

PUBLIC PROCUREMENT OF ENGINEERING SERVICES: GOVERNANCE AND CONTROL MECHANISMS

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Prior research has emphasized the importance of the early phases in construction projects. However, procuring engineering services for early phases is considered complex due to the high uncertainties and the information asymmetry favouring the service provider. This study explores public procurement of engineering services in the Swedish infrastructure sector, focusing on governance and control mechanisms. The purpose is to investigate the choice of governance and control mechanisms in engineering contracts from two perspectives, the public client's and the service providers. The findings are based on interviews with managers from the Swedish Transport Administration as well as from different engineering consulting companies. Findings indicate that the respondents from both sides seem to describe other choices and combinations of reward system and performance evaluation, compared to previous studies. This could be explained by the fact that the engineering contracts are less formalized than construction contracts in Sweden. This study shows that there are situations when clients have an information advantage in relation to their service suppliers and in-depth knowledge of the tasks procured, which affects the development of procurement strategies.

Keywords: engineering services; governance mechanisms; public procurement

INTRODUCTION

Architectural and engineering competences are considered essential, in order for the public sector to be able to build roads, facilities etc. to a high quality, (Sporrong and Kadefors, 2014). In spite of this, academic research on procurement of engineering services is scarce (Lines and Shalwani, 2019). Engineering services are considered complex (von Nordenflycht, 2010), in particular early phases of design, due to the highly iterative processes (Ballard, 2000). In addition, engineering services include knowledge-intensive and problem-solving tasks delivered by experts, indicating that clients typically face a strong asymmetry of information favouring the service provider (von Nordenflycht, 2010).

In the construction context, Transaction Cost Economics (TCE) has been widely applied in studying client-contractor relationships and procurement of contractors (e.g., Eriksson, 2010), whereas there is a lack of studies on procurement of engineering services applying a TCE perspective. According to TCE, opportunism and information asymmetry are key premises in the inter-organizational exchange, and

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it is argued that parties have to safeguard against that by applying legal contracts (Williamson, 1975) and appropriate control mechanisms (Ouchi, 1979). Hence, it is important to let the transaction characteristics tailor the procurement strategies and the control mechanisms (Eriksson, 2010).

Due to the scarcity of research on procurement of engineering services, there is arguably a lack of knowledge on how transaction characteristics affect the choice of governance and control mechanisms when procuring engineering services. Thus, this study explores public procurement of engineering services in the Swedish infrastructure sector, focusing on governance and control mechanisms. The purpose is to investigate the choice of governance and control mechanisms in engineering contracts from two perspectives, the public client's and the service providers.

LITERATURE REVIEW

Service Specification

Engineering services are usually of advisory and/or problem-solving nature (von Nordenflycht, 2010). The engineering consulting companies (ECC) providing these services are usually using non-standardized production processes, heavily relying on specific individuals to solve complex problems (ibid). In addition, the engineering process is typically iterative (Ballard, 2000), containing a lot of interactions with the client (van der Valk and Rozemeijer, 2009) making trust an important factor for the quality (Uusitalo *et al.*, 2021).

Therefore, procuring services can be perceived difficult in several ways. Wynstra *et al.*, (2018) argue that the uncertainty for the client is high, both in regard to specifications in the tender documents, but also when it comes to evaluation. In addition, it is considered difficult since the client might not have the knowledge needed to write specifications (van der Valk and Rozemeijer, 2009). Therefore, information asymmetry and in-depth knowledge of the tasks are argued being important aspects in both writing service specifications and evaluating the performance. In addition, complex tasks add to the information asymmetry between the parties (Anderson and Dekker, 2005).

Governance and Control Mechanisms

Governance mechanisms refer to ways of influencing the exchange partner and to establish coordination as well as order in the relationship (Hennart, 1993), whereas control mechanisms show how to obtain it (Eriksson, 2006). The framework is based on three main governance mechanisms; price, authority and trust (Williamson, 1985), combined with three control mechanisms, output, process and social control (Ouchi, 1979) and the main focus is on the main factors of organizational control, namely, how to specify, reward and evaluate the performance (Eisenhardt, 1985).

The transaction characteristics should tailor the governance and control mechanisms (Eriksson, 2010). More specifically, the levels of asset specificity (resulting mainly from complexity and customization), uncertainty and frequency in the transaction are the main factors determining the governance mechanisms (Williamson, 1985), whereas knowledge of the transformation process and output measurability are the factors influencing the choice of control mechanisms (Ouchi, 1979). In the control of complex tasks, knowledge of the transformation process should refer to the client's in-depth technical knowledge of the tasks (Kirsch *et al.*, 2010).

Price/Output control

The governance mechanism price is suitable for standardized transactions and usually associated with market relationships and output control (Hennart, 1993). Output control is a formal control mechanism, where the client specifies "what" goals of the client the controlled party should accomplish (Tiwana, 2010). The service provider is typically rewarded for the output in a fixed price contract (Eriksson, 2006). Fixed price contracts are usually used for rather simple tasks and requires the client to clearly specify the output, making changes costly and potentially conflict filled (Bajari and Tadelis, 2001). In output control the service provider is evaluated through monitoring of the finished delivery (Hennart, 1993). In-depth knowledge of the tasks makes both specifying and evaluating more efficient for the client (Tiwana and Keil, 2007). Output control is suggested when output measurability is high (Kirsch, 1996), which is usually the case when asset specificity is low (Das and Teng, 2001).

Authority/Process control

The governance mechanism authority is related to process control (Hennart, 1993), which is another formal control mechanism, usually specifying "how" the controlled party can accomplish the goals of the client (Tiwana, 2010). The service provider is typically rewarded for the costs related to the time worked in a cost-plus contract (Eriksson, 2006). Cost-plus contracts are usually used for complex tasks and requires less precisely specifications from the client (compared to fixed price), making changes flexible (Bajari and Tadelis, 2001). In process control the service provider is evaluated through the client's monitoring of the ongoing performance (Eriksson, 2006). In the process control of complex tasks, the client needs to have in-depth knowledge of the specific tasks when specifying and evaluating (Kirsch, 1996). However, the in-depth knowledge could be seen as detrimental in the evaluation, since the client is more likely to impose detailed and inflexible control. In addition, it is difficult for a knowledgeable client not to use process control in the evaluation (Tiwana and Keil, 2007). Process control is suitable when the asset specificity is high (Das and Teng, 2001) and the client has in-depth knowledge of the tasks (Kirsch, 1996).

Trust/Social control

The governance mechanism trust is related to social control (Das and Teng, 2001). Whereas formal control relies on information, social control is an informal control mechanism relying on shared values between the contract parties (Tiwana, 2010). In addition, social control makes use of consensus problem solving approaches, striving towards common goals (Das and Teng, 2001). The service provider is typically rewarded for the costs occurred, combined with some kind of incentives. Typically, in a contract focusing on social control joint specifications are used, hence developed in collaboration between the parties (Eriksson, 2006). In social control, the service provider is evaluated based on the shared values of the parties and self-control (Das and Teng, 2001). When it is not possible to measure the results, due to high levels of asset specificity, and the buyer does not have in-depth knowledge of the tasks, social control is suitable (Das and Teng, 2001). In fact, in transactions of knowledge-intensive tasks social control might be the only control option, since the client lacks the knowledge needed to carry out formal control (Kirsch *et al.*, 2010).

Construction context

In the construction context, design-build (DB) contracts are an example of price/output control, design-bid-build (DBB) contracts are an example of authority (process control), whereas early contractor involvement (ECI) contracts are an example

of trust/social control. The risk and responsibilities between the parties are regulated in the specification and the reward system (Eriksson and Laan, 2007).

METHOD

Research Methodology and Empirical Context

We adopted an explorative as well as abductive qualitative approach. An abductive approach is suitable when the researcher aims to discover new concepts and refine existing theories (Dubois and Gadde, 2002). Within qualitative research, interviews are considered one of the main ways to collect data usually aiming for “rich account” since the interviews are loosely structured meetings (Alvesson, 2011).

The empirical context is the Swedish infrastructure sector in general, and the Swedish Transport Administration (STA) in particular. The STA is the governmental agency responsible for the long-term planning, also managing the construction and maintenance works on the road and railway infrastructure. This study focuses on the engineering service contracts of physical planning and design. The STA procure the entire physical planning and design process from ECCs, whereas the STA focuses on specifying and evaluating these contracts. These contracts are finished before the DB, DBB or ECI contract with a contractor is signed.

In Sweden, ECCs within the field of building and civil engineering plan and design buildings and infrastructure for both public and private clients. The annually turnover within this field has been growing almost each year since the early 1990s (Innovationsföretagen, 2019).

Collection of Data

In order to gain a comprehensive and strategic view of the physical planning and design contracts, 14 managers from the client and different ECCs were selected for the interviews, see Table 1.

Table 1: Interviews

Side	Organization	Type of interview	Name in the text
Client	Investments	Physical meeting	Client manager A
Client	Investments	Skype with video	Client manager B
Client	Major projects	Skype with video	Client manager C
Client	Investments	Skype with video	Client manager D
Client	Investments	Skype with video	Client manager E
Client	Purchasing and Logistics	Skype with video	Client manager F
Client	Major projects	Skype with video	Client manager G
Client	Purchasing and Logistics	Skype without video	Client manager H
ECC	Larger	Skype with video	Engineering manager I
ECC	Larger	Skype with video	Engineering manager J
ECC	Smaller	Skype without video	Engineering manager K
ECC	Larger	Skype with video	Engineering manager L
ECC	Larger	Skype with video	Engineering manager M
ECC	Smaller	Skype with video	Engineering manager N

The managers from the STA are regional managers, unit managers and program managers that work in three different business areas: Major Projects, Investment, and Purchasing and Logistic. The managers from the ECCs were chosen to represent both those considered being Tier A (larger) and Tier B (smaller) suppliers to the STA.

These managers have titles such as division manager, business area manager and development manager. In regard to ethics, the respondents are all anonymous and the STA approved the final version of the paper.

All the interviews were semi-structured to enable engagement from both the researcher and the respondent and lasted for 45-90 minutes. The questions were based on the framework, thus included transaction characteristics, specification, reward system and performance evaluation. Due to Covid-19, most of the interviews were carried out on Skype. The interviews were all recorded, in consent with the respondents, and transcribed. In addition, notes were taken to capture reflections.

Data Analysis

The transcribed interviews, including the notes, were attached to the different categories (price/output control, authority/process control and trust/social control) in the framework. After that, within these categories themes were formed based on the empirics, hence aspects emphasized by the respondents. The findings are presented under each of these themes (knowledge of the transformation process, transaction characteristics, specification and reward system, and performance evaluation) in the next section. The themes were analysed using the theoretical framework.

FINDINGS

Knowledge of the Transformation Process and Information Asymmetry

All the engineering managers perceive the STA as a professional and knowledgeable client. Engineering manager J says "one part of the professionalism is all the skilled [technical] specialists within the STA that are able to guide" during the contract. The engineering managers also argue that the STA is experienced in procuring and managing engineering service contracts. One of the engineering managers explains that with the STA they usually discuss the solutions and functions, whereas less knowledgeable clients focus more on costs. In addition, the engineering managers say that the tender documents (including the specifications) and the tendering procedures at the STA are more clear, well written and worked through, compared to other clients. This indicates that the STA knows what they want from the ECCs.

The client managers also view their internal project organizations as knowledgeable and informed about their projects, for example in relation to uncertainties, complexities and possible solutions as well as the consultants' transformation process. Usually, the client's internal project organization has been working with project preparations during several months, sometimes years, in order to write the specification and build project specific knowledge. This preparation work results in a situation where the STA "usually has an initial advantage" (Client manager C), in relation to the engineering consultant who just won the contract. The same manager says that some of the information cannot be written in the specification, since it is considered sensitive. Another client manager also reflects on the preparation work at the STA by saying: "in some cases we tend to do a bit too much ourselves, before we procure the consultants" (Client Manager B). The manager means that it limits the flexibility of the engineering consultants later on.

Transaction characteristics

All respondents argue that the characteristics of physical planning contain more uncertainties compared to the design phase, since no one knows what to build and where. In the design phase the knowledge is more comprehensive, and the

uncertainties are reduced through the investigations that have been carried out. According to Client manager A physical planning is about “defining what you should do” whereas in design it is already “defined what should be done”.

Specification and Reward System

All respondents argue that cost-plus compensation (hourly prize per consultant) is the most suitable reward system in the physical planning contracts. That is due to the many uncertainties and the problem-solving characteristics of that phase. In addition, most of the respondents argue that in a fixed price contract the client needs to clearly describe the scope in the specifications, which is seldom possible in such an early phase. However, some of the client managers argue that cost-plus contracts also come with disadvantages. They are a lot more demanding to evaluate, in terms of resources and time needed, compared to a fixed-price contract.

Even though all the respondents argue that fixed price is not suitable in the physical planning contracts, they also say that STA recently procured several contracts in that way. Some engineering managers are frustrated about this, arguing that a contract consisting of a lot of uncertainties and less calculable specifications rewarded on fixed price is inappropriate, since a lot of risks are transferred to them. As a consequence, some argue that in a fixed price contract they will make as little effort as possible, which also often lead to conflicts. "Often you shift the focus from finding the best technical solution, to argue about money" (Engineering manager F).

Respondents from both parties claim that it is possible to use fixed price in the design phase, since the uncertainties have been reduced and the scope has become clearer, thus making precise specifications possible. Some also mention the possibility of a contract including both phases but divided into two stages, where the first stage is compensated on cost-plus, and the second stage is a fixed price contract including incentives. According to the respondents, the most important factors when choosing reward system are the client's ability to write clear and calculable specifications.

Several of the respondents argue that in the period right after the contract is signed, it is of great importance to aim for consensus between the parties, in regard to the specifications and the expectations on the performance. Client manager C says that it is difficult when the specifications contain a lot of "gaps" so that "the engineering consultants need to make interpretations and then we have another interpretation", which often lead to conflicts. Therefore, Client manager G stresses that it is important for the parties to get the same view of the contract "what's included and what isn't?"

Performance Evaluation

There are several respondents from both parties saying that the project organization at the STA in general and the technical specialists at the STA in particular, have difficulties in providing the engineering consultants enough flexibility to work on holistic solutions. Instead, the technical specialists often want to get involved and decide upon a specific solution, within their field of knowledge. As a consequence, one of the engineering managers explains that they are getting different - sometimes also contradictory - input from different technical specialists at the STA, making the consultant organization “going back and forth, based on opinions” (Engineering manager E). The same respondent further explains that they should deliver a solution on an overall level, but often they spend time in detailed discussions with different technical specialists at the STA. Client manager G agrees by saying that "our technical specialists are usually very good, and they would like to tell how it should be

done". However, there are also engineering managers that find it positive that the STA is having knowledge, experience and are able to guide the engineering consultants.

Respondents from both sides argue that the expectations and specifications on what the ECCs are supposed to deliver, in terms of quality, level of flexibility and level of detail, are sometimes unclear. One of the client managers says that sometimes the STA even changes or finishes the delivered documents, when they are perceived inaccurate, since the client thinks it is faster than letting the ECC do it themselves.

DISCUSSION

In regard to information asymmetry, there are several factors indicating that the expected imbalance, favouring the service provider (van der Valk and Rozemeijer, 2009), is not describing the current situation in the relationship between the STA and the ECCs. On the contrary, the STA seems to have an information advantage initially in the contracts. This means that information asymmetry being one of the basic premises of the TCE (Williamson, 1975), does not fully apply to these contracts, especially not in the specification stage and initially after the contract is signed. Since information asymmetry is connected to uncertainty (Greenwood *et al.*, 2005) and complexity (Anderson and Dekker, 2005), it can be argued that a reversed information asymmetry contributes to lower asset specificity from the perspective of the client. Even though procurement of engineering services is considered complex and uncertain (Greenwood *et al.*, 2005), an informed client is able to utilize the entire toolbox, choosing between all three governance mechanisms. In addition, since the formal control mechanisms rely on specification by the client (Bajari and Tadelis, 2001), instead of joint specification (Eriksson, 2006), an informed client is able to base their choice of governance mechanisms on the transaction characteristics, not being forced due to lack of information.

In general, the STA is seen as knowledgeable in writing the specifications and in the performance evaluation, which indicates that the STA is having in-depth knowledge of the tasks (Kirsch *et al.*, 2010). Even though engineering services are considered knowledge-intensive and complex (von Nordenflycht, 2010) and many clients are unable to use neither process nor output control (Kirsch *et al.*, 2010), a client that has in-depth knowledge is able to utilize the entire toolbox, choosing between all three control mechanisms. Hence, the ability of the client is possibly influencing the in-depth knowledge, not just the characteristics of the service procured.

In accordance with Kirsch (1996) and Das and Teng (2001), since the STA has knowledge of the transformation process and the asset specificity is considered high, they should rely more on authority/process control, rather than price/output control when specifying, rewarding and evaluating the physical planning contracts. Despite that, the STA seems to combine performance evaluation using process control with rewarding on fixed price (output control), which is not in accordance with previous studies (e.g., Bajari and Tadelis, 2001; Eriksson, 2006).

In the physical planning phase in Sweden, the asset specificity in terms of complexity and uncertainty is considered high, thus the service is difficult to specify. In accordance with Bajari and Tadelis (2001), the respondents from both parties argue for cost-plus contracts being most suitable, thus emphasising authority rather than price governance (Eriksson, 2006). Despite that, several of the respondents express that the STA use fixed-price contracts quite frequently. This might be explained by

the fact that cost-plus contracts are perceived more demanding in the performance evaluation, compared to fixed-price contracts. The information advantage and the in-depth knowledge might also influence the STA to underestimate the uncertainties and complexities, thus they favour price instead of authority governance.

According to previous studies, fixed-price contracts should be combined with evaluation of the output, whereas cost-plus contracts should be combined with ongoing evaluation (Eriksson, 2006). Despite that, ongoing evaluation (process control) is perceived to be frequently used by the STA in these contracts, regardless of reward system. In accordance with Tiwana and Keil (2007), this might be explained by the fact that the STA has in-depth knowledge of the tasks, and therefore it is difficult not to control the process of the engineering consultants in detail.

This study also indicates that a client that is able to utilize the entire toolbox of governance and control mechanisms, thus is not forced to use social control, face a challenge of specification. Since price/output control and authority/process control rely on specifications by the client (Bajari and Tadelis, 2001), instead of joint specifications (Eriksson, 2006), the client has to transfer the information of the complex service to the service provider, via the specifications. This challenge was stressed by some of the respondents by saying that besides the uncertainties related to the transaction characteristics, the specifications and the formulations also add on to the uncertainties for both parties, since it is possible to make different interpretations. In addition, the standard conditions of contract for construction works and engineering services in Sweden differs, meaning that the specifications, reward system and performance evaluation could be considered more clearly defined in the first mentioned. Therefore, it can be expected that there is no straightforward way of describing and combining specifications, reward system and performance evaluation when procuring engineering services. This might be the reason why the respondents emphasize the importance of clear and calculable specifications. For example, traditionally in a DB contract the client uses functional specifications, fixed price and evaluates the functional outcome, whereas in a DBB contract the client uses detailed specifications, reimbursement payments and ongoing evaluation using a bill of quantities (Eriksson, 2006). However, in an engineering service contract, interaction and an ongoing coordination process between the client and the service provider are considered a key factor (van der Valk and Rozemeijer, 2009). This indicates that since a complex service is challenging to specify, trust seem to be of great importance in these contracts, regardless of governance and control mechanisms chosen.

CONCLUSIONS

This study shows that there are situations when clients have an initial information advantage in relation to their service providers, which affects the development of procurement strategies, in terms of how to specify, reward and evaluate. When a client has an information advantage initially and in-depth knowledge of what is procured, it is equipped with more tools in the governance and control mechanism toolbox, even though the client procures complex services such as engineering services. Hence, in addition to let the transaction characteristics influence the procurement strategies, information asymmetry and in-depth knowledge are factors potentially influencing the governance and control mechanisms chosen by the client.

In addition, we conclude that one reason behind choosing different combinations of reward system and performance evaluations, could be connected to the fact that the engineering service contracts in Sweden are less formalized than construction

contracts, leaving a high degree of flexibility to the client. This flexibility increases the potential gaps in the specifications, and thus the need for interpretation. Therefore, the uncertainties for both parties are rather high, which potentially lead to conflicts during the contract period. Therefore, regardless of the governance and control mechanisms chosen in the engineering service contracts, an initial phase of consensus decision making is emphasised to compensate for the lack of formalization, thus there is a great focus on trust in these transactions.

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