates on how data is collected by means of TCE. Thereafter, methodology regarding data analysis is explained, starting with prioritization of determinants of TC. At last, verification and validation of the analysis on determinants of TC is reported. The result in chapter 4 follows the same structure as introduced in the research design.

Results are discussed (chapter 5), focusing on reliability, correctness, and limitations of the research. Finally, theoretical and managerial implications, and suggestions for further research are included in the conclusion.

2. Literature review

Temporary coalitions between client and contractor, known as projects (Winch, 1989), are characterized by the interplay between informal relationships and formal contracts (Poppo & Zenger, 2002). By indicating both mechanisms and their interplay, contractual governance (CG) and relational governance (RG) are elaborated, respectively, by means of contractual functions and buyer-supplier relationships.

The construction industry is characterized by its high transaction costs (1989), because of all its processes around the actual artwork. To indicate (indirect) costs of procedures and transactions, Transaction Cost Economics (TCE) are applied in the research. The key points of the field are explained and a framework indicating 26 determinants of transaction costs (TC) are elaborated (Li, Arditi, & Wang, 2015).

Since transaction costs are high due to construction's processes, eventually TCE is applied to indicate effectiveness of the mechanisms of CG and RG.

2.1. Contractual governance and relational governance

The mechanisms of CG and RG should be used complementary, rather than as substitutes, since the two often expresses themselves simultaneously by means of formal contracts and informal relationships (Poppo & Zenger, 2002; Musawir, Abd-Karim, & Mohd-Danuri, 2020). The interrelationship is supported by Yan and Zhang (2020), who found correlations between ex ante trust and ex post trust, both relational governance, and contract completeness and contract enforcement, both contractual governance. In addition, they state that contractual governance is positively correlated towards construction project performance (Benítez-Ávila, Hartmann, Dewulf, & Henseler, 2018), as well as relational governance.

CG can be obtained by managing contractual functions, which are elaborated below. Besides, RG can be understood by means buyer-supplier relationships and their interplay with contracts.

Contractual functions
Conform Dutch legislation a 'contract' is defined as "an agreement in the meaning of a multilateral juridical act whereby one or more parties enter into an obligation towards one or more other parties" (Chao-Duivis, Koning, Ubink, & Bruggeman, 2018, p. 11). The function of a contract is threefold, respectively control, coordination, and adaptation (Gao, Chen, Wang, & Wang, 2018).

For construction projects, Tijhuis (1996) already specified what a contract should include; (1) detailed description including who, what, where, when, and price, (2) risks and margins if detailing of risks is missing, (3) payment arrangements, (4) juridical arrangements for deviations, i.e., general terms, and (5) arrangements regarding conflicts. Those requirements are reflected by the contractual functions transcending the construction industry. The interplay between formal contract and informal relationship (i.e., contact), feeds conflict as reasoned by Tijhuis (1996).

The reasoning that informal relationships and formal contracts might result in conflicts does not stand on his own and is still relevant given recent research conducted on conflicts and disputes in relation to contracts (You J. , Chen, Wang, & Shi, 2018; Gao, Chen, Wang, & Wang, 2018; You J. , Chen, Hua, & Wang, 2019), and in relation to transaction costs (Lu, Lihan, & Pan, 2015; Haaskjold, Andersen, Laedre, & Aarseth, 2019; You et al., 2019; Wang, Lu, & Wei, 2021; You W. , Chen, Gao, & You, 2020).

Contractual control and contractual coordination can reduce the amount of relationship conflicts and task conflicts (You et al., 2019). Which is in line with Gao et al. (2018) who state that conflicts between client and contractor are minimized if all three contractual functions are guaranteed. However, Gao et al. underpin that project complexity, by means of technical, organizational, and environmental complexity must not be forgotten in (a lack of) relationship performance.

Due to uncertainty, complexity and opportunistic behavior, potential conflicts between parties are fed. As a result, cooperation and collaboration are hampered, which increases transaction costs. By repeatedly considering the contractual functions of control, coordination, and adaption an "abstract and holistic view for working with contracts" is obtained, which expresses itself in structured contracts and procedures (Wang et al, 2018, p. 58).

Contracts and buyer-supplier relationships
Regarding contracts and contractual governance, Anderson and Dekker (2005) identify four interorganizational and interdependent control dimensions. Respectively, (1) assignment of rights, (2) product and price terms, (3) after-sales service terms, and (4) terms of legal resource. Once transaction hazards increase, the relevance and importance of each dimensions also increases (Anderson & Dekker, pp. 1749-1750), which is mainly due to complexity, specificity, and uncertainty (see also 'Contractual functions', above).

When buyer and supplier sign an agreement, i.e., contract, they both have certain expectations of this agreement. To manage expectations and align them with the other party, the interrelationship between contractual governance and relational governance becomes relevant (Lumineau & Henderson, 2012). To remain a good relation, managers should have knowledge about the type of contract they work with. Bai, Sheng, and Li (2015) define two types, output-based contracts and behavior-based contracts. Since behavior-based contracts nurture conflict, output-based contracts should be favored if the objective is to mitigate conflicts (Bai et al., 2015). Otherwise, the relationship is harmed and parties are withheld of mutual gains (Williamson, 1996).

To manage interorganizational relationships, Cao and Lumineau (2014) reason that managers of suppliers' side need to become aware of the value of trust and relational norms regarding performance. They state that contracts indirectly reduce opportunism, by increasing trust and relational norms. "In countries with effective legal systems such as the United States, Hong Kong, and The Netherlands, contractual and relational governance should be treated independently" (Cao & Lumineau, 2014, p. 32). This implies

Table 1: Determinants of transaction costs (Li et al., 2015)

Role of the owner (A)	Role of the contractor (B)	Transaction environment (C)	Project management efficiency (D)
A.01 Relationships with other parties A.02 Experience in similar type projects A.03 Payment on time A.04 Organizational efficiency A.05 Change orders	B.06 Bidding behavior B.07 Qualifications of the contractor B.08 Relationships with subcontractors B.09 Relationships with previous clients B.10 Experience in similar type projects B.11 Material substitutions B.12 Frequency of claim	C.13 Project complexity C.14 Project uncertainty C.15 Completeness of design C.16 Early contractor involvement C.17 Competition between bidders C.18 Integration of design and construction C.19 Bonding requirements C.20 Incentive/disincentive clauses C.21 Risk allocation	D.22 Leadership D.23 Quality of decision making D.24 Quality of communication D.25 Conflict management D.26 Technical competency

that there should always be drawn up a contract, disregarded the relationship of parties and complexity of the project. Again, this emphasizes the complementary role of the two mechanisms (Poppo & Zenger, 2002).

Parties which rely on rich history of trust and requisite norms, tend to focus on relational norms which are documented in agreements over time (Poppo & Zenger, 2002). Such relational contracts and norms are beneficial when uncertainty is high. Besides, together with coordination and transaction costs, maintaining relations and making new connections, i.e., networking, plays an important role in the process of generating and get acquainted with new knowledge (Antonelli, 2006). Now, CG and RG are elaborated by means of contractual functions and buyer-supplier relationships, the next section starts with evaluation TCE. Afterwards TCE's implications for CG and RG are made clear.

2.2. TCE in project-oriented organizations

Already in 1989, Winch applied a transaction cost approach to indicate organizational behavior of organizations and project in the construction industry. "The transaction cost approach to the study of economic organization regards the transaction as the basic unit of analysis and holds that an understanding of transaction cost economizing is central to the study of organizations." (Williamson, 1981). Since the research of Winch, TCE in construction management research is widely applied given multiple cited studies in the field, e.g., Bajari and Tadeli (2001), Li, Arditi, and, Wang (2013; 2015), Lu, Lihan, and Pan (2015) and Winch (2001). Li et al. (2015) indicate 26 determinants of TC, which form a base for coding and categorizing collected data.

Determinants of transaction costs
The complete image of costs of a construction project goes beyond production cost only, and involve "preparing a bidding document, estimating, drawing up a contract, administering the contract, and dealing with any deviations

from contract conditions" (Li et al., 2015). They identify 26 determinants of transaction costs, classified in four sub-groups (Table 1). To understand TCE and its relation to governance mechanisms, research in this field is already ongoing for decades (Poppo & Zenger, 2002). The study of Poppo & Zenger (2002) examined whether formal contracts and informal relationships could function as substitutes or complements. Because of the unique origins of both mechanisms, they suggest using the two complementary.

In addition, Lu et al. (2015) discovered that conflicts and disputes involve hidden transactions costs, which are often neglected but should be considered. Although, some of these hidden factors relate to one or more of the determinants of transaction costs of Li et al. (2015), they are relevant to keep in mind. They divided hidden transaction costs into five factors, (1) reputation, (2) cooperation and trust, (3) emotion, (4) time and (5) execution of judgement. Consciously evaluating those factors contributes to minimization of transaction costs in case of conflicts. In general, an extensive evaluation of transaction costs results in negotiation rather than continue blaming as the preferred option for all parties involved.

By considering the determinants of Li et al. (2015), a study by Haaskjold et al. (2019) revealed five factors to be dominant for collaboration in construction projects. Respectively quality of communication, project uncertainty, owner's organizational efficiency, change orders and trust. Project uncertainty as dominant transaction cost factor can be extended to uncertainty in general (so not only project-related), since uncertainty is estimated as an important determinant in the research field of TCE (You et al., 2020). All those determinants do not stand on their own, given literature on TC, several determinants seem to be related to each other.

Relations between determinants of transaction costs

Considering determinants of TC (Li et al., 2015), several relations between determinants are elaborated by former research. As stated by Scheepbouwer and Humphries (2011), because of early contractor involvement collaboration among owner, designer and contractor becomes more intense. Both owners and contractors experienced the design phase as more efficient, although designers experienced the opposite. Efficient or not, the study of Scheepbouwer and Humprhies (2011) emphasizes that there is a relation between the relationship of an owner with other parties and early contractor involvement. In addition, they found that contractors perceive risk allocation as equal to traditional contract systems (after final design). Though, they have more influence on processes. Suprapto, Bakker, Mooi, and Moree (2015) conducted a qualitative study on owner-contractor collaboration. In addition to open and honest communication, and solution seeking instead of blaming, they emphasize the importance of senior management leadership, certainly from the contractor's side. Since this can partly be prescribed to shared team responsibility, leadership of contractor's project team is related to early contractor involvement too.

Risk allocation is positively related to early contractor involvement, certainly from a contractor's point of view, which is also substantiated by other studies (Osipova & Eriksson, 2011; Rose & Manley, 2010; Tang, Chen, Hua, & Fu, 2020; Scheepbouwer & Humphries, 2011). When a contractor takes over particular risks, managing those risks depends on the contractor's ability with respect to relational governance, both to client and to subcontractors and their ability to transfers (parts) of those risks to subcontractors (Selviaridis & Norman, 2014). Yin, Lin. Xiao, and Yin (2020) examined the relation between risk allocation and contractors' opportunistic behavior and stated that contractors in general tend to take over more risk than they could bear due to opportunistic behavior. However, as stated by Zhang, Zhang, Gao, and Ding (2016), prescribing most risks to the contractor leads to harmed relation and thus lower project performance. So, considering the studies of Selviaridis and Norman (2014), Yin et al. (2020), and Zhang et al. (2016), it seems that qualifications of the contractor and their project managements' technical competency have high influence on risk allocation in projects.

Osipova and Eriksson (2011, p. 1156) conclude that "formal risk allocation through the general conditions of contract is not sufficient for achieving the desired performance." Which implies that bonding requirements agreed on between owner and contractor should follow from the informal part of risk allocation. From a survey among 226 construction projects, Tang et al. (2020) found that clients should be responsible for potential conflict negotiation costs in the pre-mature phase where risks are allocated. Based on their research a relation seems to exist among risk allocation, bonding requirements, and conflict management, which is also emphasized by Zhu and Cheung (2020).

In allocating risks between contractor and client, 'intuition and subjectiveness' play a large role and given several studies improving this process, practitioners keep struggling with proper risk allocation (Khazaeni, Khanzadi, & Afshar, 2012). Cost overruns, time delays, and quality reduction of the product are subject to relational governance, and the extent of joint and collaborative working between client and contractor (Meng, 2012). From a contractors' perspective this requires good quality of communication and involving the client in decision making. In addition, Zhu and Cheung (2020) emphasize that incentivization can contribute to (re)allocation of risks, and to which extent allocation is perceived as fair from both parties. All in all, this results in a view that both quality of decision making and quality of communication have an impact on forming the transaction environment.

Gao et al. (2018) reason that project complexity has an impact to which extent contractual functions, control, coordination, and adaptation, need to be encountered. From a contractors' point of view, again this is subject to the quality of decision making and quality of communication of project managers.

The determinants of TC and their interrelationships are brought together with CG and RG, to evaluate contractual efficiency of contracts between client and contractor. Together, this forms the theoretical framework of the research.

2.3. Theoretical framework

Construction projects are known for their delays, cost overruns, and high and often unforeseen transaction costs to govern projects (1989). Since the research presented, concerns the (pre-)contract phase and relation between contractor and client, the sub-sets CG and RG of the project governance framework are relevant. Their interrelationship (Poppo & Zenger, 2002; Yan & Zhang, 2020) leads to formal contract and informal relationships (Poppo & Zenger, 2002; Musawir, Abd-Karim, & Mohd-Danuri, 2020) between client and contractor. Often, this interplay leads to conflicts in projects (Tijhuis, 1996; 2019). It is reasoned that CG and RG together result in contractual (in)efficiency. As stated by Benítez-Ávila et al. (2018), CG and RG are also related to project performance.
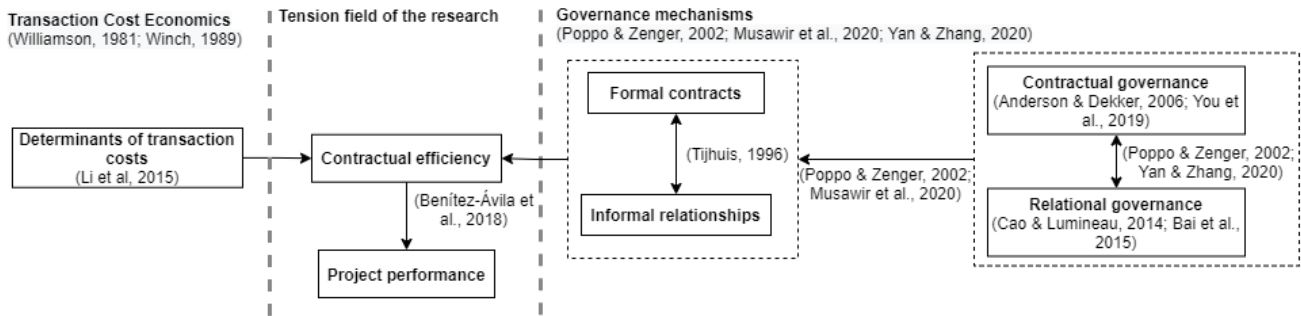
Figure 1: Schematization of theoretical framework

To indicate these governance mechanisms and their high transaction costs, 26 determinants of transaction costs (Li, Arditi, & Wang, 2015), as a derivative of TCE (Williamson, 1981) in project-oriented organizations (Winch, 1989) is applied (see Table 1). The above described theoretical framework is schematized in Figure 1.

3. Research design

The research is conducted from the perspective of a contractor. Projects are highly depended on the people executing these projects. To get acquitted with the environment, gain knowledge about current uses in contract management, and insights of experienced practitioners, the first part of the research includes semi-structured interviews.

Although, the complete set of respondents overcomes radical or misunderstood views of individuals, verification and validation of these results is of importance for the reliability and correctness of the conclusions. Therefore, there is zoomed into specific cases within the context of the organization and former research is considered.

Eventually, in selecting expert panel members, a concise decision is made to select two supervisors, two former involved members (interview respondents), and one new member.

3.1. Part I: Determinant relations – Interviews

Data is collected by fifteen semi-structured interviews with three different respondent groups, contract managers (3 respondents), managing directors (7 respondents), and project managers (5 respondents), selected based on their expertise, i.e., judgement sampling (Hartmann, et al., 2017, p. 232). Although, respondents are in the same category of 'VW employers', risks for bias and snowball effects are limited, since not only one subsidiary is considered. Seven respondents work at GTP, two are employed by VW-BVGO, six are working at other subsidiaries. Respondents are selected by the supervising project manager of the research and managing director of GTP.

The interviews focused on managing contracts, early contractor involvement, client relation, and collaboration with, and assistance from contract managers.

For analysis of the interviews, quotations are coded by 26 determinants of TC (Li, Arditi, & Wang, 2015), to obtain data display in an organized way (Hartmann, et al., p. 314). After coding the quotations by determinants: (1) Determinant codes are summed for each respondent. (2) Determinant codes are normalized for each respondent. (3) Normalized weights of determinants of individual respondents are combined, to indicate determinant weights for each respondent group (Appendix II., sections i.).

Once the three steps above are conducted, the analysis focuses on three elements of the data set of determinant coded. Dominant determinants, mismatches in dominance between respondent groups, and co-occurrences of determinant coded are indicated.

Dominant determinants
Determinant weights for all respondents are combined, such that a list of 26 determinants occur, which indicates the determinant with highest weight as most important, and so on, for the entire group of respondents. Weights are based on the number of occurrences of a determinant code in interviews.

After ranking determinants based on their normalized weight, a dominant set of determinants, i.e., the most important determinants, is selected. For practical reasons, the Pareto-rule is applied. Which means, determinants which form 80% of the total weight, are assumed to form a dominant set of determinants. So, starting with the most important determinant, the summed weight of *x* out of 26 determinants will form 80% of the total weight (see appendix II., section i.). Thereafter, the reasoning behind those dominant determinants is analyzed to get understanding what set really implies.

Mismatching dominance between respondent groups
Contract managers are known for their expertise in contracts and law, where most project managers and

managing directors in construction have mainly expertise in engineering and physical activities. Because of this knowledge gap, two groups of respondents are formed, 'Contract managers' and 'Managing directors and project managers'.

For both groups a dominant set of determinants is indicated, conform the method applied above, for all respondents together. Thereafter, differences in dominant sets of determinants indicate 'mismatches' between the two groups, which are of importance in collaborating and assistance of each other (see appendix II., section ii.).

Co-occurrences
Often, quotations are coded with more than one determinant. Co-occurrences of dominant determinants (from all respondents), with all 26 determinants are counted. For practical reasons, determinant pairs which co-occur ten times or more are selected (see appendix II., section iii.).

Interpretation of interviews
Quotations coded with dominant determinants, mismatching determinants, and/or co-occurrences are analyzed. Thereafter, an interpretation of 100-250 words is given on each dominant determinant, mismatching determinant, and co-occurring determinant pair (see appendix II., section 1 up till 3).

All interpretations together provide insight in actual importance of determinants and coherency between them. Based on interpreted importance and coherency, a model is drawn up which indicates determinant relations in the context of the (pre-)contract phase, and coherency between different relations.

Since the relational model strongly depends on perception of respondents, and interpretation, correctness of the determinant relations needs to be checked by means of verification.

3.2. Part II: Verification – Case studies and former research
The relational model is based upon semi-structured interviews. As stated by Hartmann et al. (2017, p. 137), they provide a wide variety of qualitative data. On the contrary, case studies provide detail of qualitative data. Therefore, eight projects of GTP are selected to check correctness of determinant relations. In addition, former research is consulted, to check if relations are already indicated in other studies.

Case studies
The sample of cases provides insights towards specific situations where determinant relations might be applicable. By selecting eight construction projects where GTP

functions as main contractor, all kind of project types are considered, such that the set of cases is representative (Hartmann, et al., pp. 106-121) Selection is based upon example projects discussed during interviews, and by suggestion of the supervising project manager of GTP. Based on type of project, the selection includes low-rise housing (two projects), high-rise housing (three projects), and utility (three projects). Based on contract price, the selection includes 1 – 10 million€ (five projects), 10 – 25 million€ (two projects), and 50+ million€ (one project).

Contractual documents and evaluation documents of risks and opportunities are collected for each case. For analysis of cases, those documents are accurately run through, from the perspective of the relational model. Thereafter, remarks on determinant relations for a project are discussed with the accountable project manager. If it turns out that a determinant relation is applicable to a case, expression of the relation is defined in 50-100 words.

Former research
Research in the field of TCE in construction or buyer-supplier relationships is consulted, to check whether determinant relations are emphasized by former research, by means of the literature review.

Verification of determinant relations
Support for determinant relations by case studies and former research is documented. Correctness of a determinant relation is assumed if it is applicable in at least five out of eight cases, and is supported by research published in a journal related to construction management, buyer-supplier relationships, and/or TCE.

Although, determinant relations are verified, they might not be desired or recognized by practitioners. To validate determinant relation, an expert panel is arranged.

3.3. Part III: Validation – Expert panel
To validate determinant relations, determinant relations are discussed in an expert panel. The expert panel is chaired by the researcher. In addition, the panel is attended by two supervisors, two interview respondents and one member who is not involved in the research (see Table 2).

During the expert panel, each determinant relation which remains after verification, is presented as proposition to the expert panel. Based on the discussion that arises from the proposition, it can be concluded if a determinant relation is valid.

The relational model that remains after verification and validation is made final. Based on these relations, implications for the (pre-)contract phase can be documented.

Member	Organization	Interview respondent
Managing director	GTP	Yes
Managing director	Other subsidiary	Yes
Regional director	VW-BVGO	No
Supervising project manager	GTP	No
Supervisor (observer)	University	-
Chairing researcher (author)	University	-

4. Results

Conform the research design (chapter 3), results of the research are presented in three parts, respectively determinant relations based on semi-structured interviews, verification of by means of case studies and former research, and validation by means of an expert panel.

4.1. Part I: Determinant relations – Interviews

Fifteen semi-structured interviews are analyzed on three aspects. At first, a dominant set of determinants of TC is indicated for the entire group of respondents. Second, mismatches between the dominant set of determinants between groups 'Contract managers' and 'Managing directors and project managers are indicated. At last, co-occurrences of coded determinants are evaluated. Definition of aspects is interpreted, which eventually leads to a relational model with eleven determinant relations (see Appendix II).

Dominant determinants
Determinants are ordered on weight. A dominant set of twelve out of 26 determinants is indicated (Table 3). An overview of determinant ranking and weight is included in appendix III.

Table 3: Dominant set of determinants of TC in order of weight

Rank	Determinant
1.	Quality of decision making
2.	Risk allocation
3.	Quality of communication
4.	Bonding requirements
5.	Technical competency
6.	Qualifications of the contractor
7.	Incentive/disincentive clauses
8.	Early contractor involvement
9.	Project complexity
10.	Leadership
11.	Relationships with other parties
12.	Relationships with other parties

Mismatching dominance
Respondents are classified in two groups, 'Contract managers' and 'Managing directors and project managers'.

For both groups a dominant set of determinants of TC is indicated. The sets of dominant determinants are different for the groups (see Appendix III).

For contract managers a set of twelve determinants is identified as dominant. Three of these determinants are not included in the dominant set of 'Managing directors and project managers' (Table 4).

For managing directors and project managers a set of thirteen determinants is identified as dominant. Four of these determinants are not included in the dominant set of 'Contract managers' (Table 5).

Co-occurrences
Analysis on dominant determinants which co-occur with

Table 4: Dominant determinants in the set of 'Contract managers' and not in the set of 'Managing directors and project managers'

Rank	Determinant
7.	Experience in similar type projects (owner)
8.	Organizational efficiency
9.	Experience in similar type projects (contractor)

Table 5: Dominant determinants in the set of 'Managing directors and project managers' and not in the set of 'Contract managers'

Rank	Determinant
7.	Relationships with previous clients
8.	Incentive/disincentive clauses
12.	Integration of design and construction
13.	Conflict management

other determinants, results in 21 determinant pairs that co-occur ten times or more (see appendix III). The analysis reveals that all determinants in sub-group 'project management efficiency' often co-occur with each other. In addition, 'transaction environment' determinants risk allocation, bonding requirements, and incentive/disincentive clauses often co-occur with each other, and with 'project management efficiency' determinants.

Interpretation of interviews
Considering dominant determinants, differences in dominant sets of determinants, and co-occurrences of determinant pairs, are analyzed and interpreted (an overview of quotations of each aspect is included in Appendix II). Interpretation results in eleven determinant relations (R), included in Table 6.

The relations presented are based upon perception of interview respondents, and interpretation. To verify the relations described, case studies are conducted, and former research is consulted in the next section.

Table 6: Interpretation of determinant relations

Relation	Interpretation
R01.	Relationships of the client with third parties, such as architect and consultants. If the client works closely with those parties from the start, chances for early contractor involvement decrease.
R02.	The earlier a contractor is involved, the more they are willing to bear risks. However, respondents experience an increase in risks allocated to the contractor, without getting involved in an early stage. Equivalence is experienced as most important in allocating risks, i.e., contractors are willing to bear risks, if they can govern these risks. Preferably, by getting involved in a consulting role during the design stage, and as contractor for the construction stage. If not involved in an early stage, a second opinion on design risks is desired, however this is often not funded by the client.
R03.	Bonding requirements should logically follow from risk allocation, again equivalence is experienced as most important. Bonding requirements regarding payment terms and feasibility are key for bonding requirements of each project.
R04.	To ensure that parties meet requirements, (dis)incentive clauses should function as a derivative of bonding requirements. Discussion and transparency between parties is key to achieve proper clauses.
R05.	Showing willingness and initiative from the start, leads to gaining trust from the client, certainly in early stages by consulting and warning the client in risks. By gaining trust, leadership can shift from client to contractor. In tenders, it is hard to obtain earlier involvement by showing willingness and initiative. Sharing principles and consult before the project is awarded can contribute to this.
R06.	Regarding execution of building trades, qualifications and competency are not questioned at all. However, all processes around actual building, contractors experience difficulties in involving the right people at the right time. Risk allocation is experienced as contract related and therefore up to contract managers, and construction itself as work for project managers. However, respondents emphasize that risks and opportunities should be a starting point for the contract to be drawn up. To obtain a comprehensive view of all risks and opportunities, both contract managers and project managers are required in the premature phase of risk allocation.
R07.	The impact of quality of decision making and communication on the contracting process is emphasized by almost all respondents. Quality of decision making depends on (1) follow up of procedural steps, (2) formal documentation of agreements as soon as possible, starting with risk allocation based on whether the contractor is involved early, (3) equivalence in agreements, or consciously agreeing on inequivalence.
R08.	Relationships with previous clients mainly concerns the type of client, and their experience with contracts and the construction industry. Certainly, Anglo-Saxon investors govern their projects based on contractual agreements and juridical knowledge. Acting on this (expected) behavior is key, e.g., by early involving contract managers and possibly lawyers or tax specialists. This gives extra dimensions to the project for which project complexity increases. The other way around, e.g., healthcare institutions have no experience in construction and minor contractual and juridical knowledge, which suits a proactive attitude of the contractor, in leading the project and consult the client in an early stage.
R09.	Experience teaches. Executing more projects for one client or type of client, gives insights in how a client act. Respondents identify (a lack of) experience as an important element for project complexity.
R10.	How a client acts becomes more and more clear during the project. For the contractor, this provides insights how to act and communicate with the client. The way of acting and communicating largely depends on the type of client, which indicates its experience in similar type projects and organizational efficiency.
R11.	Conflict management is closely related to managing expectations. Which means, if a contractor expects a task or requirement is not achieved or delayed, this should be reported to the client as soon as possible. If the task or requirement is eventually met in time, nothing happens. However, if a task or requirement is indeed not achieved or delayed, it is easier to discuss this with the client since they are already warned. After the first report, a project manager needs to estimate if the (potential) problem might result in a conflict or dispute. If this is the case, he should report this to managing directors and contract managers, so upscaling can be done fast if a task or requirement indeed leads to conflict, to prevent clauses.

4.2. Part II: Verification – Case studies and former research

Eight projects where GTP operates (or operated) as main contractor are selected, which are analyzed on the determinant relations of section 4.1. In addition, former research is consulted, to check whether relations are supported by other studies.

Case studies

Case studies are analyzed by contractual documents, evaluation documents of risks and opportunities, and discussion with the accountable project manager. Together, this provides insight in the presence and applicability of each determinant relation for a case (see Appendix IV). R09 and R11 were only present in two out of eight cases, where all other relations were present in at least five out of eight cases (Table 6).

Follow-up of risk allocation of bonding requirements is acknowledged as key element for cases which run fluid through the (pre-)contract phase, and in projects where disincentive clauses and disputes occurred, they lead back to inequal risk allocation and/or misalignment between risks and requirements. Bearing risks and taking the lead in projects, turned out to be possible by health care organizations, which are open to consult from construction

practitioners such as GTP. On the contrary, real estate investors and developers tend to steer on signed agreements and remain in charge throughout the project.

Former research

Considering former research of TCE in construction or buyer-supplier relationships (see section 2.2) reveals that there is no support for R09. All other relations could be supported by at least one other study (Table 7).

Verification of determinant relations

Considering the case studies and former research, R09 is not reliable since there is no support by former research, and it is only acknowledged in three out of eight cases. Although, R11 is supported by the studies of Tang et al. (2020) and Zhu and Cheung (2020), the relation is supported by two out of eight cases.

R10 is supported by Haaskjold et al. (2019) and acknowledged in all cases. However, the research focuses on the (pre-)contract phase, where R10 mainly concerns later stages. Therefore, R10 is considered as out of scope.

Table 7: Verification of determinant relations

Relation	Support by former research	Presence in cases
R01.	(Scheepbouwer, 2011)	8 out of 8
R02.	(Osipova, 2011), (Rose, 2010), (Scheepbouwer, 2011), (Tang, 2020)	7 out of 8
R03.	(Osipova, 2011), (Tang, 2020)	6 out of 8
R04.	(Osipova, 2011)	5 out of 8
R05.	(Suprapto, 2015)	7 out of 8
R06.	(Selviaridis, 2014), (Yin, 2020), (Zhang, 2016)	8 out of 8
R07.	(Khazaeni, 2012), (Meng, 2012), (Selviaridis, 2014), (Zhu , 2020)	8 out of 8
R08.	(Gao, 2018), (Selviaridis, 2014), (Zhu, 2020)	7 out of 8
R09.	-	3 out of 8
R10.	(Haaskjold, 2019)	8 out of 8
R11.	(Tang, 2020), (Zhu, 2020)	2 out of 8

4.3. Part III: Validation – Expert panel

Based on eight determinant relations (Figure 2) that remain after verification, eight propositions (P) are presented and discussed:

P1. Inefficiency of the (pre-)contract phase is a result of lack of focus on, and experience with contract management of subsidiaries.
P2. The first step to take is mapping the relationships of client with other parties.
P3. Risk allocation based on the phase a project is entered is the starting point for drawing up agreements.
P4. Requirements of client and contractor should be a derivative of risk allocation.
P5. Demarcations and (dis)incentive clauses should be a derivative of requirements of both parties.
P6. Take initiative and offer consultation to client should always be done, also if there is no pre-agreement.
P7. A reading session of the contract with the entire project team should be part of each project start-up.
P8. Projects should be selected on type of client and client relation.

The expert panel agreed on P1. The combination of P2 and P3 is agreed on, under condition that P3 is more important, and can be complemented by P2. Both, P4 and P5, seem logical to all members. On P6 is not clearly agreed nor disagreed, since it is highly project specific. However, the panel members could not indicate specific characteristics on which this is depending. Half of the panel agreed on P7, the other members agreed on P7 under the condition that this should only be done for projects of above a certain level of complexity. Finally, P8 is agreed on under the condition that market conditions are favorable for contractors.

The expert panel believes that bids should be better substantiated by assumptions and exclusions of calculations. They believe that a checklist, based on these propositions, can contribute to improve substantiation.
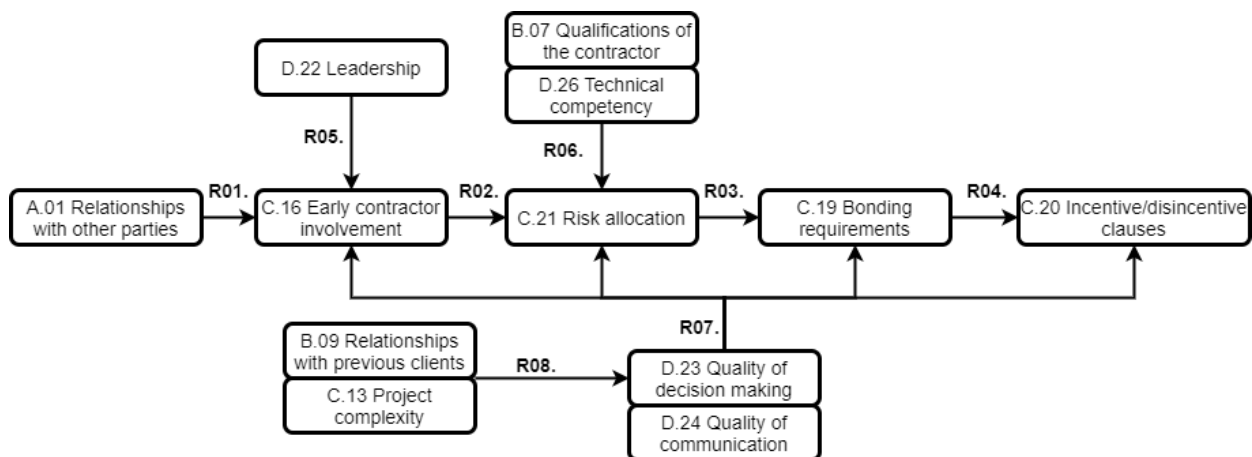

Figure 2: Determinant relations

5. Discussion

Semi-structured interviews with contract managers, managing directors, and project managers from six subsidiaries of a construction conglomerate in The Netherlands revealed that a sub-set of determinants is dominant in contractual efficiency. Quality of decision making, risk allocation, quality of communication, and technical competency turn out to be key for the (pre-) contract phase.

Contract managers emphasize the importance of experience in similar type projects from both clients and contractors, and the organizational efficiency of the client as important determinants. Interestingly, managing directors and project managers, who are largely executive and practical oriented, do not experience these determinants as important.

The other way around, managing directors and project managers acknowledge the importance of determinants, which are not experienced as dominant by contract managers. Those are the relation with a client, (dis)incentive clauses, integration of design and construction, and conflict management.

All together, quality of decision making and quality of communication are key in the entire process of contract management and drawing up agreements. This implies: (1) follow up of procedural steps, (2) formal documentation of agreements as soon as possible. Where, mapping and allocating risks should always be the starting point of drawing up agreements between client and contractor. (3) Equivalence between client and contractor needs to be key in allocating risks, or both parties should consciously agree on inequivalence.

After verification, eight out of eleven determinant relations remain. Those are validated by means of an expert panel, which results in a relational model which contributes to efficiency of the (pre-)contract phase.

5.1. Interpretation

Eight determinant relations of TC are discussed with an expert panel, which finally results in a relational model which includes eight relations and eleven determinants.

The relational model, schematized in Figure 2, functions as a checklist for contractors in the (pre-)contract phase. In drawing up agreements, project teams should consider the relationships of the client with other parties. In addition, the phase at which a project is entered should function as substantiation for risk allocation. Besides, it should be checked that bonding requirements are logically derived from risk allocation, and (dis)incentive clauses are logically derived from bonding requirements (R01, R02, R03, R04).

To gain trust and get earlier involved, consulting the client before actual contracting might be beneficial. However, it depends on the client relation if consultation should be limited to one consult in combination with a bid, or consultation is intensified (R05).

To obtain equal risk allocation, it is a prerequisite that expertise of contracts and law, and engineering and execution of construction is present during the (pre-) contract phase. This implies that at least a contract manager and project manager are involved during this premature phase (R06, R07). On the long term, this integrated way of working in a team decreases the knowledge gap between contract managers and project managers. First, this helps contracts managers better understand informal relationships with clients. Second, contractual understanding by project managers is enlarged by working more often with contract managers. By decreasing the gap between contract and practice, project complexity also decreases (R08).

5.2. Limitations

The research presented, follows a rather qualitative approach with fifteen semi-structured interviews as a basis. Respondents are all located at a large, decentralized conglomerate in The Netherlands. Six subsidiaries active in building construction and real estate development are considered, as well as general management of this department.

By means of 26 determinants of transaction costs (Li, Arditi, & Wang, 2015), TCE is applied in the context of contractual governance and relational governance. Determinant definitions are adopted from the research of Li et al. (2015). However, some determinants are subject to alterations of definitions (see Appendix I).

Verification of the results is done by considering former research and eight case studies at one subsidiary. Presentation and discussion of propositions with an expert panel is used to validate outcomes. However, the case studies for verification, and expert panel for validation exhaust from the same organizational environment as the main part of the research. To prevent ambiguity, further research in different organizational contexts is required.

6. Conclusion

TCE and the mechanisms of CG and RG are brought together, to obtain increased efficiency of contracts and contract management in construction projects. The relevance of this objective seems trivial, since the construction industry is known for its inefficient operations (Dubois & Gadde, 2002), contractual complexity leading to

conflicts (Tijhuis, 1996), and high and often unforeseen transaction costs (Winch, 1989). From a TCE perspective, Li et al. (2015) identified 26 determinants of TC, which functioned as handles for the study.

It turns out that business administrative aspects such as communication between client and contractor, and involving the right people at the right time, are key. For the (pre-)contract phase of construction projects, this implies that at least a contract manager and project manager should be involved from the start. As start-up, project managers should conduct a quick scan of the project and its draft agreements. In this scan, the relation of a client with third parties and the phase in which a contractor enters the project should function as girders for evaluation of risk allocation. As a derivative of risk allocation, bonding requirements should be drawn up, from which (dis)incentive clauses should be derived. Once a quick scan is completed it can be discussed with the contract manager.

6.1. Theoretical implications

The interrelationship between contractual governance and relational governance (Musawir et al., 2020; Poppo & Zenger, 2002; Yan & Zhang, 2020) complicates the collaboration between client and contractor in construction projects. All authors emphasize that the two mechanisms should be used as complements, rather than substitues. However, this study proves that in practice the two continously interfere, which makes it hard for practioners to use the two fluidly.

The research contributes to extenstion of a TCE approach in construciton, to indicate (efficiency of) construction management processes. Specifically, the work Li et al. (2005) is extended by focusing on the (pre-)contract phase. Broad aspects such as quality of communication and decion making, and relationships between parties turn out to play a key role. This implies that the construction industry can learn from behavioural studies and business administrative applications.

At last, the research suggests to start contract negotiations by risk allocation, with clients' third parties and the phase a contractor enters as input. As a derivative, bonding requirements can be indicated, from which (dis)incentive clauses are eventually derived.

6.2. Managerial implications

Basic principles as quality of communication and decision making seem quite broad, however they keep coming back. It confirms that pratitioners should follow-up procedural steps and document agreements to prevent conflicts, because of misunderstanding or misaligned expectations. Starting with informal acquittance with a client is a good start. However, right after acquittance, when discussion

arises how to set up an agreement, this should all be documented.

Focusing on the (pre-)contract phase, contractors should follow the procedure of risk allocation, from which bonding requirements can be derived, and (dis)incentive clauses can be derived from bonding requirements. In allocating risks, the phase a project is entered is a priority, since risks from prior phases should be left to the client, or checked before taken over.

Walking through the (pre-)contract phase, it is a prerequisite that a contract manager and project manager are involved throughout the entire process, if the objective is to increase efficiency. Certainly in decentralized organizations, such as presented in this study, intregative work of the project team can only be obtained by decreasing the physical gap between project team mebmers.

At last, experts involved in the research strongly suggest to change bidding behavior. Which means, assumptions and exclusions adapted to set up a bid, should be stated clearly in the bidding document. They recommend considering bidding documents of specialized subcontractors, e.g., plasterers or steel suppliers, since they sent much more offers per unit of time. As a result, their bidding documents are made quite efficient and standardized.

Once an analysis on subcontractors bidding documents is conducted, the experts suggest designing a checklist which is based on the eight propositions of this research, and the checklist of 'Bouwend Nederland' which considers special contracts in The Netherlands.

6.3. Future research

Haaskjold et al. (2019) already applied the framework of Li et al. (2015) to indicate factors that affect collaboration in projects. The research presented focused on the (pre-)contract phase which largely determines how collaboration during a project is shaped. Further research on collaboration and contracts between clients and contractors could provide confirmation.

The current research remains qualitative and is conducted from a contractors' perspective. Similar studies from clients' perspective might lead to interesting comparisons or contradictions.

Finally, the propositions and determinant relations are verified and validated within the same organizational context as the main part of the research. So, verification and validation of the proposed model in a different context will provide useful insights towards reliability and generalizability.

References

Anderson, S. W., & Dekker, H. C. (2005). Management control for market transactions: The relation between transaction characteristics, incomplete contract design, and subsequent performance. *Management Science, 51:12*, 1733-1752. doi:10.1287/mnsc.1050.0456

Antonelli, C. (2006). The business governance oflLocalized knowledge: An information economics approach for the economics of knowledge. *Industry and Innovation, 13:3*, 227-261. doi:10.1080/13662710600858118

Bai, X., Sheng, S., & Li, J. J. (2015). Contract governance and buyer-supplier conflict: The moderating role of instituitions. *Journal of Operations Management, 41:1*, 12-24. doi:10.1016/j.jom.2015.10.003

Bajari, P., & Tadeli, S. (2001). Incentives versus transaction costs: A theory of procurement contracts. *RAND Journal of Economics, 32:3*, 387-407.

Benítez-Ávila, C., Hartmann, A., Dewulf, G., & Henseler, J. (2018). Interplay of relational and contractual governance in public-private partnerships: The mediating role of relational norms, trust and partners' contribution. *International Journal of Project Management, 36:3*, 429-443. doi:10.1016/j.ijproman.2017.12.005

Bouwend Nederland - de vereniging van bouw- en infrabedrijven. (n.d.). *Checklist bijzondere contracten.* Zoetermeer, The Netherlands. Retrieved June 2021, from https://www.bouwendnederland.nl/service/praktische-tools/modellen-en-modelcontracten

Cao, Z., & Lumineau, F. (2014). Revisiting the interplay between contractual and relational governance: A qualitative and meta-analytic investigation. *Journal of Operations Management, 33-34:1*, 15-42. doi:10.1016/j.jom.2014.09.009

Chao-Duivis, M., Koning, A., Ubink, A., & Bruggeman, E. (2018). *A Practical Guide to Dutch Building Contracts (4th edition).* `s-Gravenhage, The Netherlands: ibr.

Dubois, A., & Gadde, L.-E. (2002). The construction industry as a loosely coupled system: Implications for productivity and innovation. *Construction Management & Economics, 20:7*, 621-631. doi:10.1080/01446190210163543

Gao, N., Chen, Y. C., Wang, W., & Wang, Y. (2018). Addressing project complexity: The role of contractual functions. *Journal of Management in Engineering, 34:3*. doi:10.1061/(ASCE)ME.1943-5479.0000613

Haaskjold, H., Andersen, B., Laedre, O., & Aarseth, W. (2019). Factors affecting transaction costs and collaboration in projects. *International Journal of Managing Projects in Business, 13:1*, 197-230. doi:10.1108/IJMPB-09-2018-0197

Hartmann, A., Bougie, R., Sekaran, U., Rimer, F. J., Kostelis, K. T., Quartaroll, M. T., . . . Matthews, T. D. (2017). *Research Methodology & Academic Skills.* University of Twente, Enschede, The Netherlands: John Wiley & Sons, Inc.

Khazaeni, G., Khanzadi, M., & Afshar, A. (2012). Fuzzy adaptive decision making model for selection balanced risk allocation. *International Journal of Project Management, 30:4*, 511-522. doi:10.1016/j.ijproman.2011.10.003

Li, H., Arditi, D., & Wang, Z. (2013). Factors that affect transaction costs in construction projects. *Journal of Construction Engineering and Management, 139:1*. doi:10.1061/(ASCE)CO.1943-7862.0000573

Li, H., Arditi, D., & Wang, Z. (2015). Determinants of transaction costs in construction projects. *Journal of Civil Engineering Management, 21:5*, 548-558. doi:10.3846/13923730.2014.897973

Lu, W., Lihan, Z., & Pan, J. (2015). Identification and analyses of hidden transaction costs in project dispute resolutions. *International Journal of Project Management, 33:3*, 711-718. doi:10.1016/j.ijproman.2014.08.009

Lumineau, F., & Henderson, J. E. (2012). The influence of relational experience and contractual governance on the negotiation strategy in buyer-supplier disputes. *Journal of Operations Management, 30:5*, 382-395. doi:10.1016/j.jom.2012.03.005

Meng, X. (2012). The effect of relationship management on project performance in construction. *International Journal of Project Management, 30:2*, 188-198. doi:10.1016/j.ijproman.2011.04.002

Musawir, A. u., Abd-Karim, S. B., & Mohd-Danuri, M. S. (2020, January). Project governance and its role in enabling organizational strategy implementation: A systematic literature review. *International Journal of Project Management, 38:1*, 1-16. doi:10.1016/j.ijproman.2019.09.007

Osipova, E., & Eriksson, P. E. (2011). How procurement options influence risk management in construction projects. *Construction Management and Economics, 29:11*, 1149-1158. doi:10.1080/01446193.2011.639379

Poppo, L., & Zenger, T. (2002). Do formal contracts and relational governance function as substitutes or

copmlements? *Strategic Management Journal, 23:8*, 707-725. doi:10.1002/smj.249

Rose, T., & Manley, K. (2010). Client recommendations for financial incentives on construction projects. *Engineering, Construction and Architectural Management, 17:3*, 252-267.

Scheepbouwer, E., & Humphries, A. B. (2011). Transition in adopting project delivery method with early contractor involvement. *Journal of the Transportation Research Board*, 44-50. doi:10.3141/2228-06

Selviaridis, K., & Norman, A. (2014). Performance-based contracting in service supply chains: A server provider risk perspective. *Supply Chain Management, 26:4*, 153-172. doi:10.1108/SCM-06-2013-0216

Suprapto, M., Bakker, H. L., Mooi, H. G., & Moree, W. (2015). Sorting out the essence of owner-contractor collaboration in capital project delivery. *International Journal of Project Management*, 664-683. doi:10.1016/j.ijproman.2014.05.001

Tang, Y., Chen, Y., Hua, Y., & Fu, Y. (2020). Impacts of risk allocation on conflict negotiation costs in construction projects: Does managerial control matter? *International Journal of Project Management, 38:3*, 188-199. doi:10.1016/j.ijproman.2020.03.002

Tijhuis, W. (1996). *Bouwers aan de slag of in de slag? - Lessen uit internationale samenwerking: Onderzoek naar Nederlandse ervaringen in het Duitse bouwproces.* PhD-thesis, Eindhoven University of Technology, Eindhoven; Kondor Wessels Berlin GmbH, Berlin.

Tijhuis, W. (2019). *Business-culture's influences on internation construction processes & projects: Lessons from international collaboration.* University of Twente, The Netherlands.

Wang, R., Lu, W., & Wei, Y. (2021). Owners' use of contract-based power in construction project transactions: restrictions from process specificity and uncertainty. *Construction Management and Economics, 39:2*, 117-132. doi:10.1080/01446193.2020.1830423

Wang, W., Chen, Y., Zhang, S., & Wang, Y. (2018). Contractual complexity in construction projects: Conceptualization, operationalization, and validation. *Project Management Journal, 49:3*, 46-61. doi:10.1177/8756972818770589

Williamson, O. (1981). The cconomics of organization: The transaction cost approach. *American Journal of Sociology, 87:3*. doi:10.1086/227496

Williamson, O. (1996). *The Mechanisms of Governance.* Oxford, United Kingdom: Oxford University Press.

Winch, G. M. (1989). The construction firm and the construction project: a transaction cost approach. *Construction Management and Economics, 7:4*, 331-345. doi:10.1080/01446198900000032

Winch, G. M. (2001). Governing the project process: a conceptual framework. *Construction Management and Economics, 19:8*, 799-808. doi:10.1080/01446190110074264

Yan, L., & Zhang, L. (2020). Interplay of contractual governance and trust in improving construction project performance: Dynamic perspective. *Journal of Management in Engineering, 36:4*. doi:10.1061/(ASCE)ME.1943-5479.0000791

Yin, Y., Lin, Q., Xiao, W., & Yin, H. (2020). Impacts of risk allocation on contractor's opportunistic behavior: The moderating effect of trust and control. *Sustainability, 12:22*, 9604. doi:10.3390/su12229604

You, J., Chen, Y., Hua, Y., & Wang, W. (2019). The efficacy of contractual governance on task and relationship conflict in inter-organisational transactions. *International Journal of Conflict, 30:1*, 65-86. doi:10.1108/IJCMA-05-2018-0061

You, J., Chen, Y., Wang, W., & Shi, C. (2018). Uncertainty, opportunistic behavior, and governance in construction projects: The efficacy of contracts. *International Journal of Project Management, 36:5*, 795-807. doi:10.1016/j.ijproman.2018.03.002

You, W., Chen, Y., Gao, Y., & You, J. (2020). Understanding the relationship between environmental uncertainty and transaction costs in construction projects: Moderating roles of prior cooperation experience and intragroup transactions. *Journal of Management in Engineering, 36:6*. doi:10.1061/(ASCE)ME.1943-5479.0000854

Zhang, S., Zhang, S., Gao, Y., & Ding, X. (2016). Contractual governance: Effects of risk allocation on contractors' cooperative behavior in construction projects. *Journal of Construction Engineering and Management, 142:6*. doi:10.1061/(ASCE)CO.1943-7862.0001111

Zhu, L., & Cheung, S. O. (2020). Power of incentivization in construction dispute avoidance. *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 12:2*. doi:10.1061/(ASCE)LA.1943-4170.0000368

Appendix I. Definitions of determinants of TC

26 determinants of transactions costs, identified by Li et al. (2015), form a base for the research. Definitions of each determinant as applied in the research are provided in Table 8. Most determinant definitions are one on one adopted in the research, however, some definitions are slightly changed.

Table 8: Definition of determinants of TC

A. Role of the owner	
A.01. Relationships with other parties	
Definition of Li et al.	"Owner's relationship with designers, suppliers and government agencies that enhances the cooperation between the parties, reduces disagreements, and facilitates the resolution of conflicts."
Alteration of definition	Focus is on the work a client already conducted in collaboration with third parties, before the contractor is contracted.
A.02. Experience in similar type projects	
Definition of Li et al.	"Relates to the effectiveness of organizational learning. … Experience in similar type projects is likely to generate fewer requests for information on the part of the contractor."
A.03. Payment on time	
Definition of Li et al.	"Concerns the timeliness of payment by the owner. A contractor who consistently receives delayed payments is likely to borrow money and incur finance costs."
A.04. Organizational efficiency	
Definition of Li et al.	"Involves the ability of a firm to produce maximum output given a set of inputs or to minimize input given a set of required outputs."
Alteration of definition	Focus on financial resources that a client can use to e.g., hire lawyers, and the way of communication (rather formal or informal).
A.05. Change orders	
Definition of Li et al.	"Post contract changes by owners and owner-initiated variations."
B. Role of the contractor	
B.06. Bidding behavior	
Definition of Li et al.	"Refers to the bidding behavior of a contractor relative to unbalanced pricing, claims games, and collusion."
Alteration of definition	In addition, relates to the type of projects a contractor focuses on tender, 'one on one' or a middle way.
B.07. Qualifications of the contractor	
Definition of Li et al.	"Refers to how cognizant the owner is of the contractor's qualifications at the time the contract is signed."
Alteration of definition	In addition, also refers to recognition of contractor's own qualifications.
B.08. Relationships with subcontractors	
Definition of Li et al.	"Concerns the quality and strength of the relationships between a general contractor and its subcontractors."
B.09. Relationships with previous clients	

Definition of Li et al.	"Even though the importance of cooperation and trust between owners and contractors has been understood somewhat well, a strong relationship between owners and contractors is still difficult to achieve."
Alteration of definition	Focus is on past projects where the contractor has already worked for a particular client.
B.10. Experience in similar type projects	
Definition of Li et al.	"Lessons learned from completed projects."
B.11. Material substitutions	
Definition of Li et al.	"Refers to the replacement of one type of material for another. Closed specification does not allow for substitution with a similar product."
B.12. Frequency of claim	
Definition of Li et al.	"Is related to the contractor's policy relative to contract administration. Construction claims usually arise as assertions for extra money or time."
C. Transaction environment	
C.13. Project complexity	
Definition of Li et al.	"Impacts the uncertainty in the transaction environment. The specific responses that different parties in construction manifest depend on the certainty of the environment. The environmental instability increases transaction costs."
C.14. Project uncertainty	
Definition of Li et al.	"The difference between the amount of information required to do the task and the amount of information already processed by the organization."
C.15. Completeness of design	
Definition of Li et al.	"A measure how well the owner or A/E have defined, documented and specified the project."
C.16. Early contractor involvement	
Definition of Li et al.	"Is bound to influence the many complex and uncertain processes owners face at the beginning of a construction project. Such cooperative route seeks to obtain long-term gains through increased cooperation and integration of design and construction."
C.17. Competition between bidders	
Definition of Li et al.	"The basic principle of project procurement. The absence of competition is associated with relatively low costs of bidding and contract negotiation."
C.18. Integration of design and construction	
Definition of Li et al.	"Capitalizes on the close relationship between design and construction. These processes can best be viewed as an integrated system."
C.19. Bonding requirements	
Definition of Li et al.	"Refers to third party guarantees on contract performance."
Alteration of definition	Refers to requirements which each party involved in a project must meet, based on signed agreements.
C.20. Incentive/disincentive clauses	
Definition of Li et al.	"Are important in construction contracts to encourage contractors to perform on schedule and/or within budget."
C.21. Risk allocation	
Definition of Li et al.	"Refers to the proper allocation of risks between the owner and contractor."

D. Project management efficiency	
D.22. Leadership	
Definition of Li et al.	"Is the key to building management capability. Leadership involves developing and communicating mission, vision, and values to the members of an organization. A successful leadership is expected to create an environment for empowerment, innovation, learning and support."
Alteration of definition	Relates to capabilities of project managers to lead a team within its own organization as well as showing and taking leadership in collaboration with client and third parties.
D.23. Quality of decision making	
Definition of Li et al.	"Is related to project managers dealing with uncertainty, complexity, multiple objectives, and multiple stakeholders. Project managers should never make decisions based on gut instinct, which tends to be biased."
D.24. Quality of communication	
Definition of Li et al.	"Has been identified as a factor that affects the occurrence of disputes, and hence as a determinant of transaction costs. Simply improving communication practices by improving information flow will not reduce per se the incidence of disputes in construction."
D.25. Conflict management	
Definition of Li et al.	"Involves the resolution of serious disagreements and arguments about something important and also of serious differences between two or more beliefs, ideas or interests."
Alteration of definition	In addition, also encounters *prevention/avoidance* of (potential) conflicts.
D.26. Technical competency	
Definition of Li et al.	"Concerns the extent of technical knowledge available in the company that is necessary to undertake specific projects and the number and type of machinery and equipment owned by the company that are necessary for the physical realization of construction projects."
Alteration of definition	Technical competency is defined as competence of a specific profession or expertise. E.g., juridical competency/expertise, executive competency/expertise, engineering competency/expertise.

Appendix II. Analysis and interpretation of interviews

Appendix II. is excluded for confidential matters.

Appendix III. Determinant ranking and co-occurrences

Determinant weights and their importance are provided in Table 9. The final column, summed weight indicates the division between dominant and non-dominant determinants.

For respondent group 'Contract managers', Table 10 provides insight to the rank and weight of determinants. Again, the division between dominant and non-dominant determinants is indicated, as well as the mismatching determinants in the dominant set.

Table 11 provides insight to the rank and weight of determinants for respondents group 'Managing directors and project managers'. Division between dominant and non-dominant determinants is indicated, as well as the mismatching determinants in the dominant set.

All determinant pairs which co-occur ten times or more are provides in Table 12.

Table 9: All respondents – Determinants ranking and weights

Rank	Determinant	Normalized weight factor	Summed weight
1	D.23. Quality of decision making	0,095	0,095
2	C.21. Risk allocation	0,094	0,189
3	D.24. Quality of communication	0,087	0,276
4	C.19. Bonding requirements	0,086	0,362
5	D.26. Technical competency	0,079	0,441
6	B.07. Qualifications of the contractor	0,062	0,503
7	C.20. Incentive/disincentive clauses	0,058	0,561
8	C.16. Early contractor involvement	0,056	0,617
9	C.13. Project complexity	0,045	0,663
10	D.22. Leadership	0,043	0,705
11	B.09. Relationships with previous clients	0,037	0,742
12	A.01. Relationships with other parties	0,032	0,774 (≈80%)
13	B.08. Relationships with subcontractors	0,030	0,805
14	C.18. Integration of design and construction	0,029	0,834
15	C.15. Completeness of design	0,023	0,857
16	C.17. Competition between bidders	0,021	0,878
17	A.04. Organizational efficiency	0,020	0,898
18	B.10. Experience in similar type projects	0,018	0,916
19	A.02. Experience in similar type projects	0,018	0,934
20	B.11. Material substitutions	0,017	0,951
21	C.14. Project uncertainty	0,016	0,967
22	A.05. Change orders	0,014	0,981
23	D.25. Conflict management	0,011	0,992
24	B.06. Bidding behavior	0,005	0,997
25	A.03. Payment on time	0,003	1,000
26	B.12. Frequency of claim	0,000	1,000

Table 10: Contract managers – Determinants ranking and weights

Rank	Determinant	Normalized weight factor	Summed weight
1	D.23. Quality of decision making	0,145	0,145
2	D.26. Technical competency	0,105	0,250
3	D.24. Quality of communication	0,099	0,349
4	B.07. Qualifications of the contractor	0,082	0,431
5	C.21. Risk allocation	0,066	0,497

Rank	Determinant	Normalized weight factor	Summed weight
6	D.22. Leadership	0,056	0,553
7	A.02. Experience in similar type projects	0,049	0,602
8	A.04. Organizational efficiency	0,039	0,641
9	B.10. Experience in similar type projects	0,036	0,678
10	C.19. Bonding requirements	0,036	0,714
11	C.13. Project complexity	0,033	0,747
12	C.16. Early contractor involvement	0,033	0,780 (≈80%)
13	D.25. Conflict management	0,033	0,813
14	A.01. Relationships with other parties	0,030	0,842
15	B.09. Relationships with previous clients	0,030	0,872
16	C.18. Integration of design and construction	0,026	0,898
17	C.20. Incentive/disincentive clauses	0,026	0,924
18	A.05. Change orders	0,020	0,944
19	B.12. Frequency of claim	0,020	0,964
20	B.06. Bidding behavior	0,010	0,974
21	C.17. Competition between bidders	0,010	0,984
22	B.11. Material substitutions	0,007	0,990
23	C.14. Project uncertainty	0,007	0,997
24	C.15. Completeness of design	0,003	1,000
25	A.03. Payment on time	0,000	1,000
26	B.08. Relationships with subcontractors	0,000	1,000

Table 11: Managing directors and project managers - Determinants ranking and weights

Rank	Determinant	Normalized weight factor	Summed weight
1	D.23. Quality of decision making	0,105	0,105
2	D.24. Quality of communication	0,094	0,199
3	C.21. Risk allocation	0,094	0,293
4	D.26. Technical competency	0,079	0,372
5	B.07. Qualifications of the contractor	0,069	0,441
6	C.19. Bonding requirements	0,062	0,504
7	B.09. Relationships with previous clients	0,051	0,554
8	C.20. Incentive/disincentive clauses	0,050	0,604
9	C.16. Early contractor involvement	0,049	0,653
10	D.22. Leadership	0,046	0,699
11	C.13. Project complexity	0,035	0,734
12	C.18. Integration of design and construction	0,029	0,763
13	D.25. Conflict management	0,028	0,792 (≈80%)
14	A.01. Relationships with other parties	0,023	0,815
15	C.15. Completeness of design	0,022	0,837
16	B.08. Relationships with subcontractors	0,022	0,858
17	A.02. Experience in similar type projects	0,021	0,879
18	B.10. Experience in similar type projects	0,021	0,900
19	A.04. Organizational efficiency	0,019	0,920
20	C.17. Competition between bidders	0,018	0,938
21	C.14. Project uncertainty	0,018	0,956
22	A.05. Change orders	0,012	0,967
23	B.12. Frequency of claim	0,011	0,979
24	B.11. Material substitutions	0,009	0,988

Rank	Determinant	Normalized weight factor	Summed weight
25	B.06. Bidding behavior	0,008	0,996
26	A.03. Payment on time	0,004	1,000

Table 12: Co-occurring determinant pairs (≥10)

Co-occurring determinant pairs		#
D.23 Quality of decision making	D.26 Technical competency	47
D.23 Quality of decision making	D.24 Quality of communication	43
C.19 Bonding requirements	C.20 Incentive/disincentive clauses	30
C.19 Bonding requirements	C.21 Risk allocation	30
D.24 Quality of communication	D.26 Technical competency	28
D.22 Leadership	D.23 Quality of decision making	26
D.22 Leadership	D.24 Quality of communication	26
C.20 Incentive/disincentive clauses	C.21 Risk allocation	25
B.07 Qualifications of the contractor	D.26 Technical competency	23
B.07 Qualifications of the contractor	D.23 Quality of decision making	19
D.22 Leadership	D.26 Technical competency	19
B.07 Qualifications of the contractor	B.10 Experience in similar type projects	16
C.16 Early contractor involvement	C.21 Risk allocation	15
D.24 Quality of communication	D.25 Conflict management	15
D.23 Quality of decision making	D.25 Conflict management	14
C.21 Risk allocation	D.23 Quality of decision making	13
D.26 Technical competency	D.25 Conflict management	13
B.07 Qualifications of the contractor	D.24 Quality of communication	12
C.19 Bonding requirements	D.24 Quality of communication	10
C.20 Incentive/disincentive clauses	D.24 Quality of communication	10
C.21 Risk allocation	D.26 Technical competency	10

Appendix IV. Determinant relations in case studies

Appendix IV. is excluded for confidential matters.