### DOCTORAL THESIS

# Efficient Governance of Construction Projects through Cooperative Procurement Procedures

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#### **Preface**

This thesis is the tangible outcome of a five-year long PhD process, carried out at the Division of Business Administration and Management, at Luleå University of Technology. Although the PhD process has occasionally felt like a lonely and highly ambiguous journey towards a distant and hazy goal, I have not made this trip alone. In fact, many people and organisations have helped me in many different ways during these years. In this preface I would like to take the opportunity to acknowledge the help and assistance I have received from these people and organisations.

First of all I would like to acknowledge the financial support I have received from SBUF, Formas, Competitive Building, Luleå University of Technology, the Swedish Road Administration (Vägverket), ICA Fastigheter, WSP Group, Svenska Bostäder, NCC and Armstrong, which made this research project possible.

The PhD process can at times be very confusing, uncertain and tiresome, making external support crucial. The fact that I have truly enjoyed the entire PhD process, despite of its uncertainties and problems, is largely due to my deep interest in the chosen topic but also to the external support and interest I have received from numerous people along the journey. In the list of individuals I would like to acknowledge my greatest gratitude goes to my supervisor TorBjörn Nilsson, who has shown remarkable commitment and interest in myself and my work from the very first day we met. You have always and unconditionally made your best effort to assist me in all kinds of ways during these years. For this I am truly grateful!

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When it comes to hardcore empirical work, a researcher without informants is like a carpenter without his tools, naked and lost. Hence, I would like to thank all you people that have given me empirical information: Anders Lin-

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Although the PhD process is more of a lifestyle than a typical job, the time spent outside the university is of paramount importance for recharging the batteries and building up stamina for tough scientific battles with editors and referees. Hence, last but not least, I would also like to thank the people that mean the most to the person Per Erik. First of all, my family and relatives; thanks for always being there for me. Especially my parents Sven and Birgitta, for being the best role models a son could ever ask for. After all these years of studies, you have still taught me the most important lesson, to enjoy life. Although I am far away from you geographically, you are always close in my mind and heart. Thanks also to all my friends, who have made my scarce spare time enjoyable and cheerful.

Luleå, May, 2007

Per Erik Eriksson

#### **Abstract**

The purpose of this research is to increase the understanding of how efficient governance of construction projects can be achieved through appropriate procurement procedures. In this PhD project, literature reviews, a pre-study, a longitudinal case study and a survey study have been conducted in order to investigate five research questions and thereby fulfil the research purpose. The main theoretical field in this thesis is transaction cost economics, which forms the basis of the developed conceptual procurement model. Other literature fields that have been reviewed are: game theory, innovation, partnering, industrial buying behaviour and principal-agent theory. All these different theories and fields of literature have one thing in common: they are all well suited to analysing different aspects of buyer-supplier relationships.

The research presented in this thesis contributes to theory and practice in four main ways. 1) The developed conceptual procurement model adds knowledge to transaction cost economics through a broad process perspective that makes it possible to describe how governance prescriptions can be achieved by suitable procurement procedures. The model also contributes to procurement practice since it may be utilised as a useful framework, guiding procurement decisions in order to tailor procurement procedures to transaction characteristics. In this way it increases the understanding of how to procure different types of projects in order to facilitate efficient governance. 2) The survey study shows that the current procurement procedures used by Swedish construction clients are still of the traditional type, facilitating governance forms focusing on price and authority, which according to the conceptual model are unsuitable in construction transactions. This finding can hopefully serve as an alert to practitioners that their procurement procedures have become obsolete due to the increased complexity and uncertainty of construction projects. 3) The case illustrations and the structural equation model show that cooperative procurement procedures facilitate the establishment of cooperation and thereby efficient governance of complex, customised and lengthy construction projects with high uncertainty. These procedures are therefore more suitable and up to date than the most common ones. 4) A side effect of this research is a suggestion of how to look upon the concept of partnering. The research results suggest that different governance forms are facilitated through different procurement procedures. An indirect finding is therefore that partnering can be viewed as a cooperative governance form, which is facilitated through cooperative procurement procedures. The TCE-perspective of this definition makes sure that partnering is not used for its own sake, but only to achieve efficient governance, tailored to the characteristics of the transaction.

#### **Sammanfattning**

Syftet med detta doktorandprojekt är att öka kunskapen om hur effektiv styrning av byggprojekt kan uppnås genom lämpliga upphandlingsmetoder. I doktorandprojektet har litteraturundersökningar, en förstudie, en longitudinell fallstudie och en enkätstudie genomförts för att undersöka fem forskningsfrågor och därmed uppnå syftet med forskningen. Den huvudsakliga teoretiska referensramen består av transaktionskostnadsekonomi, på vilken den utvecklade konceptuella upphandlingsmodellen är baserad. Andra teorier och litteraturområden som undersökts är: spelteori, innovation, partnering, industriellt inköpsbeteende samt principal-agent teori. Dessa teorier och litteraturområden har en sak gemensamt: de är alla väl lämpade för att undersöka olika aspekter av affärsrelationer mellan köpare och säljare.

Forskningen som presenteras i denna avhandling har resulterat i fyra huvudsakliga bidrag till teori och praktik. 1) Upphandlingsmodellen tillför kunskap till transaktionskostnadsekonomin genom ett brett pocessperspektiv som gör det möjligt att beskriva hur teoretiskt föreskrivna styrningsformer kan uppnås genom lämpliga upphandlingsmetoder. Modellen ger även ett praktiskt bidrag eftersom den kan användas som en guide för hur upphandlingsmetoder bör skräddarsys till olika transaktionskaraktäristika. På så vis ökar modellen kunskapen om hur olika typer av byggprojekt bör upphandlas för att främja effektiv projektstyrning. 2) Enkätstudien visar att svenska beställares nuvarande upphandlingsmetoder fortfarande är av traditionell typ som främjar projektstyrning med fokus på pris och auktoritet, vilket enligt upphandlingsmodellen är olämpligt för byggprojekt. Detta resultat kan förhoppningsvis fungera som en väckarklocka för beställare att deras upphandlingsmetoder har blivit föråldrade på grund av ökad komplexitet och osäkerhet i nutida byggprojekt. 3) Fallstudien och den strukturella ekvationsmodellen visar att samverkansinriktade upphandlingsmetoder främjar skapandet av förtroende och samarbete och därmed effektiv styrning av stora, komplexa och kundanpassade byggprojekt med stor osäkerhet. Sådana samverkansinriktade upphandlingsmetoder är därmed mer lämpliga och anpassade till dagens projekt än de vanligaste upphandlingsmetoderna. 4) En bieffekt av denna forskning är ett förslag på hur partneringbegreppet bör uppfattas och definieras. Enligt modellen uppnås olika projektstyrningsformer genom olika upphandlingsmetoder. Partnering bör därmed ses som en samverkansinriktad projektstyrningsform som uppnås genom användandet av samverkansinriktade upphandlingsmetoder. Definitionens transaktionskostnadsekonomiska perspektiv säkerställer att partnering inte används för sin egen skull, utan enbart i syfte att uppnå en effektiv projektstyrning som är skräddarsydd till transaktionskaraktäristika.

#### **Appended papers**

This is a non-monographic thesis consisting of two main parts: an introductory text, including five chapters, and the following six appended papers:

#### Paper 1

Eriksson, P. E. (2007). Cooperation and partnering in facilities construction – empirical application of prisoner's dilemma, *Facilities*, 25(1): 7-19.

#### Paper 2

Eriksson, P. E. (2006). Procurement and Governance Management - Development of a Conceptual Procurement Model Based on Different Types of Control, *Management Revue*, 17(1): 30-49.

#### Paper 3

Eriksson, P. E. and Laan, A. (2007). Procurement effects on trust and control in client-contractor relationships. Forthcoming in *Engineering, Construction and Architectural Management*, 14(4).

#### Paper 4

Eriksson, P. E. and Nilsson, T. (2007). Procurement and governance of complex construction projects. Submitted to *Journal of Management in Engineering*.

#### Paper 5

Eriksson, P. E. and Pesämaa, O. (2007). Modelling procurement effects on cooperation. Accepted for publication in *Construction Management and Economics*.

#### Paper 6

Eriksson, P. E., Dickinson, M. and Khalfan, M. (2007). The influence of partnering and procurement on subcontractor involvement and innovation, *Facilities*, 25(5/6): 203-214.

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#### 1 Introduction

The research presented in this thesis involves investigations of specific aspects, focusing on procurement and cooperative relationships, within the broader field of construction management. The overall purpose of this research is to increase the understanding of how efficient governance of construction projects can be achieved through appropriate procurement procedures. In this first chapter I introduce and motivate the choice of topic and research purpose. Additionally, the structure of the thesis is described.

#### 1.1 Background

The construction industry is one of the backbones of the economy in many countries (Ngai *et al.* 2002), often accounting for between 7% and 10% of the Gross Domestic Product (Winch 1996, Voordijk *et al.* 2000). Furthermore, construction products have a large impact on safety, health, and environmental aspects (Bayliss *et al.* 2004). For these reasons all human beings in modern societies are directly affected by the processes and/or the products of the construction industry. The importance of a healthy construction industry is therefore beyond doubt (Ngai *et al.* 2002). The term "construction" covers the erection, maintenance and repair of immobile structures, the demolition of existing structures, and land development (Eccles 1981). In this thesis the construction industry is taken in its broadest sense to include all built structure and the professional services necessary to execute such work. It would include house-building, building and civil engineering, power, process and heavy engineering, and the built environment professions including architecture, surveying, building and engineering (Eaton 2000).

In this thesis four different types of construction industry actors (organisations) are discussed: clients, main contractors, consultants and subcontractors/suppliers. In Figure 1 these actors' project network relationships are illustrated.

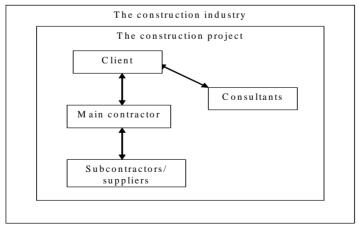


Figure 1. Different construction actors.

The customers that procure (buy) construction work are mostly referred to as clients. They can be divided into "one-off" clients that procure construction work very seldom, or professional clients that procure construction work on a regular basis, such as the Swedish road administration, municipalities, property companies, etc. The research presented in this thesis is focused on professional clients. Most clients often need assistance to design the construction product and the processes to achieve it. Different types of consultants, such as architects, constructors and different types of engineers, are thus procured to deliver their services concerning the specification of the product. The actor that is mostly in charge of the assembly work on the construction site is called the main contractor, which often performs much of the basic construction work, for example the activities regarding the erection of the building. Specialty work, such as plumbing, heating and cooling, painting, electrical work, plastering, roofing, and flooring, is however often procured by main contractors from subcontractors (Eccles 1981). As much as 60-80% of the gross work done in the construction industry involves the buying-in of material and services from suppliers and subcontractors, for which reason they have a heavy impact on most kinds of construction products (Dubois and Gadde 2000, Miller et al. 2002).

According to Nam and Tatum (1988), all kinds of construction products have five characteristics in common: immobility, complexity, durability, costliness, and a high level of social responsibility, affecting the industry and its actors in various ways. The finished product of construction is generally immobile. Hence, construction is mainly a project-based site operation, taking place at the point of consumption, making standardisation more difficult. Customisation is therefore high in construction. The tremendous variety in site conditions. materials, equipment, and finished structures dictates variations in composition, causing complexity and uncertainty (Nam and Tatum 1988). A complex production process has a large number of complicated individual parts brought together in an intricate operational network to form a work flow to be completed within a stipulated production time, cost, and quality and to achieve a required function without necessary conflict between the numerous parties involved in the process (Gidado 1996). In the construction process each party is traditionally responsible only for its specific input and has its own domain of expertise. These professional and organisational boundaries are seldom crossed (Voordijk et al. 2000). Dubois and Gadde (2000) argue that due to the high specialisation in different sub-trades, there are a huge number of actors involved in the on-site assembly. Since their activities are linked to each other and substantial adjustments have to be undertaken on site, the interaction between actors tends to be quite intense. This interaction, together with the severe time restrictions that most projects experience, creates strong interdependencies among different actors (Dubois and Gadde 2000), for which reason the coordination of specialised tasks at the site is a complex managerial task (Eccles 1981, Shirazi et al. 1996). In general, construction projects are therefore complex undertakings, involving many complex processes conducted by a large number of actors (Dubois and Gadde 2002, Rahman and Kumaraswamy 2002,

Olsen et al. 2005). However, it is important to point out that a project can consist of several transactions with different characteristics (e.g. different complexity). Often, the main transaction is the one between the client and the main contractor, which then constitutes the bulk of the project activities and therefore most of its value. Additionally, construction products have to resist the forces of nature over an extended period of time. Hence, the durability is mostly very long, almost indefinite. The complexity and durability lead to another characteristic; costliness (Gidado 1996). Due to the high costs of the products, construction design is mostly very conservative; trial and error approaches are not feasible. The general tendency is to use well-proven methods and materials (Nam and Tatum 1988). The fifth characteristic is a high degree of social responsibility to the public, since construction products have a large impact on safety, health, and environmental aspects. This too leads to conservatism regarding design, production methods, and materials (Bayliss et al. 2004). These characteristics have major effects on the industry and its actors, making it distinctly different in many aspects compared to process-oriented manufacturing and service industries. Below, problematic aspects that are characteristic in construction are discussed.

#### 1.2 Problem area

#### 1.2.1 Problems in the construction industry

Construction is a project-based industry, in which time and scope are seen in a narrow perspective (Dubois and Gadde 2002). Thus, relationships focus on the short-term, with actors attempting to lever what they can out of the existing contract, leading to opportunism (Cox and Thompson 1997). In many countries the construction industry has, over a long period, attracted criticism for its relationships, with conflicts and disputes, lack of trust and cooperation, poor customer focus and end-user involvement cited as significant amongst its shortcomings (Latham 1994, Egan 1998, Ericsson 2002, Ng et al. 2002, Chan et al. 2003). The same authors think that these input factors cause inefficiencies in outcomes, such as incapacity for innovation and improvement, time and cost overruns, and low productivity, quality and customer satisfaction. The traditionally used procurement procedures guarantee that the actor constellations change all the time (Dubois and Gadde 2000). This constant replacement of actors in construction projects creates particular cost inefficiencies for the client, since a new learning curve must be climbed by the supplier each time (Cox and Thompson 1997). Hence, the argument that each project is customised and unique is underpinned by the procurement procedures, making each project more unique than necessary (Dubois and Gadde 2000). Practitioners, researchers and society at large have, therefore, called for a change in attitudes, behaviours and procedures in order to increase the chances of project success and an improved end product (Love et al. 2000, Dubois and Gadde 2002). Generally, greater cooperation between project actors (i.e. cooperative relationships) is argued to be a suitable antidote for many of the industry's problems. In order to enhance a change towards increased cooperation, it seems suitable to first reflect upon the question: What are the main reasons for the lack of cooperation in construction projects and why are they critical?

#### 1.2.2 Construction procurement procedures

Traditional procurement procedures involve fixed price competitive tendering, in which the client first specifies the product as thoroughly as possible (i.e. fixed design) and then evaluates a large number of bids, focusing on lowest fixed bid price (Korczynski 1996, Kadefors 2005). In traditional procurement routes the division of work often leads to detached business relationships, since the construction process is managed by work being divided into distinct packages that are allocated to different specialist actors to be completed individually (Barlow 2000). The traditional method of dividing work in construction can lead to what has been termed 'functional fragmentation' among different construction disciplines. In the above presented Figure 1, this is illustrated by hierarchical relationships (arrows) between only two actors at a time, as opposed to network relationships in which all actors communicate and share knowledge with each other.

For simple products involving low uncertainty, such market based procurement procedures are suitable for decreasing costs and passing on risk (Korczynski 1996). However, the construction industry has changed from a simple and static environment to a complex and dynamic one (Gidado 1996), making traditional procurement procedures obsolete and inappropriate (Naoum 2003). Due to increased complexity and uncertainty, a high focus on cooperation is more important than competition (Korczynski 1996, Lado et al. 1997, Olsen et al. 2005). These transaction characteristics require relation-specific investments, knowledge sharing, flexibility and integration, which are facilitated in long-term cooperative relationships (Pietroforte 1997, Rahman and Kumaraswamy 2002). Since traditional procurement procedures and contracts offer little incentive for cooperation to emerge, they are potential root causes of the lack of trust and cooperation that characterises client-contractor relationships (Cheung et al. 2003). Hence, procurement is a key improvement area (Latham 1994, Egan 1998) and a key factor contributing to project success (Love et al. 1998, Cheung et al. 2001). Since different transactions may differ heavily in their characteristics, it would be relevant to investigate the question: How should different types of construction transactions be procured?

In recent years increasing interest in cooperative relationships, such as partnering, has been noticeable in the construction industry as a result of escalating conflicts and adversarial relationships in many countries (Bresnen and Marshall 2000, Ng *et al.* 2002, Chan *et al.* 2003). Swedish procurement procedures and contractual arrangements have much in common with those in other countries (e.g. UK and US), but disputes are seldom resolved in courts or by third parties (Kadefors 2004). Instead the parties handle most conflicts themselves at a low organisational level. Hence, the relationships among the construction actors have not been as adversarial in Sweden as in many other countries (Kadefors 2004). A major origin of the international trend towards greater use of partnering is therefore not found in Sweden. With this in mind, it would

be interesting to investigate if the international trend towards greater use of cooperative procurement procedures (i.e. procurement procedures that facilitate cooperation) is noticeable also in Sweden, although the number of disputes is traditionally low. A relevant question to investigate is therefore: What procurement procedures are currently used by Swedish construction clients?

#### 1.2.3 Partnering

Partnering is the most frequently discussed institutional form of cooperative relationships in construction (Wood et al. 2002). There is however no widely accepted definition of the concept of partnering (Nyström 2005). One classical definition is: "Partnering is a set of strategic actions that deliver vast improvements in construction performance. It is driven by a clear understanding of mutual objective and cooperative decision-making by a number of firms who are all focused on using feedback to continuously improve their joint performance" (Bennett and Jayes 1998). It is important to distinguish between general prerequisites, components and goals of partnering, which existent definitions fail to do (Nyström 2005). Especially, it is important that a positive outcome is not taken for granted already in the definition (Bresnen and Marshall 2000), such as in the one presented above. If a positive outcome is an integral part of the definition, partnering failures are not possible. The result of such reasoning will be that partnering is always successful (i.e. if it is not successful, it is not partnering) and hence also always a suitable way to govern construction projects. Such definitions are obviously not helpful, for which reason they are not used in this thesis. Since there is no universally suitable definition available, this thesis adopts the approach suggested by Bresnen & Marshall (2000), that for ease of presentation, partnering can be used to refer to cooperative arrangements in general.

There are two main types of partnering: Project partnering, which refers to a cooperative arrangement in a single project, and strategic partnering, which is a long-term alliance arrangement. Project partnering, which was pioneered in the US construction industry during the mid-1980s (Humphreys et al. 2003), focuses on project performance and looks for short-term benefits (Cheng and Li 2002). Strategic partnering, on the contrary, emphasises the establishment of long-term relationships and the achievement of strategic goals (Cheng and Li 2002). It can be performed within long-term framework agreements, providing the contractor with a planned steady workload, and including performance indicators and continuous improvement targets concerning, for example, reductions of costs, time schedules and accident rates (Bresnen and Marshall 2002). Strategic partnering therefore seems ideally suited to long-term professional client projects such as car manufacturing plants and airport terminals, in which incremental improvements can be achieved over a series of similar projects (Packham et al. 2003). In this thesis the term partnering refers to cooperative arrangements in general, if it is not specified as project or strategic partnering.

Both types of partnering arrangements can bring about advantages regarding quality, sustainability, dispute resolution, human resource management, innovation, and time and cost reductions (Barlow *et al.* 1997, Egan 1998, Chan

et al. 2003), but the longer the perspective, the larger the potential benefits (Barlow et al. 1997). There are however also potential disadvantages with increased cooperation in partnering arrangements. An exaggerated focus on cooperation in long-term relationships may foster cosiness and stagnation at the same time as preventing the actors from initiating relationships with other potentially more innovative partners. Some degree of competition is therefore important for the efficiency of the relationship (Bengtsson and Kock 1999). Even though the neoclassical focus on competition can be unsuitable (Teece 1992), there is also a danger that cooperation becomes the objective rather than a suitable medium for achieving the over-riding goal: improved business performance (Cox and Thompson 1997) through efficient governance. Nevertheless, much research has found many partnering arrangements beneficial in improving project performance.

Implementing partnering is not an easy and straightforward task (Saad et al. 2002, Chan et al. 2003). It implies a 'paradigm shift' (Larson 1995) and a fundamental change of behaviour and attitudes for all actors involved (Kululanga et al. 1999, Rhodin 2002). It should therefore be done in an appropriate way and for suitable reasons in suitable projects (Bresnen and Marshall 2000, Ng et al. 2002). In their empirical studies of the implementation of partnering in construction supply chains, Akintove et al. (2000) and Saad et al. (2002) found that cooperation was conceived to be important and beneficial. However, they also found that a lack of understanding of the concept and its prerequisites hindered successful implementation. Procurement determines responsibilities and authorities in the construction process (Love et al. 1998) and affects the degree of cooperation and integration among the participants (Briscoe et al. 2004). To facilitate partnering, many elements of the traditional procurement procedures thus need to be changed. A relevant question to investigate is therefore: How should partnering projects be procured in order to enhance trust and cooperation?

#### 1.2.4 Procurement of subcontractors

In the partnering literature most of the attention has been directed towards studying the relationships between clients and main contractors, while the importance of subcontractors has largely been overlooked (Bresnen and Marshall 2000, Dainty *et al.* 2001), in spite of their large share of the construction work. In cases where subcontractors are not involved in the partnering team, the increased cooperation between client and main contractor seldom spreads to subcontractor level (Bresnen and Marshall 2000, Packham *et al.* 2003). In recent years there has been slowly increasing recognition that suppliers and subcontractors should be involved in the design and planning of the construction product and processes (Bresnen and Marshall 2000). Many authors argue for such a *broad partnering* approach. All key actors on whose activities overall project performance ultimately depends should be included in the partnering team and incentive schemes (Bresnen and Marshall 2000, Ng *et al.* 2002, Chan *et al.* 2003, Packham *et al.* 2003). Then the skills of these actors can be assessed and utilised to facilitate incremental improvements and innovation

(Egan 1998), securing project success and customer satisfaction through mutual cooperation (Miller *et al.* 2002). Clients' procurement procedures, including client recommendation and nomination of subcontractors to main contractors, heavily affect subcontractor integration (Dainty *et al.* 2001, Briscoe *et al.* 2004, Khalfan and Mcdermott 2006). To achieve a change towards more cooperative relationships among the construction actors, the clients' procurement behaviour is therefore critical (Pietroforte 1997). Hence, it seems pertinent to investigate the question: How should clients' procurement procedures be performed in order to increase subcontractor involvement in value creation and innovation?

#### 1.2.5 Procurement model

Cox (1996) argues that the state of academic discourse (in 1996) in construction procurement is best characterised as pre-scientific. It is not based on a theoretical understanding of the firm but rather on "barefoot empiricism". Tools and techniques empirically proved successful in one environment are by chance tested in other environments to study their generality, without any theoretical support. Only through theoretical clarification is it possible to both develop operationally practical concepts, tools and techniques, and to assess under what circumstances and conditions they are "fit for purpose" (Cox 1996). Traditionally, construction procurement decisions are often judgmental and subject to biases of the decision-maker (Cheung et al. 2001) and therefore heavily affected by the individual procurement managers' experience of a particular procurement procedure (Briscoe et al. 2004, Laedre et al. 2006). Hence, decision-makers often continue to use the same procedures irrespective of the transaction characteristics (Laedre et al. 2006). It is, however, important that procurement decisions are based on a logic, systematic, and disciplined analysis, tailoring the procurement procedures to the transaction at hand (Love et al. 1998). Such decisions would be enhanced by the guidance of a conceptual procurement model. Developing such a model for procurement selection is therefore of strategic importance (Cheung et al. 2001). With this in mind, it still seems relevant to develop a conceptual model (called for by Cox more than ten years ago) that can increase the understanding of construction procurement in general, and partnering implementation through cooperative procurement procedures in particular.

Transaction cost economics (TCE) is a powerful framework for guiding procurement decisions (Heide and John 1990) and a suitable complement in the literature regarding buyer-supplier relationships and industrial buying behaviour (Cox 1996, Sheth 1996, Buvik and Haugland 2005). According to TCE, competitive advantage results from efficient governance of transactions, which is obtained by minimising transaction costs (Williamson 1985). TCE has also received a lot of interest in construction management research (Kadefors 2004), when investigating procurement and inter-organisational relationships (Pietroforte 1997, Voordijk *et al.* 2000, Rahman and Kumaraswamy 2002). Hence, it would be relevant to develop a TCE-based procurement model with which to compare and analyse current procurement procedures and partnering procurement procedures.

#### 1.3 Purpose and research questions

The purpose of this research is to increase the understanding of how efficient governance of construction projects can be achieved through appropriate procurement procedures. In order to give more specific guidance of what to investigate, five research questions (RQ1-5), resulting from the problem discussion, have been formulated:

RQ1: What are the main reasons for the lack of cooperation among the parties in construction projects and why are they critical?

RQ2: How should different types of construction transactions be procured in order to facilitate efficient governance?

RQ3: What procurement procedures are currently used by Swedish construction clients, and how do they fit the theoretical prescriptions of the developed procurement model?

RQ4: How should partnering projects be procured in order to enhance trust and cooperation?

RQ5: How should clients' procurement procedures be performed in order to increase subcontractor involvement, value creation and innovation?

These research questions have been focused on in different parts of the project through different methods and dealt with in different papers in this thesis, see next section.

#### 1.4 Structure of the thesis

This is a non-monographic thesis consisting of six papers. Hence, its structure and content are somewhat less homogenous and consistent than a monographic thesis. It consists of two main parts: an introductory text (including five chapters) and the six appended papers. The introductory text presents the research area and purpose of the research project, the research methods used, the theoretical frameworks, summaries of the papers, and the conclusions of the research. This gives the reader an overall view of the conducted research. In the six papers specific aspects of the research (focusing on different research questions) are presented in more detail. A reader who would like to get a quick overall view can therefore read the introductory text, while a reader who wants to understand the research in more detail should focus on specific papers. Since the papers constitute the core presentation of the research, I strongly encourage you to read them! In Table 1, an overview of the papers is presented.

Table 1. Paper overview

Paper	RQ	Title	Theory (literature field)	Method	Publication
1	1	Cooperation and partnering in facilities construction – empirical application of prisoner's dilemma	Game theory	Pre-study experiment	2007, Facilities, 25(1)
2	2	Procurement and Governance Management - Development of a Conceptual Procurement Model Based on Different Types of Control	Transaction cost economics (TCE) Industrial buying behaviour (IBB) Principal-agent theory	Conceptual	2006, Management Revue, 17(1)
3	3	Procurement effects on trust and control in client-contractor relationships	TCE + IBB + Principal agent theory	Survey	Forthcoming 2007, in Engineering, Construction and Architectural Management, 14(4)
4	2,4	Procurement and governance of complex construction projects	TCE + IBB + Principal agent theory	Case study	Submitted to Journal of Management in Engineering
5	4	Modelling procurement effects on cooperation	Procurement related literature	Survey	Accepted for publication in Construction Management and Economics
6	4,5	The influence of partnering and procurement on subcontractor involvement and innovation	Innovation + Procurement	Case study	2007, Facilities, 25(5/6)

The first research question is addressed in Paper 1, which adopts a game theoretic perspective when analysing empirical pre-study data concerning clientcontractor relationships. A game simulation is conducted to investigate what factors are hindering cooperation in construction projects and why these factors are critical. RQ2 is investigated through the development of a conceptual TCEbased procurement model in Paper 2, prescribing different procurement procedures for different types of transactions. The model is also utilised as a framework when analysing empirical case study data in Paper 4. RO3 is investigated in Paper 3 through a survey study of Swedish construction clients' currently used procurement procedures, which are then compared to the prescriptions of the conceptual model. RQ4 is addressed in Paper 4, utilising case study data describing partnering procurement, in Paper 5, which involves structural equation modelling based on survey data, and in Paper 6, describing the importance of subcontractor involvement in partnering. Paper 6 also investigates RQ5 by utilising the case study data to discuss subcontractor involvement and innovation in a partnering project.

#### 2 Research methods

In this PhD project both theoretical and empirical work has played important roles. I have conducted literature reviews, a pre-study, a longitudinal case study and a survey study to investigate the five research questions. In this chapter the chosen strategies and methods are described in order to give the reader information about how the research presented in this thesis was conducted. Problems arisen during the process are also discussed.

#### 2.1 Literature search

An initial focus on theory development prior to data collection is crucial in both case studies (Miles and Huberman 1994, Yin 2003) and surveys (Hair et al. 1998). The main theoretical field in this thesis is transaction cost economics (TCE), presented in chapter 3.2 and Papers 2, 3 and 4. Other literature fields that have been reviewed are: game theory (chapter 3.1 and Paper 1), innovation (chapter 3.4 and Paper 6), partnering (chapter 1 and Papers 4, 5 and 6), and industrial buying behaviour (IBB) and principal-agent theory (chapter 3.3 and Papers 2, 3 and 4). All these different theories and fields of literature have one thing in common: they are all well suited to analysing different aspects of buyer-supplier relationships (discussed in chapter 3). The literature was reviewed in order to first obtain a broad understanding of buyer-supplier relationships in general and partnering in particular, and later on I delved deeper into specific details of these central topics in order to make model development and hypotheses formulation possible. Most of the literature consists of scientific journal articles, which were found through searches within the databases Ebsco, JSTOR, Emerald and Scirus. Some literature involves books and theses found as key references in the articles read. Examples of key terms in these search efforts are: buyer-supplier relationships, control, cooperation, governance, partnering, procurement, and trust.

#### 2.2 Research strategies and data collection

The empirical data presented in this thesis was collected through three different approaches: a small-scale pre-study, a longitudinal case study and a survey study. The reason for using different strategies and data collection methods was mainly to increase the quality of the research and facilitate more interesting results. This is because different types of research questions require different types of strategies and methods (Yin 2003).

#### 2.2.1 Pre-study

In the very beginning of my PhD studies I conducted a small pre-study consisting of personal interviews. The purpose of the pre-study was to identify and describe potential barriers to partnering and to obtain empirical data regarding game theoretic variables (see Paper 1) in order to investigate RQ1 through a game theoretic simulation (experiment). Since Yin (2003) states that experiments are suitable for investigating *why* questions, this strategy seems appropriate. The pre-study consisted of seven individual interviews, each lasting ap-

proximately 90 minutes. These interviews were formal and unstructured, involving systematic stimuli (i.e. all respondents were exposed to the same set of questions) that allowed unsystematic (open-ended) responses (Galtung 1967). All respondents were working on either the supply side (4 contractors) or the demand side (3 clients) of the Swedish construction industry and had experience and knowledge of partnering concepts. The selection of the respondents was made to receive representative and valid data. The methods and the results of the pre-study and the game theoretic simulation are more thoroughly presented in Paper 1.

#### 2.2.2 Case study

Since case studies are a suitable research strategy when investigating *how* questions (Yin 2003), this strategy was adopted for studying RQ 2, 4 and 5 in this thesis.

#### Pilot case study

Before the main case study is planned and performed, a pilot case study should be conducted in order to help the investigator to test and refine data collection plans (Yin 2003). In this research project a pilot case study was conducted, in which I learned things that made me do a better job in the main case study. The pilot case study, which concerned the procurement and construction of industrial facilities, was selected due to convenience and access, which are common and suitable selection criteria (Yin 2003). The data collection included interviews, document studies, surveys and observation at workshops. Although I did not have the main responsibility for the surveys and workshops, I could nevertheless learn a lot from participating in the collection and analyses of this data. The knowledge obtained in the pilot study became very useful in the main case study, which dealt with a much larger project in which I had more responsibility. An example of this is that the knowledge obtained about the design of case study surveys and workshops in the pilot case resulted in significant development of these data collection techniques in the main case study. Since my effort and participation were much larger and deeper in the main case study, no data from the pilot is presented in this thesis. From a direct result perspective the pilot has no significance for this thesis, since no data is presented, but from an indirect learning perspective it has affected me as a researcher in the main case, hopefully for the better. Nevertheless, the pilot case is not mentioned in the remaining part of this thesis.

#### The selection of main case study project

The main case study deals with the client AstraZeneca's procurement and the subsequent construction of plant facilities for manufacturing of pharmaceutical products in Sweden. The project nature of the case resulted in clear boundaries in both time and space (Miles and Huberman 1994), i.e. a time-space chunk (Galtung 1967). This was a large construction project, with a value of more than 15 M€ and according to the participants, very complex. The major reason for choosing this case project for empirical illustrations was that it is suitable as

a critical case (Yin 2003) to compare with the conceptual model, developed in Paper 2. Williamson (1985) categorises construction of plant facilities as a typical occasional transaction requiring high asset specificity, which resembles very well a type 5 transaction in the conceptual model (Paper 2). Since the case study project concerned construction of plant facilities, it is suitable as a critical case, which meets the specific conditions associated with the conceptual model (Yin 2003). The case study project followed a partnering arrangement, for which reason it was also suitable for investigating how to procure partnering projects (RQ4), discussed in Paper 4. Following the argument made by Eccles (1981) that subcontracting practices increase with project size and complexity, this case also qualifies as an interesting example to investigate from a subcontractor perspective (RQ5), studied in Paper 6.

#### Case data collection

A mixed methods approach was chosen to collect the case study data. A series of three subsequent surveys to all participants in the partnering team was conducted throughout the project period. The third survey (see Appendices C and D) was conducted when the project had been finished, investigating the perceived project results. The team size varied somewhat during this time for which reason also the number of respondents varied between 23-29 people in the surveys. These surveys were combined with observation and participation in a large number of meetings and workshops (approximately 50 hours), forming the basis of the data collection. The workshops were half-day events during which problematic issues regarding the management of the project in general and the collaborative approach in particular were followed up and discussed. Before each workshop the participants responded to a survey in order to follow up the work towards the joint objectives of the project and detect problematic issues so that these could be discussed and dealt with during the project period. The design of the survey was mostly affected by the joint objectives established by the participants in the partnering team. The survey results served as a basis for workshop discussions about how to improve the collaborative process in the project. Such surveys measuring the 'temperature' of cooperative relationships followed by review workshops are common and important elements in partnering projects (Cheung et al. 2003, Cheung et al. 2003, Bayliss et al. 2004).

Furthermore, document studies and three interviews with the client's project manager, each lasting approximately one hour, were conducted in order to get a more specific insight into the client's procurement procedures, especially about how bid invitation and evaluation were performed. The main reason for the mixed methods was to collect data that facilitated project management. An example of this is that the survey identified aspects of the partnering arrangement that the respondents considered problematic and unsatisfactory. In the following workshop the participants discussed (in groups) the origins of these problems and how to best deal with them in the project. This collection of both qualitative and quantitative data is beneficial also for the purpose of triangulation (Miles and Huberman 1994).

#### **Action research**

If the research task is coupled with the task of collaborating with the case study participants in order to assist them in solving practical problems, this approach is called action research (Holme and Solvang 1997). Hence, action research, which is the most demanding and far-reaching method of doing case study research, has two goals: to solve a problem for a client and to contribute to science (Gummesson 1991). The case data collection in this thesis followed an action research approach in which I served as an advisor and facilitator to the partnering team in some specific aspects. I was responsible for the planning and execution of workshops, and the design and analysis of the surveys. In this way the action research involved some parts of the work tasks of an external facilitator, which is an important actor in partnering arrangements (Bresnen and Marshall 2002, Cheng and Li 2002). However, it is important to point out that my work was not a broad kind of action research, assisting the project manager in general. On the contrary, my role was limited both in time and scope to the above-mentioned aspects of the partnering process, thereby decreasing my involvement in and influence on project outcomes.

Earlier research has found that the construction actors are rather poor in assimilating research results. In order to increase the industry's access and absorption of research results, it is therefore important that firms and university researchers collaborate closely (Gann 2001). Empirical evidence from in-depth case studies regarding the relative effectiveness of various partnering approaches and the tools utilised during implementation would therefore seem relevant (Bayliss *et al.* 2004). Action research approaches enhance the transfer of knowledge between practitioners and academics (Gummesson 1991), since these actors collaborate closely when working together to study and solve practical problems (Miles and Huberman 1994, Holme and Solvang 1997). With this in mind, action research seems to be a suitable means to enhance research impact on specific partnering procurement practices in the case study project.

#### 2.2.3 Survey study

In 2005 I conducted a survey study together with a colleague at the department of Civil and Environmental Engineering. The survey (see Appendices A and B) concerns different aspects of the organisations' project management and procurement procedures in order to collect data that would be relevant to both our research projects. In particular, the survey aims at answering RQ3. Since Yin (2003) states that surveys are especially suitable for investigating research questions of the types *who*, *what* and *where*, this strategy seems appropriate. Through structural equation modelling, survey data was also utilised when investigating RQ4. The survey was conducted rather late in the research project and was therefore based on the results obtained by the three earlier utilised methods; literature review, pre-study and case study, improving the design of the survey (Hair *et al.* 1998). The survey data presented in this thesis concerns only the questions regarding the clients' procurement procedures (questions 11-18). The design of this part of the survey was based on the developed conceptual procurement model, in order to enhance comparison between empirical

findings and theoretical prescriptions. However, when the survey was sent out the conceptual model had not yet been finalised in its published version. In fact, the stage regarding sub-supplier selection was not yet included in the model, for which reason empirical data regarding this stage was not collected through the survey.

#### Sample

The survey sample consists of the 104 members of an association called "The Swedish Construction Client Forum" (ByggherreForum), which has the objective of promoting the interests of construction clients in Sweden. The members are regional, national or international industrial and property companies, municipalities and regional authorities, and also government services and agencies, which procure construction work regarding civil engineering, housing, industrial facilities, etc. Hence, the forum represents the majority of professional construction clients in Sweden.

Registered contact persons in all of the member organisations were first approached by e-mail or telephone in order to ask them if they or other more suitable persons were willing to participate in the study, on behalf of their organisation. Hence, it was up to the contact person to choose the most suitable respondent, given that the survey involved procurement and project management processes. Only four people declined to participate at this stage, due to lack of time, so a paper version of the survey was then sent out by mail to the 100 people that had agreed to participate. These people were mostly procurement managers, project managers or directors of the construction and facilities department in their organisations. After two reminders, a total of 87 responses were received, representing a response rate of 84 percent of the total sample size. A test for non-response bias was conducted by comparing major variables for early and late respondents. This is because several non-responses were explained by the intended respondents' lack of time. No significant differences were found between these two groups in this test. This result together with the very high response rate suggests that the survey results do not suffer from any severe non-response biases.

#### Measures

The empirical data presented in this thesis concerns clients' currently used procurement procedures. The respondents were asked to give information about how often they used different procurement procedures, measured by 7-point Likert scales (e.g. question 15: To what extent do you use standardised contract provisions (AB, ABT, etc.) when designing a contract concerning a main contractor? 1= very seldom and 7 = very often). The exception to this is question 14 regarding bid evaluation parameters, in which the importance of the parameters was estimated (How important are the below evaluation parameters when choosing a main contractor? 1 = unimportant and 7 = very important) in order to better assess their relative impact on bid evaluation results.

#### 2.3 Data analysis

The empirical data was analysed using several different methods, described below. There are large differences between how to analyse qualitative data from interviews and workshops and quantitative data from surveys, as described in the following sections.

#### 2.3.1 Analysis of qualitative data

There are three main uses for case study research: motivation, inspiration, and illustration (Siggelkow 2007). In this thesis the case study has mainly been used to illustrate the practical use of the conceptual model (Paper 4), but it is also used for motivation reasons, giving empirical support for the conceptual prescriptions, which are fundamentally different from the survey findings. This is discussed in the concluding section of this thesis.

The approach taken in this research project is a general analytic strategy, which Yin (2003) calls relying on theoretical propositions. Then the theoretical orientation, based on research questions, literature reviews and other insights, have shaped the case study design and the data collection plan, thereby guiding the case study analysis (Yin 2003). The qualitative data obtained through interviews and most of all workshop discussions was written down in the form of notes and minutes. This empirical data can be said to form an empirical data pattern, which described how the procurement procedures were performed in the case study project. This pattern was then compared to the theoretical predictions of frameworks and conceptual model, in order to investigate differences and similarities between the qualitative data and theory. Yin (2003) calls this particular analysis method pattern-matching analysis. Hence, I utilised the earlier developed frames of reference regarding procurement and innovation (Paper 6) and the conceptual model (paper 4) when structuring and analysing the qualitative data. These pattern-matching analyses are described in Papers 4 and 6.

#### 2.3.2 Analysis of quantitative data

The survey data was first computed into the Statistical Package of Social Science (SPSS). Several different multivariate data analysis techniques were used in Papers 3 and 5. Principal Component Factor Analyses (PCFA) were conducted in order to group items into a smaller number of factors/constructs. SPSS was then used to perform the rotation method Varimax with Kaiser Normalisation. To investigate the internal reliability of the formed constructs, Cronbach Alpha values were also measured. In Paper 5, written together with my colleague Ossi Pesämaa, we conducted structural equation modelling (SEM), using an additional SPSS package called AMOS (Analysis of MOment Structures). SEM is a multivariate technique used to estimate a series of interrelated dependent relationships simultaneously (Hair *et al.* 1998). It has been applied in construction management contexts before, for example by Wong and Cheung (2005). They argue that it is appropriate when inter-relationships of different hypotheses are investigated in a holistic manner, such as in the model-

ling of how different trust attributes affect partnering success (Wong and Cheung 2005). Like these authors, we utilised SEM to produce an accurate representation of the overall results, which in our model means an investigation of how different elements of procurement procedures are interconnected and together facilitate the establishment of trust and cooperation in client-contractor relationships. In this study, SEM also provides a factor structure, giving information about how well each latent construct is reflected by the suggested items (Hair *et al.* 1998). These multivariate data analysis techniques are described in more detail in Papers 3 and 5.

#### 2.4 Perceived methodological problems

During a PhD project many problems occur, both because of its large size and scope (many things can happen during a time period of five years) and the lack of experience of the (junior) researcher. During these years I have faced many problems, some of a general nature and some specific to my project. The disadvantage of these problems is that they have to some degree hampered the research results. From a learning perspective, however, these problems have probably increased my knowledge and experience as a researcher. This is because I have had to deal with them proactively or at least reflected on them in retrospect in order to avoid them in future work.

#### 2.4.1 Writing a non-monographic thesis

At this point I think it is appropriate to describe my view of the PhD process. In my opinion, the goal (research results) is not the only objective of this process; the journey itself (the learning process) towards the goal is also of crucial importance. Hence, outstanding research results are less worth if the PhD student has not learned enough on the way. This learning perspective of the PhD process has affected many of my choices during these years; e.g. I chose to write papers in English instead of a monograph in Swedish, in order to increase my learning of how to publish research results. There are both benefits and disadvantages of writing a thesis consisting of different papers instead of writing a monograph. If it is suitable to divide the research project into different parts, then it may also be beneficial to write individual papers about these parts, which also makes it possible to receive useful feedback before the entire project is finished. In this way one can report and "examine" smaller parts of the project continuously. However, since many scientific journals have high standards and slow review processes, this approach also brings many problems. For me, it took about three years of PhD studies before I had gained enough theoretical knowledge and interesting empirical experience to write papers that had the potential of being published in scientific journals. My situation deteriorated partly through my research design, focusing heavily on conceptual work and literature reviews during the first three years, and partly through my choice of journals to which I submitted my first papers. The chance for PhD students to publish conceptual work in high-ranking journals is indeed slim. During the last couple of years I have been focusing more on empirical work and also on improving the quality of my writing. This has resulted in more positive responses from the journals' editors and reviewers. However, the review processes in many journals still take a very long time, for which reason it is important for PhD students to pick suitable journals not only regarding suitable research area and ranking, but also considering the review process of the journal. In my case, these problems resulted in a highly uncertain process in which all publications were achieved during the last one and a half years.

Another problem arising from the non-monographic approach is that it is harder to achieve a focused and related purpose, research questions and overall content of the thesis. To start with, the papers one intends to write deal with different issues. The dissimilarities among the papers then tend to increase significantly during the revision and resubmission processes, since different reviewers have different opinions about how to best present the results. In this way, papers transform during the process so that in most cases they become more scattered and less inter-connected to one another than what was first intended. Collecting these papers into a group and presenting them together with an introductory text in a thesis is therefore a delicate task. One specific aspect of this type of problem is that the buying process stage regarding sub-supplier selection is included in Papers 2 and 4 but not in Paper 3 since this stage was not included in the conceptual model at the time of the survey design.

In spite of these problems, the papers constituting this thesis are not totally scattered. The logical links and order of the papers are described in the beginning of chapter 4.

#### 2.4.2 Trustworthiness and generalisations of research results

An important aspect of the quality of research is its trustworthiness, which depends on how the research is conducted.

#### **Triangulation**

There are four different types of triangulation that can be carried out in order to increase the trustworthiness of a research project (Denzin 1978):

- 1. Data triangulation (the use of a variety of data sources).
- 2. Investigator triangulation (the use of several different researchers).
- 3. Theory triangulation (the use of multiple theoretical perspectives).
- 4. Methodological triangulation (the use of several data collection methods).

In this research project all four of these triangulation types have been used to some extent, facilitating trustworthiness of the results presented in this thesis. Data was collected from many different sources through a pre-study, case study and a survey study, enhancing data triangulation. These three studies had three different sets of respondents, which have heavily influenced my understanding of procurement practices. Investigator triangulation was obtained in those situations when I worked together with other colleagues in collecting and chiefly analysing data and writing papers. Papers 3-6 are co-authored by colleagues who have had an impact on how to analyse and present the data. Transaction

cost economics is the main theory utilised in this thesis, but several other literature fields (e.g. industrial buying behaviour, innovation, and game theory) have also been used in order to get different perspectives on buyer-supplier relationships. This use of multiple theoretical perspectives enhances the quality of theory triangulation. In this way, the partnering and innovation literature receives support from the developed conceptual procurement model, based on transaction cost economics. The fact that data was collected through observation and participation in workshops, interviews and surveys, improved the methodological triangulation. In the case study, the survey results were triangulated by workshop discussions. In those situations in which differences were found, these were taken up for discussion during the workshops. Hence, the methodological triangulation led to deeper insights into several practical phenomena.

#### Reliability and validity of the research

There are also other aspects of this research that affect the trustworthiness. The survey study conducted together with my colleague Anders Wennström was very comprehensive. In some parts the design was good but in other parts the items measuring the latent constructs need further development. The internal reliability of different constructs therefore varies; some have very high internal reliability while others have not, see Papers 3 and 5. To enhance the reliability of the survey it was first piloted by five respondents, resulting in only minor changes. The high response rate enhanced validity of the results. The validity of the answers was further increased by asking the contact person to choose the most suitable respondent, given that the survey involved procurement and project management processes.

During qualitative investigations I did not tape-record interviews and workshop discussions, since I believed that this would hamper the conversations. Instead I took a lot of notes, and in all workshops the groups presented their discussion results both orally and in writing. Furthermore, there was a secretary for each workshop with whom I collaborated in order to write valid minutes. Thus, I believe that the reliability of the results has not been significantly hampered by not tape-recording interviews and discussions. To increase the validity of the qualitative results, minutes of interviews and workshop discussions were sent to respondents, who were then asked to comment on whether they agreed or not with the way I perceived the outcome of the discussions.

The action research approach is negative for the reliability. Since the researcher is much more involved in this type of research, this necessarily affects the outcome of the research to a higher degree than other approaches in which the researcher merely observes but not participates. Hence, the possibilities for other researchers to replicate the study are hampered by the action research approach. This negative aspect of action research is difficult to escape, but the documentations of the research process and its results decrease these negative researcher effects. Holme & Solvang (1997) think that action research involves a conflict between the pure researcher role and the role of assisting consultant, affecting the possibilities to be objective. In this case study this problem is lim-

ited since my role as a facilitator was limited in time and scope. The approximately 50 hours I spent together with the project participants were divided into a large number of meetings and workshops over almost two years of time, discussing specific aspects of the partnering procurement procedures. This approach resulted in fairly deep insights into these specific aspects but did not at all make me feel like a project participant myself, which may have happened if I had spent several months on the construction site. Hence, although the data collection approach was a type of action research, the limited effort decreased the negative effects concerning the validity of the findings that are sometimes associated with action research. However, action research also has positive effects on validity. The access to sensitive empirical data is increased through action research (Gummesson 1991) in which the researcher comes closer to the respondents than in other data collection alternatives. In this way, my participation in meetings and workshops may have resulted in greater trust and openness between myself and the case study participants, making them reveal more sensitive data than they would to a purely neutral researcher who only comes by for a few interviews.

#### Generalisations

The possibilities for generalisations of the results obtained in this study are of varying types and degrees. Due to the choice of sample and the high response rate, the survey results can be argued to include the majority of Swedish professional construction clients. As argued in the introduction, the construction industry adopts similar procedures and faces similar problems in different countries. The differences regarding the "big picture" among countries seem to be rather small, although there are differences regarding specific aspects. Hence, the bulk of the findings in this thesis can probably be transferred also to contexts in other countries. In spite of this, one should be somewhat careful when making generalisations outside the Swedish construction context, especially regarding specific aspects of the findings.

For the qualitative data, statistical generalisations are not appropriate. According to Yin (2003), analytical generalisation, i.e. using previously developed theory as a template with which to compare empirical results, is feasible in qualitative investigations. This research project has focused to a great extent on developing relevant theoretical frameworks and conceptual models with which to compare empirical data, which increases the possibilities for analytical generalisations.

#### 3 Theories utilised in this thesis

In this chapter the utilised theories (game theory, transaction cost economics (TCE), industrial buying behaviour (IBB), principal-agent theory, and innovation literature) and their roles in this thesis are described.

#### 3.1 Game theory

Game theory is the analysis of rational behaviour in situations where decision makers with different goals participate and where interdependence between outcomes is involved. Inter-organisational relationships is a popular research topic, for which game theory is well suited (Camerer 1991, Lado *et al.* 1997). Game theory is based on three assumptions: individualism, rationality and mutual interdependence. Individualism means that players are individual decision makers with personal and often opposite interests (organisations are often viewed as players). Rationality means that players have the ability to act rationally in order to pursue their personal interests. They can calculate the consequences of their actions and choose strategies to maximise profits. Rationality also means that the players are aware of each other's rationality. Mutual interdependence means that a player's pay-off depends on both her/his own strategy and the other player's strategy (Romp 1997).

#### 3.1.1 The Prisoner's dilemma game

The game Prisoner's Dilemma (PD) is especially suitable for modelling cooperative behaviour in buyer-supplier relationships, since it closely resembles the structure of an exchange relationship (Zagare 1984, Hill 1990). According to Lazar (2000), game theory and the PD game are useful tools for analysing client-contractor relationships in construction projects, as they are very similar to such games. PD is a 2-person nonzero-sum game that can be applied to describe the conflict between individual and collective interests in many different political and economic situations, such as inter-organisational relationships (Zagare 1984). Each player can choose to cooperate or to defect, resulting in one of four pay-offs (Figure 2).

		<u>Player B</u>		
		Cooperate	Defect	
Dlarron A	Cooperate	R, R	S, T	
Player A	Defect	T, S	P,P	

Figure 2. Symbolic pay-off matrix of Prisoner's Dilemma (Zagare 1984).

A PD requires T>R>P>S and R+R > T+S. T is temptation to defect, R is reward for mutual cooperation, P is punishment for mutual defection, and S is sucker's pay-off. Due to rational calculations the players can be caught in a "catch 22" situation, i.e. a no-win situation. Each player, in pursuing his own selfish ends, defects from cooperation even though they are both better off to cooperate (Romp 1997).

#### Factors influencing cooperation in Prisoner's dilemma

Below, five factors and their influence on cooperation are described. *The length of the game* is a very important factor, depending on how many rounds the game consists of, i.e. how many times it is repeated. A single PD has a unique Nash equilibrium in the outcome P, P; meaning both players will defect since neither can do any better by choosing another strategy. In a repeated PD with a known final period, the outcome, determined by backward induction, will be the same (P, P) (Luce and Raiffa 1957). Only in an infinitely repeated PD will mutual cooperation (R, R) emerge (Romp 1997), but only if the importance of future pay-offs is high enough (Axelrod 1984).

The size of the pay-offs is crucial for the outcome of a game. In a repeated PD the chance for cooperation can be increased when the difference between T and R decreases, due to lower demands for the discount parameter (see next factor). In a single PD a smaller difference between T and R has no theoretical significance; both players will still choose to defect (Axelrod 1984).

In a repeated PD *the discount parameter* (w) is critical. It describes the weight of the next move relative to the current move. Future moves are less important than the current move since there may be no next move, and individuals prefer receiving pay-off immediately rather than in the future. W can vary between zero and one. A value of zero means that future pay-offs are perceived as worthless, while a value of one means that future pay-offs are worth as much as the current pay-offs.

The players' strategies are also important, since a strategy specifies what course of action a player pursues, given the history of the game. One strategy may be to always defect (opportunistic strategy), another to always cooperate (altruistic strategy). Strategies can also be very sophisticated, as when a player uses the history of the game to model the behaviour of the other player and consequently uses probability theory to select the best long-term choice (Hill 1990). Rational players choose the strategy that leads to the largest pay-offs.

Empirical evidence shows that *the amount of trust between players* has an effect on cooperation in PD (Morgan and Hunt 1994, Lazar 2000). Trust decreases opportunistic behaviour, meaning that strategies become more focused on cooperation than defection. It also leads to less need for costly monitoring (Ben-Porath and Kahneman 2003) and control in long-term relationships, which decreases transaction costs (Hill 1990, Parkhe 1993, Reardon and Hasty 1996). This will increase the profits of future transactions, i.e. w will become greater, thus supporting cooperation in a repeated PD (Parkhe 1993).

#### **Cumulative values**

For a rational player who tries to maximise profits, the choice between cooperation and defection in a single PD depends on the size of the pay-offs. In a repeated PD this choice is dependent on the cumulative values of present and future pay-offs, which in turn are dependent on the size of the pay-offs and w. These two factors are therefore the most important for influencing cooperation in a repeated PD, given the assumption of rational (profit maximising) players.

#### 3.1.2 Criticism towards game theory

Game theory has had a limited impact on practitioners in the field of interorganisational relationships (Camerer 1991, Ståhl 1997). A reason for hesitation in applying game theory is that it often assumes more rationality amongst the players than they are capable of. This criticism is, however, somewhat misdirected since many games, including Prisoner's Dilemma, do not require absolute rationality. The players do not need to know the pay-offs and the rationality of the other player (Camerer 1991).

Other criticisms may be more forceful, such as the game theory being hard to use and test in real life. Research regarding game theory is often purely theoretical and mathematical, (e.g. Jehiel, 2001 and Ben-Porath and Kahneman, 2003). Empirical work is, however, very uncommon (Camerer 1991). In studies where game theory is applied in specific situations, the values of variables are often assumed and set by the researcher rather than collected from real life; see for example Hill (1990) and Reardon and Hasty (1996). Many game theorists argue for a more practical brand of game theory (Camerer 1991). It would clearly be of interest in future research to investigate the implications that specific theoretical applications have in real life contexts (Jehiel 2001). The best advice to practitioners will come from an empirically grounded game theory, telling them how other rational players are likely to behave (Camerer 1991).

#### 3.1.3 The role of game theory in this thesis

The research presented in Paper 1 attempts to achieve a more practical brand of game theory that can be used empirically, in order to increase the usefulness of PD as a tool for understanding decision-making behaviours in buyer-supplier relationships. To make a game theoretic framework more practically useful, pay-offs and the discount parameter need to be operationalised and empirically measured to understand decision-making behaviour regarding cooperation and defection. In this thesis the developed practical game theoretic frame of reference is used to simulate a PD game between a client and a contractor in a construction project in order to evaluate the chance for cooperation in such situations. Game theory is thereby utilised to investigate RQ1. In Paper 1 the operationalisation of the variables and the practical use of the framework are further discussed.

#### 3.2 Transaction cost economics

Transaction cost economics (TCE) is the interdisciplinary field of law, economics, and organisation, dealing with competitive advantage through efficient transaction governance (Williamson 1985). TCE is a predictive coordination theory that indicates how to organise different transactions from an efficiency perspective (Williamson 1996). Efficient governance is achieved by the minimisation of transaction costs, which are those incurred for searching and gathering information about buyers and sellers, writing and negotiating contractual agreements and administering their execution. Transaction costs are claimed to heavily affect buyer-supplier exchange performance (Artz 1999) and empirical research has supported the assumptions and conceptual arguments raised by TCE (Dyer 1996, Artz 1999). TCE is thus a suitable complement in the literature regarding buyer-supplier relationships and industrial buying behaviour (IBB) (Cox 1996, Sheth 1996, Buvik and Haugland 2005), as well as a powerful framework for guiding procurement decisions (Heide and John 1990).

TCE is based on the assumptions of bounded rationality and opportunism. *Bounded rationality* means that there are limitations to the actors' rationality, due to restrictions in the human ability to process information (Simon 1961, Rindfleisch and Heide 1997). *Opportunism* implies that actors are self-interest seeking with guile; they will deviate from the letter and the spirit of an agreement when it suits their purpose (Williamson 1985). However, all actors are not assumed to be opportunistic, but it is difficult to identify opportunistic actors ex ante (Rindfleisch and Heide 1997).

#### 3.2.1 Transaction characteristics

There are three principal transaction characteristics of TCE: asset specificity, frequency/duration and uncertainty. They explain the reasons for different forms of governance for different transactions (Williamson 1985). Asset specificity is the most important transaction characteristic. It refers to the dependence created through transaction-specific investments and the switching cost incurred by terminating the relationships and choosing another exchange party. Asset specificity mainly depends on the level of complexity, uniqueness, and adaptability of the assets required for the exchange (Håkansson and Snehota 1995). The *frequency*, describing how many times the transaction is repeated, affects the time horizon of the relationship. Since recurring transactions may be governed within long-term relationships, an expectation of continuity may arise (Noordewier et al. 1990). Transaction duration is also connected to the time dimension, since it concerns the measurement of how long each transaction lasts (Macneil 1978). *Uncertainty* may arise due to unanticipated changes in circumstances surrounding the transaction (Noordewier et al. 1990), leading to adaptation problems (Rindfleisch and Heide 1997). It may also arise when there is a difficulty in accurately measuring ex post the exchange partner's compliance with expected output (Williamson 1985), leading to a performance evaluation problem (Rindfleisch and Heide 1997).

#### 3.2.2 Governance structures and mechanisms

Transactions can be governed within three main structures: *market*, *hierarchy* and the intermediate *hybrid* structure. Procurement from an independent supplier in perfect competition with others implies *market* governance, which is most efficient when standardisation and mass-production make transaction-specific investments redundant (Williamson 1975). For production demanding specialised knowledge that cannot be used for other purposes, potential scale economies through inter-firm trading are diminished (Williamson 1975). Such exchanges should be governed internally within the organisation's *hierarchy*, especially when the frequency is high (Williamson 1985). The *hybrid* represents a wide range of cooperative arrangements, such as long-term contracts, networks and alliances (Blois 2002). The hybrid is most efficient for intermediate degrees of asset specificity, requiring rather high and specific knowledge, for which contractual safeguards are demanded (Williamson 1991).

The three governance structures are traditionally associated with three different mechanisms: market with price, hierarchy with authority and hybrids with trust (Bradach and Eccles 1989, Adler 2001). This association is so strong that the two concepts are often treated as one and the same. It is, however, important to distinguish between them, since empirically observed arrangements often rely on a mix of price, authority, and trust (Bradach and Eccles 1989, Hennart 1993). All three mechanisms have both advantages and drawbacks (Adler 2001), and there are supplementary relationships between them (Spekman 1988). Thus, they should be combined, since the downside of one can be diminished by the presence of the other two.

#### 3.2.3 Criticism towards TCE

TCE has been criticised for being too simplistic, for not distinguishing enough between governance structures and mechanisms. It is in need of a more profound analysis of the coordination problem (Pihl 2000). A great deal of research has demonstrated that TCE can serve as an important determinant for companies' make or buy decisions (Artz 1999), i.e. choice of an optimal governance structure. Although this choice is initially important, it is too basic to provide a profound and detailed analysis of governance and procurement. Williamson (1998) argues that TCE should move to a more detailed and strategic level, i.e. towards strategy for the individual firm rather than structures of industries. To give the buyer more guidance of how to procure and govern transactions, an additional choice regarding the mix of governance mechanisms should therefore be made. Another criticism concerns the inability of traditional TCE (based on Williamson's work) to consider trust and the social environment of the transaction (Granovetter 1985, Ghoshal and Moran 1996). Since the literature regarding procurement, buyer-supplier relationships and IBB mostly stresses the importance of trust and the social environment (e.g. Heide & John, 1992; Rokkan et al., 2003), a TCE-based procurement framework needs to incorporate these issues. Furthermore, TCE only prescribes which type of governance is suitable. To increase the value of such prescriptions, how to achieve them should also be described. According to principal-agent theory

(e.g. Ouchi, 1979; Eisenhardt, 1985; Aulakh and Gencturk, 2000), the principal (e.g. a buyer) can influence the agent (e.g. a supplier) by different types of control. Since these control types are strongly related to the mechanisms of TCE (Pihl 2000), the buyer can facilitate the establishment of different mechanisms through the exercise of different types of control during the buying process.

#### 3.2.4 The role of TCE in this thesis

TCE has received a lot of interest in construction management research (Kadefors 2004), when investigating procurement and inter-organisational relationships (Pietroforte 1997, Voordijk *et al.* 2000, Rahman and Kumaraswamy 2002). In this thesis a conceptual model is developed and presented in Paper 2. The model is of a general nature, but in this research project applied to a construction context (see Papers 3 and 4) in order to investigate RQ2-4. Theoretically, it aims at addressing the above-mentioned shortcomings of TCE by: (1) moving to a lower and more detailed level of analysis regarding the choice of mechanisms instead of a discrete structure; (2) integrating trust and social environment in the TCE framework; and (3) utilising principal-agent theory to bridge TCE and IBB in order to describe *how* to achieve governance prescriptions. Hence, principal-agent theory and IBB literature are utilised to develop new theoretic knowledge regarding the practical achievement of TCE-based governance prescriptions through procurement.

# 3.3 Principal-agent theory and industrial buying behaviour

In this section the connections among transaction cost economics (TCE), industrial buying behaviour (IBB) and principal-agent theory are described and discussed, in order to motivate the use of these theories in the model development (Paper 2).

# 3.3.1 Principal-agent theory: linking governance mechanisms with control types

According to principal-agent theory the principal (client) can influence the agent (supplier) in delegation situations with three types of control: output, process and social control. *Output control* is defined as the degree to which the focal firm monitors the outcomes produced by the partner (Aulakh *et al.* 1996). It is appropriate when it is possible to measure goal attainment, which mostly occurs when asset specificity is low, and the monitoring party has limited knowledge about the transformation process (Collin 1993, Das and Teng 2001). Output control is closely related to the price mechanism (Hennart 1993, Pihl 2000) through the invisible hand of the market (Gencturk and Aulakh 1995). The buyer can therefore facilitate a focus on price in the transaction relationship through the use of output control.

*Process control* implies that the focal firm monitors the partner's behaviour or the means used to achieve the desired ends (Aulakh *et al.* 1996). Increased interdependencies, caused by transaction specific investments, make output control less efficient and process control more suitable (Gencturk and Aulakh 1995). This is because outputs may be hard to measure, due to bounded

rationality and asset specificity (Williamson 1996, Das and Teng 2001). Process control is then feasible if the monitoring party knows the appropriate action to achieve the goal (Collin 1993, Das and Teng 2001). Process control is related to authority (Hennart 1993, Pihl 2000), through the visible hand of management (Gencturk and Aulakh 1995). Hence, the buyer can facilitate a focus on authority through the use of process control.

Social control is accomplished by minimising the divergence of preferences among the parties (Eisenhardt 1985) by building a common organisational culture that encourages self-control (Aulakh *et al.* 1996). When it is not possible to measure goal attainment and the monitoring party does not know the appropriate action to achieve the goal, social control is most efficient (Collin 1993, Das and Teng 2001). In such cases the problem is to design a relational contract that allows and motivates the supplier to use his superior knowledge efficiently, as in a partnership (Foss 2002). Through joint activities shared norms and values are utilised to develop solidarity and a mutual understanding encouraging desirable behaviour, leading to a higher level of behavioural predictability (Das and Teng 1998, Rokkan *et al.* 2003). The predictability of positive behaviour through a common ideology facilitates trust (Collin 1993). Social control is therefore the most proper form of control in trust-based network relationships (Das and Teng 2001). Hence, the buyer can facilitate a focus on trust in the transaction relationship through the use of social control.

# 3.3.2 IBB: linking control types with procurement procedures

In this thesis, a buying process based on a model by Johnston and Bonoma (1981) is used to illustrate how different procurement procedures will involve different types of control, affecting the levels of price, trust and authority. A buying process constituted by eight different stages and their links to the three control types is discussed below.

#### **Specification**

This stage entails a translation of the need into a particular solution that can be readily communicated to others (Robinson *et al.* 1967), i.e. the specification of the product (Johnston and Bonoma 1981). Output control is obtained when the buyer only specifies the performance of the output and not the work process to achieve the goal (Collin 1993). The detailed specification is then left to the supplier. Process control can be achieved if the buyer uses a fixed design (comprehensive specification) and monitors the behaviour of the supplier. This leads to a low-trusting hierarchical relationship (Korczynski 1996). Social control can be achieved by joint specification (Collin 1993), which is a key aspect of relational contracting (Grandori 1997).

#### **Bid** invitation

This stage involves the search for alternative sources of supply, resulting in qualification of potential suppliers (Robinson *et al.* 1967). When a product is purchased in a market with many competing suppliers, the main mechanism is *price* (Spekman 1988, Adler 2001). Such procedures facilitate a focus on short-

term benefits, which according to Anderson and Oliver (1987) is related to output control. Social control involves investments in the socialisation of the partner, which are enhanced by long-term relationships and expectations of continuance (Aulakh and Gencturk 2000). Process control is also related to a long-term perspective, since it removes incentives to sacrifice long-term for immediate pay-offs (Anderson and Oliver 1987). Negotiations with only one or very few suppliers, facilitating lasting relationships, therefore indicate social and/or process control.

#### **Bid evaluation**

The various offers from potential vendors are weighed and analysed, resulting in the approval of one or more offers (Robinson et al. 1967). Price is often most important when buying standardised products. When focusing only on price the client does not take the opportunity to influence the characteristics of the supplier, since these are considered unimportant in pure market relationships (Heide and John 1990). This indicates a laissez-faire approach which is related to output control (Anderson and Oliver 1987). In process control, however, the client assumes risk to gain control (Aulakh and Gencturk 2000), for which reason the consideration of soft parameters involving the characteristics of the supplier becomes important. Through the assessment of financial stability, organisation, resources and competence, the client can ensure that the supplier has the capacity to deliver. Such control of supplier inputs is closely related to process control (Anderson and Oliver 1987). Partner selection considerations regarding the collaboration and nurturing of the relationship indicate social control (Ouchi 1979, Aulakh and Gencturk 2000). This can be exemplified by soft parameters such as collaborative ability, reputation, earlier experience of the supplier and shared values, which enhance trust (Korczynski 1996).

# **Selection of sub-suppliers**

The selection of sub-suppliers can be made by the supplier (domestic contract), by the client (nominated contract) (Shoesmith 1996) or jointly by both parties in collaboration. In market relationships, suppliers have total freedom to select their sub-suppliers, leaving the client with no control of who performes specialist work (Shoesmith 1996). A departure from market governance is manifested when the buyer attempts to control the supplier's decision making in areas such as selection of sub-suppliers (Heide and John 1992). Domestic contracts therefore indicate a laissez-faire approach, enhancing a focus on price through output control, while nominated contracts entail process control, increasing the level of authority. Since relationships with buyers are affected by relationships with sub-suppliers, the selection of sub-suppliers is crucial to increase the ability to adapt to uncertainty in relational governance (Wathne and Heide 2004). To enhance customer satisfaction, careful sub-supplier selection by both buyer and supplier in collaboration should be suitable. Such joint selection indicates a concern for both parties' interests, leading to an emphasis on trust through social control.

#### **Contract formalisation**

Price-based market governance emphasises the importance of legal rules and formal documents (Blois 2002), since complete contracts are more legally binding (Woolthuis *et al.* 2005). Contract formalisation is thus an important part of output control. Even more so, process control results in formalised and bureaucratic relationships (Aulakh and Gencturk 2000). Formal contracts are therefore closely related to the establishment of authority (Grandori 1997). However, formalisation decreases trust and increases opportunism, for which reason relational norms should be used as safeguards instead (Heide and John 1992). Through social control the parties establish an implicit sense of what is acceptable and what is deviant behaviour (Aulakh and Gencturk 2000), making formalisation unnecessary.

# **Type of compensation**

According to Gencturk and Aulakh (1995), a compensation system rewarding the supplier for his output (e.g. fixed price) entails output control. Compensation for the costs of the supplier based on the time worked and the costs of input material entails process control (Gencturk and Aulakh 1995). Profit sharing together with joint objectives indicates social control (Das and Teng 1998), for which reason it is vital to obtain increased cooperation in relational contracting (Olsen *et al.* 2005).

#### Usage of collaborative tools

In some transactions the actual production takes place within the buying process, since there is no standardised ready-made product to buy. Since the buyer and the supplier then have to interact to create the product, use of collaborative tools and joint action may be suitable (Heide and John 1990). Examples of such collaborative tools are: *joint goal setting* (Das and Teng 2001), *joint office building* (Barlow 2000, Olsen *et al.* 2005), *teambuilding activities* (Das and Teng 1998), and *joint dispute resolution* (Macneil 1978, Parkhe 1998). The usage of collaborative tools will directly facilitate trust-building, through social control (Das and Teng 1998).

#### **Performance evaluation**

In this last stage the fundamental evaluation of the supplier's performance takes place, dealing with how well the purchased product solved the problem (Robinson *et al.* 1967). According to Korczynski (1996) and Pihl (2000), performance monitoring by the purchaser (process control) leads to a high focus on authority and low trust, while social control through shared values and self-control, on the contrary, facilitates trust (Das and Teng 2001). Output control through monitoring of the finished product leads to emphasis on price (Hennart 1993, Pihl 2000).

# 3.3.3 The role of IBB and principal-agent theory in this thesis

To increase the practical use of TCE, it is important to show *how* governance prescriptions can be achieved. The procurement model developed and used in this thesis (Papers 2, 3 and 4) has therefore utilised principal-agent theory to bridge IBB and TCE. Thereby it illustrates how procurement procedures (IBB) facilitate the establishment of governance mechanisms (TCE) through different types of control (principal-agent theory). In this way principal-agent theory and IBB have been important building blocks in the model development for the purpose of investigating RQ2-4.

#### 3.4 Subcontractor innovation

In the innovation literature, the importance and influence of interaction and feedback mechanisms for innovation have shifted the focus from internal structures and routines to external linkages and processes (Saad *et al.* 2002). Thus, one of the key notions in this literature is that successful innovation often requires effective cooperation, coordination and working relationships among the different parties in specific projects (Gann and Salter 2000, Ling 2003). This is because interdependency between components and subsystems in the built environment demands knowledge sharing and interaction among different specialists and disciplines, contractors and subcontractors (Gann and Salter 2000).

#### 3.4.1 Obstacles to subcontractor innovation

Despite innovation requiring good cooperation and working relationships, most traditional procurement routes have worked against this. Aspects of traditional procurement that can hinder the ability of subcontractors to innovate and contribute to innovation include the *division of work, contract conditions* and *allocation of risk*. In traditional procurement routes the *division of work* often leads to detached business relationships that impede innovation. The construction process is traditionally managed by work being divided into distinct packages that are allocated to different subcontractors to complete individually (Barlow 2000). Hence, they mostly work on projects at different points in time and for different durations to other parties. This results in difficulties coordinating and cooperating in the implementation of joint innovations (Dulaimi *et al.* 2003). Furthermore, when subcontractors work separately from other parties they may not be motivated to propose innovations that might contribute to the overall success of projects (Dulaimi *et al.* 2003).

Contract conditions can be an impediment to innovation by locking in certain specifications and imposing penalties on a party who either did something, or instructed another party to do something, that strayed beyond 'standard practice' or 'the present standard of knowledge in the industry' (Kumaraswamy and Dulaimi 2001, Kumaraswamy *et al.* 2004).

The way in which *risk* is traditionally allocated also imposes further disincentives to innovation (Kumaraswamy and Dulaimi 2001). Risk is often transferred down the supply chain from the main contractor to subcontractors, who are generally least able to bear it (Barlow 2000). Such allocation of risks

can stifle the creative capabilities of subcontractors and instead favour time-honoured and habitual solutions.

#### 3.4.2 The role of innovation literature in this thesis

To address these problems and improve the potential for subcontractors to contribute to innovation, the extension of partnering relationships to subcontractors, that is, a *broad partnering* approach is recommended (Ng *et al.* 2002). When partnering is extended to include subcontractors, several specific strategies can be employed to increase innovation contributions. In Paper 6 innovation literature is utilised to discuss how different aspects of cooperative procurement procedures affect subcontractors' contributions to innovation, in order to investigate RQ5.

# 4 Summaries of Papers

In this section each of the six papers is briefly summarised. The summaries involve: title of the paper, author(s) of the paper, publication status (giving the reader information about if, where and when the paper is to be/was published), which of the thesis's five research questions is in focus, keywords of the paper, background, purpose, theoretical framework, methods, results and contributions of the paper.

In this thesis, the six papers are logically ordered to provide a plain presentation of the research results, which are somewhat overlapping and accumulative over the series of papers. Paper 1 shows that cooperation is beneficial in construction, especially for the client, but not necessarily rational for the contractor due to the traditional procurement procedures. Hence, it is important that the client facilitate cooperation through suitable procurement procedures. In Paper 2, a conceptual procurement model is developed, offering clients a guide to how to procure different types of transactions in order to facilitate efficient governance, which in a construction project context means increased focus on trust and cooperation. The third paper shows that clients' currently used procurement procedures are not suitable for improving cooperation and efficient governance, but instead causing a lot of problems for which the construction industry is often criticised. Papers 4 and 5 show how cooperative procurement procedures should be performed in order to facilitate trust and cooperation, which enhances efficient governance of complex construction projects. Paper 6 shows how subcontractors can be involved in a broad partnering arrangement through cooperative procurement procedures. It also discusses how the parties can utilise this involvement to facilitate innovation and continuous improvements, which can increase the effectiveness of project activities.

# 4.1 Summary of Paper 1

# Title:

Cooperation and partnering in facilities construction – empirical application of prisoner's dilemma

#### Author:

Per Erik Eriksson

#### **Publication status:**

Published 2007 in the scientific journal *Facilities*, 25(1)

#### Which research question of the thesis is in focus?

RQ1: What are the main reasons for the lack of cooperation among the parties in construction projects and why are they critical?

#### **Keywords:**

Partnership, Game theory, Buyer-supplier relationships, Construction industry, Sweden

#### **Background:**

Client-contractor relationships are often criticised for being adversarial and non-cooperative. Game theory and the game Prisoner's dilemma are suitable tools for analysing cooperation in inter-organisational relationships. Since the Prisoner's dilemma game simulates cooperation and defection, it may be utilised to shed some light on the non-cooperative behaviour in client-contractor relationships.

# **Purpose:**

To investigate if game theoretic reasoning may be used to explain a lack of cooperation in buyer-supplier relationships within construction and facilities management. In order to make an empirical application of the Prisoner's dilemma game possible, important variables are operationalised and empirically measured.

#### Theoretical framework:

Game theory

#### **Methods:**

Empirical data concerning pay-offs and the variables in the discount parameter formula (created in this paper) was obtained through interviews with three clients and four contractors in the Swedish construction sector.

#### **Results:**

This paper suggests a way to operationalise pay-offs and the discount parameter, making empirical measurements possible. Due to differences in pay-offs and the discount parameter, different forms of contracts will affect cooperation. Cumulative values of cooperation are much higher in lasting relationships than in occasional transactions. Thus, the main reason for the lack of cooperation is the actors' short-term perspective caused by traditional procurement procedures. The best way to facilitate cooperation between rational players is long-term contracts. From a game theoretic perspective the practice of project partnering may not solve problems regarding lack of cooperation, due to its short-term perspective.

#### **Contributions:**

The main theoretical contribution of this paper is that it makes empirical application of the Prisoner's Dilemma game possible. This is achieved by operationalising and empirically measuring game theoretic variables that were previously given values set by the researcher rather than by the players in the game. A practical implication is that cooperation is clearly beneficial, especially to the client, but not necessarily rational for the contractor. The actors should work together in long-term relationships instead of focusing on single projects in order to increase the incentives for cooperation. Long-term strategic partnering is therefore beneficial to the construction and management of facilities.

# 4.2 Summary of Paper 2

#### Title:

Procurement and Governance Management - Development of a Conceptual Procurement Model Based on Different Types of Control

#### Author:

Per Erik Eriksson

#### **Publication status:**

Published 2006 in the scientific journal *Management Revue*, 17(1)

# Which research question of the thesis is in focus?

RQ2: How should different types of construction transactions be procured in order to facilitate efficient governance?

#### **Keywords:**

Control, Governance, Procurement, Transaction cost economics

#### **Background:**

Developing a conceptual procurement model is of strategic importance for the construction industry. Transaction cost economics (TCE) and industrial buying behaviour (IBB) seem to be suitable frameworks on which to base such a model. However, TCE has been criticised for not distinguishing enough between governance structures and mechanisms and for its inability to consider trust and the social context of the transaction. Furthermore, TCE only prescribes *which* type of governance is suitable. To increase the value of such prescriptions, *how* to achieve them through appropriate procurement procedures should also be described. IBB has, on the other hand, a surplus of descriptive empirical studies and a critical shortage of analytical and conceptual constructs. This paper addresses these shortcomings by utilising principal-agent theory to bridge IBB and TCE in a conceptual procurement model.

# **Purpose:**

The purpose of the paper is twofold: first, a conceptual model, based on TCE, regarding the analytical choice of a suitable combination of governance mechanisms for different types of transactions is developed. Second, a procedure based on IBB and principal-agent theory is developed in order to show how to obtain the suitable mechanism mix through appropriate choices during the buying process, involving different types of control.

#### Theoretical framework:

TCE, IBB and principal-agent theory

#### **Methods:**

This is a purely conceptual paper.

#### **Results:**

The developed model concerns the analytical choice of a suitable combination of governance mechanisms (price, trust and authority) for different types of transactions, depending on the transaction characteristics asset specificity and frequency/duration. Additionally, a procedure for facilitating the achievement of a suitable mechanism mix is developed. The procedure shows how decisions during the eight stages of the buying process (specification, bid invitation, bid evaluation, sub-supplier selection, contract formalisation, type of compensation, collaborative tools and performance evaluation) will affect the mechanisms' levels in the transaction relationship through different types of control (output, process and/or social control).

#### **Contributions:**

Theoretically, this paper shows 1) how the choice of a suitable governance structure can be transformed into a more strategic choice of suitable mix of mechanisms, 2) how trust and social context can be integrated in a TCE framework, and 3) how TCE governance prescriptions can be achieved through appropriate procurement procedures. Practically, the model together with its procedure can serve as a basis for analysing planned procurements, in order to tailor procurement procedures to transaction characteristics for the achievement of efficient governance.

# 4.3 Summary of Paper 3

#### Title:

Procurement effects on trust and control in client-contractor relationships

#### Authors:

Per Erik Eriksson and Albertus Laan

#### **Publication status:**

Forthcoming 2007 in the scientific journal Engineering, Construction and Architectural Management, 14(4)

# Which research question of the thesis is in focus?

RQ3: What procurement procedures are currently used by Swedish construction clients, and how do they fit the theoretical prescriptions of the developed procurement model?

# **Keywords:**

Control, Cooperation, Procurement, Partnering, Transaction cost, Trust

#### **Background:**

Traditional procurement procedures are at times blamed for causing inefficiencies (e.g. conflicts, poor productivity, cost and time overruns, decline in construction quality and decrease in customer satisfaction) in the construction industry. In recent years there has been an increasing interest in changing these

procurement procedures in order to enhance cooperation. Hence, it would be interesting to investigate current construction procurement procedures from a TCE perspective in order to analyse their fit to transaction characteristics, which facilitates efficient governance.

# **Purpose:**

To investigate how construction clients currently deal with procurement and analyse how the choices made during the buying process stages affect the combination of governance mechanisms and control types in client-contractor relationships.

#### **Theoretical framework:**

TCE + IBB + principal-agent theory

#### **Methods:**

Empirical data was collected through a survey responded to by 87 Swedish professional construction clients. The model developed in Paper 2 was used as a framework for analysing the data.

#### **Results:**

The empirical data shows that Swedish construction clients' current procurement procedures involve: specification by the client, open bid invitations, bid evaluations based on lowest tender price, high contract formalisation through standard contracts, fixed price compensation, low usage of collaborative tools and performance evaluation by the client. These procedures establish governance forms facilitating a focus on price, through output control, and authority, through process control. Since construction transactions are mostly characterised by high complexity and customisation and long duration, the conceptual model prescribes a focus on trust and a somewhat lower focus on price and authority. Hence, from a transaction cost perspective, construction clients focus too much on price and authority and too little on trust. Since current procedures may cause problems in all stages of the buying process, the result suggests that partnering arrangements, entailing completely different choices during the buying process, may be a suitable way to facilitate trust and cooperation through informal social control.

### **Contributions:**

Theoretically, this paper adopts an overall process perspective, taking into account clients' procurement procedures in their entirety, while earlier research has focused on only one or a few aspects of procurement and governance. A practical implication is that the currently used procurement procedures are not suitable. Clients wishing to establish trust-based cooperative relationships need to reconsider their procurement procedures entirely; joint objectives, teambuilding and other "fuzzy" techniques are not enough to transform adversarial relationships into cooperative ones.

# 4.4 Summary of Paper 4

#### Title:

Procurement and governance of complex construction projects

#### **Authors:**

Per Erik Eriksson and TorBjörn Nilsson

#### **Publication status:**

Submitted 2007 to Journal of Management in Engineering

# Which research questions of the thesis are in focus?

RQ2: How should different types of construction transactions be procured in order to facilitate efficient governance?

RQ4: How should partnering projects be procured in order to enhance trust and cooperation?

# **Keywords:**

Control, Cooperation, Procurement, Partnerships

# **Background:**

Traditional procurement procedures are at times blamed for causing inefficiencies (e.g. conflicts, poor productivity, cost and time overruns, decline in construction quality and decrease in customer satisfaction) in the construction industry. In recent years increasing interest in partnering arrangements has been noticeable in the construction industry as a result of escalating conflicts and adversarial relationships in many countries. The greater need for cooperation is also derived from the increased complexity, uncertainty and time pressure that characterise construction projects. These characteristics require relation specific investments, knowledge sharing, flexibility and integration, which are facilitated in long-term cooperative relationships. Hence, it would be interesting to investigate partnering procurement procedures from a TCE perspective in order to analyse their fit to transaction characteristics.

#### **Purpose:**

The purpose of this research is to investigate how partnering procurement procedures match TCE prescriptions regarding governance mechanisms in client-contractor relationships.

#### Theoretical framework:

TCE + IBB + principal-agent theory

#### Methods:

Empirical data was collected through mixed methods (interviews, surveys, and observation and participation in meetings and workshops) in a case study regarding the procurement and the subsequent construction of plant facilities for manufacturing of pharmaceutical products in Sweden.

#### Results:

The empirical illustration shows that the case client has reduced the traditional focus on price and authority and instead facilitated a relationship based on trust and cooperation, through procurement procedures involving joint specification, limited bid invitation, bid evaluation based on soft parameters, joint selection of subcontractors, standard contracts coupled with relational norms, incentive-based compensation, usage of collaborative tools and contractor self-control. The procurement procedures chosen facilitate a governance form rather similar to the one prescribed by the conceptual model. Furthermore, the actors involved in the case project are satisfied with the project result and also regard the performed procurement procedures as suitable for enhancing cooperation and efficient governance. Hence, the results provide both theoretical and empirical support for the implementation of partnering through cooperative procurement procedures in order to achieve efficient governance of construction projects that are characterised by high complexity, customisation and uncertainty.

#### **Contributions:**

A theoretical contribution of the paper is that the case study shows that trust and social context matter, for which reason the inclusion of these aspects in the conceptual model is appropriate. Furthermore, it supports the model's prescriptions regarding the governance of occasional transactions with high asset specificity. Practically, the case study shows that procurement procedures in their entirety affect the transaction relationship. Hence, an overall process perspective on governance is suitable. Another practical implication is that partnering seems to be suitable in construction projects characterised by high complexity, customisation and uncertainty.

# 4.5 Summary of Paper 5

#### Title:

Modelling procurement effects on cooperation

#### Authors:

Per Erik Eriksson and Ossi Pesämaa

#### **Publication status:**

Accepted for publication in the scientific journal Construction Management and Economics

# Which research question of the thesis is in focus?

RQ4: How should partnering projects be procured in order to enhance trust and cooperation?

#### **Keywords:**

Cooperation, Procurement, Partnering, SEM

#### **Background:**

Partnering arrangements have received increasing interest in recent years. Several studies show however that cooperative relationships are not easily achieved in construction. Implementation of cooperative relationships requires changes in several elements of the traditional procurement procedures.

#### **Purpose:**

The purpose of this paper is to propose and test a sequential model regarding clients' cooperative procurement procedures. We especially ask: what elements in clients' procurement procedures facilitate the establishment of cooperation and trust in their relationships with contractors?

#### Theoretical framework:

Literature regarding procurement and partnering was utilised when formulating the hypotheses.

#### Methods:

The model was tested through structural equation modelling. The empirical data required for the test was collected through a survey responded to by 87 Swedish professional construction clients.

#### Results:

The empirical results show that cooperative procurement procedures are triggered by clients' wish to involve contractors early in specification, which has simultaneous effects on procedures regarding bid invitation and compensation. Furthermore, these simultaneous effects breed a certain kind of partner selection based on task-related attributes, which also has a direct positive effect on cooperation in client-contractor relationships.

#### **Contributions:**

Theoretically, the results show that our proposed model regarding cooperative procurement procedures is supported with satisfactory statistical significance. Practically, the results imply that clients planning to implement cooperative relationships need to reassess their entire procurement process. Our model has verified that early involvement of contractors, limited bid invitation, incentive-based compensation and bid evaluation based on task-related attributes together increase cooperation in client-contractor relationships.

# 4.6 Summary of Paper 6

#### Title:

The influence of partnering and procurement on subcontractor involvement and innovation

# **Authors:**

Per Erik Eriksson, Michael Dickinson and Malik Khalfan

#### **Publication status:**

Published 2007 in the scientific journal *Facilities*, 25(5/6)

# Which research questions of the thesis are in focus?

RQ4: How should partnering projects be procured in order to enhance trust and cooperation?

RQ5: How should clients' procurement procedures be performed in order to increase subcontractor involvement, value creation and innovation?

# **Keywords:**

Subcontractors, Procurement, Partnering, Innovation, Construction

### **Background:**

In spite of subcontractors' large share of work, main contractors remain relatively unsophisticated in their approach to them. Traditional competitive tendering based on price results in adversarial attitudes and poor relationships between these actors. Innovation is then hampered, since in situations of conflict and mistrust, subcontractors are more likely to stick to what they know, rather than to risk trying something new.

# **Purpose:**

To investigate how a client's cooperative procurement procedures influence subcontractor involvement, value creation, and innovation in the construction of complex facilities.

#### Theoretical framework:

Literature regarding innovation and procurement.

#### **Methods:**

Empirical data was collected through interviews, surveys and participation in workshops during a longitudinal action research case study. The case study project was located in Sweden and concerned the construction of plant facilities for manufacturing of pharmaceutical products.

#### **Results:**

The case study findings reveal that the client's procurement procedures (involving a broad partnering approach concerning early involvement of subcontractors, bid evaluation based on soft parameters, incentive-based compensation, and high usage of collaborative tools including joint objectives, joint IT-database, joint project office and teambuilding activities) positively affect the level of subcontractor involvement and integration. This does not however necessarily result in increased subcontractor value creation and innovation in the construction process, since these aspects depend on other things too. To enhance innovation and value creation, the actors should adopt a long-term per-

spective and actively work to establish an innovation friendly climate, encouraging continuous improvements.

# **Contributions:**

A theoretical contribution of this paper is that it focuses on the often-neglected importance of subcontractors and their contributions to innovation and value creation. A practical contribution is that although cooperative procurement procedures set an appropriate basis for subcontractor involvement, the results highlight the importance of dedicated efforts that channel involvement into innovation activities.

# 5 Conclusions

The overall purpose of the research presented in thesis is to increase the understanding of how efficient governance of construction projects can be achieved through appropriate procurement procedures. The main ways to fulfil this purpose were the development of a conceptual procurement model and the empirical illustration of its practical use through presenting and analysing qualitative case study data and quantitative survey data. The overall purpose was specified through the formulation of five research questions. In this concluding chapter the findings regarding these questions are first presented after which broader findings and contributions are discussed and interesting issues for future research are proposed.

# 5.1 Answering the research questions

First, the specific research results pertaining to the five research questions are presented along with information about which papers contain further discussion of these results.

# 5.1.1 RQ1: What are the main reasons for the lack of cooperation among the parties in construction projects and why are they critical?

This research question was addressed in Paper 1, adopting a game theoretic perspective on cooperation between construction clients and contractors. According to game theory, pay-offs and the discount parameter are the two most important factors affecting cooperation. This investigation involved an empirical measurement of pay-offs and an operationalisation of the discount parameter, dividing it into a four-variables-formula, in order to make a practical application of game theory possible. It was found that the variable "repeat probability" heavily affected the discount parameter and in turn cooperation. The repeat probability concerns the players' perceived probability that they will play against each other also in the next game, i.e. work together in the next project. The short-term perspective that is prevalent in the industry, resulting from constantly changing project constellations, leads to a low "repeat probability", decreasing the rationale for cooperation. The short-term perspective is therefore the main reason for the lack of cooperation. The focus on the short term is caused by the clients' traditional bid invitation and evaluation procedures, decreasing the probability for the parties to play against each other in the next game. From a game theoretic perspective, clients therefore need to change their procurement procedures. Entering into long-term contracts with contractors, or performing limited bid invitations and bid evaluations based on other criteria than lowest tender price, would enhance long-term relationships and in turn also cooperation. Although the empirical results concern client-contractor relationships, the findings should be valid also for relationships with subcontractors, since they suffer from a similar short-term perspective, due to the traditional procurement procedures. For a more extensive discussion of the findings belonging to this research question, see Paper 1.

# **5.1.2** RQ2: How should different types of construction transactions be procured in order to facilitate efficient governance?

This research question was addressed in Paper 2, by developing a conceptual procurement model that utilised principal-agent theory to bridge transaction cost economics and industrial buying behaviour literature. The model was then also used as a frame of reference in Papers 3 and 4. According to the developed model, different transaction characteristics (concerning asset specificity and frequency/duration) require different combinations of the governance mechanisms: price, authority and trust, in order to achieve efficient governance. The model argues that increased levels of asset specificity (resulting mainly from complexity and customisation) should lead to a lower focus on price and a higher focus on trust and/or authority. Furthermore, higher frequency and longer duration of the buyer-supplier relationship increase the need for trust while somewhat decreasing the focus on price and authority. To facilitate the establishment of these mechanisms' combinations through different types of control (output, process and social control), clients need to tailor their procurement procedures (involving specification, bid invitation, bid evaluation, subcontractor selection, contract formalisation, type of compensation, collaborative tools and performance evaluation) in their entirety to the characteristics of the transaction. In Table 2, the different procurement procedures' effects on the governance mechanisms are summarised.

Table 2. Procurement effects on control types and governance mechanisms

Buying stage	Price focus through output control	Authority focus through process control	Trust focus through social control
Specification	Spec. by contractor	Spec. by client	Joint spec.
Bid invitation	Open bid procedure	Limited bid invitation	Limited bid invitation
Bid evaluation	Focus on tender price	Focus on authority-based soft parameters	Focus on trust-based soft parameters
Subcontractor selection	Domestic	Nominated	SCs selected by both client and MC
Contract formalization	Formal, comprehensive contracts	Formal, comprehensive contracts	Informal and incomplete contracts
Type of compensation	Fixed price	Reimbursement	Including incentives
Collaborative tools	Low usage of collaborative tools	Low usage of collaborative tools	High usage of collaborative tools
Performance evaluation	Output control by client	Process control by client	Self-control by contractor

By tailoring the different parts of the procurement procedures into appropriate combinations a client can facilitate suitable levels of the governance mechanisms, fitting different transaction characteristics. The results presented in Paper 4 show that cooperative procurement procedures in partnering arrangements, mostly involving the procedure alternatives in the right column of Table 2, facilitate efficient governance of construction transactions characterised by high complexity and customisation, high uncertainty and long duration. For a more extensive discussion of the findings regarding RQ2, see Papers 2 and 4.

# 5.1.3 RQ3: What procurement procedures are currently used by Swedish construction clients, and how do they fit the theoretical prescriptions of the developed procurement model?

This research question was addressed in Paper 3, by empirically surveying Swedish construction clients' procurement procedures and comparing them to the prescriptions of the conceptual procurement model that was developed in Paper 2. The empirical data shows that the currently used procurement procedures involve: specification by the client, open bid invitations, bid evaluations based on lowest tender price, high contract formalisation through standard contracts, fixed price compensation, low usage of collaborative tools and performance evaluation by the client. According to the conceptual model, these procedures establish governance forms facilitating a focus on price, through output control, and authority, through process control, whereas the level of trust is low due to lack of social control. Since construction transactions are mostly characterised by high complexity and customisation and long duration, the conceptual model prescribes a high focus on trust and a somewhat lower focus on price and authority. Hence, Swedish construction clients' current procurement procedures do not fit well with the theoretical prescriptions of the model. From a transaction cost perspective, construction clients focus too much on price and authority and too little on trust, through their procurement procedures. For an extensive discussion of these findings, see Paper 3.

# **5.1.4** RQ4: How should partnering projects be procured in order to enhance trust and cooperation?

This research question was addressed in Papers 4, 5 and 6, by empirically investigating a case study project and surveying Swedish construction clients' procurement procedures. In Paper 4, the procurement procedures performed in a partnering project were analysed utilising the conceptual procurement model that was developed in Paper 2. The empirical investigation shows that the case client performed procurement procedures involving joint specification, limited bid invitation, bid evaluation based on soft parameters, joint selection of subcontractors, standard contracts coupled with relational norms, incentive-based compensation, high usage of collaborative tools and contractor self-control. These procedures, which were completely different from the most commonly used procedures discussed in Paper 3, have reduced the traditional focus on price and authority and instead facilitated a relationship based on trust and cooperation. The procurement procedures used in the case study project result in a governance form rather similar to the one prescribed by the conceptual model, i.e. higher focus on trust than on price and authority. In Paper 6 it was found that subcontractor involvement through the client's cooperative procurement procedures is also an important part of partnering. In both Papers 4 and 6, the results show that actors involved in the case study project are satisfied with the project result and also consider the performed procurement procedures suitable for enhancing cooperation and efficient governance. Hence, it seems as if the case study project provides a good example of how to procure a partnering project in order to facilitate trust and cooperation.

In Paper 5, the quantitative survey data was analysed through a structural equation modelling technique. According to this analysis the use of cooperative procurement procedures, concerning early involvement of contractors in joint specification, incentive-based compensation, limited bid invitation, and bid evaluation based on task related attributes (soft parameters) facilitate the establishment of cooperation in client-contractor relationships. Hence, the results from this investigation bring further support to the findings of Paper 4.

# 5.1.5 RQ5: How should clients' procurement procedures be performed in order to increase subcontractor involvement, value creation and innovation?

This research question was addressed in Paper 6, by empirically investigating a case study project and analysing the performed procurement procedures with a frame of reference constituted by innovation literature. The case study findings reveal that the client performed cooperative procurement procedures in a broad partnering approach concerning early involvement of subcontractors, bid evaluation based on soft parameters, incentive-based compensation, and high usage of collaborative tools including joint objectives, joint IT-database, joint project office and teambuilding activities. These procedures were found to have a positive effect on the level of subcontractor involvement and integration, since it facilitated a cooperative project network in which all actors were integrated, see Figure 3.

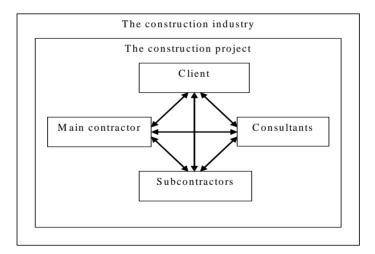


Figure 3. Cooperative project network

As opposed to the traditional project network illustrated in Figure 1, the network achieved in the case study project facilitated communication and knowledge sharing among all actors, which is considered crucial for joint innovation. However, this did not result in significantly increased subcontractor value creation and innovation in the construction process. Although cooperative procurement procedures set an appropriate basis for subcontractor involvement,

the results highlight the importance of dedicated efforts that channel involvement into innovation activities. Hence, to enhance subcontractor involvement, value creation, and innovation, cooperative procurement procedures should be coupled with the adoption of a long-term perspective and an active effort to establish an innovation friendly climate that encourages continuous improvements. For a more extensive discussion of these findings, see Paper 6.

# 5.2 Concluding discussion

Besides the specific answers to the investigated research questions, this research has also resulted in broader findings in terms of contributions to theory and practice, and also practical implications and advice for practitioners, as described in the following two sections.

#### **5.2.1** Contributions of this research

The research presented in this thesis contributes to theory and practice in four main ways. 1) The developed conceptual procurement model (Papers 2, 3 and 4) adds knowledge to TCE through utilising IBB and principal-agent theory in order to achieve a broad process perspective that makes it possible to describe how governance prescriptions can be achieved by suitable procurement procedures. It also shows how the choice of governance structures can be transformed into a more sophisticated choice of governance mechanisms and how trust and social context can be included in a TCE-framework. The model also contributes to procurement practice, since it may be utilised as a useful framework, guiding procurement decisions in order to tailor procurement procedures to transaction characteristics. 2) The survey study (Paper 3) shows that the current procurement procedures used by Swedish construction clients are still of the traditional type, facilitating governance forms focusing on price and authority, which according to the conceptual model are unsuitable in construction projects. This finding can hopefully serve as an alert to practitioners that their procurement procedures are obsolete due to the increased complexity and uncertainty of construction projects. 3) The case illustrations (Papers 4 and 6) and the structural equation model (Paper 5) show that cooperative procurement procedures facilitate the establishment of trust and cooperation and thereby efficient governance of complex, customised and lengthy transactions, such as those between client and contractors in construction projects. These procedures are therefore more suitable and up to date than the commonly used ones, criticised above. 4) A side effect of this research, which was not sought for in the purpose or the research questions, is a suggestion of how to look upon the concept of partnering. The research results suggest that different governance forms are facilitated through different procurement procedures. An indirect finding is therefore that partnering can be viewed as a cooperative governance form, which is facilitated through cooperative procurement procedures. The TCE perspective of this definition makes sure that partnering is not used for its own sake, but only to achieve efficient governance, tailored to the characteristics of the transaction. This is further discussed in suggestions for future research.

# 5.2.2 Practical implications and advice for practitioners

The findings presented in the papers of this thesis have different practical implications for different construction actors. One aspect that these actors have in common is, however, that they must shift their short-term financial focus in individual projects to a long-term strategic focus on development and efficiency over time (Papers 1, 4 and 6). The *client* is the most important actor that needs to act as a change agent in the proposed change towards increased cooperation, facilitating efficient governance of construction projects. Clients need to scrutinise their procurement procedures in their entirety, since the establishment of efficiency improving cooperative relationships requires a suitable and coherent pattern of cooperative procurement procedures (Papers 3, 4, and 5). However, it is also important to keep in mind that greater cooperation should not be viewed as an end justified on its own, it is merely a suitable means to achieve the over-riding goal of increased efficiency. Hence, clients also need to adopt a long-term efficiency enhancing perspective on their activities and actively work to encourage continuous improvements, joint value creation and innovation (Paper 6). One specific aspect of such a perspective is that clients should allow consultants to stay involved in the partnering team to some extent throughout the project life in order to enhance consultants' learning from the other actors' feedback.

When the client has set the new "rules of the game" with cooperative procurement procedures, the other actors need to adapt to these changed circumstances and act accordingly. Main contractors, which in Sweden have been keen on advocating partnering arrangements, need to take larger responsibilities and do their best to satisfy the wishes and demands of the clients and endusers. They need to switch their focus from short-term self-aggrandisement to a long-term concern for the needs of the client. This shift to a long-term perspective should result in internal changes of both attitudes and routines (Papers 1 and 4). Hence, it is reassuring to see that one of the largest contractor companies in Sweden (NCC), with an internal objective stating that 50% of their total number of projects in 2007 should be performed in partnering arrangements, has also formulated the objective that production costs should be lowered by 5% each year 2008-2012 through less material waste and more efficient assembly and management processes. Main contractors also need to take a larger responsibility for the involvement of the other actors. Subcontractors, in particular, need to be more deeply involved in the design and planning of the product and work processes (Papers 4 and 6). The main contractor's site manager is a key player when it comes to integrating the work of the contractor, consultants and subcontractors so that this team work jointly to satisfy the client.

Consultants are the actor that may have the least to benefit from partnering arrangements. In fact, it may decrease their amount of work in the design stage, since other actors are also invited to contribute to this work and since the total amount of design work may be decreased when contractors are procured early on less extensive design documents. Nevertheless, consultants need to be open-minded and positive about the involvement of other actors in the design stage. They need to set their professional prestige aside and work jointly with

the other actors in order to design the best possible product that adds the most value for the client (Paper 6). They also need to assimilate feedback from the other actors concerning the buildability of the designed product in order to enhance continuous improvements over time.

Often, *subcontractors* are the actors that are the least used to taking part in partnering arrangements. The change towards early involvement in the design stage requires a new kind of knowledge. They need to develop skills that make it possible for them to participate and contribute in the design work. This skill is also crucial for the cooperation among consultants and subcontractors. Consultants must feel that subcontractors do not merely interfere but actually contribute to the design work (Paper 6).

# 5.3 Limitations and future research

A PhD project is limited in time and scope, affecting research methods and results. In this final section of the thesis, limitations and suggestions for future research are discussed.

#### **5.3.1** Limitations of this research

The conceptual TCE-based model developed in this paper focuses on the transaction characteristics asset specificity and frequency/duration, which according to Williamsson (1985) are the most important ones. This is a limitation of the model, since other characteristics, such as uncertainty and time pressure, may also affect the transaction governance. Although these characteristics are not parts of the model as it is presented in this thesis, they could be integrated in the model if they are assumed to be important. This integration of additional variables into the model may be an interesting suggestion for future research. Furthermore, the model only suggests that procurement procedures facilitate the achievement of governance forms. The mechanism levels actually achieved in a transaction may also depend on other aspects, such as the actors' propensity to trust and act opportunistically. The procurement model is based on a transaction cost minimisation perspective, prescribing cooperative procurement procedures for complex construction projects. There are however also other aspects that may be of importance from a longer-term perspective. Many respondents emphasised the importance of cooperative relationships for improving the work environment in projects. To facilitate the recruitment of a talented young future workforce, it is important that the construction industry is perceived as a fun and inspiring environment to work in. This makes partnering arrangements beneficial also from other perspectives than the transaction governance perspective, upon which the research results in this thesis are based.

The game theoretic framework operationalised in this thesis also has limitations. In game theory, players are assumed to act rationally, striving to maximise profits. In practice, players may try to act rationally but various aspects, such as emotions, social context and lack of ability to conduct proactive analyses, prevent them from doing so. Hence, the findings of Paper 1 should not be viewed as the exact and measurable truth, but rather as a guide that suggests that cooperation should not be taken for granted since it may not be rational.

Empirically, the results have geographical and cultural limitations, since all data was collected in Sweden. Due to similarities among different countries, international generalisations are probably possible, although they should be made cautiously, as discussed in section 2.4.2.

# 5.3.2 Suggestions for future research

During this research project many ideas of potentially interesting and relevant research issues have popped up. Due to limited time and resources, these ideas have not been pursued. In this last section I propose five of these ideas as suitable areas for future research. 1) This research project has shown that the integration of the four actors: client, consultants main contractor and subcontractors, is not easily achieved. Most research focuses on client-contractor relationships. In order to reach the full potential of partnering arrangements, the integration of consultants and subcontractors needs to be improved. Future research should therefore focus more on these two actors and how to involve them in joint specification and problem solving (Paper 6).

- 2) The survey study has shown that the measurements regarding procurement procedures would benefit from further improvements (Papers 3 and 5). Constructs with strong internal reliability will improve multivariate analyses and strengthen empirical results. It would also be beneficial to develop scientifically strong surveys measuring partnering performance to be used in case studies of partnering projects (Papers 4 and 6). Such surveys are often designed from a practical project management perspective. However, it should be possible to design scientifically strong surveys that are also practically useful. Then they could be used both for project management and scientific purposes, which would increase knowledge transfer between practitioners and researchers.
- 3) In the conceptual model the different stages of the buying process are assumed to be equally important for the establishment of the governance form (Papers 2, 3 and 4). This may, however, not be the case. In future research the importance of the different stages should be investigated so that the conceptual model can lead to more sophisticated guidance of procurement decisions.
- 4) A related investigation can also concern a measurement of which procurement procedures are most important for cooperation to emerge. Information about this can then be used to assess which procedures and tools are most central to use in partnering projects. The case study survey in this research project (Papers 4 and 6) measured this to some extent, but this measurement should be more sophisticated and investigated within a larger sample. A very useful effect of such an investigation would be that one could develop an accurate definition of partnering, describing not only the purpose of partnering but also the means to be used to achieve it. In the introduction of this thesis, the lack of a definition of partnering was argued to be problematic. This research has resulted in a perspective proposing that partnering should be viewed as a cooperative governance form resulting from cooperative procurement procedures. Future research should focus on which specific elements of cooperative procurement procedures are most important for partnering implementation.

5) Last but not least, an interesting aspect to focus on in future research would be to empirically investigate the obtained benefits of partnering in terms of costs, quality, time schedule, working environment, etc. To increase the interest in partnering on a broader scale, it is most probably very important to show if this would result in tangible benefits for the actors involved. This aspect was also measured to some extent through the case study survey in this research project (Papers 4 and 6), but this measurement should be more sophisticated and investigated within a larger sample.

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## Appendix A: Survey in English

#### Dear Respondent,

At Luleå University of Technology, research is conducted on construction clients and their functions, both at the Division of Construction Management at the Department of Civil, Mining and Environmental Engineering and at the Division of Industrial Organisation at the Department of Business Administration and Social Sciences. This questionnaire is a substantial part of the data collection of two research projects at the two divisions. The research project at the Division of Construction Management has the working title "Beställarfunktionen som förändringsagent" ('The client function as an agent of change') and is managed by Professor Jan Borgbrant and Stefan Sandesten, CEO of ByggeherreForum and Visiting Professor at the division. The active researcher of the project is Anders Wennström, Licenciate in Engineering: The aim of that study is to elucidate what strategic factors influence, and can be influenced by, construction clients' procurement function in order to attain a more sustainable development and a renewal of the construction sector. The research project "Etablering ay samarbete i varaktiga relationer i byggprocessen" ('The establishment of long-term relations between parties in the construction process') is conducted at the Division of Industrial Organisation by the postgraduate student Per Erik Eriksson with Torbjörn Nilsson, acting Head of Division, as supervisor. The aim of that study is to examine what procurement procedures actors can choose in order to increase cooperation among one another in the construction process.

The questionnaire consists of five parts with a total of 25 questions and it takes about 20 minutes to answer.

The outline of the questionnaire:

Part 1 is a general section concerning your organisation's activities.

Part 2 deals with project management during the production process.

Part 3 deals with 8 procurement related choices during the construction process.

Part 4 concerns project results.

Part 5 concludes the questionnaire with some questions about yourself as a respondent.

Each question is accompanied by an instruction on how to answer it. If you think that a question is not relevant for you and your organisation, show this by crossing out that question. It is important that the questionnaire be answered and returned in order for the result to show as accurate a picture as possible of the procurement function in the Swedish construction client organisations. Please, use the enclosed return envelope to send us the questionnaire. The questionnaire will be treated as strictly confidential and the results accounted for only in the compilation of the questions in it. No reference will be made to names of companies or persons. By way of thanks, the participants in the study will be informed about the preliminary results when the answers to the questionnaire have been analysed. In this way, the participants will also have an opportunity to comment on the results.

Thanking you in advance,

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# 1. General questions

Name:	
Compan	y/organisation:
	Do you purchase in accordance with the Public Procurement Act ? (Tick off your answer)
□Yes □No	
	What types of premises/plants are used in your activities? (Estimate the approximate proportion of the total area)
Housing Public pr	cial premises % cial premises (shop/store, office etc.) % remises (schools, hospitals etc.) % cture/premises %
3. V	Who owns and uses your premises/plants? (Tick off your answer)
☐ We re ☐ We o	wn the premises/plants for our own activities ent the premises/plants for our own activities wn the premises/plants for our own activities with some leasing to external customers wn the premises/plants for leasing to external customers
t	How large a proportion of your total construction investment volume is distributed on the below types of construction activities? (Estimate the approximate proportion of the total invest volume in SEK)
	duction % constructions % ance measures %
	How large a geographical area of operations does your construction client organisation have? (Tick off the most appropriate type of market)
Seven A reg	tal market (in a certain municipality) ral local markets (in certain municipalities) ralional market (in a certain county or the like) rional market (in Sweden) riternational market (outside Sweden)
r	Have you got formulated/documented general program documents specifying demands on different types of premises/activities (e.g. demands on environment, climate, earning capacity, connections)?

# 2. Project management during the construction process

The rest of the questions are to be answered with respect to the type of construction activities that have the largest proportion of the total investment volume according to your answer to question 4. This entails that, in the following, you are supposed to answer the questions on the basis of your opinions of for example major construction projects concerning new production or reconstruction or construction activities connected to maintenance measures.

The construction process is usually divided into three phases: briefing, detailed design and production. This part of the questionnaire contains questions concerning who manages the process on behalf of the construction client during these three phases.

Detailed design

Production

Briefing

Utredning /Program	Detaljpi	Detaljprojektering				g Produktion						
project managers	n use project manager from some other orga uction phase? (Tick of	anisation	durii	ng the	briefing	the de	etailed	<u>de-</u>				
		Always from own organisation			Just as often from			Always from hired org.				
In the briefing phase the pr	roject manager is											
In the detailed design the p	project manager is											
In the production phase the	e project manager is											
	ence does the projecthe most appropriate					on the	follow	ing				
Choice of:  Form of contract  Form of compensation  Type of tender invitation (  Parameters for tender eval  Collaborative tools (join building, etc.)  How the final product is vo	uation at objectives, team	Very little					Ver grea	•				

9. When do you usually decide on the form of contract of the construction process? (Tick off the most appropriate alternative for each point of time)									
Very seldom often  At the start of the briefing phase  After the briefing phase but before the start of the detailed design  After the detailed design									
10. How important is having the below competences in your own organisation? (Tick off the most appropriate alternative for each competence)									
Competence for identification of the enduser's needs  Competence in contractual law  Technological competence (construction, ventilation and sanitation, electricity, etc.)  Competence in operation and maintenance  Competence in real estate economics  Competence in project management  Competence in societal demands (laws, etc.)									
3. Procurement related choices during the construction process									
In this part of the questionnaire, questions are asked about 8 choices (see questions 11-18) where the client chooses: who makes the specification of the product that pertains to the construction process (question 11), form of compensation (question 12), type of tender invitation (question 13), evaluation parameters for tender evaluation (question 14), tailor-made or standardised contracts (question 15), collaborative tools (question 16), who inspects finished constructions (question 17), and to what extent a finished product is inspected (question 18).									
11. Who makes the specification of the product that pertains to the construction process?  (Tick off the most appropriate alternative for each actor)  Very  Very									
The detailed design is carried out by the client and/or consultant  The main contractor is responsible for the detailed design									
The client, consultant and contractor work together with the detailed design									

12. What types of compensation do you us	se when p	rocuring	g a main	contra	ctor? (	Tick o	ff
the most appropriate alternative for each		comper	nsation)				
Ver	•					Very	
Fixed price  Reimbursement  Reimbursement with incentives  Reimbursement with bonus opportunities	lom ]					often	
13. What types of <u>tender invitations</u> do (Tick off the most appropriate alternati			procurin	g a ma	ain coi	ntracto	r?
	Very seldo	m					Very often
Open tender invitation ( <i>advertising</i> ) Somewhat limited tender invitation ( <i>the allent invites a number of (at least 5) tendered</i>							
Strongly limited tender invitation (the climinities a small number of (2-4) tenderers)							
Selective procurement (only one contractis invited to submit a tender)	tor						
14. How important are the below <b>evaluati</b> tor? (Tick off the most appropriate alte					main	contra	c-
	mportant			,			por-
Tender sum Previous experience of the tenderer Account of quality system and envi- ronment management system Account of organisation, personnel The company's size and financial stability Willingness to change (ability to con-						tar ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ] [	
sider new ideas) Reference object The tenderer's estimated ability to cooperate with the project team Technological competence							
15. To what extent do you use standard- ised contract provisions (AB, ABT, etc.) when designing a contract con- cerning a main contractor?	Very seldom					Very often	

16. To what extent do you use different "t	<u>ools"/methods for increasing the cooperation</u>
among the different actors in the constalternative for each tool)	ruction process? (Tick off the most appropriate
alternative for each toor)	Very Very
	seldom often
Formulation of shared objectives	
"Arena" for discussion of relations/solving conflicts	
Shared project database (IT tool)	
"Open books" (open accounting of costs)	
Shared project office	
Teambuilding exercises (initial meeting workshops, etc.)	
17. Who is responsible for <b>inspection</b> of off the most appropriate alternative for	finished constructions in your projects? (Tick each actor)
Very seld Client  Contractor	•
18. How extensive is <b>the inspection</b> of a falternative for each type of inspection)	inished product? (Tick off the most appropriate
Ver	
seld	•
Complete inspection	
Only spot checks	

factors in the 8 choices? (make a general answer for all the 8 choice tive for each factor)									
Unimportant									
Time factors for the project ( <i>tight schedule</i> )									
The client's experience of the procurement procedure									
Economic factors for the project ( <i>tight budget</i> )									
Uncertainty about flaws in the specification									
Risk of changes in the specification Difficulty in verifying the finished									
product Degree of complexity of the project									
Whether it is a single project or a sub- project among several similar projects The project's economic size									
The project's duration The Public Procurement Act pertains to the client organisation									
The degree of uniqueness of the prod- uct/project									
The number of potential tenderers The business cycle									
Uncertainties about the project's environment									
4. Project results									
<ol><li>Which factor do you regard as the result for the client (project succession)</li></ol>							desirable		
☐ Increased competition among actor ☐ Increased cooperation among actor									

19. There are a great number of factors that the client has to consider in connection with the 8 choices above (questions 11-18). How important is it to consider the following

21. What are the greatest <b>obstacles</b> to attaining increased <b>cooperation</b> among the actors in the construction process? (Tick off the most appropriate alternative for each poten-							
tial obstacle)	No obstacle						Great obstacle
New and different competence is required The present structure of the industry (e.g too few actors) The present organisation of the construction process (how							
to connect the actors) The present production process (too little industrial production)							
Conservative industry culture (lack of willingness to change) Unsuitable attitudes (lack of trust and commitment) Focus on short-term profits Existing relations to trade unions Lack of ethics and moral (including cartel formation) Project focus instead of process focus To little cooperation/participation by subcontractors and							
<ul> <li>suppliers in project planning/design</li> <li>22. What are the greatest obstacles to attaining a the construction client can have more influer tion process. (Tick off the most appropriate alt</li> </ul>	nce on the	desire	ed resu	ılt of t	he cor	istruc- le)	
	obstacle	)					obstacle
Existing legislation (the Public Procurement Act, the Planning and Construction Act, the Environment Act) Existing contracts (AB, ABT, etc.)							

# **5.** Questions about the respondent

23. Age	•••				
24. What is you	ur basic educa	tion? (Tick of	f)		
Construction 6	υ	, .		,	<b>(</b> )
Law					,
Selling					
<b>⊢</b>					
	es have you p propriate alter				ion process? (Tick off
	Not at all	max. 1 year	1-3 years	3-10 years	more than 10 years
As consultant As contractor					

## **Appendix B: Survey in Swedish**

Käre Respondent

Vid Luleå Tekniska Universitet pågår forskning kring byggherren och dennes funktion, dels vid Avdelningen för produktionsledning vid Institutionen för samhällsbyggnad, och dels vid Avdelningen för industriell organisation vid Institutionen för industriell ekonomi och samhällsvetenskap. Denna enkät utgör en betydande del av datainsamlingen i två forskningsprojekt vid de två avdelningarna. Forskningsprojektet vid Avdelningen för produktionsledning har arbetsnamnet "Beställarfunktionen som förändringsagent" och leds av professor Jan Borgbrant och Stefan Sandesten. VD på ByggherreForum och adjungerad professor vid avdelningen. Aktiv forskare i projektet är teknologie licentiat Anders Wennström. Syftet med den studien är att klarlägga vilka strategiska faktorer som påverkar, och kan påverkas av, byggherrens beställarfunktion för att nå en mer hållbar utveckling och förnyelse av byggsektorn. Forskningsprojektet "Etablering av samarbete i varaktiga relationer i byggprocessen" bedrivs vid Avdelningen för industriell organisation av doktoranden Per Erik Eriksson med tf ämnesföreträdare TorBjörn Nilsson som handledare. Syftet med den studien är att undersöka hur aktörerna kan gå till väga för att öka samverkan mellan dem i byggprocessen.

Enkäten består av fem delar med totalt 25 frågor och den tar cirka 20 min att svara på. Enkätens disposition:

Del 1 är ett allmänt avsnitt som berör din organisations verksamhet.

Del 2 behandlar projektledning under byggprocessen.

Del 3 behandlar 8 stycken valsituationer under byggprocessen (genomförandeform, ersättningsform, etc)

Del 4 berör projektresultat.

Del 5 avslutar enkäten med några frågor om dig som respondent.

Varje fråga följs av en instruktion om hur den ska besvaras. Om du anser att **en fråga ej är relevant just för dig och din organisation visar du detta med att stryka över frågan**. Det är viktigt att enkäten blir besvarad och returnerad för att resultatet skall ge en så rättvis bild som möjligt av beställarfunktionen i de svenska byggherreorganisationerna. Använd det svarskuvert som bifogats enkäten vid returneringen. **Enkäten kommer att behandlas konfidentiellt** och resultaten redovisas endast i sammanställning av de frågor som finns i enkäten. Ingen koppling kommer att göras till företagsnamn eller person. Som tack för hjälpen kommer deltagarna i studien att få ta del av de preliminära resultaten när enkätsvaren är bearbetade. Deltagarna får därigenom också en möjlighet att kommentera resultaten.

Med tack på förhand

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# 1. Allmänna frågor

Namn:
Företag/organisation:
1. Upphandlar ni enligt lagen om LOU? (Markera med ett kryss)
□ Ja □ Nej
2. Vilka typer av fastigheter/anläggningar används i er verksamhet? (Uppskatta ungefärlig andel av total yta)
Industrilokaler  Kommersiella lokaler ( <i>Butik, kontor etc</i> )%  Bostäder%  Offentliga Lokaler ( <i>skolor, sjukhus etc</i> )%  Infrastruktur/anläggningar%
3. Vem äger och nyttjar era lokaler/anläggningar? (Markera med ett kryss)
<ul> <li>□ Vi äger lokalerna/anläggningarna för egen verksamhet</li> <li>□ Vi hyr lokalerna/anläggningarna för egen verksamhet</li> <li>□ Vi äger lokalerna/anläggningarna för egen verksamhet med viss uthyrning till externa kunder</li> <li>□ Vi äger lokalerna/anläggningarna för uthyrning till externa kunder</li> </ul>
4. Hur stor andel av er totala bygginvesteringsvolym fördelas på nedanstående typer av byggtjänster? (Uppskatta ungefärlig andel av total investeringsvolym i kronor räknat)
Nyproduktion % Större ombyggnader % Underhållsåtgärder %
5. Hur stort geografiskt verksamhetsområde har er byggherreorganisation? (Markera med ett kryss den marknadstyp som stämmer bäst)
<ul> <li>□ En lokal marknad (inom en viss kommun)</li> <li>□ Flera lokala marknader (inom vissa kommuner)</li> <li>□ En regional marknad (inom ett visst län eller liknande)</li> <li>□ En nationell marknad (inom Sverige)</li> <li>□ En internationell marknad (utanför Sverige)</li> </ul>
6. Har ni formulerade/dokumenterade generella programunderlag som specificerar krav för olika lokaltyper/verksamheter (t ex krav på miljö, klimat, bärighet, samband)?  Ja Nej

## 2. Projektledning under byggprocessen

Enkätens resterande frågor ska du besvara med avseende på den typ av byggverksamhet som du i fråga 4 angav ha den största andelen av total investeringsvolym. Detta medför att du hädanefter besvarar frågorna utifrån åsikter om till exempel stora byggprojekt angående nyproduktion och ombyggnad eller utifrån byggtjänster kopplade till underhållsåtgärder.

Byggprocessen brukar vanligtvis delas in i skedena utrednings-/programskede, detalj-projektering och produktionsskede. I denna del av enkäten följer frågor som berör vem som driver processen för byggherrens räkning under dessa tre skeden.

Utredning/Program De	taljproje	jprojektering				Produktion					
<ol> <li>Använder ni er oftast av projektledare ledare från annan organisation under och produktionsskedet? (Markera me varje skede)</li> </ol>	utredning	gs-/p <u>ro</u> :	gramsk	edet, d	<u>etaljpro</u>	jekterir	<u>igen</u>	-			
		Alltid från egen organisation			Lika ofta från egen som extern org.			Alltid från inköpt organisation			
I utrednings- och programskedet är proje ren	ktleda-										
I detaljprojekteringsskedet är projektleda	ren										
I produktionsskedet är projektledaren											
Hur stort inflytande har projektledare kryss det svarsalternativ som stämmer				e val? (N	Markera	med e	tt				
Val av:	Mycke litet	t				•	cket tort				
Genomförandeform Ersättningsform Typ av anbudsinfordran (öppen, selektiv) Parametrar för anbudsutvärdering Samverkansverktyg (gemensamma mål, teambuilding, etc) Hur slutprodukten verifieras											

<ol> <li>När bestämmer ni vanligen genomförandeformen för byggprocessen? (Markera med ett kryss det svarsalternativ som stämmer bäst in på varje tidpunkt)</li> </ol>											
	cket lan					N	Mycket ofta				
10. Hur viktiga är nedanstående kompetenser att ha inom den egna organisationen? (Mar- kera med kryss det svarsalternativ som passar bäst in på varje kompetens)											
Kompetens för identifiering av brukarens beho Kompetens inom entreprenadjuridik Kompetens kring teknik ( <i>bygg, vvs, el, etc</i> ) Kompetens inom drift och underhåll Kompetens inom fastighetsekonomi Kompetens inom projektledning Kompetens kring samhällskrav ( <i>lagar, etc</i> )		viktig					Mycket viktigt				
3. Valsituationer under byggprocessen											
I denna del av enkäten ställs frågor om 8 valsituationer (se fråga 11-18) där beställaren väljer: vem som utför specifikationen av produkten som byggprocessen avser (fråga 11), ersättningsform (fråga 12), typ av anbudsinfordran (fråga 13), utvärderingsparametrar vid anbudsutvärdering (fråga 14), skräddarsydda eller standardiserade kontrakt (fråga 15), samverkansverktyg (fråga 16), vem som utför kontroll av utförda byggarbeten (fråga 17), samt i vilken utsträckning färdig produkt besiktas (fråga 18).											
		arje ak		ssen av	vser? (N	Markera	med Mycket ofta				
Detaljprojektering utförs av beställare och/eller projektör											
Huvudentreprenör ansvarar för detaljprojekteringen											
Beställare, projektör och entreprenör arbetar gemensamt med detaljprojektering											

12. Vilka typer av <u>ersättningsformer</u> an	vände	er ni vid	upphan	idling a	v huv	udentr	epreni	ir?			
(Markera med kryss det svarsalternativ	v som	passar bä	st in pa	i varje	ersättn	ingsfo	rm)				
M	ycke	t					Myck	tet			
Fast pris Löpande räkning Löpande räkning med incitament	ällan						ofta	l			
Löpande räkning med bonusmöjlighet	Ш		Ш	Ш	Ш	Ш	Ш				
13. Vilka typer av <b>anbudsinfordran</b> anv (Markera med kryss det svarsalternativ		passar bä Mycker sällan/	st in pa	_		dentre	prenör	? Mycket ofta			
Öppen anbudsinfordran (annonsering)		aldrig									
Något begränsad anbudsinfordran (beställ bjuder in ett flertal (minst 5) anbudsgivar											
Starkt begränsad anbudsinfordran (beställ bjuder in ett litet antal (2-4) anbudsgivar	lare										
Förtroendeupphandling (endast en entrep nör bjuds in att lämna anbud)											
14. Hur viktiga är nedanstående <u>utvärderingsparametrar</u> vid val av huvudentreprenör? (Markera med ett kryss det svarsalternativ som stämmer bäst in på varje parameter) Mycket											
Anbudssumma	vikti;				П		viktig	, c			
Tidigare erfarenhet av anbudsgivaren	H	H	H	H	H	H	H				
Redovisning av kvalitetssystem och	ᆜ										
miljöledningssystem	Ш			Ш	Ш	Ш	Ш				
Redovisning av organisation, personal											
Företagets storlek och finansiella stabi- litet											
Förändringsvilja (förmåga till											
nytänkande)	ᆜ										
Referensobjekt											
Anbudsgivarens bedömda samarbets-					П						
förmåga med projektteamet											
Teknisk kompetens	Ш	Ш									
15. I vilken utsträckning använder ni standardiserade regelverk (AB, ABT, etc) vid kontraktsutformning avseen- de huvudentreprenör?		ycket llan	7 [	] [			My-cket ofta				

<ol> <li>I vilken utsträckning använder ni olika</li> </ol>	a <u>"verktyg"/metoder för att öka sa</u>	mver-
kan mellan de olika aktörerna i byggp	processen? (Markera med kryss det svarsa	lternativ
som stämmer bäst in på varje verktyg)		
	Mycket	Mycket
	sällan	ofta
Formulering av gemensamma mål		
"Arena" för relationsdiskussion/konfliktlösning		
C		
Gemensam projektdatabas ( <i>IT-verktyg</i> ) "Öppna böcker" ( <i>öppen redovisning av</i>		Ш
kostnader)		
Gemensamt projektkontor		
Teambuildingövningar (startmöte, work-		
shops, etc)		
17. Vem ansvarar för <u>kontroll</u> av utförda kryss det svarsalternativ som stämmer		ed ett
My	cket	Mycket
säll	an	ofta
Beställare		
Utförare (entreprenör)		
18. Hur omfattande är <b>besiktningen</b> av f		svarsal-
ternativ som stämmer bäst in på varje	0 717	3.6 1 .
	cket	Mycket
säll	an — — — — —	ofta
Fullständig besiktning		$\sqcup$
Endast stickprov		1 1

valsituationerna (fråga 11-18). Hur v tuationerna? (Väg samman din analy: tillsammans. Markera med kryss det	s så att du g	er ett	genere	ellt sva	r som	gäller	alla 8 val
	Oviktigt						Mycket viktigt
Tidskritiska faktorer för projektet ( <i>snäv tidsram</i> )							
Erfarenhet av genomförandeformen hos upphandlande organisation							
Ekonomiska faktorer för projektet ( <i>snäv</i> budget)							
Osäkerhet kring brister i specifikation Risk för förändringar av specifikation Svårighet att verifiera slutprodukt							
Grad av komplexitet hos produkten/projektet							
Om det är ett enskilt projekt eller ett delprojekt av flera liknande projekt							
Projektets ekonomiska storlek Projektets varaktighet i tid LOU gäller för beställarorganisationen							
Grad av unikhet hos produk- ten/projektet							
Antalet potentiella anbudsgivare Konjunkturcykeln Osäkerheter i projektets omgivning							
4. Projektresultat							
20. Vilken faktor ser du som den viktiga da resultatet (projektframgång) av en							önskvär-
☐ Ökad konkurrens mellan aktörerna ☐ Ökad samverkan mellan aktörerna							

19. Det finns ett stort antal faktorer som beställaren måste beakta vid de ovanstående 8

processen? (Markera med kryss det svarsalternati tiellt hinder)	v som stä						
tiellt hinder)		immer	bäst ir	ı på va	rje po	ten-	
,	I						C++
	Inget hinder						Stort hinde
Gällande lagstiftning (LOU, PBL, Miljöbalken)							
	H	H	H	H	H	H	H
Gällande regelverk (AB, ABT, etc)	H	H	H	H	H	H	H
Traditionella upphandlingsformer	H	H	H	H	H	H	Η
Ny annorlunda kompetens krävs	H	H	H	H	H	H	님
Nuvarande struktur i branschen ( <i>t ex för få aktörer</i> )		Ш	Ш	Ш	Ш	Ш	Ш
Nuvarande organisation av byggprocessen (hur		П					
man knyter samman aktörerna)	_	_	_		_		
Nuvarande produktionsprocess (för lite industriellt		П	П	П	П	П	
byggande)							
Konservativ kultur i branschen (brist på föränd-		П					
ringsvilja)	ш	ш	ш	ш	ш	ш	ш
Olämpliga attityder (brist på förtroende och enga-		П					
gemang)							
Fokus på kortsiktiga vinster		Ш	Ш	Ш	Ш	Ш	
Rådande relationer med fackföreningar							
Brist på etik och moral (inkl kartellbildning)							
Projektfokus istället för processfokus							
För liten medverkan/deltagande från UE och leve-							
rantörer i projektplanering/specifikation		Ш	Ш	Ш	Ш	Ш	
<b>Byggherren</b> kan få mer inflytande nå önskat re	sultat av			torn så n (Ma		med	
<b>Byggherren</b> kan få mer inflytande på önskat re kryss det svarsalternativ som stämmer bäst in på		byggpi	rocesse	n. (Ma		med	
		byggpi	rocesse	n. (Ma		med	Stort
kryss det svarsalternativ som stämmer bäst in på	varje pot	byggpi	rocesse	n. (Ma		med	Stort hi <u>nd</u> e
kryss det svarsalternativ som stämmer bäst in på Gällande lagstiftning (LOU, PBL, Miljöbalken)	varje pot Inget	byggpi	rocesse	n. (Ma		med	
kryss det svarsalternativ som stämmer bäst in på	varje pot Inget	byggpi	rocesse	n. (Ma		med	
kryss det svarsalternativ som stämmer bäst in på Gällande lagstiftning (LOU, PBL, Miljöbalken)	varje pot Inget	byggpi	rocesse	n. (Ma		med	
kryss det svarsalternativ som stämmer bäst in på Gällande lagstiftning ( <i>LOU</i> , <i>PBL</i> , <i>Miljöbalken</i> ) Gällande regelverk ( <i>AB</i> , <i>ABT</i> , <i>etc</i> )	varje pot Inget	byggpi	rocesse	n. (Ma		med	
kryss det svarsalternativ som stämmer bäst in på Gällande lagstiftning ( <i>LOU</i> , <i>PBL</i> , <i>Miljöbalken</i> ) Gällande regelverk ( <i>AB</i> , <i>ABT</i> , <i>etc</i> ) Traditionella upphandlingsformer	varje pot Inget	byggpi	rocesse	n. (Ma		med	
kryss det svarsalternativ som stämmer bäst in på Gällande lagstiftning ( <i>LOU</i> , <i>PBL</i> , <i>Miljöbalken</i> ) Gällande regelverk ( <i>AB</i> , <i>ABT</i> , <i>etc</i> ) Traditionella upphandlingsformer Ny annorlunda kompetens krävs	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna)	varje pot Inget	byggpi	rocesse	n. (Ma		med	
kryss det svarsalternativ som stämmer bäst in på Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande)	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande) Konservativ kultur i branschen (brist på föränd-	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande) Konservativ kultur i branschen (brist på förändringsvilja)	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande) Konservativ kultur i branschen (brist på förändringsvilja) Olämpliga attityder (brist på förtroende och enga-	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande) Konservativ kultur i branschen (brist på förändringsvilja) Olämpliga attityder (brist på förtroende och engagemang)	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande) Konservativ kultur i branschen (brist på förändringsvilja) Olämpliga attityder (brist på förtroende och engagemang) Fokus på kortsiktiga vinster	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande) Konservativ kultur i branschen (brist på förändringsvilja) Olämpliga attityder (brist på förtroende och engagemang) Fokus på kortsiktiga vinster Rådande relationer med fackföreningar	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande) Konservativ kultur i branschen (brist på förändringsvilja) Olämpliga attityder (brist på förtroende och engagemang) Fokus på kortsiktiga vinster Rådande relationer med fackföreningar Brist på etik och moral (inkl kartellbildning)	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande) Konservativ kultur i branschen (brist på förändringsvilja) Olämpliga attityder (brist på förtroende och engagemang) Fokus på kortsiktiga vinster Rådande relationer med fackföreningar Brist på etik och moral (inkl kartellbildning) Projektfokus istället för processfokus	varje pot Inget	byggpi	rocesse	n. (Ma		med	
Gällande lagstiftning (LOU, PBL, Miljöbalken) Gällande regelverk (AB, ABT, etc) Traditionella upphandlingsformer Ny annorlunda kompetens krävs Nuvarande struktur i branschen (t ex för få aktörer) Nuvarande organisation av byggprocessen (hur man knyter samman aktörerna) Nuvarande produktionsprocess (för lite industriellt byggande) Konservativ kultur i branschen (brist på förändringsvilja) Olämpliga attityder (brist på förtroende och engagemang) Fokus på kortsiktiga vinster Rådande relationer med fackföreningar Brist på etik och moral (inkl kartellbildning)	varje pot Inget	byggpi	rocesse	n. (Ma		med	

# 5. Frågor om respondenten

23.	Ålder					
24.	. Vilken utbildning har du i gru	nden? (Mar	kera med et	tt kryss)		
Eko	ggteknisk ( <i>Civilingenjör, ingo</i> onomisk ( <i>Civilekonom, ekono</i> idisk rsäljning nan:	om)				
	. I vilka roller har du <u>tidigare</u> va svarsalternativ som stämmer bäs		,	essen? (N	Aarkera m	ed kryss det
Som ut	rojektör tförare eställare	Inte alls 1	nögst 1 år	1-3 år	3-10 år	mer än 10 år

## **Appendix C: Case study survey in English**

#### Dear Respondent

The collaborative project has now been completed and it is therefore time to make a concluding and all-inclusive follow-up of the project. In the beginning of the project, shared objectives were formulated concerning costs, service friendliness, quality, damage due to humidity, collaboration and work environment. This inquiry is an important part of the work of following up how well we have managed to attain the objectives. The results of the inquiry are expected to provide a good picture of how well we have managed to achieve certain important aspects through the collaborative project in comparison with traditional procurement of the project. The results will be used as a basis for feedback of experiences to future projects.

This questionnaire to the white collar workers will take 10-15 minutes to answer and consists of 21 questions and statements, where the respondent is asked to assess how well each statement corresponds to the experienced reality of the project. **If you think that a question is not relevant for you and your organisation, show this by crossing out that question.** The questionnaire will be treated as strictly confidential and the results accounted for only in the compilation of the questions in it. No reference will be made to names of companies or persons.

Thanking you in advance

Per Erik Eriksson Industrial organisation / IES Luleå University of technology S-97187 Luleå Tel: 0920- 49 30 58

E-mail: pererik.eriksson@ltu.se

Name	of respondent:							•••
Compa	any/organisation:							
Occup	ational role/post							
Relati	ons and attitudes							
1.	I feel that there has been better coo in a traditionally procured project			the pa	articipa	ants in	this p	roject than
A)	projecting/design	Not at all correct					П	Very much correct
В) р	production/building	Not at all correct						Very much correct
_			Ш	Ш	Ш	Ш	Ш	Ш
2.	I have felt greater confidence in the other participants in this pro- ject than in a traditionally pro- cured project	Not at all correct						Very much correct
3.	I have experienced greater engagement in this project than in a traditionally procured project	Not at all correct						Very much correct
4.	My feeling of participation in this project has been greater than in a traditionally procured pro- ject	Not at all correct						Very much correct
5.	I have felt happier and it has been more fun working in this project than in a traditionally procured project	Not at all correct						Very much correct
6.	I have experienced greater frankness and honesty among the participants in this project than in a traditionally procured project	Not at all correct						Very much correct
7.	I have experienced greater equality and fairness among the participants in this project than in a traditionally procured pro- ject	Not at all correct						Very much correct

	better communication among the participants in this project than in a traditionally procured project	Not at all correct				Very much correct
9.	I have felt that there has been a lesser risk of protracted and harmful conflicts among the par- ticipants in this project than in a traditionally procured project	Not at all correct				Very much correct
10.	I have felt that the participants have been more stimulated to in- novation, development and con- tinuous improvements in this project than in a traditionally proc	Not at all correct  ured project	□ ct			Very much correct
11.	I have felt that the participants have focused more on the pro- ject's long-term success than on short-term personal gains in this project than in a traditionally process.	Not at all correct	□ ct			Very much correct
End re	esults					
12.	I feel that my organisation will achieve a more adequate profit in this project than in a tradition- ally procured project	Not at all correct				Very much correct
13.	I feel that fewer changes have been made in this project than in a traditionally procured project	Not at all correct				Very much correct
14.	I feel that the project has been carried out in a more time- effective way than a traditionally procured project	Not at all correct				Very much correct
15.	I feel that the project has been carried out in a more cost- effective way than a traditionally procured project	Not at all correct				Very much correct
16.	I feel that the project's end product is more cost-effective for our activities and operation in a lifetime perspective than the end product of a traditionally proc	Not at all correct	ct			Very much correct

8. I have felt that there has been

	I feel that the end product has been improved (as regards func- tion, quality, etc.) in this project in comparison with a tradition- ally procured project	Not at all correct					Very much correct	
18.	I feel that the subcontractors/ subsuppliers have contributed more to innovation and problem solving in this project than in a traditionally procured project	Not at all correct					Very much correct	
19.	I feel that the end-users have had a greater influence on the end product in this project than in a traditionally procured project	Not at all correct					Very much correct	
The fu	nction of the collaborative too	ls						
20.	How do you think that the following functioned in this project in order pants?							
			Function					nctioned
Early p	rocurement of key actors		very bac	liy [	ПГ	7 [		y well
Joint sp	ecification and work preparation		very bac	]   [   [				y wen
Joint sp Pre-qua	ecification and work preparation diffication of suitable tenderers		very bac	]   [   [				
Joint sp Pre-qua Conside	ecification and work preparation dification of suitable tenderers eration of soft parameters in tender eva	luation	very bac					
Joint sp Pre-qua Conside The siz	ecification and work preparation diffication of suitable tenderers eration of soft parameters in tender eva- te and composition of the collaborati	lluation ve group	very bac					
Joint sp Pre-qua Conside The siz (partici	ecification and work preparation diffication of suitable tenderers eration of soft parameters in tender eva- te and composition of the collaboration pants who have endorsed joint objective	lluation ve group res)						
Joint sp Pre-qua Conside The siz (partici Form o	ecification and work preparation diffication of suitable tenderers eration of soft parameters in tender eva- te and composition of the collaborati	lluation ve group res)	Very bac					
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## The importance of the collaborative tools

21. From your experience of this project and other collaborative projects: How important do you think the following working methods and collaborative tools are for promoting collaboration among project participants in a collaborative project?

	Unimportant						Very
Early procurement of key actors  Joint specification and work preparation							important
Pre-qualification of suitable tenderers  Consideration of soft parameters in tender evaluation							
The size and composition of the collaborative group (participants who have endorsed joint objectives)							
Form of compensation including bonus opportunities "Open books" (open accounting of costs)							
Formulation of joint objectives Follow-up of joint objectives							
Promotion of continuous improvements							
Technical collaboration and problem solving Technical meetings		Н	Н	Н	$\mathbb{H}$	Н	H
Joint project database (IT-tools, PNet)							
Joint project office Teambuilding exercises		H	H	$\mathbb{H}$	$\mathbb{H}$	$\mathbb{H}$	H
Self-control of completed jobs		$\Box$					

## **Appendix D: Case study survey in Swedish**

#### Käre Respondent

Samverkansprojektet är nu avslutat och det är därför dags att göra en avslutande och helhetstäckande uppföljning av projektet. I början av projektet formulerades gemensamma mål avseende kostnad, servicevänlighet, kvalitet, fuktskador, samverkan och arbetsmiljö. Denna enkät utgör en viktig del i arbetet med att följa upp hur väl vi har lyckats uppnå målen. Enkätresultaten förväntas ge en bra bild över hur väl vi lyckats uppnå diverse viktiga aspekter genom samverkanskonceptet jämfört med om projektet hade varit traditionellt upphandlat. Resultaten kommer sedan att ligga till grund för erfarenhetsåterföring till framtida projekt.

Denna enkät till tjänstemännen tar cirka 10-15 minuter att svara på och består av 21 frågor och påståenden, där respondenten ombeds bedöma hur väl varje påstående stämmer överrens med den upplevda verkligheten i projektet. Om du som respondent anser att **ett påstående ej är relevant just för dig och din organisation visar du detta med att stryka över frågan**. Enkäten kommer att behandlas konfidentiellt och resultatet redovisas endast utifrån de frågeställningar som finns i enkäten. Ingen koppling kommer att göras till företagsnamn eller person.

Med tack på förhand

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E-post: pererik.eriksson@ltu.se

Respo	ondentens namn:		• • • • • •					••••
Företa	ng/organisation:	• • • • • • • • • • • • • • • • • • • •					• • • • • •	
Yrkes	roll/befattning							
Relat	ioner och attityder							
1.	Jag har känt att det har varit en bät ett traditionellt upphandlat projekt		rkan n	nellan	deltag	arna i o	detta p	orojekt än i
B)	projektering/design	Stämmer inte alls						Stämmer mycket bra
B)	produktion/byggnation	Stämmer inte alls						Stämmer mycket bra
2.	Jag har känt större förtroende för de andra deltagarna i detta projekt än i ett traditionellt upphandlat projekt	Stämmer inte alls						Stämmer mycket bra
3.	Jag har känt större engagemang för detta projekt än för ett tradi- tionellt upphandlat projekt	Stämmer inte alls						Stämmer mycket bra
4.	Jag har känt större delaktighet i detta projekt än i ett traditionellt upphandlat projekt	Stämmer inte alls						Stämmer mycket bra
5.	Jag har känt större trivsel och att det varit roligare att arbeta i detta projekt än i ett traditionellt upp- handlat projekt	Stämmer inte alls						Stämmer mycket bra
6.	Jag har känt större öppenhet och ärlighet mellan deltagarna i detta projekt än i ett traditionellt upp- handlat projekt	Stämmer inte alls						Stämmer mycket bra
7.	Jag har känt större jämlikhet och rättvisa mellan deltagarna i detta projekt än i ett traditionellt upp- handlat projekt	Stämmer inte alls						Stämmer mycket bra
8.	Jag har känt att kommunikationen varit bättre mellan deltagarna i detta projekt än i ett traditionellt upphandlat projekt	Stämmer inte alls						Stämmer mycket bra

	9.	Jag har känt mindre risk för seg- dragna och skadliga konflikter mellan deltagarna i detta projekt än i ett traditionellt upphandlat projekt	Stämmer inte alls			Stämmer mycket bra
	10.	Jag har känt att deltagarna upp- muntrats mer till innovation, ut- veckling och ständiga förbätt- ringar i detta projekt än i ett tradi- tionellt upphandlat projekt	Stämmer inte alls			Stämmer mycket bra
	11.	Jag har känt att deltagarna foku- serat mer på projektets långsikti- ga framgång före personliga kort- siktiga förtjänster i detta projekt än i ett traditionellt upphandlat proje	Stämmer inte alls			Stämmer mycket bra
Slu	ıtre	esultat				
	12.	Jag känner att min organisation kommer att uppnå en rimligare ekonomisk vinning i detta projekt än i ett traditionellt upphandlat projekt	Stämmer inte alls			Stämmer mycket bra
	13.	Jag känner att det blivit mindre ändringsarbeten i detta projekt än i ett traditionellt upphandlat pro- jekt	Stämmer inte alls			Stämmer mycket bra
	14.	Jag känner att projektet utförts på ett mer tidseffektivt sätt än ett traditionellt upphandlat projekt	Stämmer inte alls			Stämmer mycket bra
	15.	Jag känner att projektet utförts på ett mer kostnadsseffektivt sätt än ett traditionellt upphandlat pro- jekt	Stämmer inte alls			Stämmer mycket bra
	16.	Jag känner att projektets slutpro- dukt är mer kostnadsseffektiv för verksamheten och driften sett över livslängden än slutprodukten i ett traditionellt upphandlat projekt	Stämmer inte alls			Stämmer mycket bra
	17.	Jag känner att slutprodukten har blivit bättre (avseende funktion, kvalitet, utförande, mm) vid detta projekt än i ett traditionellt upp- handlat projekt	Stämmer inte alls			Stämmer mycket bra

18. Jag känner att UE/UL har gett ett större bidrag till innovation och problemlösning i detta projekt än i ett traditionellt upphandlat pro- jekt	Stämmer inte alls				Stämme mycket l	
19. Jag känner att brukarna/ verk- samheten har fått ett större infly- tande över slutprodukten i detta projekt än i ett traditionellt upp- handlat projekt	Stämmer inte alls				Stämme mycket l	
Samverkansverktygens funktion						
<ol> <li>Hur tycker du att nedanstående arb projekt för att främja samverkan me</li> </ol>		igarna rat	/g har f	unger	at i dett	ta Fungerat mycket väl
Tidig upphandling av nyckelaktörer Gemensam projektering och arbetsberedning Pre-kvalificering av lämpliga anbudsgivare Beaktande av mjuka parametrar vid anbudsutv Samverkansgruppens storlek och sammansättr (deltagare som har skrivit under gemensamn Ersättningsform inkluderande bonusmöjlighet "Öppna böcker" (öppen redovisning av kostna Gemensam ändrings- och prognoshantering Formulering av gemensamma mål Uppföljning av gemensamma mål Främjande av ständiga förbättringar Teknisk samverkan och problemlösning Teknikmöten Gemensam projektdatabas (IT-verktyg, PNet) Gemensamt projektkontor Teambuildingövningar Egenkontroll av utförda arbeten	ning na mål)					

#### Samverkansverktygens betydelse

21. Utifrån din erfarenhet av detta projekt och andra samverkansprojekt: Hur viktiga tycker du att nedanstående arbetssätt och samverkansverktyg är för att främja samverkan mellan projektdeltagare i ett samverkansprojekt? Mycket Oviktigt viktigt Tidig upphandling av nyckelaktörer Gemensam projektering och arbetsberedning Pre-kvalificering av lämpliga anbudsgivare Beaktande av mjuka parametrar vid anbudsutvärdering Samverkansgruppens storlek och sammansättning (deltagare som har skrivit under gemensamma mål) Ersättningsform inkluderande bonusmöjlighet "Öppna böcker" (öppen redovisning av kostnader) Gemensam ändrings- och prognoshantering Formulering av gemensamma mål Uppföljning av gemensamma mål Främjande av ständiga förbättringar Teknisk samverkan och problemlösning Teknikmöten Gemensam projektdatabas (IT-verktyg, PNet) Gemensamt projektkontor Teambuildingövningar Egenkontroll av utförda arbeten

# Paper 1

# Cooperation and partnering in facilities construction – empirical application of prisoner's dilemma

Facilities, 2007, 25(1): 7-19.

Per Erik Eriksson

# Cooperation and partnering in facilities construction – empirical application of prisoner's dilemma

Prisoner's dilemma

Per Erik Eriksson

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#### Abstract

**Purpose** – To investigate if game theoretic reasoning may be used to explain a lack of cooperation in buyer-supplier relationships within construction and facilities management. In order to make an empirical application of the prisoner's dilemma (PD) game, possible important variables are operationalized and empirically measured.

**Design/methodology/approach** – Empirical data concerning pay-offs and the variables in the discount parameter formula (created in this paper) have been obtained through interviews with clients and contractors in the Swedish construction sector.

**Findings** – This paper suggests a way to operationalize pay-offs and the discount parameter, making empirical measurements possible. Owing to differences in pay-offs and the discount parameter, different forms of contracts will affect cooperation. Cumulative values of cooperation are much higher in lasting relationships than in occasional transactions. Thus, the best way to facilitate cooperation between rational players is long-term contracts.

**Research limitations/implications** – Since, the values used are based on empirical data collected from a few respondents, they should be viewed as illustrative empirical examples, rather than statistical generalizations.

**Practical implications** – From a game theoretic perspective the practice of project partnering may not solve problems regarding lack of cooperation. To increase the incentives for cooperation, the actors should work together in long-term relationships instead of focusing on single projects. Long-term strategic partnering is, therefore, beneficial for the construction and management of facilities.

**Originality/value** – This paper makes empirical application of the PD game possible by operationalizing and empirically measuring game theoretic variables that previously have been given values set by the researcher rather than by the players in the game.

**Keywords** Partnership, Game theory, Buyer-supplier relationships, Construction industry, Sweden **Paper type** Research paper

#### Introduction

During recent years, the interest for partnering arrangements has increased in many countries in the context of construction (Bresnen and Marshall, 2000; Chan *et al.*, 2003; Ng *et al.*, 2002) and facilities management (FM) (Jones, 1995; Okoroh *et al.*, 2001; Roberts, 2001). Partnering arrangements can be divided into two main types; short-term agreements regarding a specific project (project partnering (PP)) or long-term agreements concerning a series of projects or transactions (strategic partnering). Both these types have been suggested to be suitable alternatives in order to transform the

Emerald

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traditional adversarial relationships into cooperative ones. Since, traditional contract (TC) forms give little incentive for cooperation (Kadefors, 1997), both practitioners and researchers claim that construction projects often suffer from opportunism and a lack of cooperation between clients and contractors (e.g. contractors' search for extra work and clients' rejections of contractors' suggestions regarding alternative solutions). Alternative project governance forms, like partnering, aim to address problems in resolving disputes and enhance cooperation through mutual goals and effective routines to handle conflicts (Cheng *et al.*, 2000; Barlow *et al.*, 1997).

According to Lazar (2000), game theory (GT) and the game prisoner's dilemma (PD) are useful tools to analyze inter-organizational relationships in construction projects as they are very similar to such games. GT is the analysis of rational behavior in situations where decision makers with different goals participate and where interdependence between outcomes is involved. Inter-organizational relationships is a popular research topic, for which GT is well-suited (Camerer, 1991). The PD game is especially suitable to model cooperative behavior in buyer-supplier relationships since it closely resembles the structure of an exchange relationship (Zagare, 1984; Hill, 1990). GT has been criticized for being hard to use and test in real life, GT applications are often purely theoretical and mathematical (Jehiel, 2001), while empirical work is very uncommon (Camerer, 1991). In studies where GT is applied to specific situations, the values of variables (e.g. pay-offs and discount parameters) are often assumed and set by the researcher rather than empirically collected from real life (Reardon and Hasty, 1996). Many game theorists, therefore, call for a more practical brand of GT (Camerer, 1991). Since, the most insight for practitioners would be expected to come from an empirically grounded GT (Camerer, 1991), it was seen as valuable to investigate the implications that specific theoretical applications have in real life contexts (Jehiel, 2001). This paper attempts to achieve a more practical brand of GT, based on empirical data, in order to increase the usefulness of PD as a tool for understanding decision-making behaviors in buyer-supplier relationships.

Since, traditional construction relationships are argued to be adversarial it should be interesting to investigate if the opportunistic behavior of clients and contractors in construction projects can be explained by GT and if different contract forms lead to different outcomes in PD games. There are several important game theoretic variables (especially pay-offs and the discount parameter) that influence cooperation. To empirically apply PD, these variables need to be operationalized and measured; the degree to which this was done in earlier research was unsatisfactory. The purpose of this paper is to investigate if a lack of cooperation in construction projects may be explained by game theoretic reasoning, based on the empirical application of PD. To do this, three different contract forms will be analyzed: TC, PP and lasting relationships (LR). In order to make the empirical application possible, a method to operationalize and measure the variables pay-offs and discount parameter is developed. When they have been measured, the empirical data will be used to analyze the players' decision-making behaviors regarding cooperation and defection.

#### Prisoner's dilemma

PD is a two-person nonzero-sum game that can be applied to describe the conflict between individual and collective interests in many different political and economical situations, such as inter-organizational relationships (Zagare, 1984). Each player can choose to cooperate or to defect, resulting in one of the four pay-off outcomes (Figure 1). Owing to rational calculations, the players can be caught in a "catch 22" situation, i.e. a no-win situation. Each player, in pursuing his own selfish ends, will defect from cooperation even though they are both better off to cooperate. A game is defined as a PD when T > R > P > S and R + R > T + S. T is temptation to defect, R is reward for mutual cooperation, P is punishment for mutual defection, and S is sucker's pay-off.

#### Factors influencing cooperation in PD

In this section, five factors and their influence on cooperation are described. Two of them; pay-offs and the discount parameter, need to be operationalized and empirically measured to understand decision-making behavior:

- (1) The length of the game. This is a very important factor that depends on how many rounds the game consists of, i.e. how many times it is repeated. A single PD has a unique Nash equilibrium in the outcome *P*, *P*; meaning both players will defect since neither one can do any better by choosing another strategy. In a repeated PD with a known final period the outcome, determined by backward induction, will be the same (*P*, *P*) (Luce and Raiffa, 1957). Only in an infinitely repeated PD will mutual cooperation (*R*, *R*) emerge (Romp, 1997), but only if the importance of future pay-offs is high enough (Axelrod, 1984). Different games can become connected if any of the players perceive them as such, or if the rules connect them. Long-term contracts connect subsequent games into a long series of rounds together constituting one extended game (Brandenburger and Nalebuff, 1996). Games can be connected also without rules (contracts). Many exchange parties enter the relationship with the expectation that they may interact again in the future, although neither party can predict how many times this will occur. In such cases, the relationship corresponds to an infinitely repeated PD (Hill, 1990).
- (2) The size of the pay-offs. The size of the pay-offs is crucial for the outcome of a game. In a repeated PD, the chance for cooperation can be increased when the difference between T and R decreases, due to lower demands for the discount parameter. In a single PD, a smaller difference between T and R have no theoretical significance; both players will still choose to defect (Axelrod, 1984). Pay-offs for organizations depends on three basic factors: direct stakes (including financial health of a business, the size of the transaction, and the relative size of the buyer), bargaining skills (experience leads to more accurate forecasts of marketing negotiations), and management preferences (including risk tolerance and time preference) (Reardon and Hasty, 1996).
- (3) The discount parameter. In a repeated PD, the discount parameter (w) is critical. It describes the importance of the next move relative to the current move. Future moves are less important than the current move since there may be no next move, and individuals prefer receiving pay-off immediately rather than in the future.

Player B

		Cooperate	Defect
<u>Player A</u>	Cooperate	R, R	S, T
	Defect	T, S	P, P

Source: Zagare (1984)

Figure 1.
Symbolic pay-off matrix of PD

- The discount parameter w can vary between zero and one. A value of zero means that future pay-offs are perceived as worthless, while a value of one means that future pay-offs are worth as much as the current pay-offs. Even in infinitely repeated games, cooperation will never emerge if w is too small, since the cumulative values of future cooperative pay-offs then are too small (Axelrod, 1984).
- (4) The players' strategies. In GT, a strategy specifies what course of action a player pursues, given the history of the game. One strategy may be to always defect (opportunistic strategy), another to always cooperate (altruistic strategy). Strategies can also be very sophisticated, as when a player uses the history of the game to model the behavior of the other player and consequently uses probability theory to select the best long-term choice (Hill, 1990). Rational players choose the strategy that leads to the largest pay-offs. Successful strategies in PD have similar characteristics: niceness, provocability, forgiveness, and clarity. Niceness is to never be the first to defect, provocability means immediate retaliation of uncalled for defection, forgiveness after retaliation results in avoidance of further mutual defection, and clarity of behavior means that the other player can adapt to the pattern of behavior. The most successful strategy in PD is called Tit for Tat (TFT). It is based on reciprocity; starting with a cooperative choice and thereafter does whatever the other player did on the previous move (Axelrod, 1984).
- (5) The amount of trust between players. Empirical evidence shows that trust enhances cooperation in PD (Lazar, 2000; Morgan and Hunt, 1994). Trust decreases opportunistic behavior, meaning that strategies become more focused on cooperation than defection. It also leads to less need for monitoring and control in long-term relationships, which decreases transaction costs (Parkhe, 1993; Hill, 1990). This will increase the profits of future transactions, i.e. w will become greater, thus supporting cooperation in a repeated PD (Parkhe, 1993).

#### Cumulative values

For a rational player who tries to maximize profits, the choice between cooperation and defection in a single PD depends on the size of the pay-offs. In a repeated PD, this choice is dependent on the cumulative values of present and future pay-offs, which in turn are dependent on the size of the pay-offs and w. These two factors are, therefore, the most important for influencing cooperation in a repeated PD, given the assumption of rational (profit maximizing) players.

The cumulative value of an infinitely repeated mutual cooperation (R) will be R/(1-w). Assuming that the players are provocable, i.e. use reciprocity norms, infinitely repeated rounds with pay-off T are not possible. An initial defection is then retaliated, i.e. pay-off P. The value for an initial temptation to defect (T), followed by mutual defection (P), will be T + wP/(1-w). If W is too small considering the current pay-offs, then T + wP/(1-w) will be larger than R/(1-w), in which case the players will choose to defect. This means that nice strategies (e.g. TFT) are only collectively stable if W is sufficiently large, considering the current pay-offs (Axelrod, 1984).

### Methodology

This paper aims to develop a method to operationalize and measure the factors pay-offs and discount parameter, so as to make an empirical application of PD possible. In this section, both theoretical and empirical methods are described and discussed.

Choice of type of game

Cooperation and defection can arise in several phases during a construction project consisting of several rounds, i.e. an extended play of PD (Lazar, 2000). The drawback with this point of view is that the length of the game depends more on how the activities within the projects are summed up, rather than the durability of the inter-organizational relationship. No distinct difference between relationships spanning over several projects and relationships regarding one specific project exist. An alternative view is to sum up all project activities into one act of either cooperation or defection.

In games regarding large and complex projects, the number of potential and major players is relatively low in the Swedish construction sector. This means that the probability for the players to meet again sometime in the future is high, corresponding to what Axelrod (1984) refers to as a small population of players. Because of this, players presume that they will play against each other again in future games, thus leading to connections between games, i.e. no game (project) can be regarded as completely isolated from other games. Even without rules (contracts) players accordingly connect games so that subsequent construction projects form an infinitely repeated game (Eriksson, 2001). In this paper, all construction projects are, therefore, seen as distinctive rounds of infinitely repeated games of PD. To separate single project contracts from long-term contracts, different values of w are calculated. The value of w has a considerable effect on the outcome of a game, which explains why games with single project contracts and long-term contracts differ significantly. Hence, the discount parameter, rather than the length of the game, should be used to distinguish projects with different length of contracts. This corresponds with the aforementioned arguments presented by Hill (1990) and Brandenburger and Nalebuff (1996) regarding connections between games because of the players' perceptions.

#### Data collection

In this study, empirical data was collected from client and contractor companies in the Swedish construction sector. Three clients and four contractors were interviewed. The selection of the respondents was done to receive representative and valid data. Persons with long experience, regarding facilities construction were selected from large and important companies. Obviously, the answers from the respondents differ somewhat. To facilitate the mathematical calculation, an approximate mean value of the different answers is chosen. The seemingly exact numbers in the empirical illustration should, therefore, not be mistaken for statistically correct numbers.

The empirical numbers included in the calculations are a mix of the respondents' estimates and real life respondent experiences. Even if the collected data can be measured quantitatively, the issues are probably too complex to collect quantitatively. Thus, interviews instead of a survey have been used. During the interviews the questions about different pay-offs and variables regarding the discount parameter were discussed and explained before the respondents answered. For questions concerning pay-offs, for example, hypothetical situations corresponding to the four possible outcomes of a PD were described, i.e. the four combinations of cooperation and defection. The contractors were then asked about how much they thought they could earn in each situation in a facilities construction project worth 100 million Swedish crowns (M Skr) (e.g. 11 M Skr in mutual cooperation).

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The clients were unable to answer the same kind of question as the contractors, because clients mostly count costs instead of earnings in a construction project. Thus, they were asked how much this project with a target price of  $100\,\mathrm{M}$  Skr would actually cost in each of the four situations (for example,  $95\,\mathrm{M}$  Skr in mutual cooperation). To receive their earning estimates (pay-offs), a question about their break-even costs was then asked ( $115\,\mathrm{M}$  Skr for a project with a target price  $100\,\mathrm{M}$  Skr). Therefore, data about the clients' pay-offs could be indirectly collected (for example,  $115-95=20\,\mathrm{M}$  Skr in mutual cooperation). Of the four possible outcomes in a PD, the clients argued that the temptation to defect (T) could rarely be accomplished, since contractors are hard to take advantage of. If this occurs, the pay-offs will not be drastically higher than for mutual cooperation, see Figure 2.

### Operationalization and empirical measurement of pay-offs

Empirical data regarding pay-offs were obtained through interview questions that described hypothetical situations of the four possible outcomes in a PD. The amounts of the pay-offs in construction projects depend somewhat on the contract terms. In this paper, projects with three different contract forms are analyzed and described; TC, PP, and LR.

#### Pay-offs for traditional contracts

TC is the most common project form in the Swedish construction sector as well as in most other western countries. A TC regards only one single project. Owing to the irregular basis on which they play against each other, the players do not know each other very well. The players do not share excessive profits from mutual cooperation. Since, earnings are based on individual performance, each player tries to optimize his own activities without an overall view. Communication between players is inadequate as they are unfamiliar with each other and have no emotional ties to the other person. The contractor often hopes to play against the client again in his next project, thereby leading to connected games. A project with TC corresponds to an infinitely repeated game of PD, without communication between players (Eriksson, 2001).

A pay-off matrix for TC is shown in Figure 2. The amounts of the pay-offs reflect the respondents' estimates of profits (in M Skr) that can be obtained by the players in a TC-project with a target price of 100 M Skr.

In theoretic PD's, pay-offs are often assumed to be symmetric, though this is not the case here. Client pay-offs vary much more (from -3 to 23) than for the contractor (from 2 to 14). However, this is not a problem because according to Axelrod (1984), the pay-offs of the players need not be symmetric or even comparable at all. Furthermore, they do not have to be measured on an absolute scale, they may be measured relative to each other (Axelrod, 1984).

**Figure 2.** Pay-off matrix for projects with TC

		<u>Contractor</u>		
		Cooperate	Defect	
C1:	Cooperate	20, 11	-3, 14	
Client	Defect	23, 2	1, 6	

Prisoner's

dilemma

### Pay-offs for project partnering

PP is a relatively new project form that aims to increase cooperation between the parties in a single construction project. This is obtained through mutual project goals and clear and effective routines to handle conflicts. The parties also make relation specific investments, increase their communication, and share the profits that might be obtained by mutual cooperation (Cheng *et al.*, 2000). Similar to TC, PP also regards only one single project, but communication between players is better. Because players share profits that emerge from mutual cooperation, earnings are based on both individual performance and the overall result of the project. A partnering project corresponds to an infinitely repeated game of PD, with communication between players (Eriksson, 2001).

There are several ways to close the gap between the values of the pay-offs T and R, so as to increase the probability for cooperation to emerge. Relation specific investments and concern for a reputation of cooperativeness will increase the value of R (Parkhe, 1993). Owing to partnering processes, the pay-offs of mutual cooperation (R) are a bit larger than in TC. The client receives R=22 while the contractor receives R=13. The pay-off matrix for PP differs accordingly from TC's in one way; the numbers in the upper left square are 22, 13 instead of 20, 11. The smaller difference between T and T0 in PP than in TC is positive for cooperation.

#### Pay-offs for lasting relationships

LR, covering several projects, are unusual in the Swedish construction sector. Examples of a LR are strategic partnering and the relationships between client and contractor that are governed by long-term framework contracts. In LR players know each other well and communication is good, while earnings are based on both individual performance and the overall result of the project. Like PP, players share profits that emerge from mutual cooperation. LR corresponds to an infinitely repeated game of PD, with communication between players (Eriksson, 2001). Projects within LR are a lot like PP, and have, therefore, similar pay-off matrices. Despite this, they differ considerably regarding cumulative values of pay-offs due to differences in w.

#### Operationalization and empirical measurement of w

The value of the discount parameter (w) mostly depends on the probability to meet again in future games and how high the player values future pay-offs (Axelrod, 1984). w is constituted of several variables, which should be measured on their own. Therefore, the operationalization of w involves creating a formula that contains the most important variables affecting w.

#### Empirical values of variables affecting w

The probability to meet again depends on the contractor's probability to play against the client in his next project (repeat prob.), and the probability that the client's next project will be followed through (project prob.). The amount of future pay-offs mostly depends on the players' interest calculated for costing purposes (icc) and their ability to increase profits in subsequent projects (LR profits). The formula can then be formulated as  $w = \text{(repeat prob.)} \times \text{(project prob.)} \times (1 - \text{icc)} \times (1 + \text{LR profits)}$ .

*Repeat prob.* in TC several contractors compete in the bidding process, but only one wins and gets to do the job (play the game). In TC and PP, the absence of long-term contracts leads to a high uncertainty about the continuance of the game. When playing

against a client in TC, a contractor estimates the repeat prob. to 0.5 (50 percent), if he cooperates in the game. In PP, the repeat prob. is somewhat higher at 0.6 (60 percent), due to a closer relationship between the players. In LR, the repeat prob. is 1.0 (100 percent), due to long-term contracts. For the client, the repeat prob is 1.0 (100 percent) in all types of projects, since the client has the power to choose against whom to play.

*Project prob.* not all construction projects go as planned. For several reasons, projects may be discontinued or delayed. Among other things, a client may go bankrupt or not receive the necessary building permit for the project from the authorities. The clients estimate the project prob. to be approximately 0.9 (90 percent), regardless of contract forms.

Interest calculated for costing purposes (icc) works as a discount interest, to solve companies' problems with time preferences. Thus, it can be used as an indicator of how the players value future profits, compared to equal pay-offs received today. Both clients and contractors use an icc of approximately 0.08 (8 percent). If the game frequency is assumed to be one project per year, then the players value the pay-offs of the next game as 1 - icc, relative to the pay-offs in the current game.

LR profits. LR often lead to less opportunism and increased trust, thereby decreasing the need for extensive contracts and safe guards (Parkhe, 1993). Dealing with the same supplier also decreases both search and negotiation costs, since the buyer no longer has to search for appropriate suppliers and because the establishment of norms of behavior decreases the need for negotiations (Reardon and Hasty, 1996). Hence, transaction costs are lowered as the relationship matures, leading to higher profits of future cooperation, i.e. a higher value of w (Parkhe, 1993; Reardon and Hasty, 1996). Also, production costs often decrease over time in long-term relationships, especially when the products to be built are similar between projects (Barlow et al., 1997). Owing to lower production and transaction costs, the value of w for LR-projects increases by 1 + LR profits. The players estimate the LR profits to be approximately 2 percent for each player for every subsequent project, meaning that the players estimate the pay-offs of the next game will be 2 percent larger than the pay-offs in the current game. For TC and PP, only concerning single projects, no LR profits exist.

#### Empirical values of w

Calculations of different w values for client and contractor for different forms of contract follow. The calculations are based on the formula, created in this paper,  $w = \text{(repeat prob.)} \times \text{(project prob.)} \times (1 - \text{icc}) \times (1 + \text{LR profits})$ .

The discount parameters for the client in the three different project forms are: TC and PP:  $w = 1.0 \times 0.9 \times (1 - 0.08) = 0.83$ , and LR:  $w = 1.0 \times 0.9 \times (1 - 0.08) \times (1 + 0.02) = 0.84$ . Because the client has the power to choose whom to play against, w is almost equal in all project forms, due to equal probability for repeated projects.

The discount parameters for the contractor in the three different project forms are: TC:  $w = 0.5 \times 0.9 \times (1 - 0.08) = 0.41$ , PP:  $w = 0.6 \times 0.9 \times (1 - 0.08) = 0.5$ , and LR:  $w = 1.0 \times 0.9 \times (1 - 0.08) \times (1 + 0.02) = 0.84$ . Owing to the higher probability for repeated games and since both production and transaction costs can be decreased by long-term relationships based on trust, w is accordingly twice as large in LR as in TC.

#### Analysis of cumulative values

In TC, client values are R = 20, T = 23, P = 1, and w = 0.83. The cumulative value of an infinitely repeated mutual cooperation will then be R/(1 - w) = 118, and the value

for an initial temptation to defect (T) followed by mutual defection (P) will be T+wP/(1-w)=28. Owing to the large importance of future pay-offs, the rational choice for the client is cooperation. Contractor values are R=11, T=14, P=6, and w=0.41. The cumulative value of an infinitely repeated mutual cooperation will then be R/(1-w)=19, and the value for an initial temptation to defect (T) followed by mutual defection (P) will be T+wP/(1-w)=18. Owing to the small importance of future pay-offs, the cumulative values of cooperation and defection are almost equal. Thus, it is difficult for the contractor to make the decision, for which reason their behavior is hard to predict. A rational player will choose cooperation in some situations and defection in others.

In PP, client values are R=22, T=23, P=1, and w=0.83. The cumulative value of an infinitely repeated mutual cooperation will then be R/(1-w)=129, and the value for an initial temptation to defect (T) followed by mutual defection (P) will be T+wP/(1-w)=28. Owing to the large importance of future pay-offs, the rational choice for the client is cooperation. Contractor values are R=13, T=14, P=6, and w=0.5. The cumulative value of an infinitely repeated mutual cooperation will then be R/(1-w)=26, and the value for an initial temptation to defect (T) followed by mutual defection (P) will be T+wP/(1-w)=20. The cumulative values of cooperation and defection for PP differ more than in TC. The rational choice for the contractor is cooperation. However, because of the rather small difference (26-20=6), it is uncertain if the contractor will always choose cooperation.

In LR client values are R=22, T=23, P=1, and w=0.84. The cumulative value of an infinitely repeated mutual cooperation will then be R/(1-w)=138, and the value for an initial temptation to defect (T) followed by mutual defection (P) will be T+wP/(1-w)=28. Thus, the rational choice for the client is cooperation. Contractor values are R=13, T=14, P=6, and w=0.84. The cumulative value of an infinitely repeated mutual cooperation will then be R/(1-w)=81, and the value for an initial temptation to defect (T) followed by mutual defection (P) will be T+wP/(1-w)=46. In LR, cooperation is the rational choice for the contractor since it leads to significantly higher earnings than defection.

In Table I, the client's cumulative values for cooperation (R/(1-w)), defection (T+(wP)/(1-w)), and the empirical inputs (R, T, P and w) are summarized, for the three forms of contracts (TC, PP and LR). For all forms of contracts, the cumulative values for cooperation (118-138) are drastically larger than for defection (28), for all forms of contracts. Thus, it is always rational for the client to cooperate.

In Table II, the contractor's cumulative values for cooperation (R/(1-w)), defection (T+(wP)/(1-w)), and the empirical inputs (R, T, P) and (R, T, P)

Client	R	T	P	w	R/(1-w)	T + (wP)/(1-w)
TC	20	23	1	0.83	118	28
PP	22	23	1	0.83	129	28
LR	22	23	1	0.84	138	28

Table I.
The client's cumulative values and their empirical inputs

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larger than for defection (20); thus it should be rather rational for the contractor to cooperate. However, because of the small difference, it is uncertain that the contractor will always choose cooperation. Only in LR-projects is the cumulative value for cooperation drastically larger than for defection (81 and 46, respectively). Thus, only in LR-projects is it always obviously rational for the contractor to cooperate.

#### Conclusion

Eriksson (2001) discovered that players in the construction sector tend to connect different games, since contractors hope to be a part of the client's next project, though the parties have not entered into long-term contracts. In this paper, construction projects correspond to infinitely repeated games of PD. To separate projects with different forms of contracts, different values of pay-offs and the discount parameter are calculated. These two are the most important factors influencing the choice between cooperation and defection, if the players are assumed to be profit maximizing, since these factors affect the cumulative values of pay-offs. To allow empirical measurements of pay-offs and the discount parameter, these factors need to be operationalized. In this paper, a formula for calculating the discount parameter has been created and the factors have been empirically measured through interviews. These values have in turn been used to calculate cumulative values for the two players. Different forms of contracts lead to different cumulative values of cooperation and defection.

An infinitely repeated PD is the most favorable form for cooperation to emerge. In spite of this, cooperation is not always an obvious and rational choice for all forms of contracts. According to game theoretic reasoning, defection is rational when the cumulative value for defection is higher than the corresponding value for cooperation. In the empirical example in this paper, the cumulative values for cooperation and defection for the contractor are almost equal, in projects with TC forms (see Table II). This explains why the behavior of the contractor is difficult to predict, since the contractor does not know if the players will meet again in future games. For the client, cumulative values of cooperation are always significantly larger than the corresponding values for defection, for all contract forms (see Table I), given that the client knows that he may play against the contractor again if he wants to.

PP, which is often argued as a solution to a lack of cooperation in the construction sector, does not necessarily secure mutual cooperation. According to the empirical example in this paper, the cumulative values of cooperation and defection for the contractor may not differ that drastically in partnering projects, see Table II. Thus, it is uncertain that the contractor will always choose to cooperate in PP. These results support earlier research discussing the short perspective in the construction industry. The strong emphasis on individual projects favors a narrow perspective, both in time and scope (Dubois and Gadde, 2002). Since, relationships are mostly focused on short-term for the duration of one single project, the parties attempt to lever what they

**Table II.**The contractor's cumulative values and their empirical inputs

Contractor	R	T	P	w	R/(1-w)	T + (wP)/(1-w)
TC	11	14	6	0.41	19	18
PP	13	14	6	0.5	26	20
LR	13	14	6	0.84	81	46

can out of the existing contract, resulting in opportunistic behavior in adversarial relationships (Voordijk *et al.*, 2000, Cox and Thompson, 1997). Only in projects within LR is cooperation always the obvious and rational choice for the contractor. This is because long-term contracts both decrease the uncertainty for future games and increase the value of future outcomes. The best way to enhance mutual cooperation is, therefore, to make sure that players meet each other again and again in subsequent projects. This can be obtained by long-term contracts or by using a very small pool of suppliers that are contracted on regular basis.

The main contributions of this paper are:

- It has been shown that GT and PD when it is operationalized allows for significant insights into the nature of partnering in construction and FM.
- That the factor discount parameter, rather than the factor length of the game, should be used to distinguish projects (transactions) with different lengths of contracts. According to Hill's (1990) and Brandenburger and Nalebuff's (1996) reasoning about connections between games, this issue is probably not unique for construction projects. Also other types of buyer-supplier relationships within FM probably correspond to this.
- It has been shown how the two factors pay-offs and discount parameter can be
  operationalized and measured in real life transactions, through interviews.
  To measure the discount parameter a formula comprising of several variables
  has been created, and empirical data has been used to calculate cumulative
  values of cooperation and defection.
- Furthermore, the paper gives a possible game theoretic explanation for the
  inconsistent behavior of actors in the Swedish construction sector, caused by
  lack of long-term contracts. According to game theoretic reasoning, one cannot
  expect actors to cooperate if this is not rational. Cooperation is probably not
  always a rational behavior in single construction projects.
- To increase the incentives for cooperation the actors should try to decrease the difference between the pay-offs *T* and *R*, increase the chance for future games (repeat prob.), and/or increase the profits for LR (LR profits). To do this the actors should adopt a long-term perspective regarding their inter-organizational relationships, facilitating players to meet regularly.

Since, the values used are based on empirical data collected from very few respondents, they should be viewed as illustrative empirical examples, rather than statistical generalizations. Future research should explore the possibilities to use quantitative methods to collect the data needed for calculations of the cumulative values. Statistic generalizations could then be accomplished to receive possible explanations of decision-making behavior in large contexts, such as FM.

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# Paper 2

# Procurement and Governance Management -Development of a Conceptual Procurement Model Based on Different Types of Control

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# Procurement and Governance Management – Development of a Conceptual Procurement Model Based on Different Types of Control\*\*\*

Due to the importance of external suppliers for most companies, procurement and governance management is of utmost relevance for achieving competitive advantage. Research in the field of industrial buying behaviour (IBB) has largely been influenced by transaction cost economics (TCE). However, some TCE research has been rather simplistic; not distinguishing between governance structures and mechanisms, while research in IBB has a surplus of descriptive empirical studies and a critical shortage of analytical and conceptual constructs. This paper aims to address these shortcomings by integrating IBB and TCE in a conceptual model regarding procurement and governance of transactions. The model regards the analytical choice of a suitable combination of governance mechanisms (price, trust and authority) for different types of transactions. Additionally, a procedure for facilitating the achievement of a suitable mechanism mix is developed. The procedure shows how decisions during the buying process, regarding different types of control, will affect the mechanisms' levels in the transaction relationship. The model together with its procedure can serve as a basis for analysing planned purchases, in order to tailor governance mechanisms to transaction characteristics.

Key words: Procurement, Governance, Control, Transaction Cost Economics

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#### 1. Introduction

Due to the importance of external suppliers for most companies, procurement is of utmost relevance for achieving competitive advantage (Noordewier et al. 1990), since it provides opportunities for cost reduction and profit enhancement (Anderson/Katz 1998). In recent years procurement and management of buyer-supplier relationships have received increased interest in research (e.g. Cox 1996; Anderson/Katz 1998; Artz 1999; Wathne/Heide 2004). Transaction costs are argued to be a key determinant of buyer-supplier exchange performance (Artz 1999) and empirical investigations have supported the assumptions and conceptual arguments raised by transaction cost economics (TCE) (Dyer 1996; Artz 1999). Since TCE is a predictive coordination theory, indicating how to organise different transactions (Williamson 1996), it is a suitable complement in literature regarding industrial buying behaviour (IBB) (Cox 1996; Sheth 1996) and a very powerful framework for guiding procurement decisions (Heide/John 1990; Noordewier et al. 1990).

Some research efforts within the TCE field have been rather simplistic, not distinguishing enough between governance structures and governance mechanisms. Hence, it is in need of a more profound analysis of the coordination problem (Pihl 2000). To enhance the understanding of individual firms, Williamson (1998) argues that TCE should move from analysing structures of industries to a more detailed and strategic firm level analysis. Also research in IBB has some weak spots. Sheth (1996) and Cox (1996) argue that it has an abundant surplus of empirical studies with a descriptive approach and a critical shortage of conceptual constructs with an analytical approach. Theoretical clarification is required to enhance the development of practical concepts and techniques, and to assess under which conditions they are 'fit for purpose' (Cox 1996).

This paper aims to address these weak spots suggested by Pihl, by distinguishing between structures and mechanisms, Williamson, by moving to a more strategic level, and Sheth and Cox, by having an analytical/conceptual approach. The purpose of the paper is twofold: first, a conceptual model, based on TCE, regarding the analytical choice of a suitable combination of governance mechanisms for different types of transactions will be developed. Second, a procedure based on IBB will be developed for how to obtain the suitable mechanism mix through proper choices during the buying process, involving different types of control.

### 2. Review of transaction cost economics

TCE is the interdisciplinary field of law, economics, and organisation, dealing with governance of transactions, based on the assumptions of bounded rationality and opportunism. *Bounded rationality* means that there are limitations in the actors rationalty, due to restrictions in the human ability to process information (Rindfleisch/Heide 1997). *Opportunism* implies that actors are self-interest seeking with guile; they will deviate from the letter and the spirit of an agreement when it suits their purpose (Williamson 1985). However, all actors are not assumed to be opportunistic, but it is difficult to identify opportunistic actors ex ante (Rindfleisch/Heide 1997).

The three principal transaction characteristics of TCE: asset specificity, frequency and uncertainty, explain the reasons for different forms of governance for different

transactions (Williamson 1985). Asset specificity is the most important transaction characteristic. It refers to the dependence created through transaction-specific investments and the switching cost incurred by terminating the relationships and choosing another exchange party. Asset specificity mainly depends on the level of complexity, customization, and adaptability of the assets required for the exchange. As the complexity and customization of transactions increase, so do the need for specific assets (Håkansson/Snehota 1995; Dyer 1996). The frequency, describing how many times the transaction is repeated, affects the time horizon of the relationship. Since recurring transactions may be governed within long-term relationships an expectation of continuity may arise (Noordewier et al. 1990). Transaction duration is also connected to the time dimension, since it regards the measurement of how long each transaction lasts (Macneil 1978). Due to the time dimension, transactions with very long duration can have a recurring character (Williamson 1979). Uncertainty may arise due to unanticipated changes in transaction surroundings (Noordewier et al. 1990), leading to adaptation problems (Rindfleisch/Heide 1997). It may also arise when there is a difficulty of accurately measuring ex post the exchange partner's compliance with expected output (Williamson 1985), leading to a performance evaluation problem (Rindfleisch/Heide 1997).

#### 2.1 Governance structures

Transactions can mainly be governed within three different structures: *market*, *hierarchy* and the intermediate *hybrid* structure. Williamson (1985) presents a model (see Figure 1) for the choice of an optimal governance structure for six different types of transactions, depending on asset specificity and frequency.

Figure 1: Model for the choice of governance structure (Williamson 1985)

		Asset specificity			
		Low	Medium	High	
Frequency _	Occasional	Market Purchasing standard equipment	Trilateral hybrid Purchasing customised equipment	Trilateral hybrid or Hierarchy Constructing a plant	
	Recurrent	<b>Market</b> Purchasing standard material	Bilateral hybrid Purchasing customised material	Hierarchy Site-specific transfer of intermediate product	

Procurement from an independent supplier in perfect competition with others implies market governance, which is most efficient when standardisation and mass-production

make transaction-specific investments redundant (Williamson 1975). For production demanding very high and specialised knowledge that cannot be used for other purposes, potential scale economies through inter-firm trading are diminished (Williamson 1975). Hence, the exchange should be governed internally within the organisation's hierarchy, especially when the frequency is high (Williamson 1985). The hybrid represents a wide range of cooperative arrangements, such as long-term contracts, networks and alliances (Blois 2002), which may be divided into two main forms: bilateral and trilateral hybrids. Their main difference is that the trilateral hybrid relies on third-party assistance to determine performance and resolve disputes, while the bilateral hybrid is based on private ordering, considering the entire relationship as it has developed through time, rather than any original contract (Macneil 1978; Williamson 1998). The *hybrid* is most efficient for intermediate degrees of asset specificity, requiring rather high and specific knowledge, for which contractual safeguards are demanded (Williamson 1991). Trilateral governance is appropriate for short-term relationships regarding occasional transactions while the bilateral hybrid is favoured for long-term recurrent transaction relationships (Williamson 1985).

#### 2.2 Governance mechanisms

Governance mechanisms refer to basic alternative ways to influence the exchange partner and to establish good order and coordination in a business relationship (Hennart 1993; Pihl 2000). The three governance structures are traditionally associated with three different mechanisms: market with price, hierarchy with authority and hybrids with trust (Bradach/Eccles 1989; Adler 2001). This association is so strong that the two concepts are often treated as one and the same. It is, however, very important to distinguish between them since empirically observed arrangements often rely on a mix of price, authority, and trust (Bradach/Eccles 1989; Hennart 1993; Foss 2002). Accordingly, trust and authority can be utilized to some extent in the governance of a market transaction even if the main mechanism is price. All three mechanisms have both advantages and drawbacks (Adler 2001), and there are supplementary relationships between them (Spekman 1988; Das/Teng 1998). Hence, they should be combined, since the downside of one can be diminished by the presence of the other two.

The price mechanism can be illustrated by the 'invisible hand', adjusting the transaction in relation to the prices resulting from supply and demand (Larsson 1993). The price mechanism creates incentives and opportunities (Williamson 1985; Adler 2001), but diminishes the possibilities for specifying any special and custom-made features (Håkansson/Snehota 1995).

Authority is illustrated by the 'visible hand', adjusting the transaction by giving authoritative orders to the agents executing them (Larsson 1993). Authority is normally viewed as a process of regulation and monitoring for the achievement of organisational goals. It is a powerful lever for assuring stability and equity (Adler 2001), but it decreases participation and creativity and stifles commitment and motivation (Aulakh et al. 1996; Das/Teng 2001).

Trust can be illustrated by the 'handshake', adjusting the transaction in relation to structural agreements resulting from negotiations between organisations (Larsson 1993). In a transaction governed by trust the exchange partners believe that they,

without the exercise of authority, can get what they want from each other, without fearing opportunism (Håkansson/Snehota 1995). Hence, trust can be defined as positive expectations regarding the other in a risky situation and, therefore, essentially means to take risk and leave oneself vulnerable to the actions of the trusted partner (Das/Teng 1998). Trust can decrease the need for formalization and monitoring, leading to lower transaction costs (Adler 2001) and facilitate incentives (Williamson 1985) and creativity compared to authority (Korczynski 1996). A drawback is that trust is often associated with exclusive reliance on a few relationships (small-number exchange), creating rigidity and risks (Adler 2001).

Various scientific disciplines (e.g., psychology, sociology, TCE and strategic management) have focused their research on trust (Castaldo/Dagnino 2004), resulting in abundant studies suggesting many different types of trust. For the arguments put forward in this paper it is sufficient to distinguish between two types; calculative (economic) trust and social (goodwill) trust. Calculative trust is based on rationality; you can trust another actor as long as it is economically rational for him to cooperate with you. It is affected by issues such as safeguards, incentives (Williamson 1993), pay-offs and the shadow of the future, which is derived from expected long-term reciprocity (Axelrod 1984). This calculativeness is an important part of theory fields such as neoclassical economics, TCE and game theory (Castaldo/Dagnino 2004). Social trust is a non-calculative (Williamson 1993) psychological concept, yet based on social interaction and the social environment where the relationship occurs (Castaldo/Dagnino 2004). Traditionally, social trust has not played a prominent role in TCE research (Ghoshal/Moran 1996; Nooteboom 1996). The arguments made in this paper therefore extend traditional TCE by making explicit consideration of this concept. This because social trust and relationships are important in understanding cooperation and governance of transactions (Nooteboom 1996; Hoetker 2005).

# 3. Model development

Williamson's model (Figure 1) prescribes a single governance structure as optimal for a certain transaction. Although this choice is initially important and relevant, it is not detailed enough to guide more specific buying behaviour. To enhance procurement decisions on a lower and more detailed level of analysis it should be useful to focus on the choice of a suitable mix of governance mechanisms to be utilized within the optimal governance structure. In this section a model for the choice of a suitable combination of mechanisms for different types of transactions is developed and presented in Figure 2.

The model prescribes approximate values (low, medium, and high) of the three mechanisms, together adding up to 100% of the coordination, for six different types of transactions, depending on asset specificity and frequency. In Figure 2, both variables (frequency and asset specificity) and the prescribed mechanisms combinations are measured in ordinal scales with only two or three discrete levels. The reason for using such simple and rough scales is to enhance the illustration and understanding of the model. However, to facilitate new and innovative ways of combining the mechanisms they should be combined over a continuum, not in discrete chunks (Grandori 1997; Foss 2002). In reality, therefore, the scales should be viewed as continuous, i.e.

each mechanism level can vary between zero and 100% of the coordination. Accordingly, the levels may not be exactly similar for different transaction types even though the same scale level is prescribed (e.g. the emphasis on price should be somewhat lower in type 2 than in type 1).

Figure 2:	Model for the	he choice of	of governance	mechanisms
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		Asset specificity			
		Low	M edium	High	
Frequency	Occasional	Type 1 Emphasis on price: high trust: low authority: low	Type 3 Emphasis on price: medium trust: medium authority: medium	Type 5 Emphasis on authority: high/medium trust: medium/high price: low	
rioquotioy	Recurrent	Type 2 Emphasis on price: high trust: medium authority: low	Type 4 Emphasis on trust: high price: medium authority: low	<i>Type 6</i> Hierarchical production	

## Type 1. Occasional transactions with low asset specificity

An example of this is purchasing standard equipment (Williamson 1985). Price is most efficient for optimising standardised production, i.e. when asset specificity is low and performance is easy to measure (Adler 2001). Authority is not important since standardisation makes supervision unnecessary (Håkansson/Snehota 1995), and trust is not greatly needed because performance is easy to measure. Consequently, high emphasis on price, low trust and low authority should be a suitable combination of mechanisms in these types of transactions.

## Type 2. Recurrent transactions with low asset specificity

An example of this is purchasing standard material (Williamson 1985). These transactions should have a similar combination of mechanisms as type 1 due to similar asset specificity, but with somewhat less emphasis on price and more emphasis on trust due to higher frequency. According to Macneil (1978), the need for trust and adaptability is higher in lasting relationships because comprehensive long-term contracts are not realistic, due to bounded rationality and uncertainty of future situations. Furthermore, the emphasis on price often becomes somewhat lower since other product factors, e.g. quality, flexible and timely deliveries, and after sales service, also become important in long-term relationships (Christopher et al. 1991). Consequently, high emphasis on price, medium trust and low authority should be a suitable combination in these types of transactions.

## Type 3. Occasional transactions with intermediate asset specificity

An example of this is purchasing customised equipment (Williamson 1985). As asset specificity increases, the efficiency of price as governance mechanism decreases, since performance becomes more difficult to measure (Håkansson/Snehota 1995) and opportunism hazards increase (Williamson 1975). In handling opportunism, trust and authority are more efficient than price (Håkansson/Snehota 1995). Furthermore, in exchanges where transaction-specific investments are required and the quality of products and services are difficult to evaluate, a great deal of trust is needed (Das/Teng 1998; Parkhe 1998a). Consequently, the focus of price should be lower while trust and authority should be higher than in transactions of type 1. Medium emphasis on all three mechanisms should therefore be a suitable combination.

## Type 4. Recurrent transactions with intermediate asset specificity

An example of this is purchasing customised material (Williamson 1985). This type should have a similar combination as type 3, due to similar asset specificity, but with somewhat less emphasis on price and authority and more emphasis on trust due to higher frequency. In long-term partnerships trust is more important than authority (Aulakh et al. 1996; Parkhe 1998a), due to increased needs for adaptability (Macneil 1978). Furthermore, the history of successful transactions and the expectancy of continued interactions decrease opportunism and increase trust (Håkansson/Snehota 1995). In long-term partnerships, customers often focus less on price and more on softer parameters related to trust, due to increased switching costs (Christopher et al. 1991). Consequently, the focus of trust should be higher while the focus of price and authority should be lower in this type of transaction than in type 3. Medium emphasis on price, high trust and low authority should therefore be a suitable combination.

# Type 5. Occasional transactions with very high asset specificity

In this type of transactions, such as constructing a plant, the hazards of opportunism are very high (Williamson 1985), explaining why high levels of trust or authority are needed. Traditionally, authority is seen as most efficient when asset specificity is very high (Håkansson/Snehota 1995), but trust can often be a suitable substitute (Aulakh et al. 1996). Price is inefficient for optimising production and allocation of knowledge (Adler 2001), that is, in transactions with high asset specificity.

Since transactions are socially embedded in relationships between actors (Granovetter 1985), the levels of trust and authority should depend on the potential for trust building and the purchaser's knowledge about the transformation process. According to Collin (1993b) and Das/Teng (2001), a necessary condition for high authority is that the monitoring party has a satisfactory understanding of the transformation process and hence knows exactly what kind of behaviour is suitable. Due to the low frequency this may not be the case. Then a somewhat lower level of authority and a higher level of trust are more suitable (Collin 1993b; Pihl 2000). However, high emphasis on trust may not be obtained very easily either, since it may take a long time to establish. Through careful partner selection and reputation effects significant levels of trust may nevertheless be established also in a shorter period of time (Parkhe 1998b). Consequently, low emphasis on price, medium or high trust and high or medium au-

thority should be a suitable combination. Whether the level of trust or authority should be high depends on the possibilities to exercise authority and build trust in the transaction relationship.

## Type 6. Recurrent transactions with very high asset specificity

These transactions are the only ones for which hierarchical production is most efficient (Williamson 1985). Since this does not entail a procurement situation it falls outside the scope of the model.

## 4. Achievement of the mechanisms levels

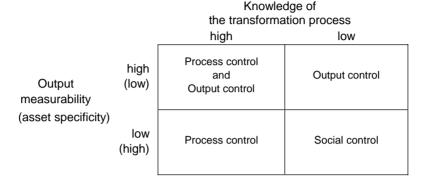
For the developed model to be of practical use it is not sufficient to know only *which* mechanisms mix is optimal for the transaction at hand; the purchaser must also know *how* to obtain it. The procedure developed in this section illustrates how buying behaviour facilitates the establishment of governance mechanisms through different types of control. Thereby it utilizes principal-agent theory to integrate TCE and IBB.

### 4.1 Control types

According to principal-agent theory (e.g. Ouchi, 1979; Eisenhardt, 1985; Aulakh and Gencturk, 2000) there are three main types of control: output, process and social control, with which the principal (e.g. a buyer) can influence the agent (e.g. a supplier) in delegation situations. These three types of control are strongly related to the three governance mechanisms (Pihl 2000). The buyer can therefore facilitate the establishment of different governance mechanisms in a transaction relationship through the exercise of different types of control.

The three types of control are suitable in different situations, mainly depending on the variables output measurability and knowledge of the transformation process (Das/Teng 2001), see Figure 3. Output measurability is inversely related to asset specificity. Increased complexity leads to performance ambiguity since outputs are difficult to measure (Dyer 1996; Houston/Johnson 2000). An example of this is the construction of a plant, which requires highly specific assets (see Figure 1). Output control is not suitable for such a transaction since construction work is often hidden and very difficult to inspect after the completion of the building (Kadefors 2004). Ghoshal and Moran (1996) therefore argue that output control is most suitable for standardized products and processes, whereas complexity and dynamism render process control more suitable. Additionally, mutual transaction specific investments creates interdependencies between exchange parties (Nooteboom 1993; Collin 1993a), which increase the need for coordination of activities, complicating the control task. Also unilateral specific investments often lead to interdependence since they take time to develop and both parties have to cooperate to design and utilize the idiosyncratic resources (Vandegrift 1998; Buvik/Reve 2001). Increased interdependencies make it harder to separate the respective parties' contributions, thereby decreasing the measurability of the output. In such situations process control is more suitable than output control (Collin 1993b; Gencturk/Aulakh 1995). This is in line with the argument presented in Figure 3, that process control is more efficient than output control for transactions with low output measurability. The other variable in Figure 3; knowledge of the transformation process, is not directly related to the TCE variables in the procurement model. Although low frequency may decrease the chance for high knowledge of the transformation process in some cases, as discussed in section 3, this variable is mainly dependent on other factors that are outside the scope of this paper.

Figure 3: Control types and their suitability. Developed from Das and Teng (2001)



Output control is defined as the degree to which the focal firm monitors the results or outcomes produced by the partner (Aulakh et al. 1996). It is efficient when it is possible to measure goal attainment, which mostly occurs when asset specificity is low, and the monitoring party has low knowledge about the transformation process (Collin 1993b; Das/Teng 2001). Output control is closely related to the price mechanism (Hennart 1993; Pihl 2000) through the invisible hand of the market (Gencturk/Aulakh 1995). Hence, through the use of output control the buyer can facilitate a focus on price in the transaction relationship.

Process control refers to the extent to which the focal firm monitors the partner's behaviour or the means used to achieve the desired ends (Aulakh et al. 1996). Increased interdependencies, caused by transaction specific investments, make output control less efficient and process control more suitable (Gencturk/Aulakh 1995). This since outputs may be hard to measure, due to bounded rationality and asset specificity (Williamson 1996; Das/Teng 2001). Process control is then feasible if the monitoring party knows the appropriate action to achieve the goal (Collin 1993b; Das/Teng 2001). Process control is related to authority (Hennart 1993; Pihl 2000), through the visible hand of management (Gencturk/Aulakh 1995). Hence, through the use of process control the buyer can facilitate a focus on authority in the transaction relationship.

Social control is achieved by minimizing the divergence of preferences among the parties (Eisenhardt 1985) by building a common organizational culture that encourages self-control (Aulakh et al. 1996). When neither output nor process control are appropriate, i.e. when it is not possible to measure goal attainment, caused by high asset specificity, and the monitoring party does not know the appropriate action to achieve the goal, social control is most efficient (Collin 1993b; Das/Teng 2001). In such cases the problem is to design a relational contract that allows and motivates the supplier to use his superior knowledge efficiently, as in a partnership (Foss 2002). Joint goal setting, participatory decision making and teambuilding activities are impor-

tant examples of social control (Das/Teng 2001) which can work as substitutes to more formal safeguards (Rokkan et al. 2003). Through such activities the parties utilize shared norms and values to develop solidarity and a mutual understanding encouraging desirable behaviour, leading to a higher level of behavioural predictability (Das/Teng 1998; Rokkan et al. 2003). Important relational norms involves collaboration, continuity expectations and communication (Artz/Brush 2000). The predictability of positive behaviour trough a common ideology facilitates trust (Collin 1993b). Social control is therefore the most proper form of control in trust-based network relationships (Das/Teng 2001). Hence, through the use of social control the buyer can facilitate a focus on trust in the transaction relationship.

### 4.2 Buying process

In this section, a buying process based on a model created by Johnston and Bonoma (1981) is used to illustrate how different decisions and causes of actions during the stages of the buying process will involve different types of control, thereby affecting the levels of price, trust and authority.

## 1. Problem recognition and transaction type identification

Stage one involves the recognition of a problem and the awareness that the needs may be satisfied through a purchase (Robinson et al. 1967), resulting in a make or buy decision. To use the procurement model, presented in Figure 2, the purchaser first has to decide which transaction type (1-6) best fits the transaction at hand, depending on the two variables of frequency and asset specificity. The frequency is not very hard to estimate. Does the client procure similar kinds of products on a regular basis or not? Asset specificity is somewhat harder, requiring an estimation of the levels of complexity and customisation of the product. To guide this decision, one should consider the descriptions and examples of each transaction type in section 3, i.e. which typical products that represent the three different sets of asset specificity. When the transaction type has been identified, the buyer receives a mechanism combination prescribed by the model. Then the buyer may continue to the next stage in the process, if the product is to be bought from an external supplier (transaction type 1-5).

# 2. Specification

This stage entails a translation of the need into a particular solution that can be readily communicated to others (Robinson et al. 1967), i.e. the specification of the product (Johnston/Bonoma 1981). Generally, a specification can be made by the supplier, by the buyer or by both parties in joint specification. These three types of specification are congruent with the three control types: output (supplier), process (buyer) and social control (both) (Collin 1993b). Output control is obtained when the buyer only specifies the performance of the output and not the work process to achieve the goal (Collin 1993b). The detailed specification is then left to the supplier. Process control can be achieved if the buyer uses a fixed design (comprehensive specification) and monitors the behaviour of the supplier (Korczynski 1996). Social control can be achieved by joint specification (Collin 1993b), which is a key aspect of relational contracting (Grandori 1997). Spekman (1988) argues that buyers should seek supplier input early in the specification stage of collaborative relationships, since a dialog concerning

components, materials and technology in joint specification and problem solving increases trust and commitment (Spekman 1988).

Consequently, how the specification is executed will affect the levels of price, authority and trust in the transaction. Output control, by specifying performance rather than technology, facilitates high emphasis on price while process control through detailed specification facilitates high emphasis on authority. Lower level of authority is facilitated when technical specification and characteristics of the product are developed by both buyer and supplier in collaboration. This mostly entails social control but also process control (if the buyer has the formal responsibility of the specification) or output control (if the supplier has the formal responsibility) to some extent. Hence, joint specification facilitates high emphasis on trust, medium (or low) emphasis on authority and low (or medium) emphasis on price.

## 3. Supplier search

This stage involves the search for alternative sources of supply, resulting in qualification of suppliers, i.e. a conclusion of which suppliers will be considered as potential vendors (Robinson et al. 1967). If the number of vendors is very low, negotiation rather than bidding takes place (Johnston/Bonoma 1981). When a product is purchased in a market with many competing suppliers, the main mechanism is price (Spekman 1988; Adler 2001). Trust is obstructed when a large number of suppliers compete mainly on price and are played off against each other (Spekman 1988). Such procedures facilitate a focus on short-term benefits, which according to Anderson and Oliver (1987) is related to output control. Social control involves investments in the socialization of the partner, which are enhanced by long-term relationships and expectations of continuance (Aulakh/Gencturk 2000). Also process control is related to a long-term perspective, since it removes incentives to sacrifice long-term for immediate pay-offs (Anderson/Oliver 1987). Negotiations with only one or very few suppliers, facilitating lasting relationships, therefore indicate social and/or process control. Such procedures, related to the preferred supplier approach, are often based on trust related issues, such as past experience, reputation, reliability and shared values (Spekman 1988; Parkhe 1998b). The issue of supplier search later in this study was discussed during a two-hour group interview with four professional construction clients in order to gain improved insights. The respondents argued that clients sometimes invite several bidders from their pool of suppliers just to 'keep suppliers warm'. This indicates a need to control the pool of suppliers, keeping them alert and up to date, facilitating some extent of authority.

Consequently, the way the client deals with the qualification of potential suppliers will affect the levels of price, trust and authority in the transaction. A large number of bidders is related to output control, facilitating an emphasis on price, while few bidders are related to social and process control, enhancing trust and authority.

#### 4. Bid evaluation

In this stage, the various offers from potential vendors are weighed and analysed, resulting in the approval of one or more suppliers' offers and rejection of others' (Robinson et al. 1967). Price is often the most important parameter when buying

standardised products. When focusing only on price the client does not take the opportunity to influence the characteristics of the supplier, since these are considered unimportant in pure market relationships (Heide/John 1990). This indicates a laissezfaire approach which according to Anderson and Oliver (1987) is related to output control. In process control, however, the client assumes risk to gain control (Aulakh/Gencturk 2000), for which reason the consideration of soft parameters involving the characteristics of the supplier becomes important. Through the account for organisation, financial stability, resources and competencies, the client can control (ex ante) the supplier in delivering what is promised. Such control of supplier inputs are closely related to process control (Anderson/Oliver 1987). Partner selection considerations regarding the collaboration and nurturing of the relationship indicate social control (Ouchi 1979; Aulakh/Gencturk 2000). This can be exemplified by soft parameters such as collaborative ability, reputation, earlier experience of the supplier and shared values, which are enhancing trust (Korczynski 1996; Nooteboom et al. 1997). Earlier experience of the supplier have been shown to be very important when complexity is coupled with high uncertainty (Hoetker 2005). In fact, soft parameters are often more important than price when buying complex and specialised products, such as capital equipment (transaction type 3 or 4) (Baptista/Forsberg 1997).

Consequently, the weight the client gives to hard and soft parameters in the bid evaluation will affect the levels of price, trust and authority in the transaction. The more weight on price (related to output control) and less weight on soft parameters (related to social and/or process control), the higher the emphasis on price and the lower the emphasis on trust and authority, and vice versa.

# 5. Selection of sub-suppliers

The selection of sub-suppliers can be made by the supplier (domestic contract), by the client (nominated contract) or by both parties in collaboration. In market relationships, suppliers have total freedom to select their sub-suppliers, rendering the client with no control over who carries out specialist work (Shoesmith 1996). A departure from market governance is manifested when the buyer attempts to control the supplier's decision making in areas such as selection of sub-suppliers (Heide/John 1992). Domestic contracts therefore indicate a *laissez-faire* approach, enhancing a focus on price through output control, while nominated contracts entail process control of inputs, increasing the level of authority. According to Wathne and Heide, downstream buyer-supplier relationships are to a large extent affected by upstream relationships with sub-suppliers. To increase the ability to adapt to uncertainty in relational governance, the selection of sub-suppliers is therefore crucial (Wathne/Heide 2004). To enhance customer satisfaction careful sub-supplier selection by both buyer and supplier in collaboration should be suitable. Such joint selection indicates a concern for both parties' interests, facilitating an emphasis on trust through social control.

Consequently, the selection of sub-suppliers will affect the levels of price, trust and authority in the transaction. Sub-supplier selection by the supplier facilitates an emphasis on price, through output control, while selection managed by the client facilitates an emphasis on authority, through process control. When both parties collaborate in doing the selection, an emphasis on trust is facilitated, through social con-

trol. In a collaborative selection some emphasis authority or price can also be facilitated if the client or the supplier, respectively, has the formal responsibility.

## 6. Formalization and product exchange

This stage mostly deals with contract design, entailing many different decisions such as terms of payment and warranty details, which must be agreed upon before the exchange takes place (Johnston/Bonoma 1981). This stage is divided into three substages: contract formalization, type of compensation, and usage of collaborative tools.

### Contract formalization

Price-based market governance emphasises the importance of legal rules and formal documents (Blois 2002), since complete contracts are more legally binding in court ordering (Macneil 1978; Woolthuis et al. 2005). Contract formalization is therefore an important part of output control. Even more so, process control results in formalized and bureaucratic relationships (Aulakh/Gencturk 2000). Thus, formal contracts are closely related to the establishment of authority (Grandori 1997), through process control (Das/Teng 2001). However, formalization may decrease trust and increase opportunism, for which reason relational norms should be used as safeguards instead (Heide/John 1992). Through social control the parties establish an implicit sense of what is acceptable and what is deviant behaviour (Aulakh/Gencturk 2000), making formalization unnecessary. Increased trust therefore makes it possible to decrease formalization and lower transaction costs (Das/Teng 1998; Parkhe 1998b). However, the relationships between formalization, authority and trust are not straightforward. Authority through high formalization can in some cases enhance trust and low formalization does not necessarily lead directly to high trust (Woolthuis et al. 2005). Hence, it is important to couple incomplete relational contracts with social control in order to establish relational norms that can serve as safeguards (Artz/Brush 2000).

Consequently, the scope of the contracts between the parties will affect the levels of price, trust and authority in the transaction. Formal and comprehensive contracts facilitate a high emphasis on price and authority, through output and process control, while low formalization coupled with social control facilitate trust.

## Type of compensation

According to Gencturk and Aulakh (1995), the type of compensation is closely related to the type of control. A compensation system rewarding the supplier for his output (e.g. piecework or commission schemes) entails output control. Compensation for the costs of the supplier based on the time worked (e.g. salaried agents) and costs of input material entail process control (Gencturk/Aulakh 1995). Such compensation also achieves contract flexibility and is suitable for transactions in which change is anticipated (Macneil 1978). Profit sharing together with joint objectives indicates social control (Das/Teng 1998).

Consequently, the type of compensation used will affect the levels of price, trust and authority in the transaction. A fixed price for a product delivered (piecework) facilitates a high emphasis on price, through output control, while reimbursement compensation for the time put into the work facilitates a high emphasis on authority, through process control. When reimbursement compensation is coupled with incen-

tives schemes and profit sharing it also facilitates social and output control, which increase the levels of trust and price while authority decreases, resulting in medium emphasis on all three mechanisms. The "exact" levels of the mechanisms depend on the design of the incentive scheme.

### Usage of collaborative tools and techniques

In some transactions the actual production takes place within the buying process, resulting in very long duration. Since the buyer and the supplier then have to interact to create the product, use of collaborative tools may be suitable. These tools are closely related to what Heide and John (1990) refer to as joint action, indicating close cooperative relationships.

- Social control may be performed through joint goal setting, where participatory decision-making makes the partners interact and gain a better understanding of each other (Das/Teng 1998). This results in collective norms and mutual interests, enhancing trust in cooperative relationships (Das/Teng 2001). However, if goals are aggressive and measurable, they will also increase competition through output control (Das/Teng 1998). Joint goal setting is therefore a mix of social and (participatory) output control.
- Communication and information exchange is an important element of relational contracting (Noordewier et al. 1990) since it enhances relationship trust (Aulakh et al. 1996; Das/Teng 1998). It is important to allow key people in each organisation to speak directly with each other, which is facilitated by the members *sharing the same office building* or workspace (Barlow 2000).
- Social control through *teambuilding activities* is efficient in creating understanding and shared values among the parties (Das/Teng 1998).
- Private ordering is a vital part of relational contracting (Macneil 1978; Williamson 1998). Through *joint dispute resolution* or an arena for relationship discussions, firms can increase communication and mutual understanding, enhancing trust-building (Parkhe 1998b; Das/Teng 2001).

The usage of collaborative tools will directly facilitate trust building, through social control (Das/Teng 1998). Indirectly, it will also facilitate lower emphasis on authority through less need for process control and lower emphasis on price since these tools and techniques create human asset specificity, leading to switching costs. Consequently, the extent of use of collaborative tools will affect the levels of price, trust and authority in the transaction. No or low usage of collaborative tools facilitates emphasis on price and authority, while high usage facilitates high emphasis on trust, through social control.

## 7. Performance feedback and evaluation

In this last stage the fundamental evaluation of the supplier's performance takes place, dealing with how well the purchased product solved the problem (Robinson et al. 1967). According to Korczynski (1996) and Pihl (2000), performance monitoring by the purchaser (process control) facilitates high focus on authority and low trust, while social control through shared values and self-control, on the contrary, facilitates trust

(Das/Teng 2001). Output control through monitoring of the finished product facilitates an emphasis on price (Hennart 1993; Pihl 2000).

Consequently, the way the performance feedback and evaluation is carried out will affect the levels of price, trust and authority in the transaction. Monitoring of the ongoing performance facilitates high emphasis on authority, through process control, while monitoring of the performance outcome facilitates high emphasis on price, through output control. The more the supplier is allowed to monitor performance and the result, the higher the emphasis on trust, through social control.

## 5. Combination calculation and analysis

In each stage, all three mechanisms should be given a value that illustrates its part of the coordination in that stage. For example: in the specification stage, price may be set to 70%, authority to 0% and trust to 30% (summing up to 100% of the coordination) if the supplier is responsible for the specification (output control) but collaborates with the client in joint specification (social control) in some aspects of the specification work. When the different levels of the mechanisms are set in each of the buying process stages (2-7), the mean values for each mechanism can be calculated, by adding the values of each stage and dividing it by eight (the amount of stages and sub-stages). The received combination should then be compared to the one prescribed by the model (see Figure 2), in order to see if the courses of action taken/planned by the buyer are suitable for the transaction in question. However, just as the prescribed model combination is based on a somewhat approximate evaluation, so is the "calculated" combination. Hence, due to human bounded rationality, the model and its procedure should be viewed as a valuable framework in guiding procurement decisions rather than an exact technical instrument.

Nevertheless, if the buyer uses the model for ex ante analysis of an upcoming purchase, any significant discrepancies between the calculated combination and the one prescribed by the model should cause the buyer to reconsider the planned procurement decisions. Modified decisions in some stages may be enough to achieve a more suitable mechanism combination if the discrepancies are not too big. If the discrepancies are very large, however, the buyer may have to reconsider the whole procurement strategy and the entire buying process. In such cases the model can serve as an alert, showing that there is a theoretical implication that the traditional procurement strategy is not appropriate.

To implement and achieve change, a system perspective must be adopted (Senge 1990). Hence, it is important to recognize that the decisions during the buying process stages are not totally isolated and independent of each other. In terms of the supplier search stage, small-numbers exchange is vulnerable to the possibility of opportunism (Collin 1993b). Traditional TCE displays a bias towards ascribing opportunistic rather than cooperative behaviour to actors, thereby assuming suppliers to squeeze above-market rents or shirk in small-numbers bargaining situations, irrespective of the social relationship between the parties (Ghoshal/Moran 1996). In reality, trust and mutual dependency can mitigate opportunism in small-numbers bargaining situations because the firms trust that pay-offs will be divided equitably, even when comparable market transactions do not exist (Uzzi 1997). When a long-term perspective is adopted, op-

portunism does not pay even in cases characterized by small numbers and high switching costs (Hill 1990). Accordingly, if only calculative trust exists, small-numbers bargaining situations should be avoided, since opportunistic behaviour may be calculated as more profitable than cooperative behaviour. In relationships where social trust is apparent, however, a small number of suppliers should lead to closer cooperation. It is therefore important to couple direct negotiation in the supplier search stage with decisions facilitating trust through social control in other stages.

One must also recognize that the use of collaborative tools is not sufficient to create a trust-based relationship. Recent trends in many industries towards increased cooperation have given fuel to the development of concepts, such as supply chain management, partnering and relational contracting, emphasising the importance of teambuilding activities (Das/Teng 1998), joint objectives (Das/Teng 2001), an arena for relationship discussions (Parkhe 1998b) etc. The implementation of such cooperative concepts, however, requires re-engineering of all elements of the contractual relationship. Incentives alone or performance of workshops and other teambuilding activities are not sufficient (Cox/Thompson 1997). Hence, the buyer has to consider all stages and make cooperative choices involving social control in several stages to facilitate trust-building.

#### 6. Conclusions

In this paper, a conceptual procurement model has been theoretically deduced from TCE literature. Much research has shown that TCE can serve as an important determinant for companies' make or buy decisions (Artz 1999), dealing with the choice of an optimal governance structure (market, hybrid, or hierarchy) for different types of transactions. Although this choice is initially important, it is too basic to provide a profound and detailed analysis of transaction governance and procurement. To give the buyer more information and guidance about how to procure and govern transactions an additional choice regarding the mix of governance mechanisms should be made. The model developed in this paper concerns the analytical choice of a combination of governance mechanisms, prescribing different levels of price, trust and authority for different types of transactions. Since the three mechanisms can be combined in a variety of ways, this choice is more detailed and manifold than the choice of a discrete structure, thereby providing the buyer with more sophisticated guidance about how to govern the transaction. In this way the model works on a lower and more detailed level of analysis, thereby serving as a valuable complement to the traditional frameworks regarding make or buy decisions. To increase the practical use of the model, a procedure for how to obtain these mechanisms combinations has been developed. It has been shown how decisions made and actions taken by the purchaser during the stages of the buying process affect the levels of the governance mechanisms through the use of output, process and social control.

Traditionally, purchasers have mostly focused on the price mechanism in their market relationships. During the past two decades, concepts such as supply chain management, just-in-time delivery, relationship marketing, and strategic sourcing have shifted the focus from price alone to also include softer parameters related to the trust mechanism and the hybrid structure of TCE. The developed model and its procedure

show how trust and social control, considered crucial issues in these empirically observed arrangements, can be integrated in a TCE model. According to the model, pure price based market relationships and authority-based hierarchical production are suitable in only two of the six transaction types. In the remaining four types trust plays an important role that is not to be ignored. Still, it is important not to over-emphasise it either. Much research has been carried out, demonstrating the importance of trust in inter-organisational relationships. However, Wicks et al. (1999) call for a neutral attitude towards this concept; one should discuss optimal trust rather than high trust. Since it is not free of charge, over-investment in trust may be as inappropriate as under-investment (Wicks et al. 1999). The model developed in this paper is based on such a perspective, prescribing optimal levels of price, trust and authority, rather than prescribing high levels of trust in all transactions. Hence, the model and the procedure can serve as a basis for analysing planned purchases in order to tailor governance mechanisms to transaction characteristics, i.e. fit for purpose procurement and governance management.

It is important to point out that the calculated mechanisms levels are *facilitated* by the procurement decisions. The levels actually obtained in practice depend also on other factors, such as the actors' propensity to trust and act opportunistically and their previous experience of each other, which is related to social embeddedness (Granovetter 1985). In this paper all choices during all stages and sub-stages are assumed to be equally important. In practice this may not be the case. Some choices may be more important than others, for which reason they should be given a higher weight in the calculation of mean values for the mechanisms. This relative importance of different stages should be empirically investigated in future research.

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# Paper 3

# Procurement effects on trust and control in clientcontractor relationships

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# Procurement effects on trust and control in clientcontractor relationships

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#### Abstract

**Purpose**: To investigate how construction clients currently deal with procurement and analyze how the choices made during the buying process stages affect the combination of governance mechanisms and control types in client-contractor relationships.

**Methodology/approach**: Empirical data was collected through a survey to 87 Swedish construction clients.

**Findings**: Current procurement procedures establish governance forms facilitating a focus on price, through output control, and authority, through process control. Since construction transactions are mostly characterized by high complexity and customization and long duration, the theoretical framework prescribes a focus on trust and a somewhat lower focus on price and authority. Hence, from a transaction cost perspective, construction clients focus too much on price and authority and too little on trust. Since current procedures may cause problems in all stages of the buying process, the result suggests that partnering arrangements, entailing completely different choices during the buying process, may be a suitable way to facilitate trust and cooperation through informal social control.

**Research limitations/implications** – Since the empirical results are based on data collected from only Swedish clients, international generalizations should be made cautiously.

**Practical implications** – Clients wishing to implement trust-based collaborative relationships need to reconsider their procurement procedures entirely; joint objectives, teambuilding and other "fuzzy" techniques are not enough to transform adversarial relationships into cooperative ones.

**Originality/value** – Earlier research has focused on one or a few aspects of procurement and governance, while this paper adopts an overall process perspective, taking into account clients' procurement procedures in their entirety.

**Keywords** - Control, Cooperation, Procurement, Partnering, Transaction cost, Trust **Paper type** - Research paper

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#### Introduction

In many countries, the construction industry has been criticized for its incapacity for innovation and improvement (Egan, 1998; Ericsson, 2002; Ng et al., 2002; Chan et al., 2003). Poor productivity, cost overruns, decline in construction quality, decrease in customer satisfaction, conflicts and late completion are problematic areas for the sector (Egan, 1998; Yasamis et al., 2002). Root causes for these inefficiencies have over the years been directed to the industry's fragmentation, the uniqueness of construction as a product, the divorce between design and construction, obsolete procurement methods (Naoum, 2003) and lack of trust and cooperation between the actors (Cheung et al., 2003). Since the extent of trust and cooperation is affected by the procurement procedures, this is a key improvement area (Latham, 1994; Egan, 1998) and a key factor contributing to project success (Cheung et al., 2001).

Transaction cost economics (TCE) is a common theoretical framework when investigating procurement and inter-organisational relationships in general (Aulakh et al., 1996; Eriksson, 2006) and in construction (Voordijk et al., 2000; Rahman and Kumaraswamy, 2002). According to TCE, competitive advantage results from efficient governance of transactions (Williamson, 1985), which requires tailoring of procurement procedures to transaction characteristics (Eriksson, 2006). Hence, it would be interesting to investigate current construction procurement procedures from a TCE perspective in order to analyse their fit to transaction characteristics, which facilitates efficient governance. The purpose of this research is to investigate how construction clients deal with procurement and utilize a TCE framework to analyze how the choices made during the buying process affect the combination of governance mechanisms in client-contractor relationships. After this short introduction of the paper, a presentation of the theoretical framework follows, describing first how to identify suitable governance forms and then how to establish them through procurement. Then the data collection method is described (survey to Swedish construction clients) and the empirical results are presented. The paper continues with an analysis of how the current procurement procedures affect governance mechanisms and project performance, and ends with conclusions.

## Governance mechanisms and different types of control

TCE considers three main governance mechanisms (price, authority and trust) that are strongly related to three different control types (output, process and social control). A client can thus facilitate different levels of price, authority and trust in a transaction relationship through the use of these different types of control (Eriksson, 2006). The suitability of these mechanisms mostly depends on the levels of asset specificity and frequency in the transaction (Williamson, 1985). Price is traditionally associated with market relationships, suitable for standardized transactions. The price gives information about what to be delivered and incentives to do it. The 'invisible hand' illustrates this mechanism, adjusting the transaction in relation to the prices resulting from supply and demand (Larsson, 1993). The price mechanism is closely related to output control (Hennart, 1993), defined as the degree to which the focal firm monitors the results or outcomes produced by the partner (Aulakh et al., 1996). Output control is efficient when it is possible to measure goal attainment, which mostly occurs when asset specificity is low, and the monitoring party has limited knowledge of the transformation process (Collin, 1993b; Das and Teng, 2001). Therefore, it is the most proper form of control in price-based market relationships.

In a transaction governed by *authority*, the buyer can get the desired product from the supplier through control of behaviour and inputs (Håkansson and Snehota, 1995). The 'visible hand' illustrates this mechanism, adjusting the transaction by giving authoritative orders to the agent executing them (Larsson, 1993). Authority is related to *process control* (Hennart, 1993), referring to the focal firm's monitoring of the partners' behaviour or the means used to achieve the desired ends (Aulakh et al., 1996). It may be realized through formal structures, contractual specifications and managerial arrangements (Das and Teng, 2001). Increased inter-dependencies, caused by asset specificity, make output control less efficient than process control (Gencturk and Aulakh, 1995). Furthermore, bounded rationality and asset specificity make outputs hard to measure (Williamson, 1996; Das and Teng, 2001). When asset specificity is high, process control is suitable, if the client knows the appropriate action to achieve the goal (Collin, 1993b; Das and Teng, 2001).

To obtain the advantages and synergies of cooperative relationships, the establishment of *trust* is vital (Aulakh et al., 1996). In a transaction governed by trust the parties to an exchange believe that, without the exercise of authority, they can get what they want from each other, without fearing opportunism (Håkansson and Snehota, 1995). Trust can be defined as positive expectations regarding the other in a risky situation (Das and Teng, 2001). This mechanism is illustrated by the 'handshake', adjusting the transaction in relation to agreements resulting from negotiations between organizations (Larsson, 1993). The most proper form of control in cooperative relationships is *social control*, facilitating trust and commitment (Das and Teng, 2001). Social control may be defined as building a common organizational culture that encourages self-control (Aulakh et al., 1996). When neither output nor process control is appropriate, i.e. when it is not possible to measure goal attainment and the monitoring party does not know the appropriate action to achieve the goal, social control is most efficient (Collin, 1993b; Das and Teng, 2001).

Eriksson (2006) has developed a TCE-based procurement model that identifies six different types of transactions, depending on their asset specificity and frequency. Different combinations of mechanisms should coordinate each transaction type. In the model (see Figure 1), approximate values (low, medium, and high) of the three mechanisms are described, together constituting 100% of the coordination.

**Figure 1.** Model for the choice of governance mechanisms (Eriksson, 2006).

The TCE-based model argues that increased levels of asset specificity (resulting mainly from complexity and customization) should lead to a lower focus on price and a higher focus on trust and/or authority as governance mechanisms. Furthermore, higher frequency and longer duration of the buyer-supplier relationship increase the need for trust while somewhat decreasing the focus on price and authority. Transactions of type 6 involve hierarchical production, not entailing a procurement situation, for which reason they are outside the scope of the model.

## **Procurement effects on governance mechanisms**

For the TCE-based model to be of practical use, it is not sufficient to know only *which* combination of mechanisms is favourable for the transaction at hand; the purchaser must also know *how* to obtain it. Eriksson (2006) therefore illustrates how different causes of actions during the stages of the buying process will involve different types of control, affecting the levels of price, authority and trust, see Table I.

Table I. Procurement effects on control types and governance mechanisms

#### Problem recognition and transaction type identification

Stage one involves the recognition of a problem and the awareness that the needs may be filled through a purchase, resulting in a make or buy decision. Hence, the client first has to decide which type (1-6) best fits the transaction at hand, by assessing the two transaction characteristics of frequency and asset specificity. Then the client may continue to the next stage in the process, specification, if the product is to be procured from an external supplier (transaction type 1-5).

#### **Specification**

By specifying performance rather than technology (e.g. design-build contracts), output control facilitates a high emphasis on price, while through detailed specification (e.g. design-bid-build contracts), process control facilitates a high emphasis on authority. A lower level of authority is obtained when the technical specification and the characteristics of the product are developed by both client and contractor in cooperation (e.g. design partnering). This mostly entails social control but also process control to some extent, facilitating a high emphasis on trust, medium emphasis on authority and low emphasis on price (Eriksson, 2006).

#### **Bid** invitation

By using a large pool of potential suppliers who are often replaced, buyers facilitate competition (Spekman, 1988; Stump, 1995) and a focus on price and short-term benefits, which according to Anderson and Oliver (1987) is related to output control. Social control involves investments in the partner's socialization, enhanced by long-term relationships and expectations of continuance (Aulakh and Gencturk, 2000). Process control is also related to a long-term focus, since it removes incentives to sacrifice long-term for immediate pay-offs (Anderson and Oliver, 1987). Negotiations with only one or very few suppliers therefore indicate social and/or process control, while open bid procedures indicate price focus through output control. Consequently, the larger the number of bidders, the higher the emphasis on price and the lower the emphasis on trust and authority and vice versa (Eriksson, 2006).

#### **Bid evaluation**

When focusing only on the lowest tender price, the client does not take the opportunity to affect the characteristics of the supplier (Heide and John, 1990), indicating a laissez-faire approach, which, according to Anderson and Oliver (1987), is related to output control. In process control, however, the client takes most of the risk (Aulakh and Gencturk, 2000). Then consideration of the characteristics of the supplier, such as competence and capacity (i.e. control of inputs), becomes important (Anderson and Oliver, 1987). Considerations regarding the collaboration and nurturing of the relationship indicate social control (Aulakh and Gencturk, 2000). This may be exemplified by soft parameters such as collaborative ability, reputation and earlier experience of the supplier. Consequently, the more weight on price and the less weight on soft parameters, the higher emphasis on price and the lower emphasis on trust and authority, and vice versa (Eriksson, 2006).

#### **Contract formalisation**

Complete contracts are more legally binding because more specific clauses make the contract easier to interpret and enforce (Woolthuis et al., 2005). Thus, contract formalisation is important in price-based market relationships (Macneil, 1978), involving output control. Even more so, process control results in formalised and bureaucratic relationships (Aulakh and Gencturk, 2000). Through social control, however, the parties establish an implicit sense of acceptable and deviant behaviour (Aulakh and Gencturk, 2000), making formalisation unnecessary. Consequently, the more formal and comprehensive the contracts are, the higher the emphasis on price and authority, and the lower the emphasis on trust, and vice versa (Eriksson, 2006).

#### Type of compensation

A compensation system rewarding the supplier for his output (e.g. a fixed price for a product delivered) indicates output control and a high emphasis on price, while compensation for the costs of the supplier based on the time worked and the costs of input material (reimbursement compensation) entails process control (Gencturk and Aulakh, 1995), emphasising authority. Profit sharing (incentives) together with joint objectives indicates social control (Das and Teng, 1998), emphasizing trust.

#### Usage of collaborative tools

In some transactions (e.g. construction work) the actual production takes place within the buying process since there is no ready-made product to buy. Because the client and the contractor then have to interact to create the product, use of collaborative tools, such as joint objectives, shared office building, teambuilding activities and joint dispute resolution techniques, may be suitable (Cheung et al., 2003; Eriksson, 2006). A larger extent and scope of such joint actions and collaborative tools will directly facilitate trust building, through social control (Das and Teng, 1998), for which reason they indicate closer cooperative relationships (Heide and John, 1990). Indirectly, it will also decrease the emphasis on authority, through less need for process control, and price, since these tools create human asset specificity, leading to switching costs for the client. Consequently, no or low usage of collaborative tools results in increased need for output and process control, indicating emphasis on price and authority, while high usage indicates high emphasis on trust, through social control (Eriksson, 2006).

#### **Performance evaluation**

This deals with the fundamental evaluation of how well the procured product solved the problem and how well the supplier performed. Monitoring of ongoing performance enhances high emphasis on authority through process control, while inspection of the outcome enhances high emphasis on price through output control. The more the supplier himself is allowed to control the performance and the result, the higher the emphasis on trust, through social control (Eriksson, 2006).

## Methodology

The empirical data was collected through a survey, which was first piloted by five respondents, resulting in only minor changes. The population investigated was 104 Swedish construction client organizations that are members of ByggherreForum, a national construction client association. Registered contact persons were first approached by email or telephone and asked if they or other more suitable persons in their organizations were willing to participate in the study. Hence, it was up to the

contact person to choose the most suitable respondent, given that the survey involved procurement and project management processes. Four people declined to participate at this stage, due to lack of time, so a paper version of the survey was then sent out by mail to the hundred people that had agreed to participate. These people were mostly procurement managers, project managers or directors of the construction and facilities department in their organizations. After two reminders, a total of 87 responses was received, representing a response rate of 84 percent. In this paper only the empirical data regarding different aspects of the organizations' procurement procedures are discussed. The respondents were asked how often they used different procurement procedures (e.g. To what extent do you use the collaborative tools listed below during the construction project period?). The items were measured using 7-point Likert scales anchored by 1= very seldom and 7 = very often. The exception to this is the items regarding bid evaluation parameters, in which the importance of the parameters was estimated: 1 = unimportant and 7 = very important.

## **Empirical results: Clients' current procurement procedures**

In Table II, descriptive data are presented for all buying decision alternatives.

#### **Table II.** Descriptive empirical results

In the design and *specification* stage, the respondents stated that the detailed design of the construction product is mostly made by the clients and their consultants (mean value 5.40). The specification is seldom left to be managed by the contractor (3.01) and joint specification is seldom used (2.76).

In the *bid invitation* stage the usage of an open bid procedure was more common (4.38) than limited invitation (2.90). The limited invitation construct is measured by three items (slightly limited, strongly limited and direct negotiation), with a Cronbach alpha (CA) of 0.65.

A principal component factor analysis (PCFA) grouped *bid evaluation* parameter items into three factors/constructs (authority-based soft parameters, trust-based soft parameters and price) with a KMO MSA = 0,829, explaining 75.75 % of the total variance, which is satisfactory. The statistical package of social science (SPSS) was used in performing the rotation method Varimax with Kaiser Normalization. The alpha reliability coefficient is 0.81 for the authority-based factor (supplier organization and project staff, quality and environmental management systems, and references of similar projects) and 0.83 for the trust-based factor (earlier experience of the supplier, supplier's attitudes toward change, their collaborative ability and their technical competence). The mean values show that price (6.40) is considered more important than authority-based (4.72) and trust-based (4.97) soft parameters; see Table III.

Table III. Factor analysis of bid evaluation parameters

Regarding *contract formalization*, almost all respondents stated that they very often (6.97) use standardized contracts (AB, ABT etc), established by the third party Byggandets Kontraktkommitté ('The Construction Contract Committee').

The most commonly used *type of compensation* is fixed price for the product delivered (6.46). Reimbursement compensation for the obtained costs is not very common (2.72) and compensation including incentives is seldom used (1.83). The

incentive construct consists of two items (CA=0.70): compensation including gain share/pain share and bonus opportunities.

Different kinds of "collaborative tools" are not used very often (2.69) in construction projects. The collaborative tools construct consists of five items (CA=0.73): joint objectives, team building activities, joint IT-database, joint project office and an arena for relationship discussions and dispute resolution.

*Performance evaluation* is mostly based on formal process (5.51) and output control (5.92) by the client. Control during the construction process is also executed by supplier self-control (4.44). This self-control does not, however, have much implication for the clients' end inspections, which are mostly very comprehensive. Limited random inspections of the outcome are not common (2.56).

## **Analysis**

The theoretical framework (Figure 1 and Table I) serves here as a basis for analyzing procurement decisions' effects on governance mechanisms and project performance.

## Governance mechanisms prescribed by the theoretical framework

To identify a suitable mechanism mix, the transaction characteristics (i.e. asset specificity and frequency/duration) must be evaluated. According to Rahman and Kumaraswamy (2002), today's construction industry is a very high-risk, complex, and multiparty business. The transactions are mostly parts of construction projects, which involve many complex processes (Dubois and Gadde, 2002). Furthermore, each project is customized and unique; standardized products are very rare. Transaction frequency is generally low, since few clients are able to offer repeat orders for work over a long time horizon (Cox and Thompson, 1997). However, transaction duration is very long; projects generally last for at least a year, which increases the opportunity for trust-building also within a single project (Kadefors, 2004).

According to Williamson (1985), the construction of plant facilities is a typical occasional transaction involving high asset specificity, i.e. a type five transaction. Overall, most construction projects are of that type. However, some projects are significantly less complex than constructing a plant, for example production of small houses with modular construction. Such projects may be categorized as transactions of type 3 or 4. For construction projects in general, the model prescribes medium emphasis on authority, medium to high trust, and low to medium emphasis on price.

#### Procurement procedures' effect on control and governance mechanisms

The empirical results show that the most common procurement decisions facilitate a focus on price and/or authority in all stages of the buying process, see Table IV.

## Table IV. Decisions' effect on governance mechanisms

This means that the procurement procedures used by Swedish construction clients mostly result in governance forms based on the mechanism combination of high emphasis on price and authority and low emphasis on trust. From a control perspective, clients almost exclusively rely on formal output and process control, while informal social control is rare. Consequently, there are significant discrepancies between the theoretical prescriptions and the empirical behaviours.

### Procurement procedures' effects on project performance

The high focus on price and authority together with a lack of trust may cause problems in most of the buying process stages. Comprehensive *specification* made by the client before the contractor is procured results in a divorce between design and construction. The drawbacks of this approach are that construction planning cannot affect design and it cannot meet the increasing need for speed and time reductions in construction projects (Cheung et al., 2001; Dubois and Gadde, 2002). Early involvement of contractors in specification is thus legitimate in order to integrate design and construction planning (Akintoye et al., 2000) and shorten project duration (Cheung et al., 2001).

Bid invitation through open bid procedures results in many hours spent on design, planning and calculations that are never used, causing waste and non-value adding costs (Dubois and Gadde, 2000; Ngai et al., 2002). Furthermore, it guarantees that the actor constellations change all the time (Dubois and Gadde, 2000), which deters the parties from making relation-specific investments. The constant replacement of actors creates inefficiencies, since a new learning curve must be climbed by the supplier each time (Cox and Thompson, 1997). Thus the short-term focus erodes long-term sustainable competitive advantage (Ingirige and Sexton, 2006).

The focus on low tender price during *bid evaluation* causes many project delivery problems. Contractors bid low to win the contract and then make everything in their power to earn more money through extra work not specified in the contract. Thus, softer parameters should be more important (Latham, 1994); bid price should be an order qualifier instead of an order winner criterion. (Yasamis et al., 2002).

Construction actors rely heavily on *contract formalization* through standard forms of contracts, which are instruments seeking strict liability and attaching blame to events that occur, encouraging non-collaborative behaviour and driving distance between the parties (Barlow et al., 1997; Cox and Thompson, 1997). However, high formalisation may also be a suitable complement to trust when contracts are coupled with strong relational norms (Woolthuis et al., 2005). Hence, the common use of standard contracts in construction is only harmful if they are used as safeguards in the absence of relational norms.

Many projects last for several years and the design is often changed during that time because of changes in the client's preferences (Kadefors, 2004). Since uncertainties in construction are high and derived from many different sources (Voordijk et al., 2000), output-based *compensation* (fixed price) is inappropriate. This is because output control through fixed prices may lead to inflexibility since the supplier may resist adapting to changed circumstances (Aulakh and Gencturk, 2000). Reimbursement compensation, preferably coupled with incentives, should thus create a better basis for adaptation, suitable in complex and uncertain projects (Bajari and Tadelis, 2001).

The use of *collaborative tools* is normally missing in traditional projects. Such lack of joint actions hinders integration of the actors and their activities, making them work on arm-length distance from each other (Heide and John, 1990).

The heavy reliance on output control in *performance evaluation* is problematic, since construction work is often hidden and very difficult to inspect after the completion of the building. When outputs are hard to measure, due to bounded rationality and asset specificity (Williamson, 1996; Das and Teng, 2001), process control is suitable if the monitoring party knows the appropriate action to achieve the goal (Collin, 1993b; Das and Teng, 2001). This is however not always the case. Not every client organization has a large and highly experienced staff organization with deep construction knowledge. In such cases social control is most efficient (Collin, 1993b; Das and

Teng, 2001). Hence, self-control by the contractor seems appropriate, increasing trust and commitment and decreasing the costs of non-value adding client-led inspections.

In recent years, interest in collaborative approaches (e.g. partnering) has increased among practitioners and researchers in the construction sector (Li et al., 2000). Partnering is based on several fundamental principles, such as commitment, trust, respect, equality and communication (Chan et al., 2003), which are applied to mitigate the problems in the sector. A true partnering approach involves client decisions during the buying process period (e.g. joint specification, limited bid invitation, bid evaluation based on soft parameters, incentive-based compensation and collaborative tools) completely different from the most common decisions presented in the empirical results. Hence, this approach may be a suitable alternative to the traditional procurement procedures, facilitating an emphasis on trust rather than price and authority, as prescribed by the TCE framework. This argument is supported by several empirical investigations, which have found significant benefits of partnering (for example regarding quality, sustainability, dispute resolution, innovation, and also time and cost reductions) compared to traditional procurement procedures (Barlow et al., 1997; Egan, 1998; Chan et al., 2003; Fortune and Setiawan, 2005).

#### **Conclusions**

This study has shown how Swedish construction clients' current procurement decisions establish governance forms that facilitate a focus on price through output control, and authority through process control. Trust-breeding procedures entailing social control are seldom used. The theoretical framework prescribes a mechanism combination focusing on trust and with somewhat lower emphasis on price and authority for construction transactions, due to high complexity/customization and long duration. Hence, there are significant discrepancies between the theoretical predictions and the empirical results. From a TCE perspective, construction clients focus too much on price and authority and too little on trust. Since the most common decisions taken by clients may lead to problems in all of the buying process stages, these findings give theoretical support to the criticism arguing that the traditional procurement procedures result in adversarial and trust-lacking relationships. From a TCE-standpoint, the common combination of high price and authority is not suitable for any type of transaction. Hence, changed procurement procedures are called for. In recent years, interest in more collaborative approaches to procurement and governance has increased. Through a change of buying behaviour, clients implementing partnering may establish governance forms facilitating trust and cooperation through informal social control rather than the traditional price- and authority-based relationships, utilizing formal output and process control. From a TCE-perspective, partnering therefore seems to be more suitable than the currently used procurement procedures. However, it also important to mention that trust-building arrangements do not solve all problems; some extent of price and authority is needed to achieve efficient transactions.

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		Asset specificity			
		Low	Medium	High	
F	Occasional	Type 1 Emphasis on price: high trust: low authority: low	Type 3 Emphasis on price: medium trust: medium authority: medium	Type 5 Emphasis on authority: high/medium trust: medium/high price: low	
Frequency	Recurrent	Type 2 Emphasis on price: high trust: medium authority: low	Type 4 Emphasis on trust: high price: medium authority: low	Type 6 Hierarchical production	

Figure 1. Model for the choice of governance mechanisms (Eriksson, 2006).

**Table I.** Procurement effects on control types and governance mechanisms

Buying stage	Price focus through output control	Authority focus through process control	Trust focus through social control
Specification	Spec. by contractor	Spec. by client	Joint spec.
Bid invitation	Open bid procedure	Limited bid invitation	Limited bid invitation
Bid evaluation	Focus on tender price	Focus on authority- based soft parameters	Focus on trust-based soft parameters
Contract formalization	Formal, comprehensive contracts	Formal, comprehensive contracts	Informal and incomplete contracts
Type of compensation	Fixed price	Reimbursement	Including incentives
Collaborative tools	Low usage of collaborative tools	Low usage of collaborative tools	High usage of collaborative tools
Performance evaluation	Output control by client	Process control by client	Self-control by contractor

 Table II. Descriptive empirical results

Buying stage	Buyer decision	Mean	Std.dev	Items	Alpha
Specification	Spec by client/consultant	5.40	1.93	1	
	Spec by contractor	3.01	1.85	1	
	Joint specification	2.76	1.75	1	
Bid invitation	Open bid procedure	4.38	2.81	1	
	Limited bid invitation	2.90	1.55	3	0.65
Bid evaluation	Tendering price	6.40	0.87	1	
	Authority-based soft parameters	4.72	1.28		0.81
	Trust-based soft parameters	4.97	1.40	7	0.83
Contract formalization	Usage of standardized contracts	6.97	0.24	1	
Type of compensation	Fixed price	6.46	1.01	1	
	Reimbursement	2.72	1.69	1	
	Including incentives/bonus	1.83	1.05	2	0.70
Collaborative tools	Usage of collaborative tools	2.69	1.20	5	0.73
Performance evaluation	Process control by client	5.51	1.85	1	
	Self-control by contractor	4.44	2.00	1	
	Complete output control by client	5.92	1.60	1	
	Random output control by client	2.56	1.75	1	

**Table III.** Factor analysis of bid evaluation parameters

Bid evaluation items	Item mean value	Factor 1 Authority-based parameters	Factor 2 Trust-based parameters	Factor 3 Price
Organization, personnel	5.14	0.856	0.219	
Quality and environmental management systems	4.24	0.799	0.156	0.128
References	4.80	0.777	0.290	-0.254
Experience of supplier	4.82		0.837	0.170
Attitudes towards change	4.54	0.226	0.789	-0.241
Collaborative ability	5.08	0.490	0.731	-0.127
Technical competence	5.46	0.503	0.626	
Tendering price	6.40			0.970
Factor eigenvalue		2.53	2.41	1.13
Percent of variance		31.58	30.08	14.09
Cronbach Alpha		0.81	0.83	
Factor mean values		4.72	4.97	6.40
Factor standard deviation		1.28	1.40	0.87

**Table IV.** Decisions' effect on governance mechanisms

Buyer Decision	Control type	Governance mechanism
Specification by client/consultant	Process control	Authority
Open bid procedure	Output control	Price
Focus on tendering price	Output control	Price
High usage of standardized contracts	Process+output	Authority and price
Fixed price compensation	Output control	Price
Low usage of collaborative tools	Output+process	Price and authority
Continuous monitoring and complete	Process+output	Authority and price
end inspection by client		_

# Paper 4

# Procurement and governance of complex construction projects

Submitted to Journal of Management in Engineering

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## Procurement and governance of complex construction projects

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Abstract: In recent years increased interest in cooperative arrangements, such as partnering, has been noticeable in the construction industry in many countries. To facilitate cooperative relationships many aspects of the traditional procurement procedures need to be changed. The research presented in this paper offers an analysis that compares empirically observed partnering procurement procedures with conceptual prescriptions provided by a transaction cost economics framework. The empirical illustration shows that the case client has reduced the focus on price and authority and instead facilitated a relationship based on trust and cooperation, through procurement procedures involving joint specification, limited bid invitation, bid evaluation based on soft parameters, joint selection of subcontractors, standard contracts coupled with relational norms, usage of collaborative tools and contractor self-control. The procurement procedures chosen result in a governance form rather similar to the one prescribed by the conceptual model. Furthermore, the actors involved in the case project are satisfied with the project result and also consider the performed procurement procedures as suitable. Hence, the results provide both theoretical and empirical support to the implementation of partnering procurement procedures in construction projects characterized by high complexity and uncertainty.

CE Database subject headings: Control; Cooperation; Partnerships; Procurement.

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#### Introduction

The construction industry has received criticism in many countries for its incapacity for innovation and improvement (Chan et al. 2003; Egan 1998; Ng et al. 2002). The same authors state that poor productivity, cost overruns, decline in construction quality, decrease in customer satisfaction, conflicts and late completion are problematic areas for the sector. Root causes for these inefficiencies have over the years been directed to the industry's fragmentation, the uniqueness of construction as a product, the divorce between design and construction, obsolete procurement methods (Naoum 2003) and lack of trust and cooperation between project actors (Cheung et al. 2003). Since the extent of trust and cooperation is affected by the procurement procedures, this is a key improvement area (Egan 1998; Latham 1994) and a key factor contributing to project success (Cheung et al. 2001). Traditionally, procurement procedures have been focusing on enhancing competition. However, in recent years increased interest in cooperative arrangements, such as partnering, has been noticeable in the construction industry as a result of escalating conflicts and adversarial relationships in many countries (Bresnen and Marshall 2000; Chan et al. 2003; Ng et al. 2002). The increased need for cooperation is also derived from the increased complexity, uncertainty and time pressure that characterize construction projects (Gidado 1996; Pietroforte 1997). These characteristics require relation specific investments, knowledge sharing, flexibility and integration, which are facilitated in long-term cooperative relationships (Pietroforte 1997; Rahman and Kumaraswamy 2002). Partnering, aiming at increasing cooperation and integration between the involved actors by building trust and commitment and decreasing disputes, can bring about advantages regarding quality, sustainability, dispute resolution, human resource management, innovation, and time and cost reductions (Barlow et al. 1997; Chan et al. 2003; Egan 1998). Since the degree of cooperation and integration between the participants is influenced by procurement (Briscoe et al. 2004) many aspects of the traditional procurement procedures need to be changed when implementing cooperative relationships.

Transaction cost economics (TCE) is a widely utilized theoretical framework when investigating procurement and inter-organizational relationships in general (Aulakh et al. 1996; Eriksson 2006) and in construction (Pietroforte 1997; Rahman and Kumaraswamy 2002). According to TCE, competitive advantage results from efficient governance of transactions (Williamson 1985), which requires tailoring of procurement procedures to transaction characteristics (Eriksson 2006). Hence, it would be interesting to investigate partnering procurement procedures from a TCE perspective in order to analyze their fit to transaction characteristics. The purpose of this research is to investigate how partnering procurement procedures match TCE prescriptions regarding governance mechanisms in client-contractor relationships. After this short introduction of the paper, a presentation of the theoretical framework follows, describing first how to identify suitable governance forms and then how to establish them through procurement. Then the data collection method is described (an action research case study) and the empirical results are presented. The paper continues with an analysis of how the case procurement procedures affect governance mechanisms and ends with conclusions.

## Governance mechanisms and different types of control

TCE considers three main governance mechanisms (price, authority and trust), which are strongly related to the three different control types; output, process and social

control. Hence, a client can facilitate different levels of price, authority and trust in a transaction relationship through the use of these different types of control (Eriksson 2006). The suitability of the three mechanisms mostly depends on the levels of asset specificity and frequency in the transaction (Williamson 1985). *Price* is traditionally associated with market relationships, which are suitable for standardized transactions. The price gives information about what to be delivered and incentives to do it. It is illustrated by the 'invisible hand', adjusting the transaction in relation to the prices resulting from supply and demand (Larsson 1993). The price mechanism is closely associated to *output control* (Hennart 1993), defined as the degree to which the client monitors the results or outcomes produced by the partner (Aulakh et al. 1996). Output control is efficient when it is possible to measure goal achievement, which mostly occurs when asset specificity is low, and the monitoring party has limited knowledge of the transformation process (Collin 1993b; Das and Teng 2001). Thus, it is the most appropriate form of control in price-based market relationships.

In a transaction governed by *authority*, the buyer gets the desired product through control of the supplier's behavior and inputs (Håkansson and Snehota 1995). This mechanism is illustrated by the 'visible hand', adjusting the transaction by giving authoritative orders to the supplier executing them (Larsson 1993). Authority is related to *process control* (Hennart 1993), referring to the client's monitoring of the supplier's behavior or the means used to achieve the desired ends (Aulakh et al. 1996). It may be achieved through formal structures, contractual specifications and managerial arrangements (Das and Teng 2001). Increased inter-dependencies, caused by asset specificity, render output control less efficient than process control (Gencturk and Aulakh 1995). Additionally, bounded rationality and asset specificity make outputs difficult to measure (Das and Teng 2001; Williamson 1996). When asset specificity is high, process control is suitable, if the client knows how to achieve the goal (Collin 1993b; Das and Teng 2001).

To achieve the advantages and synergies of cooperative relationships, *trust* is important to establish (Aulakh et al. 1996). In a transaction governed by trust the exchange parties believe that, without the exercise of authority, they can obtain what they want from each other, without fearing opportunism (Håkansson and Snehota 1995). Trust may be defined as positive expectations regarding the other actor in a risky situation (Das and Teng 2001). It is illustrated by the 'handshake', adjusting the transaction in relation to agreements resulting from negotiations between organizations (Larsson 1993). The most appropriate form of control in cooperative relationships is *social control*, facilitating trust and commitment (Das and Teng 2001). Social control can be defined as building a common organizational culture that encourages self-control (Aulakh et al. 1996). When neither output nor process control is suitable, i.e. when it is not possible to measure goal achievement and the monitoring party does not know how to achieve the goal, social control is most efficient (Collin 1993b; Das and Teng 2001).

Eriksson (2006) presents a TCE-based procurement model, which identifies six different types of transactions, depending on their asset specificity and frequency. Different combinations of mechanisms should coordinate each transaction type. In the model, approximate values (low, medium, and high) of the three mechanisms are prescribed, together constituting 100% of the coordination (see Figure 1).

Fig. 1. Model for the choice of governance mechanisms (Eriksson 2006).

The model argues that increased levels of asset specificity (resulting primarily from complexity and customization) should lead to a lower focus on price and a higher focus on trust and/or authority. Additionally, higher frequency and longer duration of the transaction relationship increase the need for trust while somewhat decreasing the focus on price and authority. Transactions of type 6 involve hierarchical production instead of procurement, for which reason they are outside the scope of the model.

## **Procurement effects on governance mechanisms**

For the model to be of practical use, it is not sufficient to know only *which* combination of mechanisms is favorable for the transaction at hand; the client must also know *how* to achieve it. Thus, Eriksson (2006) also illustrates how different causes of actions during the stages of the buying process involve different types of control, affecting the levels of price, authority and trust, see Table 1.

**Table 1.** Procurement effects on control types and governance mechanisms

#### Problem recognition and transaction type identification

The first stage involves the recognition of a problem and the consciousness that the needs may be satisfied through procurement, resulting in a make or buy decision. First, the client must decide which type (1-6) best fits the transaction at hand, by assessing the two transaction characteristics of frequency and asset specificity. Then one may continue to the next stage, if the product is to be procured from an external supplier (transaction type 1-5).

#### **Specification**

Output control by specifying performance rather than technology (e.g. design-build contracts) facilitates a high emphasis on price, while process control through detailed specification (e.g. design-bid-build contracts), facilitates a high emphasis on authority. A lower level of authority is obtained when the technical specification and the characteristics of the product are developed by both client and contractor in cooperation (e.g. design partnering). This mostly entails social control but also process control to some extent if the client has the main design responsibility. Hence, it facilitates a high emphasis on trust, medium emphasis on authority and low emphasis on price (Eriksson 2006).

#### **Bid** invitation

By using a large pool of potential suppliers who are often replaced, buyers facilitate competition (Spekman 1988; Stump 1995) and a short-term focus on price, which is related to output control (Anderson and Oliver 1987). Social control involves socialization of the partner, which is facilitated by long-term relationships and expectations of continuance (Aulakh and Gencturk 2000). Also process control is related to a long-term focus, since it removes incentives to sacrifice long-term for immediate pay-offs (Anderson and Oliver 1987). Negotiations with only one or very few suppliers thus indicate social and/or process control, while open bid procedures indicate price focus through output control (Eriksson 2006).

#### **Bid** evaluation

When focusing only on lowest tender price, the client does not take the opportunity to affect the characteristics of the supplier (Heide and John 1990), indicating a laissez-faire approach that is related to output control (Anderson and Oliver 1987). Through process control, however, the client takes most of the risk (Aulakh and Gencturk 2000). Consideration of the supplier's characteristics, such as competence and capacity (i.e. control of inputs), then becomes important (Anderson and Oliver 1987). Considerations regarding the collaboration and nurturing of the relationship indicate social control (Aulakh and Gencturk 2000). This may be exemplified by the evaluation of soft parameters (e.g. collaborative ability, reputation and earlier experience of the supplier). Accordingly, the more weight on price and the less weight on soft parameters, the higher emphasis on price and the lower emphasis on trust and authority, and vice versa (Eriksson 2006).

#### **Selection of sub-suppliers**

The selection of sub-suppliers can be made by the supplier (domestic contract), by the client (nominated contract) (Shoesmith 1996) or by both parties in collaboration. In market governance, suppliers have total freedom to select their sub-suppliers, rendering the client with no control over who carries out specialist work (Shoesmith 1996). A departure from market governance is manifested when the client attempts to control the supplier's decision making in areas such as selection of sub-suppliers (Heide and John 1992). Domestic contracts therefore indicate a *laissez-faire* approach, enhancing a focus on price through output control, while nominated contracts entail process control, increasing the level of authority. Since the selection of sub-suppliers is crucial to increase suppliers' ability to adapt to uncertainty in relational governance (Wathne and Heide 2004), careful sub-supplier selection by both buyer and supplier in collaboration is suitable in order to enhance customer satisfaction. Such joint selection indicates a concern for both parties' interests, facilitating trust through social control.

#### **Contract formalization**

Complete contracts are more legally binding because more specific clauses make them easier to interpret and enforce (Woolthuis et al. 2005). Contract formalization is therefore central in price-based market relationships (Macneil 1978), involving output control. Even more so, process control results in formalized and bureaucratic relationships (Aulakh and Gencturk 2000). Through social control, however, the actors can establish an implicit sense of tolerable and deviant behavior (Aulakh and Gencturk 2000), making formalization unnecessary. Accordingly, the more formal and comprehensive the contracts are, the higher the emphasis on price and authority, and the lower the emphasis on trust, and vice versa (Eriksson 2006).

#### Type of compensation

Compensations rewarding the supplier for his output (e.g. fixed price) indicates output control and a high emphasis on price, while compensation for the costs of the supplier (reimbursement compensation) entails process control (Gencturk and Aulakh 1995), emphasizing authority. Profit sharing (e.g. gain/pain share incentives) together with joint objectives indicates social control (Das and Teng 1998), emphasizing trust.

#### Usage of collaborative tools

In construction transactions the actual production takes place within the buying process because there is no ready-made product to buy. Since the client and the contractor then have to interact to create the product, use of collaborative tools (e.g. joint objectives, shared office building, teambuilding activities and joint dispute resolution techniques) may be suitable (Bayliss et al. 2004; Cheung et al. 2003). A larger extent and scope of such joint actions and collaborative tools facilitate trust building, through social control (Das and Teng 1998), for which reason they indicate closer cooperative relationships (Heide and John 1990). Indirectly, they decrease the emphasis on authority, through less need for process control, and price, since they create human asset specificity, leading to switching costs (Eriksson 2006).

#### **Performance evaluation**

The last stage deals with the essential evaluation of how well the procured product solved the problem and how well the supplier performed. Monitoring of ongoing performance enhances high emphasis on authority through process control, while inspection of the outcome enhances high emphasis on price through output control. The more the supplier is allowed to control the performance and the result (i.e. self-control), the higher the emphasis on trust, through social control (Eriksson 2006).

#### Method

The case study regards the client AstraZeneca's (AZ) procurement and the subsequent construction of a plant for manufacturing of pharmaceutical products in Sweden. The transaction in focus concerns the relationship between the client and the main contractor (MC) in this construction project. Approximately two thirds of the projects procured in the past ten years were appointed to this particular MC, resulting in a long-term relationship. The focal transaction is therefore affected by both earlier and parallel transactions, for which reason the case is of an embedded nature (Yin 1994). Earlier on, the parties did not act deliberately to achieve closer interaction and cooperation. The case project however adopted a collaborative approach, often referred to as partnering, which the client developed in a couple of previous projects.

A mixed methods approach was chosen to collect the case study data. A series of three subsequent surveys to all participants in the partnering team (varying between 23-29 people for each survey) and observation and participation in a large amount of meetings and workshops (approximately 50 hours) formed the basis of the data collection. Furthermore, document studies and three interviews with the client's project manager, each lasting approximately one hour, were conducted in order to get more specific insight into the client's procurement procedures. In this paper only relevant parts of the data collected are presented. This is because the data collection was a part of a larger study which followed an action research approach in which the first author of this paper served as an advisor and facilitator to the partnering team. Due to this approach the mixed methods were chosen to collect data in order to facilitate project management. However, they also enhanced triangulation since the data regarding each buying process stage was collected by more than one method. The workshops were half-day events during which problematic issues regarding the management of the project in general and the collaborative approach in particular were followed up and discussed. Before each workshop the participants responded to a survey in order to follow up the work towards the joint objectives of the project and detect problematic issues so that these could be discussed and dealt with during the duration of the project. The design of the survey was mostly affected by the joint objectives established by the participants in the partnering team. The survey results served as a basis for workshop discussions about how to improve the collaborative process in the project. The first author served as an external facilitator, responsible for these workshops and the design and analysis of the surveys.

#### Case illustration

The case illustration describes the decisions taken by the client during the buying process and how they affect the levels of price, trust and authority in the transaction. The approximate mechanisms' levels presented in each stage have been set by the authors on the basis of the different types of control used in the case.

## Problem recognition and transaction type identification

The case project participants argue that the project is not 'normal'. It is more challenging, regarding complexity and customization than the average construction project. Even though AZ is a professional client procuring construction projects on a regular basis, this kind of complex project is not common. Generally, construction projects are complex procurements (Olsen *et al.* 2005), with very long duration (Kadefors 2004), and Williamson (1985) argues that construction of plant facilities is a typical occasional transaction involving high asset specificity (i.e. type five). The model prescribes high or medium emphasis on authority, medium or high emphasis on trust and low emphasis on price, see Figure 1. Whether the emphasis should be high on trust or authority depends on the possibilities for trust building and the client's ability to conduct process control. Due to the long duration of the project (approximately two years) coupled with the parties' earlier experience of each other (social embeddedness), the possibility for trust building should be good. Since AZ has a highly experienced staff organization with deep knowledge regarding construction, the possibility for authority is also good.

#### **Specification**

The MC was involved very early in the specification stage, when only approximately 15% of the total specification was completed by the client and its consultants. This allowed for parallel design and construction, making possible a time saving early construction start. It also increased the buildability by the utilization of the MC's construction and planning competence during design work. The joint specification indicates social control. However, despite this involvement, the actual design work was mostly conducted by AZ and its consultants, indicating even more reliance on process control. Since the MC did not have much design responsibility of its own, the extent of output control was very low. The way specification was managed facilitates a focus on authority and trust through process and social control. The authors of this paper set the approximate levels at price 10%, trust 40%, and authority 50%.

#### **Bid** invitation

AZ adopted a pre-qualification approach. Through the evaluation of site organization, staff competence and reference projects, three contractors that the client trusted to have the ability to complete this complex project were selected. The invitation of only three bidders indicates a higher focus on trust and authority, through social and process control, than on price. The reason for not negotiate directly with the MC, with whom AZ has a long-term relationship, was that AZ wanted to obtain some competition, but also to keep the market alert and interested in AZ as a major construction client. This intention of managing and affecting the market by 'keeping

suppliers warm' indicates use of authority. Approximate levels are set at price 20%, trust 40%, and authority 40%.

#### **Bid** evaluation

AZ used several soft parameters, foremost concerning competence and collaborative ability, together with price when evaluating bids. These soft parameters were weighted 60% and bid price constituted 40%. Through this evaluation procedure the client ensured that the contractor selected was suitable to conduct the work. The 60% weight on soft parameters was therefore not only a sign of trust but also of authority. Approximate levels are set at price 40%, trust 40% and authority 20%.

#### **Selection of sub-suppliers**

Subcontractors responsible for construction related work, such as paintjobs and inside floors and ceilings, were domestic and thus selected by the MC. Subcontractors responsible for installation work, such as electricity and ventilation, were nominated to the MC by AZ. However, AZ and the MC discussed these selections and had some influence on each other's choices. The reason for the client to manage the selections of some subcontractors was that their work was very complex and also critical for the functioning of the building. Hence, their involvement in the design stage was sought for and AZ thus wanted to assure that they were not selected only on a lowest price basis. The mixed use of both domestic and appointed subcontractors facilitates a focus on price and authority respectively. Since both parties collaborated and influenced each others selections some trust was also facilitated. Approximate levels are set at price 40%, trust 20% and authority 40%.

#### **Contract formalization**

The standard construction contract AB92 was utilized 'as always'. The integration between the parties, due to the collaborative approach, made the standard contracts a little blurred. However, AZ's project manager did not see this formalization issue as a problem. Due to the trustful project climate, the parties relied somewhat less on the contracts, which diminished this ambiguity. This indicates high emphasis on authority but also some emphasis on price, since formal contracts are an important part of price-based market relationships, and trust, due to the decreased reliance on the contracts. Approximate levels are set at price 30%, trust 20% and authority 50%.

## Type of compensation

The compensation was a delicate mix of cost reimbursement with a gain share arrangement (connected to a target price) for all direct cost (e.g. material, blue collar workers, subcontractors and site costs for cranes, site huts) and a fixed price for the lower indirect costs (e.g. insurance, overheads and white collar staff on site). The reason for dividing the compensation into two parts is that all types of cost are not affected by the collaborative approach. Direct cost, which can be lowered by successful collaboration, was reimbursed to decrease the contractor's risks. The possibility of a reward if direct costs are below the target budget serves as an incentive for the different actors to collaborate and avoid sub-optimization. All indirect costs that cannot be decreased through collaboration were compensated by a fixed price, which facilitated competition and decreased the risk for cost overruns. The use of reimbursement with a gain share arrangement indicates emphasis on trust and authority, while the fixed price enhances emphasis on price. Approximate levels are set at price 20%, trust 50% and authority 30%.

#### Usage of collaborative tools

The backbone of the collaborative approach was the two processes of first establishing *joint objectives* early in the project and then the *continuous evaluation* of the fulfilling of the objectives during the reminder of the project. The establishment of the objectives document was conducted through a couple of subsequent half day workshops. The follow up process was constituted by quick checks and discussions during regularly meetings every other week and perhaps more importantly by four half day workshops spread out during the project time.

A *joint project office* was established for the client staff near the site, well before the midpoint of the project. Although contractors had their own site office and the consultants rather worked in their respective offices as usual, the project office served its purpose as a joint meeting place for staff from different organizations, since consultants and sometimes contractors came there to meet the client staff.

A *shared IT database* facilitated communication and information sharing. All project participants were not, however, enthusiastic about this tool, since it requires a certain level of user knowledge. In future projects user education will be offered in the beginning of the project to increase the efficacy of this collaborative tool.

Teambuilding activities were initially formal and work related, through meetings and workshops concerning an introduction to the collaborative approach and the establishment of joint objectives. Later, informal and more social teambuilding events took place. The lesson learned was that these events are useful for getting to know each other and should therefore be initiated early in the project.

The client had used these tools in two earlier projects, in order to enhance participation, creativity and commitment and to create a collaborative project climate. Through encouraging the actors to communicate and take a larger responsibility, AZ depended less on authoritative orders and directives and instead trusted the actors to solve problems in a collaborative manner, beneficial for the project as a whole. The extensive use of collaborative tools in the case project leads to a high emphasis on trust. However, AZ carefully considered the costs of the collaborative activities, such as whom to invite to workshops. This together with the aggressive objectives regarding project result also led to some focus on price. Furthermore, AZ's way of deciding which and how collaborative tools should be used indicates some focus on authority. Approximate levels are set at price 20%, trust 60% and authority 20%.

#### **Performance monitoring**

Continuous control of work in progress was mostly conducted by the MC (approximately 80%) and only to a lower extent by AZ (20%). In the end inspection, the MC was responsible for conducting self-control inspections of the finished product, indicating social control. To increase the importance and benefits of this self-control AZ did not conduct a traditional full scale end inspection, but instead relied on random inspections to a large extent. About 50% of the finished work, concerning the most complex and critical functions of the building, was controlled by traditional full scale end inspections, while the remaining 50% was only randomly inspected. This coupling of self-control with random inspections saved money compared to traditional full scale end inspections and facilitated trust and commitment since the MC was responsible for ensuring that they had performed as promised. This mix of different control types indicates a low level of authority, due to a very small extent of process control by AZ. The focus on price is lower than traditional but still rather high due to AZ's output control through the mix of full scale and random end inspections. The level of trust is high since the MC's self-control is a critical part of both the end

inspections and the control of work in progress. Approximate levels are set at price 30%, trust 60% and authority 10%.

#### Calculation of mechanisms' combination

When the different levels of the mechanisms are set in each of the process stages, the combination for the transaction as a whole can be calculated. In Table 2, the inputs and the results (measured in %) of this calculation are presented.

#### **Table 2.** Inputs and results of the mechanisms' combination calculation

In order to calculate the mechanisms' combination, one simply has to calculate the mean values for each mechanism by adding the values of each stage and dividing it by eight (the amount of stages). The mechanisms' combination will be: emphasis on price 26%, trust 41% and authority 33%. The model prescription of low emphasis on price, high/medium emphasis on trust and medium/high emphasis on authority is not very different from the calculated combination. According to the model, the emphasis on price should be somewhat lower in the case project, but the discrepancy is small.

## Suitability of buying process decisions

In this section the suitability of the measures taken during the buying process are discussed, based on earlier research results and on case survey results. When the case project was finished the 29 partnering team participants responded to a final survey in which they assessed the general importance of the different measures taken during the buying process stages and how well these measures had been executed in the case project in order to facilitate collaboration. 7-point Likert scales were used (1= unimportant, functioned very badly, 7= very important, functioned very well). The empirical results from this survey are presented in Table 3.

**Table 3.** Importance and function of buying stage decisions

#### **Specification**

Traditional comprehensive specification made by the client side before contractor procurement results in a divorce between design and constructions and long project durations (Cheung et al. 2001; Dubois and Gadde 2002). Early contractor involvement in specification is thus legitimate (Akintoye et al. 2000) which can be obtained by joint specification; an important part of partnering, promoting value engineering and risk management (Bresnen and Marshall 2000). The case survey results show that early involvement in joint specification is considered very important in general (mean value 5.6) to facilitate collaboration and that this approach functioned rather well (mean value 4.7) in the case project.

#### **Bid** invitation

Construction clients strongly rely on open competitive tendering (Dubois and Gadde 2002), facilitating constant switches between different suppliers. Relationships have therefore been focused on the short-term, with actors attempting to lever what they can out of the existing contract, leading to opportunism (Cox and Thompson 1997). This is one major reason for the strained relationships in the construction sector. The case survey results show that the use of pre-qualification instead of open tendering is considered important in general (5.3) and that this approach functioned rather well (4.6) in the case project.

#### **Bid** evaluation

Traditionally, tender price is the most significant parameter in bid evaluation, especially among public sector clients (Fong and Choi 2000). This price focus is a prime reason for project delivery problems, since contractors bid low to win the contract and then try to earn more money through extra work, not specified in the contract. Thus, soft parameters should be more important (Latham 1994), especially in the procurement of partnering projects (Bresnen and Marshall 2000; Brown et al. 2001). The case survey results show that the use of soft parameters is considered important in general (5.4) but that this approach did not function very well (4.4) in the case project. In discussions during meetings and workshops the project participants argued that the price focus of 40% was still a little too high, due to the high complexity and sketchy specification.

#### **Selection of sub-suppliers**

Domestic contracts based on price are most common, resulting in strained contractor-subcontractor relationships even when client-contractor relationships are collaborative (Dainty et al. 2001; Packham et al. 2003). To improve subcontractor relationships, client actions in improving supply chain integration are therefore critical (Dainty et al. 2001), e.g. by involving subcontractors in the partnering team (Packham et al. 2003). The case survey results show that a broad partnering team (including subcontractors) is considered rather important in general (4.7) and that this approach functioned well (4.9) in the case project. According to the project manager and the site manager the joint selection procedure and the integration of subcontractors in the partnering team resulted in that subcontractors showed increased involvement, flexibility and responsibility by coordinating their work with that of other actors.

#### **Contract formalization**

Traditionally, construction transaction parties rely heavily on the formality of the governing contract; the focus is contractual rather than relational (Thompson et al. 1998). The commonly used standard forms of contracts are instruments seeking strict liability and attaching blame to events that occur (Cox and Thompson 1997). They may prevent true partnering since they bring a formality that may stifle good relationships and encourage non-collaborative behavior (Barlow et al. 1997; Thompson et al. 1998). In the case project the contracts were connected to the standard AB92 'as always', but due to the trustful project climate the parties relied somewhat less on the contracts. The participants did thus not see the high formalization as harmful. This finding is in line with the one made by Woolthuis et al. (2005) that formalized contracts can be beneficial in collaborative relationships if they are coupled with trust and relational norms.

#### Type of compensation

Fixed price is the most common compensation in construction, while reimbursement and incentive-based compensations are rather rare (Fong and Choi 2000). Fixed price is a frequent cause of conflicts in complex and uncertain projects, since design changes result in hard negotiations regarding price adjustments (Kadefors 2004). Since economic incentives clearly communicate that cooperation is desired, incentive-based compensation is vital in partnering projects (Barlow et al. 1997; Bayliss et al. 2004). The case survey results show that compensation including incentives is considered important in general (5.1) but that the chance for financial rewards did not

serve as a major motivation factor (4.5) in the case project. Many participants argued that intrinsic rewards, such as a better working environment and the chance for future projects with the client, were more important for collaboration to emerge. Hence, too much faith should not be placed in economic incentives (Kadefors 2004).

## Usage of collaborative tools

The use of collaborative tools is normally missing in traditional projects. In partnering projects, however, collaborative tools such as joint objectives, joint project office, shared IT-database and teambuilding events are commonly used (Bayliss et al. 2004; Cheung et al. 2003; Olsen et al. 2005). The case survey results show that the collaborative tools were considered important (4.9-5.3) and that they functioned well 4.9-5.7) in the case project, especially the joint project office.

#### **Performance monitoring**

Construction work is often hidden and very difficult to inspect after the completion of the building (Kadefors 2004). Still, most construction clients rely heavily on extensive end inspections of the finished work. The case survey results show that contractor self-control is considered very important in general (5.7) and that this approach functioned rather well (5.0) in the case project. This unorthodox approach therefore seems to be a suitable way of emphasizing trust and social control through instead of the traditional costly client-led control of work in progress and end product.

## Analysis of the facilitated governance form

Through purposeful decisions during the buying process, AZ has taken suitable steps in the right direction in order to reduce the traditional high emphasis on price. In spite of this the case project participants argue that the focus on price should have been even lower. Furthermore, the model prescribes either a high emphasis on trust or on authority. Due to the collaborative approach AZ wanted to focus on trust rather than on authority, by empowering other actors to take responsibilities in a trustful manner. The establishment of trust was also enhanced by the parties' earlier positive experience of each other in their long-term relationship (Olsen et al. 2005). This is related to social embeddedness, which is a vital aspect when analyzing transactions (Granovetter 1985). The social embeddedness was probably a prerequisite for some procurement decisions. In joint specification it helps a lot if the contractor has previous experiences of the client and its demands and joint selection of sub-suppliers is enhanced if client and contractor have mutual knowledge and previous experience of the chosen actors. Furthermore, contractor self-control is based on concern for the client and the end product and would probably not work very well in anonymous short-term market like relationships. Hence, the case study shows that trust and social context are vital in transaction governance.

It is important to recognize that the governance mechanisms affect and complement each other (Olsen et al. 2005) and that the decisions during the buying process stages are inter-connected. The implementation of a cooperative approach requires re-engineering of all elements of the contractual relationship. Incentives alone or performance of workshops and other teambuilding activities are not sufficient (Cox and Thompson 1997). In the case project, AZ took collaborative decisions in most stages of the buying process. This resulted in a governance form facilitating an emphasis on trust rather than the traditional emphasis on price and authority. The case project was finished successfully. It was completed on time and below the budget and more importantly the participants are satisfied and consider the project as a success.

As abovementioned, the final case survey results show that the procurement procedure alternatives chosen by AZ were considered more suitable than traditional procurement approaches, which produce many problems affecting the construction process and the end product negatively. Thus, the TCE framework, earlier construction research and the case survey results all support a low emphasis on price and high emphasis on trust when procuring complex construction projects.

#### Conclusions

The research presented in this paper offers an analysis that compares empirically observed partnering procurement procedures with conceptual prescriptions provided by a transaction cost economics (TCE) framework. The results provide both theoretical and empirical support to the implementation of partnering procurement procedures in construction projects characterized by high complexity and uncertainty.

Traditionally, the emphasis on price and authority is high in client-contractor relationships. However, the empirical illustration showed that the case client has reduced the focus on price and authority and instead facilitated a relationship based on trust and cooperation. This resulted from purposeful procurement procedures involving joint specification, limited bid invitation, bid evaluation based on soft parameters, joint selection of subcontractors, standard contracts coupled with relational norms, usage of collaborative tools and contractor self-control. The procurement procedures chosen by the client in the case project result in a governance mechanisms' mix rather similar to the one prescribed by the TCE-model. Hence, the TCE-model offers theoretical support for implementing partnering procurement procedures, focusing on trust rather than on price and authority, in construction projects characterized by high complexity and long duration.

Since the actors involved in the case project are satisfied with the project result and also consider the performed procurement procedures as suitable, this study also offers empirical support for partnering procurement in this particular project. However, the empirical results also show that the procedures were not performed optimally; there is still plenty of room for improvements. By adopting a long-term perspective the case client can work purposefully to achieve continuous improvements over time, in order to facilitate effective governance of future construction projects.

A practical implication from this research is that the implementation of partnering through cooperative procurement procedures is suitable in construction projects characterized by high complexity and long duration. Since this implementation is not easily achieved it is important to adopt a long-term perspective and continuously improve procurement procedures over time in order to facilitate increase the benefits of effective governance.

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## Figures and tables

		Asset specificity			
		Low	Medium	High	
F	Occasional	Type I Emphasis on price: high trust: low authority: low	Type 3 Emphasis on price: medium trust: medium authority: medium	Type 5 Emphasis on authority: high/medium trust: medium/high price: low	
Frequency	Recurrent	Type 2 Emphasis on price: high trust: medium authority: low	Type 4 Emphasis on trust: high price: medium authority: low	Type 6 Hierarchical production	

Fig. 1. Model for the choice of governance mechanisms (Eriksson 2006).

Table 1. Procurement effects on control types and governance mechanisms

Buying stage	Price focus through output control	Authority focus through process control	Trust focus through social control
Specification	Spec. by contractor	Spec. by client	Joint spec.
Bid invitation	Open bid procedure	Limited bid invitation	Limited bid invitation
Bid evaluation	Focus on tender price	Focus on authority-based soft parameters	Focus on trust-based soft parameters
Subcontractor selection	Domestic	Nominated	SCs selected by both client and MC
Contract formalization	Formal, comprehensive contracts	Formal, comprehensive contracts	Informal and incomplete contracts
Type of compensation	Fixed price	Reimbursement	Including incentives
Collaborative tools	Low usage of collaborative tools	Low usage of collaborative tools	High usage of collaborative tools
Performance evaluation	Output control by client	Process control by client	Self-control by contractor

Table 2. Inputs and results of the mechanisms' combination calculation

	Price	Trust	Authority
Specification	10	40	50
Bid invitation	20	40	40
Bid evaluation	40	40	20
Selection of sub- supplier	40	20	40
Contract formalization	30	20	50
Type of compensation	20	50	30
Collaborative tools	20	60	20
Perform ance evaluation	30	60	10
M ean value	210/8 = 26	330/8 = 41	260/8 = 33

**Table 3.** Importance and function of procurement procedures

Performed procedures	General importance		Function of	
	of proced	lures	procedures in case	
	Mean	SD	Mean	SD
Joint specification	5.6	1.3	4.7	1.2
Pre-qualification	5.3	1.2	4.6	1.1
Soft parameters	5.4	1.1	4.4	1.2
Broad partnering team	4.7	1.4	4.9	1.2
Bonus chance	5.1	1.4	4.5	1.0
Joint objectives	5.3	1.1	4.9	0.8
Joint project office	5.2	1.6	5.7	1.3
Shared IT-database	4.9	1.6	5.1	1.3
Teambuilding	4.8	1.3	4.6	1.4
Self-control	5.7	1.2	5.0	1.2

# Paper 5

# **Modelling procurement effects on cooperation**

Accepted for publication in Construction Management and Economics

Per Erik Eriksson and Ossi Pesämaa

# **Modelling Procurement Effects on Cooperation**

# Per Erik Eriksson and Ossi Pesämaa

#### **Abstract**

Cooperative arrangements, such as partnering, have received increased interest in recent years. Several studies show however that cooperative relationships are not easily achieved in construction. Implementation of cooperative relationships requires changes in several elements of the traditional procurement procedures. The purpose of this paper is therefore to propose and test a sequential model regarding clients' cooperative procurement procedures. We especially ask: what elements in clients' procurement procedures facilitate the establishment of cooperation and trust in their relationships with contractors? The model was tested through structural equation modelling. The empirical data required for the test was collected through a survey responded to by 87 Swedish professional construction clients. The empirical results show that cooperative procurement procedures are triggered by clients' wish to involve contractors early in specification, which has a simultaneous effect on procedures regarding bid invitation and compensation. Furthermore, these simultaneous effects breed a certain kind of partner selection based on task related attributes, which also has a direct positive effect on trust and above all on cooperation in clientcontractor relationships. Besides these implications from the model, the improvement of measurements for future modelling is discussed.

Key words: cooperation, partnering, procurement, SEM.

#### Introduction

In recent years increased interest in cooperative arrangements, such as partnering, has been noticeable in the construction industry as a result of escalating conflicts and adversarial client-contractor relationships (Bresnen and Marshall 2000, Ng et al. 2002, Chan et al. 2003). The increased need for cooperation also stems from the increased complexity, uncertainty and time pressure that characterize construction projects (Gidado 1996, Pietroforte 1997). These characteristics require relation-specific investments, knowledge sharing, flexibility and integration, which are facilitated in long-term cooperative relationships (Pietroforte 1997, Rahman and Kumaraswamy 2002). Partnering, aiming at increasing cooperation and integration between the involved actors by building trust and commitment and decreasing disputes, can bring about advantages regarding quality, safety performance, sustainability, dispute resolution, human resource management, innovation, and also time and cost reductions (Barlow et al. 1997, Egan 1998, Chan et al. 2003). Implementing cooperative relationships is however not an easy and straightforward task (Saad et al. 2002, Chan et al. 2003); it should therefore be done in a proper way and for the proper reasons in suitable projects (Bresnen and Marshall 2000, Ng et al. 2002). In their empirical studies of the implementation of cooperation in construction supply chains, Akintoye et al. (2000) and Saad et al. (2002) found that cooperation was conceived to be important and beneficial. However, they also found that a lack of understanding of the concept and its prerequisites hindered successful implementation.

Procurement determines responsibilities and authorities in the construction process (Love *et al.* 1998) and affects the degree of cooperation and integration between the participants (Briscoe *et al.* 2004). To facilitate cooperative relationships many elements of the traditional procurement procedures thus need to be changed. With this in mind, it seems relevant to increase the understanding of partnering implementation through cooperative procurement procedures (i.e. procurement procedures that facilitate cooperation). The purpose of this paper is therefore to propose and test a sequential model of clients' cooperative procurement procedures. We especially ask: what elements in clients' procurement procedures facilitate the establishment of cooperation and trust in their relationships with contractors? The model is tested through a structural equation modelling technique, based on empirical survey data from 87 Swedish professional construction clients. Apart from this unique empirical data set, the paper offers (1) a model of how cooperation is formed through clients' procurement procedures; (2) how individual measures are linked to one another; and (3) a report on how well the individual measurements work in the context of construction.

# **Cooperative procurement procedures**

According to Korczynski (1996), there are two main ways for the client side (including management contractors) to manage the relationships with construction actors: the competitive low-trust route and the cooperative high-trust route. These two routes start with the way of handling specification and affect the entire procurement process. The competitive route, which is traditional in construction (Kadefors 2004), is based on a comprehensive and fixed design, seeking to gain short-term profits by passing on risks and pressure contractors to lower their prices (Korczynski 1996). Hence, this fixed design approach is mostly coupled with fixed price compensation. This traditional procurement paradigm receives criticism for hindering contractor input regarding planning and technical solutions, which hampers innovation and buildability (Korczynski 1996, Dubois and Gadde 2002). Furthermore, it makes parallel design

and construction impossible, leading to longer project duration (Cheung *et al.* 2001). Hence, it seems important that a new stream of cooperative procurement procedures emerges. Such a cooperative route seeks to obtain long-term gains through increased cooperation and integration of design and construction, through early involvement of contractors (Korczynski 1996).

We argue that complex, uncertain and more customized construction solutions require the procurement procedures to become more negotiable in nature (Bajari and Tadelis 2001, Cheng and Li 2002, Rahman and Kumaraswamy 2002). Increased integration and cooperation between the actors through early involvement of contractors in specification is thus suitable in order to achieve efficient and value adding solutions (Korczynski 1996, Barlow et al. 1997, Briscoe et al. 2004). Such integration of design and construction affects procurement procedures and cooperation throughout the entire project. This is because it becomes important to establish a trust-based cooperative relationship in order to facilitate contractors' contributions in the design stage (Korczynski 1996). Cooperative procurement procedures therefore demand a different kind of approach, involving more joint specification together with incentivebased compensation (Bajari and Tadelis 2001, Love et al. 2004) and limited invitation of contractors that are able to meet and fulfil certain task related attributes (Geringer 1991, Love et al. 2004). All of these procurement elements are assumed to increase trust and cooperation in inter-organisational relationships (Korczynski 1996, Bayliss et al. 2004, Eriksson 2006). In our depicted model (see Figure 1), we therefore propose that clients' desire to involve contractors early in specification affects their choices regarding compensation, bid invitation and task attributes, which further facilitates trust and cooperation. In order to develop and test this model, individual hypotheses connecting the different elements of the overall process are required. Below, these hypotheses are briefly discussed.

#### Insert **Figure 1** The Model: Cooperative Procurement Procedures

#### 1. Specification effects on compensation and bid invitation

Fixed price compensation is well suited to fixed and comprehensive design (Bajari and Tadelis 2001). However, this approach may cause win-lose profit protection attitudes, which inhibit flexibility (Ng et al. 2002) and discourage value adding solutions. An alternative approach is early involvement of contractors in which the actors jointly specify both contract and construction related activities (Korczynski 1996). This early involvement is an effect of the many complex and uncertain processes clients perceive in the beginning of a new construction process. Since joint specification requires a lot of time and effort, it is often coupled with some kind of cost-plus (reimbursement) compensation (Bajari and Tadelis 2001), which motivates that the activity be prioritized. Reimbursement contracts are occasionally coupled with cost incentives that reward (or penalize) contractors for having actual costs below (or above) a cost target (Bajari and Tadelis 2001). Such incentive-based compensation is important in partnering arrangements so that all participating actors can reap the benefits of increased cooperation and integration between design and construction (Egan 1998, Bayliss et al. 2004, Love et al. 2004).

H1: Early contractor involvement in specification has a significant effect on incentive-based compensation.

Additionally, joint specification requires close relationships and a long-term focus (Grandori 1997), since relation-specific investments are needed (Williamson 1985). Thus, specification is also related to bid invitation procedures. For cooperation to emerge, continuance is of the essence (Heide and John 1990), which can only be obtained when the buyer utilizes a small pool of potential vendors who are regularly used as suppliers (Spekman 1988). The constant replacement of actors between construction projects creates cost inefficiencies in the traditional competitive procurement route, since a new learning curve must be climbed by the supplier each time (Cox and Thompson 1997) and because it discourages relation-specific investments. Love et al. (2004) therefore argue that when integration of design and construction is desired, contractors who have previously worked with the design participants should be selected. By using the same project team members, a partnering culture based on cooperation and teamwork can emerge (Love et al. 2004). In order to enhance a longterm perspective on contractors' involvement and contributions in joint specification, professional clients should therefore utilize a small numbers of suppliers contracted on a regular basis, which is facilitated by limited bid invitations (Eriksson 2006).

H2: Early contractor involvement in specification has a significant effect on limited bid invitation.

## 2. Compensation and invitation effects on task-related attributes.

When purchasing standard products based on price, the client does not take the opportunity to influence the characteristics of the supplier, since these are considered less important (Heide and John 1990). Such price-based bid evaluation coupled with fixed price compensation is traditional in construction. However, when incentive-based compensation is chosen, in order to motivate the contractor to contribute to value-adding design solutions, the initial bid price is of less importance than the characteristics of the contractor. Cooperative procurement procedures therefore contain an element in which the client evaluates the contractor's ability to perform crucial tasks. Such an evaluation of what Geringer (1991) calls task related attributes is a complex and time-consuming effort. It requires a broad base of information ranging from earlier experiences, quality and environmental management systems, financial record, change attitudes, references, cooperative and technical skills (Spekman 1988, Parkhe 1998). When clients initiate relational contracting, involving joint specification and incentive-based compensation, such a partner selection based on task-related attributes should be performed (Rahman and Kumaraswamy 2002, Love *et al.* 2004).

H3: Incentive-based compensation has a significant effect on task related attributes.

When clients decide to invite a limited number of contractors to bid, they lose short-term price focus (Eriksson 2006) and gain long-term benefits, by increasing the opportunities for continuous learning and relation-specific investments. Then it is important to ensure that contractors are trustworthy and able to contribute to better construction solutions (i.e. increased buildability), in order to reap the benefits from closer ties (Brown *et al.* 2001, Love *et al.* 2004). Thus, when only a few bidders are invited, it is important to perform a partner selection based on task-related attributes.

H4: Limited bid invitation has a significant effect on task-related attributes.

#### 3. Task attributes' effects on trust and cooperation

A key aspect of cooperative relationships is joint actions that the partners perform together (Heide and John 1990). In a construction context, establishment of joint objectives, team-building activities, shared information, shared office building and joint dispute resolution techniques are joint actions that are considered important aspects of partnering relationships (Barlow 2000, Cheung *et al.* 2003, Bayliss *et al.* 2004). To facilitate this cooperation, the characteristics of the partners are of importance. Careful partner selection, based on task-related attributes, has therefore been found to set a proper basis for cooperation to emerge both in a general industry context (Heide and John 1990, Stump and Heide 1996) and in construction (Brown *et al.* 2001).

H5: Task-related attributes have a significant effect on cooperation.

Another beneficial effect of evaluation of task-related attributes is trust, which is an important ingredient in partnering arrangements (Korczynski 1996, Cheng and Li 2002). Trust decreases the need for authority and control, since the parties instead can build a common organizational culture that encourages self-control (Aulakh *et al.* 1996, Adler 2001). When trust is present, transaction parties believe that they can get what they want from each other without the exercise of authority and control (Håkansson and Snehota 1995). Hence, trust has the role of decreasing traditional monitoring and formal control that can create negative feelings for the entity and increase the propensity for opportunistic behaviour (Ghoshal and Moran 1997). In cooperative relationships, the buyer should therefore trust the supplier to execute self-control of work in progress and finished work (Hagen and Choe 1998). A key prerequisite for establishing this trust is knowledge about the partner and behaviour predictability, which is facilitated by careful partner selection based on task-related attributes (Parkhe 1998, Das and Teng 2001).

H6: Task related attributes have a significant effect on trust.

#### Method

Sample

The data required for the test of our model was collected through a survey. The sample consists of the 104 members of an association called "The Swedish Construction Client Forum", which have the objective of promoting the interests of construction clients in Sweden. The members are regional, national or international industrial and property companies, municipalities and regional authorities, and also government services and agencies, which procure construction work regarding civil engineering, housing, industrial facilities, etc. Hence, the Forum represents the majority of professional construction clients in Sweden. Registered contact persons in all of the member organizations were first approached by e-mail or telephone in order to ask them if they or other more suitable persons were willing to participate in the study, on behalf of their organization. Hence, it was up to the contact person to choose the most suitable respondent, given that the survey involved procurement and project management processes. Only four people declined to participate at this stage, due to lack of time, so a paper version of the survey was then sent out by mail to the hundred people that had agreed to participate. These people were mostly procurement managers, project managers or directors of the construction and facilities department in their organizations. After two reminders, a total of 87 responses were received, representing a response rate of 84 percent of the total sample size.

#### Measure – procurement procedures

The survey concerns different aspects of the organizations' procurement procedures. It was first piloted by five respondents, resulting in only minor changes. In the final version the respondents were asked how often they used different procurement procedures, measured by 7-point Likert scales (e.g. to what extent do you use reimbursement compensation including cost incentives? 1= very seldom and 7 = very often). The exception to this is the questions regarding task-related attributes in bid evaluation, in which the importance of the attributes was estimated (1 = unimportant and 7 = very important) in order to better assess their relative impact on bid evaluation results.

#### Multivariate analysis

The data was computed into the statistical package of social science (SPSS). For conducting structural equation modelling (SEM) we used an additional SPSS package called AMOS (Analysis of MOment Structures). SEM is a multivariate technique used to estimate a series of interrelated dependent relationships simultaneously (Hair *et al.* 1998). It has been applied in construction management contexts before, for example by Wong and Cheung (2005). They argue that it is appropriate when interrelationships of different hypotheses are investigated in a holistic manner, such as in the modelling of how different trust attributes affect partnering success (Wong and Cheung 2005). Like these authors, we utilize SEM to produce an accurate representation of the overall results, which in our model means an investigation of how different elements of procurement procedures are interconnected and together facilitate the establishment of trust and cooperation, see Table 3. In this study SEM also provides a factor structure, giving information about how well each latent construct is reflected by the suggested items (Hair *et al.* 1998), see Table 2.

# Results and analysis

In Table 1 we report the respondents' mean ratings (M) and standard deviations (SD) on items regarding early contractor involvement, incentive-based compensation, limited bid invitation, task related attributes, cooperation and trust.

#### Insert **Table 1** Descriptive Summary of Summated Scales

In order to investigate the suitability of the items measuring the constructs in Table 1, a factor analysis was conducted in AMOS. Table 2 reports the unstandardized and standardized factor estimates of each item. The factor scores prove that 18 out of 23 scores have an estimate that exceeds a .5 cut-off point. The measurement estimates on each latent construct is reported, since future studies may benefit from this information. The result suggests that the 18 items with satisfactory scores may be considered appropriate measures of their latent constructs, while the remaining 5 items need to be further developed in future research. This is further discussed in the conclusions.

#### Insert Table 2 Factor Analysis Measurements

To investigate the relationships among the different constructs (Table 1) proposed in the model (Figure 1), a SEM-analysis was conducted. The overall model receives only limited support if considering that IFI = .8, see Table 3. According to the rule of thumb, IFI should exceed .9 and in exploratory analysis a .8 level. More importantly, however, the most conservative criterion, Chi square divided by degrees of freedom, proves an almost perfect fit ( $\chi^2/d.f. = 3.50$ ), despite the relatively small sample size.

As a rule of thumb, models having a  $\chi^2/d$ .f. of more than five may be considered poor and less than two as over-fitted (Hair *et al.* 1998). This means that the overall model of the proposed cooperative procurement procedures fits our data. Hence, it seems that clients involving contractors early in specification adopt a system perspective on their procurement procedures, adapting them in their entirety to facilitate more cooperative relationships. This result is quite different from earlier research. Cheung *et al.* (2001) argue that there is a need for a more objective and systematic selection model, since construction procurement decisions are often judgmental and subject to biases of the decision-maker. Our results, on the contrary, show that such a model regarding a systematic view on cooperative procurement procedures is evident.

## Insert **Table 3** Test of Model and Hypotheses

The individual hypotheses in the model also show some interesting results if focusing on the standardized estimates (presented in brackets) and level of significance (p < .05), see Table 3. Unexpectedly, early contractor involvement in specification does not have a significant positive effect (+.48) on incentive-based compensation (H1), nor (+.4) on limited bid invitation (H2). This may indicate that many clients still perform a traditional competitive approach entailing open bid procedures and fixed price compensation when involving contractors in specification. Since many of the respondents represent public clients, for whom limited bid invitations are restricted, the rejection of H2 is not a surprise. Fixed price compensation is however not stipulated by law, for which reason the rejection of H1 cannot be explained by such an argument. As anticipated, we found that both incentive-based compensation (H3) (+.37) and limited bid invitation (H4) have significant positive effects on task-related partner attributes (+.32). This indicates that clients' partner selection is highly dependent on their earlier choices regarding type of compensation and bid invitation. Desirable task-related partner attributes (H5) also have a strong positive significant effect on cooperation (.491), as predicted. This is in line with earlier research, which has found that careful partner selection forms a proper basis for cooperation to emerge both in a general industry context (Heide and John 1990, Stump and Heide 1996) and in construction (Brown et al. 2001). Unexpectedly, task-related attributes (H6) have only a weak and not significant positive effect on trust in contractor's self-control (+.02). The rejection of H6 may be due to trust being harder and taking more time to establish than cooperation. It requires a cultural change, which may be facilitated by a widespread long-term use of cooperative procurement procedures. To summarize Table 3: the overall model was supported, the individual hypotheses H1, H2 and H6 were rejected, while H3, H4 and H5 were confirmed.

#### Conclusions

This paper offers three contributions that are important to consider in the context of construction procurement. The first conclusion considers the overall procurement process, which relates to the model and how the order of the procurement procedures is formed. The second contribution considers the isolated hypotheses in the model, regarding interconnections between individual procedures. Finally, we discuss the measurements and how future research may benefit from them.

Starting with the overall model, it confirms that clients' desire to involve contractors in specification triggers them to perform cooperative procurement procedures. We can now verify that clients are bound by the chosen specification procedure in their subsequent decisions regarding compensation, bid invitation and partner se-

lection, in order to facilitate trust and cooperation with contractors. This systematic view on procurement is quite different from earlier research results, which have found that construction procurement decisions are often judgmental and subject to biases of the decision-maker.

When looking at the individual hypotheses, we did not find any support for the first two hypotheses. Early involvement in specification and its relations to compensation and bid invitation were both insignificant, which may indicate that many clients still perform open bid procedures and fixed price compensation when involving contractors in specification. An additional contribution to the rejection of H1 and H2 is that the measure of early contractor involvement reports somewhat weak internal reliability (discussed below). On the positive side, we found support for the idea that partner selection based on task-related attributes is positively influenced by both incentive-based compensation and limited bid invitation, supporting hypotheses H3 and H4. Furthermore, the model confirms that clients performing such a partner selection are more likely to establish cooperation than trust in their relationships with contractors, supporting H5 but rejecting H6. Hence, it confirms that the extent of cooperation is highly dependent on a partner selection based on task-related attributes, which is in line with earlier research. The rejection of H6 may be due that the establishment of trust requires not only a short-term change of procurement procedures in a specific project but also a long-term cultural change.

Finally, we reported that 18 out of 23 items proved a satisfying loading to their constructs regarding compensation, invitation, task attributes and cooperation, despite the relatively small sample size. We believe it is important to report also the weak results in order to develop better future instruments. Starting with the specification construct, which is mediated by the others, it plays an important role in how cooperation is formed in the construction industry. As aforementioned, the construct in itself reports weak internal reliability if focusing on factor estimates, and additionally it has a limited isolated effect on the subsequent constructs in the model (H1 and H2). Future research should thus focus on more details of the specification process (a better construct) or, given a larger sample, test if client, contractor or joint specification treated as different groups, has moderating effects on this kind of model. Next, the construct of trust in contractor's self-control may also benefit from a more fine-grained instrument consisting of a larger number of suitable items. Another interesting idea for future research would be to investigate the procured parties' opinions regarding different procurement procedures' effects on cooperation. Since this study has a pure client perspective, we cannot compare their responses with those of the contractors.

#### **Practical implications**

The results imply that clients planning to implement cooperative relationships need to reassess their entire procurement process. Our model has verified that early involvement of contractors, limited bid invitation, incentive-based compensation and task-related attributes together affect trust and cooperation in client-contractor relationships. Therefore, partnering approaches based on only one or two of these procedures (e.g. incentive-based compensation) are not suitable. Furthermore, partnering initiated in the construction stage, based on the client's fixed design, may not be suitable since cooperative procurement procedures are triggered by clients' desire to integrate design and construction through early involvement of contractors in specification.

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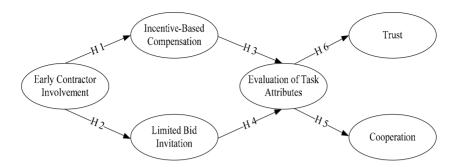


Figure 1 The Model: Cooperative Procurement Procedures

 Table 1 Descriptive Summary of Summated Scales

Definition	Item	M	SD
Early contractor involvement	To what extent specification is		
Integrated design and construction through early involvement of contractors in design-build contracts	Specified by contractor (design-build contracts)  Joint specification (client, consultants and contractors work together with design)	3.01	1.85
or joint specification.		2.76	1.75
Incentive-based compensation	To what extent contractors are compensated by		
Reimbursement compensation cou-	Incentive-based reimbursement (A gain/pain sharing approach)	1.99	1.19
pled with shared rewards (and risks) connected to a target price.	Bonus-based reimbursement (A gain sharing approach)	1.67	1.2
Limited bid invitation	To what extent bidding process is executed by		
A limited number of contractors are	Slightly limited invitation (5-10 bidders)	3.64	2.32
invited to bid	Strongly limited invitation (2-4 bidders)	3.09	2.24
	Direct negotiation (only one bidder)	1.98	1.36
Task related attributes	Importance of task related attributes		
	Earlier experiences of contractor	4.81	1.74
	Contractor's quality and environmental management systems	4.24	1.43
D	Contractor's project staff and labour	5.14	1.49
Partner selection through careful assessment of contractors' task re-	Contractor's financial record	4.67	1.39
lated attributes in bid evaluation.	Contractor's attitudes towards change	4.54	1.76
lated attributes in old evaluation.	Contractor's references	4.80	1.59
	Contractor's cooperative skills	5.08	1.82
	Contractor's technical skills	5.46	1.53
Cooperation	To what extent do the following parts of cooperation occur		
	Joint objectives	3.29	1.96
Cooperation is based on sharing	Policy for conflict solution	1.90	1.18
goals, information, operations and	Shared information in shared IT-database.	3.01	1.98
interpersonal teambuilding.	Shared coordination office to operate from.	1.99	1.37
	Teambuilding activities	3.25	2.01
Trust	To what extent monitoring of performance is		
Client's trust in contractor's self-	Process control by client (reversed code)	2.49	1.85
control	Process control by contractor	4.44	2.2
Colition	Limited random output control by client	2.56	1.75

 Table 2 Factor Analysis Measurements

	Estimate (Standardized)						
Item	Early inv	Inc comp	LBI	Task attr	Соор	Trust	P
Early contractor							
involvement	47 (22)						.029
Item 1	.47 (.32)						
Item 2	1 (.73)						N/A
Incentive-based compensation							
Item 1		1 (.56)					N/A
Item 2		1.73 (.97)					.003
Limited bid invitation (LBI)							
Item 1			.73 (.47)				.000
Item 2			1 (.68)				N/A
Item 3			.66 (.73)				.000
Task related attributes							
Item 1				1 (.56)			N/A
Item 2				.85 (.58)			.000
Item 3				1.08 (.71)			.000
Item 4				.74 (.52)			.000
Item 5				1.28 (.70)			.000
Item 6				1.17 (.72)			.000
Item 7				1.61 (.86)			.000
Item 8				1.21 (.77)			.000
Cooperation							
Item 1					1. (.70)		N/A
Item 2					.59 (.69)		.000
Item 3					.67 (.46)		.000
Item 4					.48 (.48)		.000
Item 5					1.02 (.70)		.000
Trust							
Item 1						1.07 (.75)	.004
Item 2						1 (.59)	N/A
Item 3						.49 (.36)	.014

 Table 3 Test of Model and Hypotheses

		Estimate (Standardized)						Decision confirmed
Item	Prop. Effect	Inc Comp	LBI	Task attr	Coop	Trust	р	if p < .05
H1 Early inv	+	.25 (48)					.088	Rejected
H2 Early inv	+		.47 (.40)				.082	Rejected
H3 Inc Comp	+			.495 (.37)			.010	Confirmed
H4 LBI	+			.192 (.32)			.028	Confirmed
H5 Task attr	+				.723 (.491)		.001	Confirmed
H6 Task attr	+					.029 (.02)	.88	Rejected
Model Fit: $\chi^2 = 885.861$ , d.f. = 253, p = 0.000, IFI = 0.80, $\chi^2/\text{d.f.} = 3.501$								

# Paper 6

# The influence of partnering and procurement on subcontractor involvement and innovation

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# The influence of partnering and procurement on subcontractor involvement and innovation

The influence of partnering and procurement

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## Abstract

**Purpose** – The aim of this paper is to investigate how a client's cooperative procurement procedures influence subcontractor involvement, value creation, and innovation in the construction of complex

Design/methodology/approach - Empirical data were collected through interviews, surveys and participation in workshops during a longitudinal action research case study. The case project was located in Sweden and concerned the construction of plant facilities for manufacturing of pharmaceutical products.

Findings – The case study findings reveal that the client's procurement procedures affect the level of subcontractor involvement and integration, but that this does not necessarily result in increased subcontractor value creation and innovation in the construction process.

**Research limitations/implications** – Since the empirical results are based on data collected from only one case project, the possibilities for generalisations are limited.

Practical implications - Clients' procurement procedures heavily affect subcontractor involvement. but in order to increase subcontractor contributions to innovation and value creation the actors should adopt a long-term perspective and actively work to establish an innovation-friendly climate.

Originality/value - This paper focuses on the often-neglected importance of subcontractors and their contributions to innovation and value creation.

Keywords Subcontracting, Partnership, Innovation, Procurement, Construction operations, Sweden

Paper type Research paper

#### Introduction

One prominent characteristic of the construction industry is the practice of subcontracting portions of a project to specialist subcontractors by main contractors (Eccles, 1981). As much as 75-80 per cent of the gross work done in the construction industry involves the buying-in of material and subcontracting services, when only considering new construction of large and complex facilities (Dubois and Gadde, 2000; Miller et al., 2002). However, in spite of subcontractors large share of work main contractors remain relatively unsophisticated in their approach to them (Briscoe et al., 2001). Traditionally, these relationships are mostly of transactional nature, strained by conflict and mistrust, enabling the main contractor to effectively apportion risk to the subcontractor (Miller et al., 2002). In fact, many main contractors exploit subcontractors mainly to shift liability risks, resulting in a reliance on complete © Emerald Group Publish contracts rather than cooperative relationships (Pietroforte, 1997). The poor



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relationships between these actors are also derived from traditional competitive tendering based on price (Miller *et al.*, 2002), resulting in adversarial attitudes (Hinze and Tracey, 1994; Latham, 1994; Dainty *et al.*, 2001).

Furthermore, subcontractors are often divorced from the main contractor's decision-making processes (Miller *et al.*, 2002; Packham *et al.*, 2003). Since main contractors mostly seek cost reductions rather than expertise and mutual cooperation, subcontractors are frequently not integrated in the design and planning of the work that they are responsible for executing (Miller *et al.*, 2002). Innovation is then hampered since in situations of conflict and mistrust, subcontractors are more likely to stick to what they know, rather than to risk trying something new (Miller *et al.*, 2002). Egan (1998) suggests that too much talent is therefore wasted through the failure to recognise the significant contributions that suppliers and subcontractors can make to innovation. Through an integrated supply chain the skills of these actors can be assessed and utilised to facilitate incremental improvements and innovation (Egan, 1998), securing project success and customer satisfaction through mutual cooperation and harmonisation (Miller *et al.*, 2002).

In recent years partnering arrangements have become popular in both construction (Bresnen and Marshall, 2000b; Ng *et al.*, 2002; Chan *et al.*, 2003) and facilities management (Jones, 1995; Okoroh *et al.*, 2001; Roberts, 2001), in order to transform the adversarial relationships into cooperative ones. However, partnering and its incentive schemes are most often focused solely on relationships between client and main contractor, and only sometimes also with consultants, and very rarely with suppliers and subcontractors (Bresnen and Marshall, 2000a; Saad *et al.*, 2002). In cases where subcontractors are not involved in the partnering team the increased cooperation between client and main contractor seldom spreads to subcontractor level (Bresnen and Marshall, 2000b; Packham *et al.*, 2003). Thus it is argued that all key actors on whose activities overall project performance ultimately depends should be included in the partnering team and the incentive schemes (Ng *et al.*, 2002; Chan *et al.*, 2003; Packham *et al.*, 2003).

A change towards increased integration between different tiers of contractors should be driven by clients for two reasons; first, clients often seem more enthusiastic than main contractors about retaining subcontractors' experience (Briscoe et al., 2004). This is because clients can appreciate value creation more than main contractors, to whom profitability is more directly affected by low costs. Second, the relationship between different contractors is affected by the relationship between client and main contractor (Pietroforte, 1997; Saad et al., 2002). Clients' procurement procedures, including client recommendation and nomination of subcontractors to main contractors, thus heavily affect subcontractor integration (Dainty et al., 2001; Briscoe et al., 2004; Khalfan and McDermott, 2006). To achieve a change towards more collaborative relationships between these actors the clients' procurement behaviour is therefore critical (Pietroforte, 1997). However, due to the large differences between them, integration and harmonisation cannot be construed as being easy and automatic (Miller et al., 2002). Hence, it seems pertinent to increase the understanding about how to integrate subcontractors to enhance value creation and innovation. The purpose of this paper is to investigate how clients' cooperative procurement procedures affect subcontractor involvement, value creation and innovation in the construction of complex facilities.

#### Innovation in construction

In the innovation literature, the importance and influence of interactions and feedback mechanisms for innovation has shifted the focus from internal structures and routines to external linkages and processes (Saad *et al.*, 2002). Thus, one of the key notions within this literature is that successful innovation often requires effective cooperation, coordination and working relationships between the different parties in specific projects (Gann and Salter, 2000; Ling, 2003). This is because interdependency between components and subsystems in the built environment demands knowledge sharing and interaction between different specialists and disciplines, contractors and subcontractors (Gann and Salter, 2000). Despite innovation requiring good cooperation and working relationships, most traditional procurement routes have worked against this. Aspects of traditional procurement that can hinder the ability of subcontractors to innovate and contribute to innovation include the division of work, contract conditions and allocation of risk.

#### Obstacles to innovation

In traditional procurement routes the division of work often leads to detached business relationships that impede innovation. The construction process is traditionally managed by work being divided into distinct packages that are allocated to different subcontractors to complete individually (Barlow, 2000). Hence, they often have to work on projects at different points in time and for different durations to other parties, and as result can find it difficult to coordinate and cooperate to implement joint innovations (Dulaimi *et al.*, 2003). Furthermore, when subcontractors work separately to other parties they may not be motivated to propose and initiate innovations that might contribute to the overall success of projects (Dulaimi *et al.*, 2003). The traditional method of dividing work in construction can lead to what has been termed "functional fragmentation" between different construction disciplines.

The innovation obstacles of the functional fragmentation are further exacerbated by the adversarial contractual systems and allocation of risk commonplace in non-partnering construction. Contract conditions can be an impediment to innovation by locking in certain specifications and imposing penalties on a party who either did something, or instructed another party to do something, that strayed beyond "standard practice" or "the present standard of knowledge in the industry" (Kumaraswamy and Dulaimi, 2001; Kumaraswamy et al., 2004).

The way that risk is traditionally allocated also imposes further disincentives to innovation (Kumaraswamy and Dulaimi, 2001). Risk is often transferred down the supply chain from the main contractor to subcontractors, who are generally least able to bear it (Barlow, 2000). Such allocation of risks can stifle the creative capabilities of subcontractors and instead favour time-honoured and habitual solutions.

The combinations of the traditional division of work, nature of contract procedures and allocation of risk in non-partnering procurement frequently result in adversarial attitudes among project parties. When faced by adversarial attitudes, subcontractors are generally concerned about completing the project to fulfil their individual interests rather than mutual interests (Dulaimi *et al.*, 2003). Such focus on individual interest limits inter-firm cooperation and knowledge transfer across disciplines required for joint innovation and value creation (Gann and Salter, 2000).

Drivers for innovation

To address these problems and improve the potential for subcontractors to contribute to innovation the extension of partnering relationships to subcontractors, that is, a broad partnering approach is recommended (Ng *et al.*, 2002). When partnering is extended to include subcontractors several specific strategies can be employed to increase innovation contributions. Early involvement of subcontractors is one way to focus their attention towards the collective interest of the project (Dulaimi *et al.*, 2003). Such an approach acknowledges the importance of integrated teams and recognises that for joint innovations to be successful there must be strong cooperation from all relevant parties (Ling, 2003). In addition, it can increase the motivation of subcontractors to propose and initiate their own innovations in particular projects (Dulaimi *et al.*, 2003). Early involvement and increasing subcontractors' participation in key decisions can facilitate faster construction, better understanding of client needs and project objectives, improved communication and involvement in value engineering tasks, and result in added value to the project (Briscoe *et al.*, 2004).

To further improve working relationships between firms, suitable contractual conditions are crucial. The possibility of successful innovation is increased radically when there is fair sharing of risk and minimal contractual and statutory constraints to innovation (Ling, 2003). In addition, contracts can also be designed on a win-win basis to include incentives and rewards for all participants involved in innovation. This is important because innovation is facilitated if all firms are motivated and optimistic about sharing the potential benefits.

To further increase the integration of different actors and create a collaborative project climate, "collaborative tools" should be utilised throughout the project duration (Eriksson, 2006). Examples of such tools are: establishment of joint objectives and continuous evaluation of them, joint project office, shared IT-database, teambuilding events, dispute resolution techniques, and partnering facilitator (Cheung *et al.*, 2003; Bayliss *et al.*, 2004; Olsen *et al.*, 2005).

#### Case study

The case study concerns the client AstraZeneca's (AZ) procurement and subsequent construction of plant facilities for manufacturing of pharmaceutical products in Sweden. This was a large construction project, with a value of more than €15 million, and according to the participants, very complex. Following the argument made by Eccles (1981) that subcontracting practices increase with project size and complexity, this case qualifies as an interesting example to investigate from a subcontractor perspective. The project was governed by a collaborative approach, which is often referred to as partnering.

The case study data were collected through: three interviews with the client's project manager, each lasting approximately one hour; a series of three subsequent surveys to all participants in the partnering team (approximately 25-30 people for each survey); document analysis; and arguably most valuably observation and participation in a significant number of meetings and workshops. The data collected also concerned other aspects of partnering implementation that are beyond the scope of this paper. The case study followed an action research approach in which the first author was deeply involved, serving as an advisor/facilitator to the partnering team. The action researcher was responsible for the design and management of the surveys and the

subsequent workshops. At the end of the project the third survey was sent out in order to compare several aspects of the collaborative approach with traditionally procured projects. The 29 respondents (all white-collar staff in the partnering team) were asked to give their opinion of several aspects of the project climate. They were also asked to assess the importance (in general terms) and the function (in this particular project) of different techniques used in the project to create the collaborative climate. A seven-point Likert scale (1 = do not agree, or not important, 7 = fully agree, or very important) was used.

Case study: techniques to establish subcontractor involvement

The client used several techniques to integrate the different actors and create a collaborative project climate: a broad collaborative approach, early procurement not based solely on lowest price, contracts based on joint profit sharing, suitable risk allocation and various collaborative tools. In Table I, results from the final case study survey regarding the importance and function of the techniques used are presented.

The client chose a broad collaborative approach, involving the main contractor, several consultants and three subcontractors in the partnering team. The latter were responsible for installation work (electrical work, ventilation, heating and cooling), and were considered to be crucial actors, since their work was very complex and critical to the functioning of the facilities. Hence, their involvement was sought in both design/planning and production. This broad partnering approach was said to be a key aspect of this project (function mean value 4.9), enhancing commitment and participation of all key actors, both in specification and production work.

These subcontractors were procured at an early stage and appointed to the main contractor. This was because the client wanted to assure that they were selected on the basis of their technical competence and collaborative ability, rather than on lowest price. When evaluating their bids, qualitative selection criteria were weighted 60 per cent and price only 40 per cent. The main contractor, to which these subcontractors were appointed, had some influence on the selection but it was the client who made the ultimate decision. The final case survey showed that early procurement and use of qualitative selection criteria are considered the most important techniques to facilitate collaboration (5.7 and 5.4) in any construction project. For this reason, it is of utmost importance that these practices are executed in a correct way; however, the partner selection procedures in the case project were not a total success. The case survey results also show that early procurement based on qualitative criteria was rated poorly because of bad execution (5.0 and 4.4). Not all participants were considered suitable for

	General importance	Function in case project	
Broad partnering	4.7	4.9	
Early procurement	5.7	5.0	
Soft parameters	5.4	4.4	
Shared profits	5.1	4.5	
Joint objectives	5.3	4.9	Table I.
Joint IT database	4.9	5.1	Importance and function
Joint project office	5.2	5.7	of collaborative
Teambuilding	4.8	4.6	procedures

collaboration, due to inappropriate attitudes and reluctance to change behaviour. During workshops, participants argued that due to the complexity of the project coupled with the sketchy specification, the focus on price was still too high and that the focus on soft parameters regarding the collaborative ability was too low.

In the case project the compensation included shared profits. The partnering team would receive a bonus to share, if costs were lower than accounted for in the project budget. In this way, the actors had an incentive to work collectively to come up with cost saving improvements. At the end of the project the actors received a small bonus to share. Since the individual bonus amounts depended on the individual share of the total costs, the subcontractors received a very small amount of money while the main contractor received a lot more. These shares did not depend on who contributed the most to the saving of costs, for which reason subcontractors did not have much incentive to come up with improvements. The case survey results reveal that this opportunity for financial bonus is generally considered as an important procedure (5.1) but that it did not serve as a major motivation factor for collaboration among the actors (4.5) in this particular project. Many participants argued that intrinsic rewards, such as a better working environment and the opportunity for future work with the client, were more applicable to the emergence of collaboration. During the final workshops the design of the incentive scheme was discussed. Some participants first called for incentives to be based on the individual contribution to innovation and not the collective ability to lower costs. They argued that this would increase the individual incentives to contribute improvements. However, the conclusion of the discussion was that most improvements are derived from collaboration (i.e. joint innovation), for which reason individual contributions are difficult to discern. Another drawback with individual incentives is that they may encourage solutions that are sub-optimal: lowering the costs of one part but increasing the costs for the whole project.

In the case project a suitable risk allocation was facilitated through the procurement procedures and contract forms. Subcontractors were not primarily utilised to bear risks. Their early involvement allowed them to contribute knowledge about technical solutions and planning of work, without taking main responsibility for these issues. In spite of the early involvement the contract still allocated risks regarding design work to the client and their consultants. This approach facilitated subcontractors' control and planning, especially regarding time and resources, which in turn decreased their risks.

In order to change attitudes and facilitate a collaborative project climate characterised by shared values and a team spirit, several "collaborative tools" (such as joint objectives, joint IT-database, joint project office and teambuilding) were utilised. The case survey results show that these collaborative tools are considered important (4.8-5.3) and that they functioned well (4.6-5.7) in the case project, especially the operating of a joint project office. During the project, team building activities were conducted for project staff at all levels. Predominately white-collar staff, but also blue-collar workers, attended meetings and completed exercises in order to increase commitment and participation. Furthermore, joint objectives enhanced the development of commitment and shared values among the participants. The process of establishing joint objectives was in itself a very useful teambuilding exercise. And the process of continuously reviewing work against objectives maintained high commitment to the collaborative approach throughout the project duration. Midway

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Case study: results of subcontractor involvement

The subcontractors had less experience of collaborative approaches than the main contractor, resulting in difficulties to adopt the concept immediately. However, both client and main contractor argued that the collaborative approach resulted in subcontractors showing increased involvement, flexibility and responsibility by coordinating their work with other actors. Generally, the subcontractors were very positive about taking part in the collaborative approach and they expressed a desire to continue working in this way.

During workshop discussions several participants argued that the collaborative approach resulted in broader competence. Joint specification and technical collaboration throughout the construction process made them interact and share knowledge to a substantial extent. Hence, they learned a lot from each other, resulting in broader competence for all participants and facilitating future collaboration. In addition, to implement new procedures regarding specification, bid evaluation, and new types of compensation systems required all actors to develop competences in these areas. Such competences were difficult to master over the duration of the single project, and therefore might rather be developed by incremental learning over a series of projects so that the actors can benefit more from future partnering projects.

According to the respondents in the final case survey, the subcontractors had contributed somewhat more (4.5 on a seven-point Likert scale) to innovation and problem solving in this particular project compared to traditionally procured projects in general. Among these respondents, some consultants were not so positive regarding this aspect. In their opinion the contributions from subcontractors were marginal, and not more apparent than in traditionally procured projects. During the final workshop discussions, it became evident that collaboration between consultants and subcontractors in early design stages is somewhat problematic. There is a risk that consultants look upon subcontractor involvement as an interference rather than assistance. To improve the relationships between contractors/subcontractors and consultants two suggestions regarding increased communication were made. First, contractors/subcontractors should discuss any construction changes with the consultants before they are executed. This facilitates better solutions and also results in feedback which the consultants can learn from. Second, consultants should visit the construction site regularly in order to meet site staff for discussions.

Furthermore, the survey results show that the actors in the partnering team did not feel that they were more encouraged to innovate and continuously improve in this project than in a traditionally procured project (4.1 on a seven-point Likert scale). This was a somewhat disappointing result which was discussed during the final workshop. It is not easy to encourage innovation and continuous improvements, but the participants agreed that communication and feedback are central factors. Communication and information sharing between consultants and subcontractors is especially important. The suggestions mentioned above regarding the improvement of this relationship would therefore help to facilitate a climate for innovation and continuous improvements. Another aspect that was considered important was a

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long-term perspective. Innovation and continuous improvements are hard to obtain in the short-term. This discussion ended (not surprisingly) with the participants stating that they hoped that they would all get involved also in the client's next project, in order to benefit from the lessons learned in this project.

#### Analysis

In spite of their importance, the development of subcontractors receives little interest (Miller *et al.*, 2002). In fact, both clients and particularly main contractors seem unaware that subcontractors can bring added value to the construction process (Dainty *et al.*, 2001) if they are integrated in important decision-making processes.

Analysis: techniques to establish subcontractor involvement

During recent years there has been a slowly increasing recognition that suppliers and subcontractors should be involved broad partnering approaches (Bresnen and Marshall, 2000a). All key actors on whose activities overall project performance ultimately depends should be included in the partnering team and incentive schemes (Ng et al., 2002; Chan et al., 2003; Packham et al., 2003). Suppliers and subcontractors should be fully involved in the design team (Egan, 1998), for which reason they should be procured in early stages, thus facilitating their involvement in value engineering and innovation exercises (Briscoe et al., 2004; Khalfan and McDermott, 2006). In the case project, three subcontractors, whose work was considered very important, were involved very early in the broad partnering team. They were invited to participate in design work and contribute their knowledge regarding construction planning. In this way different actors (client, consultants, main contractor and subcontractors) and different work stages (design and production) were integrated, which in turn enhanced both design and planning, and construction work.

To increase the financial benefits many researchers argue that it is vital to share profits from increased cooperation between all key actors (Rhodin, 2002; Bayliss *et al.*, 2004). In the case project the participants received a small bonus since the actual costs were lower than the target budget. Whether the bonus should depend on collective performance or just individual contributions was discussed during the final case workshop. The conclusion of this discussion was that incentives should be based on collective performance if increased collaboration is considered more important for innovation and value creation than individual contributions. However, the participants argued that financial incentives were not very important for cooperation to emerge. Hence, it seems that too much faith should not be placed in such incentives (Kadefors, 2004). They can serve as an additional basis for motivation and commitment but the collaborative approach should involve "softer" benefits, such as an improved working environment.

Traditionally, the needs and objectives of subcontractors are often overlooked (Miller *et al.*, 2002). The most important reasons for using subcontractors in construction are reducing risks and costs (Pietroforte, 1997). This risk allocation imposes disincentives to innovation (Kumaraswamy and Dulaimi, 2001), since it stifles the creative capabilities of subcontractors and instead favours time-honoured and habitual solutions. In the case project the subcontractors were involved at early stages in order to contribute knowledge, not to bear risk. This increased involvement and suitable risk allocation lowered the risk for subcontractors.

The influence of

partnering and

procurement

To increase integration and facilitate collaboration the usage of collaborative tools is important in partnering projects (Bayliss et al., 2004; Eriksson, 2006). In the case project several collaborative tools were utilised in a satisfactory way. These tools were considered important aspects of the collaborative approach, creating a collaborative project climate that further facilitated supply chain integration.

Analysis: results of subcontractor involvement

The results of the subcontractor involvement in the case project were somewhat ambiguous. The subcontractors were very positive regarding deeper involvement and how this contributed to improve the planning of their work. It also resulted in increased flexibility and coordination with other actors. This is an important positive effect since subcontractors do often not recognise the importance their role in relation to the trades that follow their work (Karim et al., 2006). However, their involvement only led to small improvements in their contributions to innovation in the case project. This result is in line with an earlier study regarding subcontractor involvement, which found that only 53 per cent of the main contractors felt that the partnered suppliers were innovative and that 91 per cent indicated that this was an area where significant improvements were expected (Beach et al., 2005). In another study Haksever et al. (2001) found that long-term relationships with subcontractors result primarily in indirect benefits such as better cooperation, team spirit and communication and fewer disputes. Direct benefits concerning time, costs and quality are not as apparent (Haksever et al., 2001). In the case study this disappointing result may be derived from the fact that the client failed to create a project climate that encouraged the actors towards innovation and continuous improvements. If these aspects are considered important they should be highlighted and prioritised.

Subcontractors' contribution to innovation depends to a large extent on collaboration with consultants, which is problematic since these actors are not used to collaborating with each other. This is because partnering approaches seldom are broad enough to include both consultants and subcontractors. Increased communication and feedback were suggested as important ways of improving the relationships between these actors, facilitating joint innovation and value creation. It is important to allow key people in each organisation to talk directly to each other. For example allowing assembly people to talk directly to those involved in the earlier design and planning stages (architects and client) (Barlow et al., 1997). Such face-to-face communication is enhanced by the members sharing the same office building (Barlow, 2000; Bresnen and Marshall, 2002). In the case project, however, the consultants chose not to be located in the joint office. During the final workshop it was therefore considered important to arrange for regular meetings on site between consultants and contractors/subcontractors in future projects.

All participants argued that the collaborative approach enhanced learning and knowledge sharing; they acquired new and broader competences. These competences were not fully utilised over the course of this project, but they may contribute to innovation in a long-term perspective if the parties are "allowed" to work together in subsequent projects. Such long-term relationships will increase the parties' incentives to cooperate (Eriksson, 2007) and facilitate the improvement of consultant-subcontractor relationships, which are important for innovation.

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#### Conclusions

This case study investigated how the client's procurement procedures affect subcontractor involvement and if and how such involvement affects value creation and innovation in a construction project regarding complex facilities. The empirical results show that subcontractor involvement and integration is facilitated by:

- · early procurement of subcontractors;
- · subcontractor selection not based solely on lowest price;
- · compensation including joint profit sharing;
- suitable risk allocation:
- · use of collaborative tools; and
- · broad collaborative approach.

In the case project the client increased subcontractor involvement and integration by performing the abovementioned purposeful procurement and project management procedures. These procedures are often important parts of partnering processes but they often concern only client and main contractor. In the case project, however, these processes also included important consultants and subcontractors through the client's broad collaborative approach.

However, the experiences from the case study also show that there is not an isolated direct link between increased involvement/integration and innovation/value creation. Integration and involvement can be beneficial in many ways but it does not necessarily result in increased innovation and value creation, which depend on many other factors. The empirical results suggest that subcontractor contributions to innovation and value creation are facilitated by:

- · subcontractor involvement and integration;
- · suitable climate for innovation and continuous improvements;
- close relationships between consultants and subcontractors; and
- long-term relationships between the participating actors.

In the case project the actors failed to create a climate that encouraged innovation and continuous improvements. Furthermore, relationships between design consultants and subcontractors need to be strengthened in order to increase subcontractor impact on design related innovations. By adopting a long-term perspective the client can learn from these shortcomings and improve these aspects in future projects. It should also be beneficial to let project participants work together over a series of projects in order to reap the benefits of closer relationships, increased knowledge sharing and continuous learning. In this way increased innovation and value creation can then be obtained through a long-term perspective of involvement and integration of subcontractors.

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