

HOW TO PROMOTE INNOVATION FROM AN
ORGANIZATIONAL CONTROL PERSPECTIVE

A CASE STUDY OF A PUBLIC INFRASTRUCTURE CLIENT

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Construction Management and Building Technology



DOCTORAL THESIS

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Abstract

Within the infrastructure sector, a public client can have various roles and responsibilities that extend beyond its own organization, such as stimulating and supporting innovation. As an infrastructure project is seldom standardized, the client needs to procure each contract based on the relevant uncertainties and complexities for that specific context. To encourage a contractor's compliance with the client's objectives, the client employs some degree of organizational control. When a public client procures all its infrastructure from contractors, it also needs to find ways of eliciting innovative solutions from the suppliers. Therefore, a public client needs strategies to both promote innovation by the contractors and direct and oversee the contractors' work to ensure the deliverables meet the project's objectives. The demands for increased innovation in the construction sector in general needs to be handled concomitant with the client's need to check that the contractor delivers accordingly to the client's objectives and demands. The overall purpose of this thesis is to explore the relationship between organizational control and promoting innovation by a public infrastructure client. More specifically, it explores how a public client can promote innovation by its contractors from an organizational control perspective.

The theoretical background is provided by an organizational control framework (Ouchi, 1979; Aulakh et al., 1996), i.e. a client can manage and steer an agent via three different control systems: process, output, and social. The empirical data is derived from 47 semi-structured interviews, complemented by observations, from 10 different infrastructure projects. The client (The Swedish

Transport Administration; STA) is the same for each project, but the contractors differ. Two types of contractor are represented: contractors that have not worked with the STA before (“unfamiliar contractors”), and contractors that have worked with the STA before (“familiar contractors”). A majority of the contract type is design-build. Four appended papers, each presenting a public client perspective, provide the basis of the thesis.

Previous findings that the client’s role is important for promoting innovation is explored further in this thesis from an organizational control perspective, emphasizing the role of the public client. It is important that during the procurement phase the client tries to find the right balance between achieving the intended objectives and creating space for innovation. Ex-ante planning is important, because how the client writes the control mechanisms into the procurement documents, and later the contract, has a direct effect on the opportunities for innovation by the contractors. In addition, the client has to manage the project in a way that does not cause irritation of frustration for the contractor, or hinder their work, thus supporting the view that organizational control should be enabling instead of coercive, so that the client’s input encourages innovation rather than creating obstacles. In addition, when adding a relationship history perspective on organizational control, an unfamiliar contractor (i.e. a contractor that has not worked with the client before) can find process control unsuitable and social control confusing, which means output control is probably the most appropriate approach to take when working with unfamiliar contractors. However, just relying on procurement strategies such as a design-build (DB) contract in combination with strict functional demands is not enough to promote innovation. Furthermore, a collaborative setting only seems to lead to innovative solutions if the client regards innovation as a mutual task and utilizes the collaborative setting for innovative co-creation.

From the client’s perspective, the practical and managerial implication of this thesis is the importance of finding a balance between giving the contractor space to be innovative in the execution of the contract, and at the same time making sure that the requisite end product is delivered. The results of this thesis suggest that the client does not hand over the “how” to the contractor when it comes to executing the project, as would be expected in a DB contract. From the contractor’s perspective, the responsibility for innovation within a DB contract can be confounded by the client’s use of social control, by which the client may encourage discussions and collaboration regarding innovative solutions but blur

the line over responsibilities. This could explain why social control often fails to have a positive impact on innovative output.

Sammanfattning

En beställare i infrastrukturektorn kan ha varierande roller och ansvar som går utöver den egna organisationen, detta kan exempelvis vara att stimulera och supportera innovation. Ett infrastrukturprojekt är sällan standardiserad, vilket ger att beställaren behöver upphandla varje enskilt kontrakt utifrån gällande komplexitet och osäkerhet för just det kontraktet. För att försäkra sig om att entreprenören uppfyller beställarens krav kan beställaren använda sig av olika typer av styrning. En beställare som upphandlar alla kontrakt externt för byggande behöver således också upphandla innovationer från entreprenörssidan. Detta ger att en offentlig beställare behöver ha strategier för att både stimulera innovation hos entreprenörerna och samtidigt se till att entreprenörerna levererar enligt krav. Kravet på ökad innovationsgrad i anläggningsbranschen måste hanteras samtidigt som beställaren styr mot övriga krav. Det övergripande syftet med denna uppsats är att undersöka relationen mellan organisatorisk styrning och stimulering av innovation hos en offentlig beställare i infrastrukturektorn. Mer specifikt är syftet att undersöka hur en offentlig beställare kan stimulera innovation hos entreprenörerna från ett organisatoriskt styrningsperspektiv.

Den teoretiska grunden utgörs av organisatorisk styrningsramverk framtaget av Ouchi (1979), som är vidareutvecklat av Aulakh et al. (1996). Ramverket innefattar tre styrningsmodeller – *process*, *output*, och *social control*. Den empiriska datan består av 47 semi-strukturerade intervjuer, kompletterade med observationer, i 10 infrastrukturprojekt. Beställaren – Trafikverket – är densamma i samtliga projekt, men entreprenörerna varierar. Entreprenörerna utgör två grupper – entreprenörer som arbetat med Trafikverket tidigare samt

entreprenörer som är nya för Trafikverket. En stor andel av de upphandlade projekten är totalentreprenader. Fyra artiklar utgör sammanläggningsavhandlingen, där samtliga artiklar har ett offentlig beställarperspektiv.

Tidigare studier har påvisat vikten av beställarens roll i stimulering av innovation, vilket studeras ytterligare i denna avhandling. Det är av vikt att en offentlig beställare försöker hitta balansen mellan att nå uppsatta mål i projektet samtidigt som det skapas utrymme för innovationsmöjligheter. Planeringen i upphandlingsfasen, innan kontraktet skrivs under, är viktig, eftersom detta påverkar innovationsmöjligheterna för entreprenörerna. Förutom detta, så är det av vikt att beställaren hanterar styrningen i projektet så att det inte skapar irritation eller frustration för entreprenörerna, så att styrningen inte blir ett hinder. Detta ger att styrningen borde vara möjliggörande istället för tvingande, så att beställarens styrning och insats uppmuntrar till innovationsarbete istället för att förhindra densamma. Om aktörerna har haft tidigare relation eller ej påverkar styrningen. En ny aktör på marknaden kan finna *process control* olämplig och *social control* förvirrande, vilket ger att *output control* kan vara den mest gångbara. *Social control* verkar enbart leda till innovationsmöjligheter ifall beställaren anser att innovationsskapande är ett gemensamt uppdrag, och inte enbart entreprenörens ansvar. Dock så verkar det inte räcka med att förlita sig på upphandlingsstrategier som totalentreprenadform i kombination med strikta funktionskrav för att skapa innovationsmöjligheter, utan situationen verkar vara mer komplex än så.

De praktiska bidragen i avhandlingen är kopplat till vikten av att hitta balansen emellan att ge entreprenörerna utrymme att vara innovativa, och samtidigt se till att korrekt leverans sker generellt i enlighet med kontraktet. Slutsatserna i denna avhandling tyder på att beställaren inte lämnar över "hur" kontraktet ska utföras till entreprenören, vilket torde vara fallet i en totalentreprenad. För en entreprenör kan nyttjandet av *social control* orsaka förvirring, där syftet från beställaren är att skapa möjligheter för innovativa diskussioner, men kan orsaka problem gällande ansvar. Detta skulle kunna förklara avsaknaden i denna avhandling av stöd för att *social control* ger positiva effekter på innovationsmöjligheter för entreprenörerna.

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Acknowledgement

My interest in procurement and clients started after my MSc. in Business Administration and during my work as a procurement officer for two different public authorities. When an opportunity to study public procurement and how to increase innovation by utilizing design-build contracts was presented as a PhD student, I decided to follow this path. Being a procurement officer has resulted when looking back on my doctoral project, that I have regarded procurement and promoting innovation from the client's perspective as a natural starting point. In addition, this has spurred thoughts about the theoretical point of view, as the role of the client and actions steers, directly or indirectly, its contractors. Working as a procurement officer also entails solving different problems. You are to procure goods and services of high quality at the right time for the taxpayers' money and also need to procure with environmental consideration and new, innovative solutions. The demand for solving societal issues via public procurement seems to increase, resulting in more pressure on the procurement officers. Therefore, this is a fascinating aspect to study.

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Moreover, to my children (the best in my life) – yes, it takes a long time to write articles. Nevertheless, now, I am hopefully done.

List of appended papers

Contextual communicative competence in multinational infrastructure projects

Järvenpää, A-T., Pavlik, A., and Karrbom Gustavsson, T.

Published in *Buildings* 2021, 11, 403.

Järvenpää and Pavlik designed the concept and method. Data collection was conducted by Järvenpää and P. E. Eriksson (the latter not included as an author). Earlier versions of the paper were written by Järvenpää and Pavlik; later versions and revisions were written by Järvenpää and Karrbom Gustavsson.

Exploring a public client's control systems in infrastructure projects from a relationship history perspective

Järvenpää, A-T., Eriksson, P. E., and Larsson, J.

Published in *Construction Management and Economics* 2022, 40 (1), 56–71

Järvenpää was the lead author and developed the focus of the paper, and was primarily responsible for framing its theoretical context, analysis, discussion, and conclusions. Data collection was conducted by all three authors. All three authors were actively involved in writing the paper.

Innovation outcomes and processes in infrastructure projects – a comparative study of design-build and design-build-maintenance contracts

Larsson, J., Eriksson, P. E., Lingegård, S., and Järvenpää, A-T.

Published in *Construction Management and Economics* 2022, 40 (2), 142-156

Larsson was the lead author and developed the focus of the paper, and was primarily responsible for framing its theoretical context. Data collection was conducted by all four authors. All four authors were actively involved in writing the paper.

How public client's control systems affect contractors' innovation possibilities

Järvenpää, A-T., Larsson, J., and Eriksson, P. E.

submitted to *Construction Innovation* in 2022

Järvenpää was the lead author and developed the focus of the paper, and was primarily responsible for framing its theoretical context, analysis, discussion, and conclusions. Data collection was conducted by all three authors. All three authors were actively involved in writing the paper, with the lead author as most involved and responsible.

Other publications

The transition from design-bid-build contracts to design-build

Järvenpää, A-T., Larsson, J. and Eriksson, P. E.

Lill, I. and Witt, E. (Ed.) 10th Nordic Conference on Construction Economics and Organization (Emerald Reach Proceedings Series, Vol. 2), Emerald Publishing Limited, Bingley, UK, pp. 213–220. <https://doi.org/10.1108/S2516-285320190000002054>

This paper was presented at a peer-reviewed conference, the 10th Nordic Conference on Construction Economics and Organization, 7–8 May 2019, Tallinn, Estonia, a biannual Construction Researchers on Economics and Organisation in the Nordic Region (CREON) conference, and published in the conference proceedings. Järvenpää was the lead author and developed the focus of the paper, and was responsible for framing its theoretical context. Data collection was conducted by all three authors. All three authors were actively involved in writing the paper.

Exploring entry barriers in the public infrastructure market

Järvenpää, A-T., Larsson, J. and Eriksson, P. E.

This paper was presented as a working paper at a peer-reviewed conference, the annual Association of Researchers in Construction Management (ARCOM) conference, 3–5 September, 2018, Belfast, UK. Järvenpää was the lead author

and developed the focus of the paper, and was responsible for framing its theoretical context. Data collection was conducted by all three authors. All three authors were actively involved in writing the paper.

1 INTRODUCTION

1.1 Background

Higher innovation rates are being pursued across the construction sector (Chan et al., 2014; Ozorhon et al., 2014; Winch, 2003), which has inspired work that emphasizes the client as a supporter of innovation (Nam and Tatum, 1997) and innovation champion (Kulatuga et al., 2011). However, the client also has the potential to hinder innovation (Blayse & Manley, 2004; Ivory, 2005), leading to studies that have investigated the client's role and behavior in general (Boyd & Chinyio, 2008) and more specifically how an infrastructure client can promote innovation (Lindblad & Guerrero, 2020).

An infrastructure client is often a public authority. In Europe, the role of the public client is strongly influenced by the Public Procurement Act, which stipulates how the client can procure contractors and consultants (Dir. 2014/24/EU "Public sector Directive"). This directive prescribes transparency, utilizing competition, the prohibition of discrimination, and specifications written in a way that does not obstruct interested suppliers. Private clients do not need to follow this directive, resulting in differences regarding motivation, interests, transparency, and regulations between the public and private sectors (Hartmann et al., 2008). Previous research has identified the potential for public procurement to promote innovation (Edler & Georghiou, 2007; Obwegeser & Dueholm Müller, 2018), emphasizing the public client as an enabler and catalyst for stimulating innovation via their procurement procedures and specifications (Aouad et al., 2010; Arrowsmith, 2010; Uyarra & Flanagan, 2010).

To steer via procurement could be by utilizing different control aspects, which theoretically connects to the framework of organizational control (Ouchi, 1979). The concept of organizational control has its roots in early work by Anthony (1952), and organizational control has been identified as an important part of management, comprising a variety of mechanisms to align the actions, goals, and capabilities of the different actors towards the overall project objectives (Sitkin et al., 2020). Within managing organizational control, it could be viewed that there is a principal-agent relationship (Williamson 1975), where the client is the principal and the contractor is the agent. Principals can utilize organizational control to direct, monitor, manage, oversee, and reward agents to achieve set goals (Merchant & Otley, 2006).

The etymology of the word “control” provides insight into organizational control:

“Control” has an interesting etymology dating back to the Latin contra, “opposite,” and rotulus, “a script,” and draws upon an opposition between two poles: a “rôle” (role-player) who acts to a script, and a “counter-rôle” (counter-role), which monitors the role player’s compliance. This etymology says a lot about the purposes of control: it is about making sure (or having the impression) that someone and/or something that plays a “role” (for instance an employee or a machine on the shopfloor) follows the script. Yet, there needs to be a wise balance between an excess of control, which would lead to resistance and organizational turmoil, and a lack of it, which would cause organizational chaos and disintegration. How and why such a balance exists is a matter of effective control. (Macintosh & Quattrone, 2010, s. 5)

As well describing organizational control and why it is needed, this quote also explains two facets of organizational control that are of applicability to this thesis – the script and someone following that script. Translated into an infrastructure setting, it is the client (principal) who has written the contract (i.e. the script) and the contractor (agent) who is to follow the script. The script can be written with more than one objective in mind, such as the more general aims of quality, cost, and time (Eriksson & Laan, 2007), as well as increased innovation.

Despite the academic interest in both innovation and organizational control, there is a lack of studies exploring their relationship. Cardinal et al. (2017 p. 580) state:

[i]n an external environment with hyper competition, unrelenting change, fleeting competitive advantage, and environmental shocks, we would expect scholars to be more focused on understanding the links between control and outcomes associated with innovation ...

To take advantage of innovative output, a greater understanding of how innovation and organizational control are connected is needed.

1.2 Problem discussion

Within the infrastructure sector, there is usually a situation where the initiator and developer are different actors, because most of the work is procured by a client from a contractor (Lim & Ofori, 2007, Loosemore & Richard, 2015). This has stimulated studies investigating the role of the client in the innovation process. Clients can be initiators and investors, and therefore have a direct impact on the contractors' opportunities to be innovative (Lim & Ofori, 2007). A client can also be passive, balanced, or dominant towards the contractor (Sexton et al., 2008). However, within infrastructure, creating innovation is more than contractors 'pushing' their innovations onto the market, or a client 'pulling' innovations onto the market by dictating its requirements (Ivory, 2005). A recent study suggests that consideration of the public client's role to date has been too shallow and overly simplified (Lindblad & Karrbom Gustavsson, 2021), thus warranting further study.

As well as creating an environment for innovation (Loosemore & Richard, 2015), a client must monitor and oversee contracts to make sure they meet the required targets for quality, cost, and schedule (Eriksson & Laan, 2007). However, infrastructure contracts seldom procure standardized solutions; procurements tend to be characterized as engineering-to-order, with many complicated and non-routine tasks and procedures (Geraldi, 2009). Because the solutions are rarely the same, the client's management and steering of a project cannot be standardized. The management system, including organizational

control, has to be adjusted for each specific project to ensure a satisfactory delivery, resulting in that the client has to monitor and oversee to both general targets and goals as well as steering towards innovation. This also adds to the intricacies of organizational control, as the client has to take all the objectives into consideration while steering a procured contractor towards a successful delivery.

Organizational control can be complemented by a contingency perspective; many studies have highlighted the need for control systems to be able to adapt to evolving circumstances (Stendahl et al., 2021; Turner & Makhija, 2006). The level and type of organizational control can change over time, resulting in a dynamic control process (Cardinal et al., 2004). Gulati (1995) identified relationship history, or prior relationships, as a contingency factor that can affect organizational control and how it functions. The relationship between unfamiliar actors (who are new to each other, without prior relationships) and actors who have worked together before (and are familiar with each other) can change, often from formal towards informal control (Aulakh & Gencturk 2000, Fryxell et al., 2002, Li et al., 2010, Sitkin et al., 2020). Arguably, public clients face strong challenges in terms of relationship history because of the temporary nature of infrastructure projects and the difficulties in taking prior relationships into consideration in public procurement. Relationship history has been studied to some extent, but there is a lack of studies on the role of relationship history in this empirical context, i.e. public procurement in a project-based industry, and its link to promotion of innovation.

The pursuit of higher innovation rate in the construction sector could be from a governmental demand to stimulate and promote innovation, directed at construction clients (SOU 2012:39, 2012; UK Innovation Strategy, 2021). The Swedish Transport Administration (STA) is both the major client in the Swedish infrastructure sector as well as a public authority, and has received such a directive to promote innovation within the Swedish infrastructure sector (SOU 2012:39, 2012). As a consequence, the STA has adopted several strategies to encourage innovation, including utilizing more design–build (DB) contracts, and increasing the number of non-domestic contractors submitting tenders to the STA and becoming established with the Swedish infrastructure sector. While increasing the rate of innovation, the STA still has to steer their procured contractors towards satisfactory delivery of the required end product. Because the public client has such an important role in creating possibilities for

innovative solutions via inter-organizational relationships with the contractors, how organizational control and promoting innovation are related represents the core of this thesis.

1.3 Purpose and research questions

How a client utilizes organizational control within inter-organizational infrastructure projects has been the focus of other studies (Eriksson & Laan, 2007; Lin et al., 2019; Liu et al., 2014), but without a specific focus on the public client. The purpose of the thesis is to explore, from an organizational control perspective, how a public client can promote innovation. The following research questions were addressed:

RQ1: How do familiar and unfamiliar contractors perceive a public client's control system?

RQ2: How can a public client promote innovation through the design and implementation of organizational control?

1.4 Delimitations

The focus of the thesis is the client's actions and decisions that influence the procured contractors via their inter-organizational relationships. The starting point is the client, and how, as the actor that has procured the necessary work, it promotes innovation by the contractors. Whether or not the contractors have utilized the opportunities given for innovation, or actually been innovative, is not included in the thesis.

How to promote innovation from an organizational control perspective

2 THEORETICAL BACKGROUNDS AND PREVIOUS RESERACH

2.1 Client driven innovation in construction

There is a rich and extensive literature on construction innovation. Based on Slaughter's (1998) definition, innovation is the implementation of larger changes and improvements that are novel to an organization, and Haugbølle and Boyd (2017) added the perspective that innovation is a struggle between change and stability for construction clients. Examples of innovation construction studies are project knowledge transfer (Liu & Chan, 2017), stakeholder interests (Whyte & Sexton, 2011), and the innovation that arises from inter-organizational relationships (Bygballe & Ingemansson, 2014). The role and function of the client have also received attention (e.g. Adam & Lindahl, 2017; Blayse & Manley, 2004; Brandon & Lu, 2008; Lindblad & Karrbom Gustavsson, 2021). Hartmann et al. (2008) identified the importance of the client's role in deciding both the construction process as well as the outcome, which is supplemented by Winch's (2008) observation that a client can stimulate innovative solutions. The client has been viewed as innovation champion (Kulatunga et al., 2011), agent of change (Haugbølle et al., 2015), and innovation supporter (Nam & Tatum, 1997). A construction client's role in public procurements is therefore important because it can function as a catalyst for innovation and development (Aouad et al., 2010).

However, clients find it difficult to stimulate and assess innovation objectively, often because of a lack of knowledge and experience (Lenderink et al., 2020). A

client's actions and procedures can both enable and hinder innovation, for example through the choice of procurement system (Blayse & Manley, 2004; Lenderink et al., 2020). Clients as initiators and investors have a direct impact on a construction firm's innovation (Lim & Ofori, 2007). However, innovation in construction is a complex process. Being innovative is more than contractors introducing their innovations to the market, or clients forcing innovations onto the market via their specific requirements (Ivory, 2005).

2.2 Organizational control

Client–contractor relationships in construction projects can be viewed as principal–agent relationships, where the client acts as the principal and the contractor the agent. To encourage an agent's compliance with the principal's objectives, the principal can employ some form of organizational control. Based on transaction cost economics, Ouchi (1979) developed a framework that includes three organizational control systems: bureaucratic, market and clan. In addition, organizational control is usually divided into two levels; systems and mechanisms, where the mechanisms combine to form the system (Sitkin et al., 2010). Examples of mechanisms include fixed prices, handbooks, rules and regulations, trust, and social interactions (Sitkin et al., 2010). Organizational control can be applied in internal as well as external principal–agent relationships, because of the similar logistics within intra- and inter-organizational relationships (Eisenhardt, 1985).

Ouchi (1979, p. 840) made a philosophical comparison between his theoretical framework and fishes:

If the price requirements of a Market cannot be met and if the social conditions of the Clan are impossible to achieve, then the Bureaucratic mechanism becomes the preferred method of control. In a sense, the Market is like the trout and the Clan like the salmon, each a beautiful, highly-specialized species which requires uncommon conditions for its survival. In comparison, the bureaucratic method of control is the catfish – clumsy, ugly, but able to live in the widest possible range of environments and, ultimately, the dominant species. The bureaucratic mode of control can withstand high rates of turnover, a high degree of

heterogeneity, and it does not have very demanding informational needs.

This presents a rather negative view of the bureaucratic system (“clumsy and ugly”), but it presides over the market and clan control systems because it can function across a much wider area. This analogy also highlights the particular conditions needed for the clan and market control systems to function.

Control methods have also been described as coercive and authoritative, and more recently as empowering:

While earlier research assumed more bureaucratic, authoritative, and coercive methods of control, work in the mid-1990s and 2000s in this topical area began increasingly to emphasize how organizations direct the accomplishment of their desired objectives through control mechanisms that empower, provide autonomy to, and increase the perceived self-determination.
(Sitkin et al., 2020, p. 341).

More coercive methods have been replaced with an enabling form of organizational control, suggesting that organizational control does more than address issues of an agent’s compliance. Instead of being viewed as unwilling or incapable of cooperating with the principal, an agent is instead encouraged to achieve the principal’s objectives successfully (Sitkin et al., 2020).

The framework originally developed by Ouchi (1979) has stood the test of time, and has increased in popularity in the last decade (Cardinal et al., 2017). While bureaucratic control uses explicit rules, details, standards and regulations, market control relies on prices, competition and outputs, and clan control is based on social relations, values, beliefs, integrity and trust (Ouchi, 1979, Sitkin et al., 2010). Developments arising from Ouchi’s (1979) original work have resulted in a new conceptual framework of organizational control, in which bureaucratic control is replaced by *process* control, such that a client monitors the contractor’s behavior to achieve the desired end product (Aulakh et al., 1996); market control is replaced by *output* control, where the client’s focus is the output, or end product (Aulakh et al., 1996); and clan control is referred to as *social* control, meaning a cooperative control system based on trust and commitment (Das & Teng, 2001). This revised framework has been applied previously in a construction context (e.g. Eriksson & Laan, 2007).

Utilizing either Ouchi's (1979) original framework or the revised version presented above is a matter of taste. A *bureaucratic* system is labelled *process* to emphasize the focus on managing the detailed process of the agent's work. A bureaucratic system can have negative connotations, as exemplified by Ouchi's comparison with fishes, but a comparison of the respective descriptions of bureaucratic and process control by Ouchi (1979) and Aulakh et al. (1996) suggests that they are very similar and can be used synonymously. Clan control (Ouchi, 1979) and social control Aulakh et al. (1996) are probably even more alike, for example Ouchi (1979) updated his and Maguire's (1975) earlier framework to include clan as a social dimension to organizational control. In contrast, the difference between Ouchi's (1979) market control and Aulakh et al.'s (1996) output control should be highlighted. While Ouchi (1979) emphasizes the market to determine a fair price and competition, Aulakh et al. (1996) focus on output, where price could be one of the mechanisms.

2.2.1 Control systems

Process control

A *process control system* monitors another actor's processes, practices, activities, and procedures to achieve the desired objectives (Aulakh et al., 1996). In a contractual relationship between a client and a contractor, process control can be applied to make sure the contractor adheres to instructions and uses prescribed methods and materials (Ouchi, 1979). This system is resource demanding because of the close supervision of the agent, and has been described as the "visible hand of management" (Anderson & Oliver, 1987; Gencturk & Aulakh, 1995). A principal's use of process control may be suitable if the situation is regarded as complex and uncertain (Celly & Frazier, 1996), but the agent can regard it as intrusive and unwarranted (Aulakh & Gencturk, 2000).

Output control

An *output control system* focuses on the agent's outcomes or results (Aulakh et al., 1996, Bello & Gilliland, 1997, Aulakh and Gencturk, 2000). This control system has been described as the "invisible hand of the market" (Anderson &

Oliver, 1987, Gencturk & Aulakh, 1995). Ouchi (1979) considers it to be the most effective type of control when the market is frictionless; the price provides the means for solving any problems with inconsistent goals, and the price contains all the information necessary for decision-making. Output control assumes that, in a principal–agent relationship, the agent is most likely to determine its own direction and level of effort (Aulakh & Gencturk, 2000). If the agent has sufficient information and knowledge to fulfil the contract, the principal only needs to check that the terms and conditions have been met. Output control focuses, therefore, on the principal’s specifications of *what* is expected to be developed/delivered, and is recommended when output measurability is high (Kirsch, 1996), which is usually when asset specificity is low (Das & Teng, 2001). With high complexity or uncertainty, output control can be less suitable because the principal is not able to predict the outcome (Bello & Gilliland, 1997), and output control is less efficient than process control (Anderson & Oliver, 1987; Celly & Frazier, 1996). An example would be the low output measurability of a complex project, because of the many interdependent deliverables or parts.

Social control

A social control system requires social interactions that develop shared norms and values, as well as mutual understanding, to guide the agent’s behavior (Aulakh & Gencturk, 2000; Fryxell et al., 2002; Ouchi, 1979). The recursive social interactions between the principal and agent result in relationship boundaries and a sense of socially acceptable behavior within a systematized and shared-value setting (Aulakh & Gencturk, 2000, Fryxell et al., 2002). This behavior can encompass a set of agreements within a specific group, such as integrity, values, beliefs or socialization processes within a culture (Ouchi, 1979). Examples of social control include jointly developing specifications, collocation, teambuilding, mutually agreeing on objectives and profit sharing (Das & Teng, 1998; Eriksson & Laan, 2007). Social control is resource and communication intensive, and tends to work best in long-term partnerships, because of the human investment needed to develop the relationships, especially if there are cultural differences (Bello & Gilliland, 1997). Social control is also an informal control mechanism, relying on shared values between the different parties to the contract (Tiwana, 2010). It uses consensus, and strives towards

common goals (Das & Teng, 2001). Social control is recommended when the results cannot be measured because of high levels of asset specificity, and when the principal does not have in-depth knowledge of the required processes (Das & Teng, 2001). For knowledge-intensive processes, social control might be the only option because the client lacks the expertise needed to apply formal control (Kirsch et al., 2010).

2.3 Procurement systems

Another facet of control is the strategic choices that a client can make to direct and steer the contractors in the procurement phase. Examples of various steering alternatives in the shape of procurement strategies can be applied before procuring a contractor are presented below.

2.3.1 Type of contract

A client usually chooses between design–build (DB) and design–bid–build (DBB) contracts when procuring a contractor (Eriksson, 2017). This decision is one of the most important decisions a construction client makes in the early phases of a project, as this decision connects to the client’s own organization and competence (Jung & Kang, 2017). Deciding on the type of contract is a strategic choice made by the client, and forms part of the client’s process of organizational control. In DBB contracts, the client is responsible for the design and the contractor executes the project (Hale et al., 2009). The challenge for the client is choosing the right level of control and determining the technical requirements needed to make best use of the contractor’s knowledge and expertise (Bröchner & Silfwerbrand, 2019; Sullivan et al., 2017). In DB contracts, both the design and the execution of the project are the contractor’s responsibility, resulting in one procurement instead of two (as in DBB) (Hale et al., 2009). This separation between the client and the design (as well as the execution) places the client in a potentially difficult situation because of information asymmetry: the client has less information than the contractor (Eisenhardt, 1989; Eriksson, 2017). A client can react to an imbalance in information by increasing their level of monitoring and supervision (Bajari & Tadelis, 2001, Park & Kwak, 2017).

Reasons for choosing DB contracts include a closer relationship between design and production, higher productivity, and a belief that performance specifications

promote innovation (Bröchner & Silfwerbrand, 2019; Nyström et al., 2016), and earlier comparisons between DB and DBB contracts have showed that DB contracts outperform DBB (El Asmar et al., 2013; Koppinen and Lahdenperä, 2007). DBB contracts, in contrast, can hinder innovation because of a lack of joint problem solving by the client and contractor, and no holistic overview of the design and construction (Eriksson & Westerberg, 2011; Korczynski, 1996). It has been argued that clients prefer to use DB contracts not only to facilitate innovation, but also to increase the contractor's involvement in the construction project (Eriksson, 2017).

However, just labelling a contract as DB is not sufficient to create innovation at the contractor; there needs to be a clear adding of degrees of freedom for the contractor by the client (Nyström et al., 2016). Performance-based specifications, which are common in DB contracts, can be too detailed and difficult to deliver if the client maintains strict ownership of the project (Bröchner & Silfwerbrand, 2019). There is also more than one type of DB contract, and the practical implementation of a DB contract can result in a variance in the contractual arrangement. A DB contract that resembles a DBB is called a *controlled DB contract*, where the client has a greater managerial role than in a "pure" DB contract (Bröchner & Silfwerbrand, 2019). Nyström et al. (2017) found that a controlled DB contract does not provide incentives for innovation.

DB contracts can be regarded conceptually as a form of output control, and DBB contracts as a form of process control (Eriksson & Laan, 2007), because the client prescribes the details of the design in DBB contracts, and focuses more on the outcome and functionality in DB contracts.

2.3.2 Reward systems and incentive-based payments

The two main reward systems utilized in construction are fixed price payment and cost reimbursement. They can also be combined with other alternatives, such as cost reimbursement coupled with incentives and a fixed contractor fee and/or bonuses (Eriksson, 2017). The most common reward system used to be a fixed price, to take advantage of the market and the lowest tendered price (Eriksson, 2008). However, its impact on innovation has since been reviewed, because contractors may be less interested in delivering higher quality or innovative

solutions if the reward system does not cover uncertainty and risk (Eriksson, 2017). Pure cost reimbursement can reduce the risk for the contractor, but, because it would lead to reduced compensation, may discourage efforts to reduce costs or provide innovative cost solutions (Eriksson, 2017). Combining cost reimbursement with economic incentives, to share increased or reduced costs or savings, can counteract the disadvantages of cost reimbursement (Chan et al., 2007). Other options are also available, for example bonuses for non-economic factors such as quality, work environment, time keeping, or collaboration, based on pre-specified criteria (Love et al., 2011).

Translated into a contractual situation, a reward system that covers the agent's costs, based on the time worked (e.g. salaried agents) and costs of input material, equates to process control (Eriksson & Laan, 2007; Gencturk & Aulakh, 1995). A reward system based on fixed price (Aulakh et al., 1996), or incentive-based rewards and pay-for-performance that influences the outcome, are examples of output control (Cardinal et al., 2017). A reward system based on profit sharing, for example through cost reimbursement together with target costs and incentives, is indicative of social control (Das & Teng, 1998; Eriksson & Laan, 2007).

2.3.3 Staffing and partner selection

Selecting partners and staff for a construction project for a public client is part of the procurement process, and choosing a suitable contractor is vitally important (Caldwell et al., 2009; Chen et al., 2018). A public client can base the procurement on soft criteria, such as competence level and knowledge, either as a bid evaluation or as a requirement (Eriksson & Westerberg, 2011). Soft criteria are often considered to be the opposite of lowest price evaluation, which can reduce the possibilities for innovation (Eriksson, 2017). A contractor is usually less invested in innovative work before being awarded a contract, because such an investment might not be reimbursed. Soft criteria need to be evaluated if the client expects the contractor to be innovative in the design phase (Bosch-Sijtsema & Postma, 2009). A client wanting to encourage innovative solutions by the contractor could, for example, target criteria such as collaborative competence, references, and technical competence (Eriksson & Westerberg, 2011).

When procuring a DB contract based on lowest price, the contractor may not be incentivized to spend resources on development, and will rely on known solutions and existing knowledge (Ahola et al., 2008). A client choosing to procure in accordance with lowest price, by letting a number of contractors compete with each other, shifts the focus onto short-term benefits, which can be viewed as output control (Anderson & Oliver, 1987; Eriksson, 2006). In contrast, investing in a long-term relationship with the contractor, and focusing on a continued relationship, is regarded as social control (Aulakh & Gencturk, 2000). This, however, can be in breach of the Public Procurement Act (SFS 2016:1145), which states that all interested suppliers should be treated equally. Process control can also have a long-term perspective, as it removes incentives to sacrifice the long-term for an immediate payoff (Anderson & Oliver, 1987). By taking account of organization, financial stability, resources and competence during procurement, the client can steer the contractor during delivery, thus implying a process control (Anderson & Oliver, 1987).

2.3.4 Social interaction and collaboration

Social interactions involve creating strong social relationships and building trust during the course of a project (Tiwana, 2008). This is important in complex construction projects, because the client and contractor need to co-create the end product (Eriksson, 2017). A shift from a more traditional client-contractor setup towards collaboration entails a change at both the client and contractor, from conflicting interests to agree on common goals (Bresnen & Marschall, 1998). Collaboration has been identified as a useful platform for innovative co-creation and may serve as engagement platforms for innovative co-creation practices (Eriksson *et al.*, 2017; Jacobsson & Roth, 2014; Ozorhon et al., 2014). Examples of enabling social interaction include a joint project office, formulating joint objectives, and strategies for conflict resolution (Eriksson, 2008). These activities should encourage communication and interactions on site, which is important for innovative work (Alderman & Ivory, 2007).

Building trust and formulating joint objectives are examples of social control (Aulakh & Gencturk, 2000). Adding formal collaboration into a contract is also indicative of social control, because of the link between collaborative tools and social control (Das & Teng, 1998). Social control in construction is heavily

affected by the strategies used for procurement and contracts, because a client can select an agent that has objectives and values that agree with the principal's (Fryxell et al., 2002). Because a public client's choice of partner is governed by the Public Procurement Act (SFS 2016:1145), how the client handles sub-contractors should also be considered (Eriksson, 2006). To base the choice of sub-contractors on collaborative and mutual selection indicates social control (Eriksson, 2006).

To summarize the theoretical background presented in this chapter, Table 1 links procurement strategies with control systems. The procurement strategies are based on the Public Procurement Act, which prescribes how a client can procure a contractor.

Table 1 - A control system perspective of construction procurement

| Procurement strategy/Control system | Type of contract | Reward system and incentive-based payment | Staffing and partner selection | Social interaction and collaboration |
|--------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------------------------------------------|
| <i>Process control</i> | <i>DBB contract</i> | <i>Covering the agent's costs (time worked) Costs of input material</i> | <i>Taking account of organization, financial stability, resources and competence</i> | <i>Choosing sub-contractors directly</i> |
| <i>Output control</i> | <i>DB contract</i> | <i>Fixed price or incentive-based rewards and pay-for-performance to influence the outcome</i> | <i>Lowest price</i> | <i>Focusing on price when selecting sub-contractors</i> |
| <i>Social control</i> | <i>Formal collaboration model included in contract</i> | <i>Profit-sharing, for example through cost reimbursement, together with a</i> | <i>Investing in long-term relationships</i> | <i>Building trust Formulating joint objectives</i> |

| | | | | |
|--|--|-----------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------|
| | | <i>target cost and incentives</i> | | <i>Joint project office</i> <i>Conflict resolution strategies in place</i> <i>Collaborative selection of sub-contractors</i> |
|--|--|-----------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------|

2.4 Relationship history and organizational control

Studies in the organizational control field have sometimes adopted a contingency perspective, resulting in a need to adjust the control system to the conditions surrounding the control setting (e.g. Turner and Makhija 2006, Stendahl et al. 2021). In addition, control systems have a dynamic nature, which could lead to changes in them as well (Cardinal et al. 2004). Therefore, changes in the control system could happen over time, for example due to the development of relationship history between the principal and agent, as studied by Gulati (1995). The connection between control systems and relationships has been the focus of other studies (e.g. Aulakh and Gencturk, 2000; Emsley and Kidon, 2007; Fryxell et al., 2002; Sihag and Rijdsdijk, 2019; Wang et al., 2019). The contingency factor relationship history has impacted control systems as alliance actors with a relationship history (i.e. they are familiar to each other because they had prior ties from previous alliances), relied more on an informal social control based on trust, whereas unfamiliar actors without prior ties relied more on formal contractual control (Gulati, 1995). As familiarity grows between new actors, and their relationship matures over time, they can move towards social control systems (Aulakh & Gencturk, 2000; Fryxell et al., 2002; Li et al., 2010; Sitkin et al., 2020).

Furthermore, Fryxell et al. (2002, p. 870) conclude that “fresh blood” (i.e. unfamiliarity) in a relationship results in a higher usage of formal (i.e. process or output) control mechanisms, due to uncertainty from not having worked together before. In addition, Fryxell et al. (2002) conclude that the use of formal

control mechanisms has a negative effect on the relationship over time, if a principal utilizes formal control mechanisms with familiar agents there is an increased risk of conflicts and mistrust.

The link between output control and relationship history is especially strong, due to the hands-off arrangement (Emsley and Kidon 2007; Fryxell et al. 2002), where the principal observes the agent's work in an arm's length relationship. Hence, output control is possible when relationship history is absent; whereas it takes more time to build a relationship based on familiarity and trust, enhancing social control (Dekker et al. 2019; Velez et al. 2008).

The suitability of social control is highly contingent on relationship history because the potential for social control is usually limited at the beginning of a relationship without prior ties (Fryxell et al., 2002). Without a relationship history, there is only a weak foundation for a social control system until some familiarity has developed (Anderson & Oliver, 1987, Gulati, 1995). Informal (i.e. social) control can then replace formal control over time (Mellewigt et al., 2007), leading some authors (e.g. Aulakh & Gencturk, 2000, Fryxell et al., 2002, Li et al., 2010) to suggest that social control is more suitable in long-term relationships, where continuous interactions help develop familiarity based on values and shared norms. Repeated interactions provide principals and agents with relationship boundaries and an implicit sense of what behaviors are acceptable or not, as the organizational values become systematized and shared (Fryxell et al., 2002, Sihag and Rijdsdijk, 2019; Zollo et al., 2002).

There are other studies that offer other aspects of relational ties (Reuer and Ariño 2007, Ryall and Sampson 2009, Wang et al. 2019). From a contractual point of view, prior ties with another organization may result in more detailed contracts and stronger enforcement terms when compared to a situation without prior ties (Ryall and Sampson 2009). In addition, inter-organizational routines could be created, independent of trust, based on learning each other's culture and capabilities (Reuer and Ariño 2007).

Furthermore, prior ties could influence how an agent anticipates and experiences control by the principal. Liuokas and Reuer (2015) suggest that relationship history generates knowledge about behavioral patterns and anticipated, future interactions. Familiarity can thereby improve the ability to anticipate another actor's future behavior, and thus supporting the design of control systems

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(Dekker and Van den Abbeele 2010). However, familiarity does not per se reduce oversight if uncertainty is sufficiently high (Lee 2013).

3 METHOD

3.1 Research context

The research context “ProcSIBE”, that I am a part of, is aiming towards establishing multidisciplinary research in construction, both public and private, to challenge common beliefs about the relationship between policies, practices and effects of procurement. This network is a collaboration between five Swedish universities, with focus on sustainable procurement in the built environment. In this research context, my and all my supervisors are actively taking part, as well as other researchers connected to this network. My supervisors are also actively taking part in the research projects presented below.

As part of the funding agreement, I have attended STA meetings as both delegate and presenter. The meetings provided insight into how the STA functions (mostly internally) and helped me understand how the STA plans and follows up its strategies regarding purchase and procurement.

My results build on two projects that I worked on during my PhD studies, one covering the entire doctoral period (Study A) and a shorter sub-project (Study B). One of the papers (Paper III) also includes the results from a third study (Study C), which was carried out by another researcher (Dr. Sofia Lingegård), who is also part of the ProcSIBE network.

The focus of **Study A** was DB contracts and their effects on innovation. The STA has, as presented in the Introduction, a government directive to promote innovation in the infrastructure sector; one of its strategies is to increase the

number of DB contracts. I studied the implementation of this strategy in my licentiate thesis (Järvenpää, 2020).

Study B focused on how the STA attracts non-domestic contractors to tender and establish themselves in the Swedish infrastructure sector. This strategy was also used by the STA to promote innovation in the infrastructure sector, by increasing competence and knowledge via the non-domestic contractors' in-house design teams, as well as increasing capacity in general. Some of these contracts were procured as DB contracts, thus data from Study B could also be used in Study A.

Study C focused mainly on design–build–maintenance (DBM) projects. The data consisted of three DBM contracts that included long-term (15–20 years) maintenance responsibilities for the procured contractors. The DBM contracts were used to incentivize the contractors to adopt a life-cycle perspective in their designs and promote innovative solutions to aid maintenance. The data collection was based on interviews held during the maintenance stage.

The data collection methods (mainly interviews) and interview questions used were similar across all three studies, and all three studies focused on the STA's ambition to promote innovation.

The first appended paper in this thesis, Paper I, relates to Study B, with a focus on entry barriers to non-domestic contractors. Paper I is a development of a conference paper (Järvenpää et al., 2018) that discussed how a client manages a contractual arrangement in terms of language and culture.

Paper II focuses on relationship history and organizational control. Data from studies A and B was used in this paper. All the contracts included were DB contracts, but half of the contractors were already established in the Swedish market (i.e. they were contractors known by the STA) and half of the contractors were new entrants to the Swedish market (i.e. they were unfamiliar to the STA).

Paper III focuses on innovation outcome from a procurement perspective: the client's choices between DB and DBM contracts could promote innovation.

Paper IV focuses on the possibilities for innovation from an organizational control perspective, and can be considered a development of Papers II and Paper

III, exploring the relationship between organizational control and innovation potential.

Table 2 summarizes the data collection methods, research questions and appended papers to provide an overview on how these aspects relate to one another and are linked within the thesis.

Table 2 – A summary of the studies, research questions, and appended papers

| Study | Data collection method | Research question | Paper |
|---------|---------------------------------------------|-------------------|-------------|
| Study A | Semi-structured interviews and observations | RQ1, RQ2 | II, III, IV |
| Study B | Semi-structured interviews | RQ1, RQ2 | I, II, IV |
| Study C | Semi-structured interviews | RQ2 | III |

3.2 Research design

A case-study approach is suitable when the aim is to explore and understand a topic in-depth. For this thesis, the empirical setting is the Swedish infrastructure market, the STA, and its suppliers. The empirical data used in the appended papers was collected from on-going or recently completed infrastructure contracts with the STA as the client. The rich dataset that resulted from exploring multiple contracts, and client and supplier perspectives, enabled both comparisons with and additions to the existing literature (Eisenhardt & Graebner, 2007).

The approach taken was abductive (Alvesson & Sköldberg, 2017). Rather than using inductive and deductive approaches, iterations were used to adjust and redefine the questions, findings and conclusions. Hence, I alternate between

empirical data and theory, to provide a better understanding of the phenomena under study (Alvesson & Sköldbberg, 2017). This approach, developing and interpreting additional empirical data and revisiting the theory, provides a deeper level of understanding than taking either an inductive or deductive approach (Alvesson & Sköldbberg, 2017). As required by an abductive approach, the data collection in Study A took place on more than one occasion; further data was collected during later stages, and follow-up interviews were conducted after an initial analysis to complement the earlier data collection.

3.3 The case study

The aim of case studies is to understand the dynamics of a single setting within a research strategy (Eisenhardt, 1989). The question “*what is this case a case of*” (Flyvbjerg, 2006, p. 238) provides a reasonable starting point. This thesis presents an explorative study of client procurement and the promotion of innovation. The purpose of the thesis is to clarify the effects the design and implementation of a client’s control systems have on innovation possibilities, not to describe the symptoms of any problems or how often they occur. The latter is a common misconception about the use of case studies (Flyvbjerg, 2006).

Based on the purpose of the thesis, an embedded single-case study was deemed appropriate, as the purpose is exploring how a public client can promote innovation from an organizational control perspective. An embedded single case study entails studying a main unit coupled with sub-units, where the sub-units focus on and contributes to different aspects of the studied phenomena (Scholz & Tietje, 2002). All three research studies (A, B and C) are concerned with various strategies to comply with the government directive, directed at the STA, to increase the rate of innovation, resulting in an inter-organizational level, rather than contractual level, focus. Each contract utilized the formal procurement requirements, hence the foundation for all included contracts are similar. Therefore, each contract is not regarded as a case study in itself; instead, the contracts provide the empirical setting for data collection and are regarded as sub-units that combined make the empirical setting for studying this phenomena.

The STA is the largest client in Sweden’s infrastructure sector, and serves as a model for other actors in the infrastructure market, making it ideally suited for a study of procurement and innovation. Obtaining access to projects and actors

that are willing to help with the enquiry is an important part of qualitative research (Stake, 1995), and the STA was supportive in the search for suitable contracts to study. The search was based on a list of study criteria formulated by the researchers: for Study A the criteria were DB contract, project execution ongoing on site, and a duration of two years; for study B, a non-domestic contractor (new to the Swedish infrastructure sector) that had not worked with the STA before.

There were some similarities between the contracts in Study A and B: they were all for the same client, and they had all been procured based on the lowest evaluation, after the implementation of two different strategies to increase the innovation rate within the Swedish infrastructure sector.

3.4 Study A

Study A focused on the STA's strategy to increase the innovation rate in the sector by procuring DB contracts. The data collected from the different contracts provided the basis for studying the STA's control mechanisms and the potential for innovations. However, some of the contracts could be regarded as unusual, for example one was the first DB contract that the STA had procured for railways, and another was a highly complex tunnel project.

3.4.1 The contracts

The contracts in Study A differed in size, duration, contractor, complexity, and population density of the target area. They included contracts for roads, railways, and tunnel projects, but they were all DB contracts.

A summary of each contract is presented below.

Contract A

This contract was for a conventional road project, apart from the length of road involved, which was 40 kilometers. This was the first DB contract procured by the STA in northern Sweden. Because of the winter snow and ground frost, construction work in northern Sweden can only be carried out during a short season. The length of the road and short season meant STA prolonged the initial contract by one year, resulting in a three-year contract.

Semi-structured interviews were complemented with observations taken during a day spent with a construction site inspector.

Contract B

This contract was for the construction of a new road across virgin land without on-going traffic flow. The road connected two larger roads, and included a bridge crossing a small river. It was not regarded as a complex infrastructure project.

Contract C

This contract was for a railroad, and was the first DB contract procured by the STA for railways. Because a single track between two cities was insufficient for the level of commuting, a double track was needed to increase capacity. The contract included a tunnel, and the need for on-going traffic flow next to the construction site, which meant the project was highly complex.

Contract D

This contract was part of a mega-project in a highly populated area, and included constructing a road. The presence of ancient monuments in the surrounding area necessitated a complex approach to accommodate special ground clearance and cultural monitoring.

Semi-structured interviews were complemented with observations taken during a collaborative meeting between client and contractor representatives including different levels of staff, such as project director, project management, administration and health and safety.

Contract D was meant to be one of the longitudinal studies, and the start-up interviews were therefore relatively short, to get an initial sense of the project, and the respondents' views and plans.

Contract E

Contract E was a larger project comprising three different contracts, all with different contractors, and all of DB contract type. The project was relatively complex because it included a bridge requiring a curved track, and an adjacent

road, as well as cultural heritage demands. The contracts were interconnected and impacted on each other.

Data collection took place before the contracts were completed. The first three interviews were held on the same occasion, and, observations were taken during a collaborative meeting. This was also meant to be one of the longitudinal study contracts, and, as with Contract D, some of the initial interviews were only relatively short.

3.4.2 Data collection

Most of the empirical data was collected during 2017 and 2018. For some of the contracts, initial interviews were conducted over a relatively short time period, and then follow-up interviews held later on with project managers, in order to obtain perspectives from across the entire contract period. Some of the interviews took place as the project was being executed, in which case the respondents only talked about the contracts up to that point.

After the initial data collection period during 2017 and 2018, the intention was to study two contracts (D and E) for an extended time period, in order to follow the contracts over a longer term. Initial start-up interviews were held with both client and contractor representatives. However, because of the coronavirus pandemic, further observations and interviews could not be carried out on site. The original longitudinal study had to be abandoned, and instead further data had to be obtained using digital tools; for example, some interviews were held and observations made during a collaborative meeting held on Zoom. The plan was then to continue the empirical work after the pandemic but, unfortunately, at the time of writing, the pandemic is still ongoing.

Most of the interviews in Study A were carried out by the author. The interviews were all semi-structured. Semi-structured interviews allow the respondents to elaborate, explain, and describe the phenomena being studied (Galletta, 2013), providing a rich source of empirical data (Eisenhardt & Graebner, 2007). In order to obtain multiple perspectives (Eisenhardt, 1989), interviews were held with both client and contractor representatives, including project managers, project directors, project engineers, design managers, contract managers, and construction site inspectors. A number of interviews were also held with

consultant representatives, who were then categorized for the analysis as being representatives of either the client or contractor, depending on who had contracted them. For example, the STA procures a vast number of consultants as construction site inspectors, design managers, and sometimes project managers. All the interviews were recorded, except for one as a result of technical problems; written notes were taken during the latter interview. Details of the respondents are given in Table 3.

During the interviews, respondents were asked about their perceptions and experience of the procurement strategy, collaboration, opportunities for innovation, project-specific characteristics, and organization (see Appendix for the interview guide). For the follow-up interviews, another interview guide was developed to get a better picture of the entire contract (see Appendix). As some of the respondents had not participated in, for example, the procurement phase (e.g. the site inspector), they were not asked about that aspect; instead they were questioned about the areas they did have knowledge of. The length of the interviews therefore differed; the longest interviews were usually with the project managers.

In order to triangulate the empirical data and expand understanding, the interviews were complemented with observations. Observations were made on three occasions: shadowing a construction site inspector performing an inspection; sitting in on a start-up collaborative meeting; sitting in on a collaborative meeting between actors who had worked together for a longer period of time. The observations were documented in field notes, and offered an insight into how the construction site was monitored on site, and how the different actors collaborated. The field notes were not used directly in the empirical findings in the appended papers, but they supported the background understanding of the phenomena under study, as site inspection could be regarded as a process control mechanism.

Supplemental data was also collected in order to understand the STA and its procurement process better, including interviews and meetings with representatives from the STA who were not connected to a specific infrastructure project. These STA representatives were chosen because of their role in connection with the studied phenomena. The STA can be described as a project-led organization (Hobday, 2000), and strategic decisions are made at levels other than the project itself; it was therefore important to understand those strategies.

Table 3 – Summary of respondents in Study A

| Contract | Role | Actor | Length of interview (minutes) |
|----------|-----------------------------|------------|-------------------------------|
| A | Project manager | Client | 90 |
| | Procurement officer | Client | 60 |
| | Project engineer | Client | 40 |
| | Project director | Contractor | 90 |
| | Project engineer | Contractor | 90 |
| | Design manager | Contractor | 35 |
| | Project support | Contractor | 60 |
| | Project manager | Client | 45 |
| | Construction site inspector | Client | 30 |
| | Contract manager | Client | 55 |
| B | Project manager | Client | 100 |
| | Procurement manager | Client | Not recorded |
| | Project engineer | Client | 30 |
| | Project director | Contractor | 70 |
| | Design manager | Contractor | 75 |
| | Construction site inspector | Client | 40 |
| C | Project manager | Client | 103 |
| | Sub-project manager | Client | 70 |
| | Project director | Contractor | 74 |

| | | | |
|----------|-------------------------------------|------------|----|
| | Design manager | Contractor | 58 |
| | Construction site inspector | Client | 22 |
| D | Project manager | Client | 53 |
| | Project engineer | Client | 80 |
| | Project director | Contractor | 38 |
| | Site manager | Contractor | 32 |
| | Design manager | Contractor | 30 |
| E | Project manager | Client | 26 |
| | Procurement officer | Client | 26 |
| | Project engineer | Client | 26 |
| | Project director (2 nd) | Contractor | 24 |
| | Construction site inspector | Client | 64 |
| | Sub-project manager | Client | 34 |
| | Project manager (2 nd) | Client | 35 |
| | Project director | Contractor | 45 |

3.5 Study B

Study B focused on the STA's strategy to increase the innovation rate in the sector by attracting non-domestic contractors to submit tenders. The STA's aim was to both increase capacity and incorporate new contractors into the in-house team, thus introducing new ideas and innovative solutions from other countries to Sweden.

3.5.1 The contracts

The contracts in Study B differed in size, duration, complexity, and population density of the target area, but all of the contractors were new to working with the STA. Study B included both DB and DBB contracts.

A summary of each contract is presented below.

Contract F

This contract was for a smaller infrastructure project, including roads and a bridge in a relatively small town. The duration was one year and the contractor was still on-site handling the results of the final inspection when the interviews took place. It was a DB contract.

Contract G

This contract was a conventional road project, including the reconstruction of an existing road junction, a new bridge, and a roundabout. The duration was three years. The bridge was to be constructed over an existing road while at the same facilitating on-going traffic flow, which added a level of complexity. It was a DB contract.

Contract H

This contract consisted of constructing tunnels in a highly populated area, and was a part of a mega-project. On completion, one of the tunnels will be one of the longest in the world in an urban environment. The contract also included temporary constructions, such as a harbor for shipping out materials. It was a DBB contract.

No contractor representative was available for an interview, so the data from this contract did not include a dualistic perspective.

Contract I

This contract was a part of a mega-project and involved the construction of a tunnel under a river. The project was highly complex, and was on-going when the interviews took place. It was a DB contract.

Contract J

This contract was for part of a metro system, with the intention of doubling the capacity on certain lines. It included the construction of both new underground tracks as well as a new station and maintenance tracks. The project was highly complex because of the need to carry out blasting directly under central city areas including, for example, old churches. It was a DBB contract.

3.5.2 Data collection

Study B took place in 2017. All the interviews in Study B followed the same approach as in Study A, i.e. they were semi-structured interviews of both client and contractor representatives. The respondents were selected in order to provide multi-faceted viewpoints, and included project managers, project directors, project engineers, design managers, contract managers, and construction site inspectors. All the interviews were recorded and transcribed, except for one where notes were taken because of technical problems. Details of the respondents are given in Table 4. The interviews were held in both Swedish and English depending on the respondent's choice of spoken language. The interview guide has been translated to English by the researchers involved in this study.

Table 4 – Summary of respondents in Study B

| Contract | Role | Actor | Length of interview (minutes) |
|----------|---------------------|------------|-------------------------------|
| F | Project manager | Client | 49 |
| | Procurement officer | Client | 65 |
| | Project director | Contractor | 36 |
| | Warranty manager | Contractor | 27 |

| | | | |
|----------|---------------------|------------|--------------|
| | Project engineer | Contractor | 46 |
| G | Project manager | Client | 121 |
| | Procurement officer | Client | 33 |
| | Project director | Contractor | 93 |
| | Project director | Client | 58 |
| H | Project manager | Client | 139 |
| | Project director | Client | 70 |
| | Procurement officer | Client | 41 |
| I | Project manager | Client | 73 |
| | Procurement officer | Client | 53 |
| | Project director | Contractor | 55 |
| | Project director | Client | 65 |
| | Site manager | Contractor | 62 |
| J | Project manager | Client | 113 |
| | Procurement officer | Client | Not recorded |
| | Project director | Client | 73 |
| | Project director | Contractor | 40 |
| | Project manager | Contractor | 65 |

3.6 Data analysis

As two of the appended papers did not utilize the theoretical framework of organizational control, a re-visit of both the theoretical framework and Papers I and III is needed. When an organizational control lens was applied

retrospectively to Papers I and III, new patterns emerged. In Paper I, the control mechanism used (demanding the use of Swedish for all communication with non-domestic contractors) was identified as both process control (deciding how the communication should be carried out) and social control (social interactions between the actors). Paper III, the new findings are regarding the created innovations from the client perspective (“who” has initiated and been the driving force) as well as the detailed and strict functional requirements that is utilizing process control.

For the thesis, the appended papers and theoretical framework (Chapter 2) were analyzed using an iterative process. The research questions and findings from the appended papers did not follow a linear trajectory, but the papers were revisited to identify data that could be used to explore the promotion of innovation from an organizational control perspective. Firstly, data relating to relationship history was extracted from the papers. This provided an understanding of the type of organizational control implemented, so that the link between organizational control and promoting innovation could then be explored. Secondly, data relating to the public client’s perspective of promoting innovation was identified. By regarding procurement strategies as organizational control mechanisms, their importance to the public client in planning how, in the ex-ante phase of the procurement, to promote innovation by the contractors could be determined.

3.7 Research ethics

In inter-organizational relationships between client and contractor, tensions between both organizations and individuals may arise because of the competitive aspects to the relationship. The client expects high-quality deliverables, and the contractor expects fair compensation for those deliverables. For some of the contracts included in this thesis, there were on-going issues that could have affected my participation as researcher. When joining a meeting, I had to state that I was not interested in the conflict as such, and that I was present only as an observer to study procurement in general. All the respondents are anonymized in the appended papers, no contractor company name is mentioned, and the contracts/projects are not mentioned by project name. The only organization that

is named is the STA; as one of the funding partners of the study, it is appropriate to be open about this relationship.

3.8 Research quality

It is important to reflect on the quality of research, and how any issues arising could have been addressed. When performing semi-structured interviews, Flick (2009) highlights the risk of irritating potential respondents by asking questions that could be perceived as confrontational, or the respondent's answer may be too general or miss the point of the question. To handle these risks, an interview guide should be prepared with alternative questions, or the researcher can rephrase the question (Flick, 2009). During the few interviews where such issues arose, I tried to re-phase the question.

The empirical data used in the appended papers was collected from a number of different contracts, providing a rich dataset that fulfilled the purpose of the study and could be used to answer the research questions. Both cross-case and single-case analyses were utilized, with multiple sources and multiple levels of data collection. Hence, the analysis and conclusions build on more than one source.

An aspect that influences the research quality is the data collection. I have collaborated with supervisors and other researchers in the ProcSIBE network in order to learn and develop better understanding of the research context, method and the empirical material. I have conducted interviews by myself, with one of my supervisors and I have also taken part in a group that analyzed interview material collected by another ProcSIBE researcher. While we both used the same interview guide, it was clear from the interview transcripts that we had utilized it differently and asked different follow-up questions, presumably because we had somewhat different interests and focuses. As a result, all the ProcSIBE researchers read the analyses of the empirical data, and made notes after each interview regarding how it had been interpreted, for example whether the respondent was talkative and open, or did not want to elaborate on certain questions. Having four people carry out the data collection can be viewed both as a weakness and as a strength. The wider spread of data could be considered a weakness; some of the interviews had to be excluded from the analyses because follow-up data was lacking. In contrast, the collaboration between fellow

researchers that shared a familiarity with the data, and could therefore discuss, analyze and interpret the results at a deeper level, can be considered a strength.

Transparency is an important foundation of qualitative research, because there is no objective reasoning process to follow (Ketokivi & Choi, 2014). Transparency criteria are fulfilled by the descriptions of the data analyses in the appended papers, together with the more in-depth methods section in this thesis. Any researcher bias arising from the selection of cases, data collection, and choice of theoretical framework, is also addressed by providing a detailed methodology.

Credibility in qualitative research is provided by triangulation, peer briefing, analysis of negative results, appropriateness of the terms of reference, and validation of the data and interpretation by other members of the field (Flick, 2009). Triangulation was fulfilled by adding observations to the semi-structured interviews to decrease the risk of unjust interpretations. Peer briefing occurred during discussions with other researchers of the analyses presented in the appended papers. Negative descriptions of the studied phenomena were addressed by re-visiting the empirical data to see if there was any more data that contradicted the analysis. An example of this is in Paper IV, where the lack of a link between social control and innovation potential required a further iteration of the data to make sure nothing had been overlooked. In addition, discussions with other members of the field during seminars with staff at the STA contributed to the doctoral project.

Lastly, the applicability, or generalizability, of this research is limited because of the Swedish setting and the focus on one client. Much of the empirical data relates to how the contractor respondents perceived the STA as a client, and the actions taken by this client. Generalizing from these results can only be done with caution, although it is nevertheless possible (Flyvbjerg, 2006). Because the STA is the largest client in the infrastructure sector in Sweden, it provides an excellent case study of procurement and innovation in Sweden, and can be used as the basis for future research with a wider scope.

4 SUMMARY OF APPENDED PAPERS

4.1 Paper I Contextual communicative competence in multinational infrastructure projects

This paper focuses on how a client steers communication in infrastructure projects. In construction projects with multiple actors, communication is a vital factor for creating quality and a satisfying end result. Communication is dynamic, challenging and multifaceted, and this is especially true in construction projects that influence the international aspects. This could entail a difference in culture and language, resulting in a need for establishing mutual understanding and effective routines.

In this study, the dataset comprised 17 interviews with non-domestic contractors and the client (the STA in each case) from four different infrastructure projects. All the non-domestic contractors were new to the client and, therefore, new to the Swedish infrastructure market. The study explores the challenges there are in this kind of setting and what competencies are needed for communication between the actors.

The findings suggest that communication lies not just in mutually agreed texts, such as contracts, but also understanding and mutual behavior. The contracts underpinning the relationships between the client and the contractors stipulated that all communication must be in Swedish, a requirement that then had to be managed. This contractual demand was not, however, necessarily enforced during project execution. Client representatives have instead used a more flexible approach, allowing for more communication alternatives, and showing

an adaptation to learn and develop over time. In addition, the contractors and client built up a mutual trust, enabling an environment that allowed trial-and-error when communicating, and focused on mutual understanding and tolerance instead of perfect language use, thus creating room for an intercultural exchange that benefited both sides. It could therefore be concluded that the substance (contractual arrangement) was of less importance than performance (being able to communicate).

4.2 Paper II Exploring a public client's control systems in infrastructure projects from a relationship history perspective

The focus on how the client's handling of contractual arrangements with unfamiliar contractors in Paper I is further explored in Paper II by investigating how familiar and unfamiliar contractors perceive the client's organizational control. The need for increased supply capacity within the Swedish infrastructure market has resulted in new entrants that do not have a prior relationship with the STA. Prior research has indeed identified relationship history as a potentially vital contingency factor in organizational control, however, there is a lack of studies connecting relationship history with how different control systems function in a project-based context. The purpose of this paper was, therefore, to compare how the client's control systems function in construction projects with familiar (known to the client) compared with unfamiliar (new to the client) contractors.

The dataset included 32 interviews conducted with representatives from six infrastructure projects, three projects with familiar contractors and three projects with unfamiliar contractors. All the unfamiliar contractors were non-domestic, and all the domestic contractors had worked with the client, the STA, before.

The analysis is conducted with the seminal work of Ouchi's (1979) regarding organizational control systems (bureaucratic, market, and clan). Findings show that relationship history heavily influences how the control systems is perceived, especially bureaucratic and clan control. The unfamiliar contractors were unaccustomed to the client's extensive use of bureaucratic control, and did not think it was as suitable in DB contracts as the more expected market control approach. The unfamiliar contractors did not think that the client had handed over the "how" to them when it came to executing the project, as would be

expected in a DB contract, because the client exercised a high level of control and limited the contractor's flexibility in the design phase. This is highlighted in the findings by the example of inspecting documents more than the unfamiliar contractors find appropriate. Familiar contractors, that are accustomed to working with the client in design-bid-build contracts, and a more bureaucratic control view, are less confused and frustrated.

The reliance on bureaucratic control in a DB contract generated confusion for unfamiliar contractors regarding responsibilities. Previous research suggests that, over time, formal control can be replaced with informal control, but this does not seem to be supported by this study, because the client also relied more on bureaucratic (formal) and less on clan (informal) control with the familiar contractors.

Furthermore, lack of relationship history with unfamiliar contractors reduces the opportunity to use clan control from the beginning of a project, due to unfamiliarity with both the client and the control system. Findings indicate that the client's implementation of formal collaboration (as clan control) is perceived confusing by the unfamiliar contractors, as they are more accustomed to working in arm's-length relationships than collaboration. This collaboration entails communicating regarding the progress of the project, which further cause confusion, as the unfamiliar contractors are not sure if suggestions during collaborative communication is suggestions or formal demands, or if the client has taken responsibility over suggested solution. The findings also highlight that it is extra important to utilize the formal collaboration model as tool to describe the client's routines when working with unfamiliar contractors. This in comparison to a familiar contractor that has had the opportunity to get accustomed to a client's routines in the form of organizational control, resulting in that they do not perceive it uncalled for or inexplicable, as they have grown accustomed to it.

4.3 Paper III Innovation outcomes and processes in infrastructure projects – A comparative study of design–build and design–build–maintenance contracts

As Paper II suggest, the client steering has an impact on the contractor's work. This paper focuses on innovation in construction and how procurement strategies

and contract type in the shape of design-build (DB) and design-build-maintenance (DBM) influence project-level innovation. The overall purpose of the study is to compare the influence of DB and DBM contracts on actual innovation outcomes and innovation processes in infrastructure projects.

The dataset was based on six infrastructure projects, three with DB and three with DBM delivery systems; two innovations from each project were selected for comparison. The innovations were sorted into themes in accordance with the type of innovation (what), benefit of innovation (why), process of innovation (how), and actors involved (who). At an aggregated level those themes were connected with innovation as a process (how and who) and as an outcome (what and why) in a cross-case analysis.

The findings are that both DB and DBM delivery systems have an effect on both outcomes and processes. However, collaboration between the actors does not seem to have a strong impact on innovation processes, which is in contrast with earlier research. In addition, the contractor's product innovation process usually requires acceptance from the client before implementation, even if this is the contractor's responsibility. This also points to another aspect, even if most of the innovative solutions are identified as connected to the contractors' initiative, that the client also could be the driving force behind innovations in DB contracts. Furthermore, findings support the importance of clients analyzing intended innovation outcomes and processes before deciding on procurement strategies. The client's choice of contractual arrangement when procuring a contractor is therefore of importance when wanting to stimulate innovation. However, detailed and strict formulated functional requirements by the client could prompt contractors to be innovative in order to meet these demands and requirements.

4.4 Paper IV How public clients' control systems affect contractors' innovation possibilities

Paper II and Paper III offers insight to organizational control and how a client could enable innovation respectively. The contributions from these two papers are a foundation for this paper, where these two aspects are combined.

Earlier research have identified public demand as a major potential for innovation in the European Union, and that public procurement can serve as a

powerful force to speed up the innovation rate through increasing demand for innovation. This places the client role in focus, as construction clients could function as catalysts for innovation and development through procurement. The client, therefore, has tools for creating innovation possibilities for the contractors they procure. There is, however, an impacting factor for these possibilities when looking through an organizational control perspective. As the client wants to make sure that the deliveries in the construction projects will be satisfactory, the client utilizes different control systems to monitor and oversee the contractors' work. However, studying how a public construction client could both create innovation for the contractor, and, simultaneously, utilize organizational control systems to steer the contractor, has not received much attention. The purpose of this paper, therefore, is to study how a public client's use of different types of control system affects contractors' innovation possibilities.

The dataset comprised semi-structured interviews with 35 respondents from both client and contractor organizations. The empirical data included the respondents' descriptions of opportunities for innovation, with the authors' interpretation of how those opportunities were connected with organizational control. Rather than Ouchi's (1979) work, Aulakh et al.'s (1996) updated version of control systems was used as a basis for the analysis, replacing bureaucratic control with process control, market control with output control, and clan control with social control.

The findings are that process control has mostly a negative impact on innovation possibilities, except when certain types of requirements utilized through process control spur innovative initiative. Nevertheless, when the client early prescribes details and processes that the contractor must utilize reduce the innovative possibilities. Many of these details are decided in the procurement phase before the contractor is involved. According to client respondents, output control has a positive impact on innovation possibilities. However, contractor respondents do not confirm this to the same extent. Furthermore, social control has a weak connection to creating innovation possibilities in this study. The efforts made to create a joint project office, collaborative settings and culture are not utilized for innovative co-creation in this study. This could be due to that the client regards the innovative work as the contractor's responsibility, and not as a co-creation activity.

An aspect that seems to have an impact on innovation possibilities is time – the control mechanisms that the client has decided in the procurement phase (ex

ante), has a greater negative impact on innovation possibilities. This is due to the Public Procurement Act, which stipulates that requirements stated in the contract cannot be departed from. It is therefore important that the client early tries to find the right balance between steering towards intended objectives and creating space to open up for innovation, and that the preparation in the procurement phase via writing tendering documents is done in a way that later creates innovation possibilities.

5 DISCUSSION

5.1 Familiar and unfamiliar contractors' perceptions of a public client's control system

As Macintosh and Quattrone (2010) highlight, the level of organizational control needs to be suitably balanced: not too much and not too little. A tight level of control can lead to resistance and turmoil, while a slack level can lead to chaos and breakdown. The findings from Paper II, from the perspective of relationship history, indicate that unfamiliar contractors perceived the client's level of control as excessive. In contrast, familiar contractors were more accustomed to the client's control methods, and perceived them as more suitable. The suitability of a client's overall level of organizational control may therefore depend on whether the client and contractor are familiar with each other.

Viewing Paper I from an organizational control perspective revealed a different outcome compared with the original conclusions when utilizing the theoretical framework of process, output, and social control systems (Aulakh et al., 1996, Das & Teng, 2001). Communication is social and relational, and it guides mutual understanding and inter-organizational behaviour. The contract that underpinned the relationship between the client and the contractor stipulated that all communication had to be in the native language (i.e. Swedish). This can be interpreted as process control, because the client is prescribing how the communication must be carried out. This indicates that the client is interested in steering how the contractor should perform, instead of focusing on outcome or meaning of the communication, for example, outcome in the shape of understanding each other, which could be identified as output control (Aulakh et

al., 1996). The process control (Aulakh et al., 1996) identified and discussed in Paper I had not been strictly enforced during the execution of some of the projects, instead client representatives used a more flexible approach, allowing alternative means of communication, and they showed an interest in adaptation, i.e. a willingness to learn and develop over time. This development could be identified as a form of social control (Das & Teng, 2001), i.e. building trust and allowing trial-and-error when communicating, and trying to develop a mutual understanding despite language differences when working to meet the objectives of the project. The findings in Paper I could, therefore, indicate that the client was using a social control approach later, rather than process control by focusing strictly on the contractually agreed use of language.

The contractors interviewed in Paper I were unfamiliar with the client's process and the demand to only communicate in the native language (i.e. Swedish). This demand seemed to emphasize substance rather than performance: it could be argued that the detailed contractual demands written by the client resulted in a focus on aspects such as what language to use, rather than project execution. Familiar contractors are usually more aware of a client's routines (Zollo et al., 2002), as well as how to communicate with them, but this is not the case for unfamiliar contractors. It could therefore be argued that detailed contractual demands written by the client are resulting in that the actors are focusing on other aspects, such as the what language to use, rather than project execution.

Paper II elaborates further on social control, indicating that unfamiliar contractors perceived the client's use of social control as confusing. Social control based on informal factors, such as trust, takes time to mature (Dekker et al., 2019; Fryxell et al., 2002), which could explain the perplexity felt by the unfamiliar contractors. Not having worked together but still needing to collaborate based on trust, where no trust has had the opportunity to grow, can cause confusion. The unfamiliar contractors were more used to working with a client in an arm's-length relationship rather than a collaboration. In addition, collaboration can result in dynamic roles (Bresnan & Marshall, 1998), for example when the client and contractors in Paper II had to report on the progress of the DB contract. The confusion arising from the collaboration was because the client's role became unclear to the contractors, in particular in relation to responsibilities. Collaboration seems to blur the line between the client's and contractor's responsibilities, because the unfamiliar contractors did not know

whether the opinions and comments given by the client representatives were simply suggestions or formal demands, as found in Paper II.

Whether the contractor viewed the level of organizational control as enabling or coercive is discussed in Paper IV, based on the addition of a formal collaboration model to the contract. This control mechanism indicates social control (Das & Teng, 1998), with the aim of enabling productive discussions between the actors. A coercive form of control is used to address the lack of an agent's compliance with the principal's objectives, rather than the agent showing an interest in achieving the stated objectives (Sitkin et al., 2020). The client's formal collaboration model (described in Papers II and IV) indicated a partially coercive control mechanism, which conflicted with an enabling mechanism. The familiar and unfamiliar contractors differed in their views of the control system used, while the client considered formal collaboration to be particularly important when working with unfamiliar contractors (Paper II). A formal collaboration model can be used as tool to impart a client's routines (Zollo et al., 2002), as identified in Paper II. Familiar contractors had had the opportunity to become accustomed to the client's routines, so did not perceive the level of organizational control as uncalled for or inexplicable. In contrast, the unfamiliar contractors did not know how to handle informal information and discussions during collaborative meetings, such as whether information given by the client representatives was to be regarded as suggestions or demands.

Nevertheless, being a public client entails a complex situation. As identified earlier, building trust via social interaction and collaboration takes time, because relationships need time to mature (Dekker et al., 2019; Fryxell et al., 2002). A public client cannot actively choose which contractors to work with, because that would be in breach of the Public Procurement Act (SFS 2016:1145) and the principle of treating all suppliers equally. In contrast, a private client can choose a contractor based mainly on prior relationships. However, prior relationships or relationship history can still have an impact on a public client if known contractors are awarded the contract, even though a certain contractor cannot be specifically chosen.

Comparing the control system used and prior relationships from the client's perspective, as in Paper II, it appeared that the client focused more on strict implementation of the contract through process control regardless of whether or not there were any prior relationships with the contractor. This was the case even

if the DB contract is regarded as conceptually based on market control (Eriksson & Laan, 2007), and therefore less suitable for process control, even in mature relationships. The discrepancy between the expected and experienced control system in a DB contract was identified through the lens of unfamiliar contractors in Paper II. Utilizing process control within a DB contract caused confusion and frustration when the contractor was unaccustomed to the client's routines. In addition, process control could be regarded as an intrusion into the agent's work (Aulakh & Gencturk, 2000), which the agent considers unnecessary. The findings from Paper II suggest that output control is the most suitable form of organizational control for unfamiliar contractors, because social control is confusing and process control intrusive.

As most of the contracts studied were DB, the pre-design that constitutes part the procurement documents should therefore include a more functional and outcome-orientated perspective rather than just focusing on the details of the requirements (Bröchner & Silfwerbrandt, 2019). However, Paper II indicates that the client did not hand over the "how" to the contractor when it came to executing the project, as would be expected in a DB contract. The STA's DB contracts considered in this thesis are examples of a controlled DB contract (Bröchner & Silfwerbrandt, 2019; Nyström et al., 2017), where a contract model is not used to its full capacity. Unfamiliar contractors appeared to find the combination of a DB contract and process control confusing, because how to execute the project was not communicated as expected (Paper II). From an organizational control perspective, a controlled DB contract can lean towards process control rather than output control, which the unfamiliar contractors felt was unsuitable.

5.2 Promoting innovation through organizational control

While construction clients can promote innovation (e.g. Adam and Lindahl, 2017; Blayse & Manley, 2004; Brandon & Lu, 2008), their role is not straightforward (Lindblad & Karrbom Gustavsson, 2021). In DB contracts, which were the focus of Papers II, III and IV, often assume that innovation arises from the contractor's initiative (Bröchner & Silfwerbrandt, 2019, Sullivan et al., 2017), with the client taking a different, or a more passive role. However, Paper III indicates that the client can in fact be the driving force behind innovations in

DB contracts. Most of the innovative solutions identified in Paper III arose from initiatives suggested by the contractors, but one arose from the client. This variance could be explained by which actor benefits the most from an innovation: in the latter example, the client was responsible for maintenance. This could put another level on complexity when creating innovation possibilities as a public client – how to promote innovation through organizational control could be via economic incentives (Das and Teng, 1998, Eriksson and Laan, 2007). However, the economic incentive to stimulate innovative solutions (an example of social control), is not supported by the findings in Paper IV, as there is no link established between social control and created innovation possibilities for the contractors.

Good use of a DB contract can theoretically balance of the level of organizational control and create an environment encouraging innovation (Nyström et al., 2016) by the contractor in the design phase. However, the contractor's responsibility for innovation in a DB contract can become unclear if the client utilizes social control; if a client wants to discuss and collaborate on innovative solutions, the line between responsibilities can become blurred, as indicated in Paper II. This could explain the lack of a positive impact of social control on innovation, as found in Paper IV. Similarly, in Paper III, there was no clear indication that collaboration between contractors and client was needed for innovation in any of the studied projects. Efforts made to create a joint project office and a collaborative environment and culture did not result in innovative co-creation, because the client still regarded innovation as the contractor's responsibility (Paper IV). This lack of innovative co-creation is in contrast with findings from previous studies (Eriksson *et al.*, 2017; Jacobsson & Roth, 2014; Ozorhon et al., 2014). Nevertheless, the client had created room for intercultural exchange, which Paper I identified as benefiting both client and contractor. It seems that the client merely utilized collaboration as a tool for establishing relationships with the contractors, not as a platform for innovative co-creation as suggested by prior research (Eriksson *et al.*, 2017; Jacobsson & Roth, 2014; Ozorhon et al., 2014).

Furthermore, separating the client from the design process in a DB contract results in information asymmetry: the client has less information than the contractor regarding the design and execution of the project (Eisenhardt, 1989; Eriksson, 2017). As a result, a client may increase the level of monitoring and management to even out the balance of information (Bajari & Tadelis, 2001,

Park & Kwak, 2017). Paper II indicates that this was happening with the STA, when the contractors felt that the client wanted to inspect documents more than was appropriate. The degree of supervision seemed higher in DB contracts compared with DBB contracts, because more responsibility had been handed over to the contractor. However, a DB contract should facilitate better use of the contractor's knowledge, expertise and innovative ability (Bröchner & Silfwerbrand, 2019), emphasizing the need for the client to manage information asymmetry with the need to give contractors some degree of freedom to execute the contract.

A DB contract, conceptually based on an output control system, should allow the contractor space to the execute the contract alongside fulfilling the client's required outcomes (Eriksson & Laan, 2007). The results from Paper II, regarding the STA's use of DB contracts, do not, however, support this. Some of the contractors found the STA's implementation of DB contracts confusing and unsuitable, with no leeway in the design phase. The STA's reliance on process control was problematic, preventing the DB contract being used to its full potential regarding innovation.

Furthermore, findings in Paper II point towards the problematic implementation of DB contract at the STA, which is connected to the process control approach. However, the lack of contractor respondents that contributes innovation possibilities to manifestations of output control in Paper IV raises questions regarding the impact of output control on innovation possibilities. Previous research has linked output control in the shape of DB contracts with innovative output (Eriksson, 2017), but this is not corroborated by Paper IV. It could be that output control itself does not create possibilities for innovation; the situation is more complex than just procuring with functional demands.

Despite this, and in line with previous research (Edler & Georghiou, 2007; Obwegeser & Dueholm Müller, 2018), Paper IV does identify public procurement as having the potential to promote innovation, through the public client's use of organizational control. Paper III also supports the potential for public procurement to promote innovation, encouraging contractors to be innovative in order to meet detailed and strict functional requirements. However, this needs to be initiated in the early phases of a project. Ex-ante (before signing the contract) steering mechanisms are important, because once the client writes control mechanisms into the procurement documents, and later contract, they

have a direct effect on the potential for contractors to be innovative. It can be difficult to implement changes later on, because wording in the procurement phase and contract needs to be kept intact, in accordance with the Public Procurement Act (SFS 2016:1145). This highlights the importance of good preparation during the procurement phase, by writing tender documents that both create space for innovation as early as possible in the process, and still enable the client to balance the need for innovation with steering the contractor towards the required objectives.

6 CONCLUSION

6.1 Theoretical contributions

Previous findings that the client's role is important for promoting innovation (e.g. Adam and Lindahl, 2017; Blayse & Manley, 2004; Brandon & Lu, 2008; Winch, 2008) is explored further in this thesis from an organizational control perspective, emphasizing the role of the public client. It is important that during the procurement phase the client tries to find the right balance between achieving the intended objectives and creating space for innovation. Ex-ante planning is important, because how the client writes the control mechanisms into the procurement documents, and later the contract, has a direct effect on the opportunities for innovation by the contractors. It can be difficult to implement changes later on in the process, because the Public Procurement Act requires some of the writing in the procurement phase and contract to remain intact. However, a public client can promote innovation through organizational control by planning for it in the procurement phase.

In addition, promoting innovation as a public client is a complex task as the client has to manage the project in a way that does not cause irritation or frustration for the contractor, or hinder their work. This thesis supports the view that organizational control should be enabling and supporting rather than coercive (Cardinal et al., 2020), so that the client's input encourages innovation rather than creating obstacles. If a client's organizational control is regarded as coercive, it does not actively promote innovation.

However, just relying on procurement strategies such as a DB contract in combination with functional demands is not enough to encourage innovation. Most of the studied contracts studied in this thesis were DB, which should mean that the client should rely on an output control approach. However, this assumes that the pre-design has a more functional and outcome perspective than focusing on the finer details of the requirements (Bröchner & Silfwerbrandt, 2019). The STA appeared to use a process control approach in general, which is more naturally associated with a DBB contract, and this seems to have had a negative impact on the opportunities for innovation. These findings support previous research that both DBB and process control limit the possibilities for innovation (Bröchner & Silfwerbrandt 2019; Gann et al., 1998; Koppinen & Lahdenperä, 2007), except for the examples where process control via high requirements have spurred the contractor to be innovative. The discordance between the DB contract and the client's organizational control can be explained from the perspective of stimulating innovation. A client promoting innovation for their contractors needs to provide some direction, as a lack of organizational control would otherwise lead to chaos (Macintosh & Quattrone, 2010), but it is important to find an effective level of control and identify which actor should be the driving force behind innovative solutions. Focusing only on avoiding chaos (as a result of a lack of control) seems to reduce the possibilities for innovation, as higher, strict requirements could spur innovative solutions, as identified in this thesis.

In addition, the DB contract itself is not sufficient to generate innovation. Utilizing process control in combination with a DB contract creates confusion and frustration when the contractor is unaccustomed to the client's routines. Even if a DB contract is based on market control (Eriksson & Laan, 2007), if the client focuses on process control, applying a strict level of management, regardless of whether or not there is has been a prior relationship with the contractor, the agent can consider that process control intrusive. An unfamiliar contractor can find process control unsuitable and social control confusing, which means output control is probably the most appropriate approach to take when working with unfamiliar contractors.

Earlier studies have suggested that DB contracts and collaboration can lead to innovation (Eriksson *et al.*, 2017; Jacobsson & Roth, 2014; Ozorhon et al., 2014), but this thesis does not corroborate that. A collaborative setting (e.g. social control) only seems to lead to innovative solutions if the client regards

innovation as a mutual task and utilizes the collaborative setting for innovative co-creation. The contribution of this thesis, regarding the relationship between social control and the possibilities for innovation in an inter-organizational setting, is to emphasize the importance of the client seeing innovation as co-creation. Otherwise, while social control can help build relationship between the actors, it will not encourage innovation.

6.2 Practical and managerial contributions

The first practical and managerial contribution of this thesis is to highlight the importance of the client finding a balance between giving the contractor space to execute the contract and making sure that the order is fulfilled. In this study, the client did not appear to relinquish the “how” to the contractor when it came to executing the project, as would be expected in a DB contract. A DB contract assumes that the contractor will take the initiative regarding innovation, but this results in a less clear role for the client regarding innovation in a construction project. Because more responsibility is given to the contractor in a DB contract compared with a DBB contract, this could explain why the client relied on a higher level of control rather than being flexible. The contractor’s responsibility for innovation in the DB contract was also confounded by the client utilizing social control; the client’s use of discussions and collaboration in fact blurred the line between responsibilities. Because the use of social control did not have a positive impact on innovation discussions, the client needs to handle the level of control in DB contracts so that the full potential of this type of contract can be achieved.

The second contribution is that social control and social interactions have no impact on the potential for innovation if the client regards innovation as solely the contractor’s responsibility. Creating a joint project office and a collaborative environment and culture will not result in innovation if the client does not use them for co-creation. Social control in the shape of a collaborative environment should have a clear focus on innovative co-creation, if that is what is sought after. Organizational control should also have a focus on enabling instead of coercion. The client should encourage the agent to focus on the principal objectives rather than micro-manage compliance. The use of social control

mechanisms, such as a joint project office, joint goal formulation, etc., can help the agent focus on the principal goals.

Lastly, the public client's organizational control from a relationship history perspective could have practical implications. Demanding that all communication must be in Swedish can be problematic if all suppliers are to be treated as equal, as stipulated in the Public Procurement Act. This type of demand therefore needs to be considered carefully before being written into a contract. A client that generally works with the same contractors may not have these issues, because a familiar contractor will be more accustomed to the client's routines, but it needs to be taken into consideration if new, non-domestic contractors are to be encouraged. Enabling negotiation between the actors regarding how to communicate, and being flexible instead of enforcing the exact wording of the contract, can facilitate intercultural exchanges that benefit both client and contractor.

6.3 Limitations and further research

The findings from Paper IV suggest that there is no link between social control and innovation potential. This should be studied further, as previous research has indicated this is the case. It would be interesting to explore why social control (i.e. collaboration) can or cannot affect opportunities for innovation, and how social control could be used to promote innovation. It would also be interesting to examine whether formalization of social control (which is usually regarded as informal) has an impact on innovation possibilities. Writing mandatory collaboration into a contract could result in a type of formal control and, perhaps, detract from the inter-organizational relationship. Future studies could consider both the aspect of regarding social control as formal, as well as how formal and informal social control could impact innovation.

In addition, how the client formulates a contract based on prior relationships, or lack of, could be investigated. The Public Procurement Act does not allow the client to choose which contractor is awarded a contract: it is decided by market competition. Studies of contract complexity based on prior relationships and earlier alliances are therefore not usually relevant to a public client (e.g. Reuer & Arinño, 2007, Ryall & Sampson, 2009). In the present study, the wording of the contracts was only of interest when the actors felt that it raised obstacles to

the execution of the project or had an impact on the inter-organizational relationships. Future studies could consider the contract in more detail, and how it is used as steering mechanism.

Lastly, the match between the client's organization and competence in regard to the contractors when promoting innovation could be of interest for further studies. This aspect is not investigated thoroughly in this thesis, but there are aspects in the empirical data and papers of the dynamic relationship between the contractors' competence when creating innovative solutions and how the client acts when inspecting, and approving, these solutions.

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APPENDIX

Example of interview guide – Study A

Respondent (name)

Organization

Role in project

Respondent background

General project description

1. Describe the project and its characteristics (in terms of complexity, uncertainties, degrees of freedom, duration and contract sum, work site conditions, external influences (municipality, political, citizens)?
2. What were the major challenges to the project and how did you work with these?
3. Have any major changes occurred that have affected the project's initial goals / time / cost?
 - a. If so, how has this affected the project?

4. Did the project have any explicit focus on sustainability? If so, what were the consequences?

Procurement strategies

5. How and by who was the procurement conducted? (What roles participated and in what way?)
6. What procurement strategies have been used and why?
 - a. Type of contract
 - i. In what phase was the supplier procured?
 - ii. Who was responsible for the design and how was it conducted?
 - b. Reward system (fixed, target, incentives, bonus, penalty)
 - c. Bid invitation (open, prequalification)
 - d. Bid evaluation (price, soft parameters, e.g. competence, organization, social demands, environmental demands)
 - i. How were soft parameters monitored during the execution?
 - e. Collaboration model
 - i. What collaboration activities/tools were carried out (e.g. joint project office, joint goal formulation and follow up, partnering manager, conflict resolution model)
7. Why did you choose these procurement strategies?
8. Do you think the goals (time, cost, quality, environmental) were communicated clearly within the project organization?
9. What was your experience of the different procurement strategies?
10. What are the advantages and disadvantages of the choices made above?
11. Would you have taken a different approach with your current knowledge, why and how?
12. What components of the procurement strategy are the most important to create opportunities and drivers for foreign suppliers to submit tenders in our contracts?
13. What components of the procurement strategy are most important to create opportunities and drivers for foreign suppliers to work efficiently and be innovative in our projects?

Work methods and organization

14. Do work methods differ in projects with foreign suppliers compared with Swedish suppliers?
 - a. If so, how does it differ?
15. How has the cooperation (in general how they have worked together) worked with foreign suppliers?
 - a. Is it any different compared with Swedish suppliers?
 - b. Can you describe the communication (e.g. how was it conducted, between which people)?
16. What are the major challenges when working with foreign suppliers?
17. Have cultural differences been a challenge?
 - a. If so, how have these differences been handled in the project?
18. How have the foreign suppliers handled our demands regarding work environment/safety and social requirements?
 - a. Do we need to improvement our work/methods in these areas with regard to our foreign suppliers?
19. What did your project organization look like in this project?
 - a. Is this in any way different from projects with Swedish suppliers?
 - b. Do you see any key roles for these projects to work successfully?

Innovation (these are not questions for the procurement officer)

20. How did you work with innovation and development in the project?
 - a. What kind of improvement work did you focus on (process, product, organization)?
 - b. Did you focus on developing completely new solutions or enhancing existing ones?
 - c. What drivers and opportunities does the supplier have to develop innovations in the project?
 - d. Were there any specific barriers to implementation of innovation and improvement work?
21. Describe a couple of specific important innovations that were developed and implemented within the project.
 - a. What was the reason for the development (driver, opportunity, problem solving)?
 - b. Who was the initiator?
 - c. Who were involved?
 - d. How was the development work performed?

- e. Is this solution only for this project or could it be used in future projects as well?

Final questions

- 22. Was this a successful project? Why/why not (time, cost, quality)?
- 23. What were the top three most important factors (decisions/work methods) that positively affected the project?
- 24. What were the top three most important factors (decisions/work methods) that negatively affected the project?
- 25. What would you have done differently if you were to redo the project?

Interview guide later stages

Respondent

Organization

Role in project

Respondent background

1. In this late stage of the project, how would you describe the project and its progress?
2. What more significant challenges have there been, and how have you handled them?
3. Have any more significant changes affected the initial plans regarding goal, time, and cost? And how has this affected the project?

Procurement strategy

1. How has the selected procurement strategy affected the project's outcome?
2. Do you regard the selected procurement strategy as suitable for this project? Why/why not?

Project-specific questions (Contract A)

1. How have you followed up on the project during execution and afterwards?
2. How have you, as contract manager, been active in the project?
3. There have been some more significant changes in staff at the contractor; how do you, as client representative, regard this?
4. Has the client made staff changes, and how has this affected the project?

Outcome and result

1. Do you regard this as a successful project (time, cost, quality, innovation, collaboration)? Why/why not from your perspective?
2. Have there been any innovations or developments you would like to describe (product, material, solutions, methods, processes)?
3. Which driving forces and opportunities has the contractor displayed for new ideas and developments?
4. Which obstacles to innovations and improvements have you encountered?

Summarizing questions

How to promote innovation from an organizational control perspective

1. What are the most contributing factors to the positive aspects of the project?
2. What are the most contributing factors to the negative aspects of the project?
3. What would you do differently if you could re-do the project?

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