PROCUREMENT OF ENGINEERING CONSULTANTS

A literature study

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Preface

At the request of, and financed by, the Swedish Transport Administration, I have carried out a literature study, regarding public procurement of engineering consultants for physical planning and design. This study relates to the research presented in the report by Eriksson et al. (2019). In this literature study, Tina Karrbom Gustavsson and Per-Erik Eriksson has contributed as well as supervised.

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1. Introduction

The introduction is divided into two parts. In the first part, this literature study will be put in a more practical context and then a background in the existing literature will follow in part two.

1.1 Practical and empirical background

In order to facilitate innovation and sustainability within the built environment, public procurement is a current focus area of development. In cooperation with the Swedish Transport Administration (STA), the national researching group ProcSIBE (Procurement for sustainable innovation in the built environment) has carried out research projects covering several aspects of public procurement (e.g. cooperation, incentives, innovation) in different types of contexts (engineering services, construction works, mega projects and maintenance) during the last years. Most of these studies have covered construction works, mega projects and maintenance.

However, in order to start exploring the area of engineering services more, Eriksson et al. (2019) wrote the Swedish report "Konsultupphandling i Trafikverket – Uppföljning av konsultuppdrag inom kategori planering och projektering" (Author's translation: Engineering services procurement within the Swedish Transport Administration – Follow-up of consulting assignments within the category of physical planning and design). The report was funded by two research projects (TRV 2018/53555 and TRV 2016/43484) within the Swedish Transport Administration.

The main reason behind the abovementioned research projects and the report, is that in 2012 STA made a strategic decision to transfer a greater part of the responsibility and authority to private suppliers, within the engineering and construction industry. Furthermore, STA had the ambition to stimulate productivity and efficiency within the engineering firms. As a consequence of the decision, engineering services procurement with fixed price was initiated within procurement of physical planning and design. Furthermore, the two consulting services, physical planning and design, belonging to the same project were packaged and procured in the same contracts. In 2015, STA set the goal that 40 % of the contracts procured during the year, should use the contract type fixed price. This goal was set without stating under which conditions and for which projects, fixed price is appropriate for this kind of consulting assignments.

Eriksson et al. (2019) follow-up the consequences of the strategic decisions mentioned, by examining the effects of the two different compensation terms, fixed price and cost-plus, as well as analyze the correlation between project characteristics and execution/performance.

This literature study should be seen in close connection to the report mentioned, exploring the field of existing research of engineering services in a greater depth. Above the research problem was discussed from a more empirical and practical perspective, below a more academic problematization will follow.

1.2 Literature background

During recent decades, in line with the thought of New Public Management (NPM) (Hood, 1991), governments have investigated new ways of involving the private sector to further develop the public infrastructure (Birch and Siemiatycki, 2016). The main focus of NPM was to make the public sector more efficient and effective. Since the private sector was seen as a role model in that sense, the public sector has gone through a transformation process, trying to adapt (Massaro et al., 2015), using best practices from the private sector (Roodhooft and Van den Abbeele, 2006).

Currently, the view of the private sector being the role model is criticized. It is argued that questions of transparency, accountability and sustainability extend the scope of the public sector, making it more complex than the private sector (Dal Mas et al., 2019, Stentoft Arlbjørn and Vagn Freytag, 2012).

As a consequence of NPM, a range of services and infrastructure originally provided by the public sector, have gone through a marketization process. The concept of marketization describes the introduction of markets in the public sector (Birch and Siemiatycki, 2016). Consequently, the importance of procurement has increased.

The demand on public procurement seems to be greater and more varied than for procurement within a private company. It is argued that public procurement has become more complex in order to meet demands of innovation and higher flexibility (Sporrong and Kadefors, 2014). In addition, it is more challenging for procurement staff within the public sector to make procurement decisions (Dal Mas et al., 2019), due to the many trade-offs between procurement goals and socio-economic goals (Thai, 2001) as well as higher demands in combination with budget constraints (Bausman et al., 2014). The fact that public procurement is highly regulated also makes it more challenging (Stentoft Arlbjørn and Vagn Freytag, 2012).

In regards to procurement, Hay (2008) argues that due to NPM, the public sector has increased the use of consultants. In addition, governments in both developed and developing countries have increased the number of contracts awarded for complex services and is still doing so (Malatesta and Smith, 2013). During the recent decades, this extensive use of consultants have also drawn much interest within academic research (Ylönen and Kuusela, 2019). In regards to this, it is argued that procuring services is more challenging than procuring products, due to the higher buyer uncertainty (Gallouj, 1996, Wynstra et al., 2018).

Nearly three decades ago, Hood and Jackson (1991) coined the term *consultocracy* to describe the extensive use of consultants within the public administration and governance. In most studies on *consultocracy* since then, the focus has been on policy and management consultants that give advice about policies and political decisions (e.g Boston, 1994, Saint-Martin, 1998, Pollitt, 2001, Howlett and Migone, 2013) even though studies on consultants in local planning authorities also have been conducted (Wargent et al., 2020). In regards to the later, Ylönen and Kuusela (2019) argue for a broader perspective, defining *consultocracy* as "a phenomenon in which often short-term, outsourced expert knowledge production is increasingly replacing the long-term work of civil servants and even politicians" (p. 242).

Hence, according to the definition above, procurement of engineering consultants could also be argued to be included in the concept of *consultocracy*. Architectural and engineering competences are considered being essential for the public sector to be able to build roads, facilities etc. to a high quality (Sporrong and Kadefors, 2014, Bausman et al., 2014, Oyedele and Tham, 2007).

Within the construction sector, the cost spent on architectural and engineering services is significantly lower, than the cost spent in the production phase. In regards to this, research show that the client, in terms of project managers and technical staff, focus more on the construction works, than the procurement of engineering consultants (Sporrong and Kadefors, 2014). Furthermore, it is argued to be fewer studies carried out on procurement of engineering services compared to procurement of construction works (Sporrong, 2011, Waara and Bröchner, 2006).

Before procurement of design takes place, there is usually a process of physical planning. This process differs substantially between different countries. For example, in Great Britain, France and The Netherlands, physical planning is rather centralized whereas in the Nordic countries it is considered decentralized. In Sweden, parts of or the entire physical planning, is outsourced to engineering consultants (SOU, 2013). This could be problematic since some researchers argue that public services has a larger complexity than what consultants from the private sector have knowledge of (Craig and Brooks, 2006). Consequently, this might be seen as another aspect of *consultocracy*.

In general, public clients have limited experience in procuring consultancy services (Roodhooft and Van den Abbeele, 2006) and Sporrong and Bröchner (2009) found that the perception of 36 percent of the public clients within Swedish municipalities lack competence in procuring architectural and engineering services.

As stressed above, the challenges that the public sector is facing due to NPM, the significant use of consultants as well as the importance of the early phases within the construction projects, highlight the importance of procurement of engineering consultants. Lines and Shalwani (2019) argue that studies about procurement of architects and engineering services are rare. Furthermore, from a governance perspective, there seem to be a need for more studies of how NPM has effected planning practices (Sager, 2011), where procurement could be seen as one of the aspects. Hence, there seem to be a need to map the scant literature within this field.

The purpose of this literature study is two-fold. Firstly, to describe and categorize what has been studied regarding procurement of engineering consultants within the public sector. Secondly, to outline the need for future research regarding procurement of engineering consultants within the public sector.

2. Method

2.1 Database search

In an effort to explore what has been addressed in international literature, I have read several articles. The search terms “Procurement”, “Tender”, “Contract design”, “Specification”, “Consult*”, “Engineer*”, “Architect*”, “Physical planning” and “Construction” have been

combined in topic search (Titel + Abstract + Keywords) in several ways. There was no restriction on year of publication.

I carried out the search in two databases, Scopus and Web of Science. Scopus is considered one of the most appropriate databases within social science (Massaro et al., 2015) and was therefore used. In addition, I searched in Web of Science since that database seem to be used as a compliment to Scopus within the field of procurement (de Araújo et al., 2017, Karttunen, 2018). In addition to the search in the databases, reference snowballing was used to make the list of articles more covering.

In the search for appropriate articles, the title and abstract were scanned. Two aspects were considered important in choosing relevant articles. Firstly, the relation/perspective studied should be the one between the public client and the engineering firm, alternatively the internal process/organization within one of these parts. Articles covering both procurement of consultants and construction works were also selected. Secondly, it was considered important that the empirical data (if not a conceptual article) was gathered from engineering consultants/services within the construction industry, alternatively other rather complex consultancy services (e.g. offshore drilling, defense, IT).

Since only one article on procurement of physical planning was found in the database search, snowballing was used to grasp more literature. Altogether, this resulted in 49 articles and 2 reports. The reason for including the report by Chinowsky and Kingsley (2009) is that it is being referred to by articles in this study (Lines and Shalwani, 2019, Bausman et al., 2014) in discussions related to Qualification Based Selection (QBS). The other report (Eriksson et al., 2019) is used because it includes resent research and also act as a pre-study for this literature study.

This study has some limitations. Firstly, relevant articles might be covered in other databases than Scopus and Web of Science. Secondly, the search terms used might not apply to relevant articles within the databases either. Finally, relevant contributions might be found in books, conference proceedings and PhD theses, which was not covered in this study.

2.2 Terms and definitions

The terms “Architect” and “Engineer” differ in some articles but are used as one term (Architectural/Engineering or A/E Services) in others. In this study, architects and engineers are considered being closely related. Therefore, literature covering both are referred to and the terms are used as synonyms. It is also worth clarifying that design consultants and physical planning consultants in this study are considered to be different types of engineering consultants, who all are employed by an engineering firm. The contracts between the client and the engineering firms are referred to as both projects and consulting assignments.

A physical planning consultant make a plan proposal by doing successive and incremental assessments of different alternatives, which are then narrowed down to form one final alternative (Witzell, 2019). In doing this, several aspects need to be considered, e.g. cities, landscape, nature and the cultural environment. Design consultants, on the other hand, produce

drawings and specifications that guide the contractor in the production phase of bridges and roads for example (Sturts and Griffis, 2005).

2.3 Categorization

I read the articles found in the database search entirely and then summarized them in 3-10 sentences. After that, I printed the summaries, cut them into pieces (one piece for each article) and then put them according to the main phases of the public procurement presented by Holma et al. (2020) showed in Figure 1. Within each phase, I formed categories (shown as bullet points in Figure 1) based on the themes found and then I started to write the study.

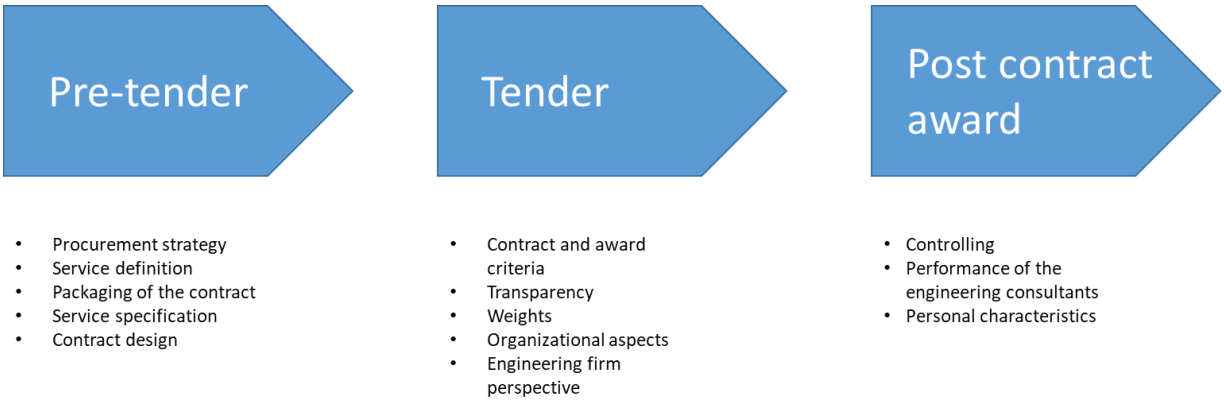

Figure 1: The three phases of the procurement process.

After the categorizing and writing begun some "holes" in the text appeared and in order to make the text more covering, I used snowballing to gather more articles. When reading the abstract in these articles I got an understanding of whether it was covering broader aspects of procurement, or just a specific part. The broader articles were read in entirely, whereas I had a different approach to the more specific ones. After reading the abstract, I used the search function in the PDF to find the specifically interesting parts and then finished off reading the conclusions and future research.

After reading a new article from the snowballing, these findings where then added directly to the suitable phase and category in the text. In this process, some new categories were also found and added.

The conclusions were formed mainly in two ways. Firstly, I compared some of the results of the different phases of the procurement process with each other. In the comparison, aspects of method, perspective and empirical field (physical planning and/or design) were chosen. Secondly, I tried to find common themes across the different phases of the procurement process and form conclusions based on that. Hence, when reading the text, some terms and words was referred to in more than one of the phases of the procurement process. I highlighted these terms in the margin and then I formed conclusions based on them.

In order to outline the need for future research, the most recent articles, from 2010 and onwards, will be presented. The reason for not presenting the suggestions in the older articles, is that these are usually tied to the current situation and therefore get outdated as things change. The future research will be structured in the same way as the other text, finishing each part.

3. Findings

In general, public procurement is divided into three main phases: pre-tender, tender and post-tender (Holma et al., 2020). Therefore, the findings will be structured accordingly.

As seen in Table 1, the most commonly used methods were quantitative. In the following text, the articles and reports referred to in each phase will be presented in a table, also showing the method used as well as the field (physical planning, design or various consultancy services) of empirical data.

Table 1: Methods used in the articles and reports.

Method	Number of references	Share of total
Qualitative	18	35%
Quantitative	24	46%
Combination	1	2%
Conceptual	6	12%
Other	3	6%
Total	**52**	**100%**

3.1 Pre-tender phase

To begin with, the procurement strategy has to be developed. According to (Bryntse, 1996) this includes for example the decision of make or buy, as well as packaging of the contract. Furthermore, the pre-tender phase includes aspects such as service definition, planning procurement needs and specifications, defining the characteristics of the service required, contract agreement and preparing the tender documents (Selviaridis et al., 2011).

3.1.1 Procurement strategy

To start of the discussion, the question of make or buy is central. Studies of planning show that there has been a change of governance (Sager, 2011) and a shift of power and initiative to the market (Witzell, 2019, Grange, 2016) due to the outsourcing to private engineering firms. There seem to be a clash between the aim of planning theory and the aim of NPM (Sager, 2009, Sager, 2011), which is also confirmed by an empirical study (Witzell, 2019). “Physical planning involves making successive, incremental assessments of alternatives while moving forward, eventually narrowing down to a final plan proposal.” (Witzell, 2019 p. 1426) When this is carried out by private engineering firms it has been critically described as “technocratic solutions to political problems” (Kantola and Seeck, 2010 p. 27).

3.1.2 Service definition

After the decision of procuring instead of carrying out the task in-house is made, it is worth discussing the nature of engineering services. According to Roodhooft and Van den Abbeele (2006), consulting projects are considered to be services and should be distinguished from products. Furthermore, they argue that the services are more abstract activities than objects and thus challenging for the buyer to test and for the seller to communicate before. According to the service management literature, there are four main characteristics that differ between products and services: inseparability, heterogeneity, intangibility and perishability, also

referred to as IHIP (Lovelock, 1983, Gordon et al., 1993). Wynstra et al. (2018) argue that most studies of procurement of services are based on the IHIP characteristics.

Sturts and Griffis (2005) argue that engineering design products are getting standardized. According to them, the work of a design consultant has dramatically changed, from manual to computerized work and in parallel there has been a shift from clients focusing on the individual engineers, to the organization behind the engineers. The researchers also discuss that the client usually hire one engineering firm to do the design, which in turn hires several sub-consultants who is specialized in different engineering fields (e.g. geotechnical, structural or electrical) (ibid). However, this change in efficiency has mostly gained the clients, not the engineering firms (ibid). This is because the most common terms of compensation is time-based fee, usually per hour. Hence, the consultants will not be able to get as much paid for the same work when performed faster, since their business model did not change accordingly (Parks, 2006).

In addition to that, researchers mean that people in general do not understand what an engineer does and therefore, engineering services are simplified, standardized and seen as commodities (Parks, 2006, Sturts and Griffis, 2005, Witzell, 2019, Farr, 2001). Commodities in this sense could be defined as "traditional civil engineering products such as plans and specifications for small buildings and subdivisions along with surveying services" (Farr, 2001 p. 225). From the engineering firms' perspective, Farr (2001) elaborate more on the topic by making a distinction between engineering firms that either provide value-based services or commodities. In addition, he means that the large international engineering firms are able to not only sell the products but also additional value, unlike a small, local or specialist firm. From this perspective, it could also be seen as a choice made by the engineering firm, not the client. However, it could be questioned why a small or specialist firm cannot offer added value.

3.1.3 Packaging of the contract

This discussion regarding engineering services as a commodity is present in journals of construction management (Sturts and Griffis, 2005, Farr, 2001), physical planning (Witzell, 2019) and in industry magazines (Parks, 2006, Horns and Jenkins, 2011). Consequently, this put pressure on the engineering firms to argue for their unique expertise and quality towards the client (Sturts and Griffis, 2005, Farr, 2001). On the contrary to commoditizing, Gallouj (1996 p. 43) mean that "the output of consultancy can be considered a process in which knowledge is made available, transformed and transferred". Hence, the viewpoint of how the client perceive engineering services might be of importance to understand, since it might affect how these contracts will be designed and procured by the client.

The use of framework contracts could be seen as another aspect of packaging. Apte et al. (2019) studied the implementation of category management of services using empirical data from the Department of Defense. In their study, they concluded that there are opportunities for process savings using category management. One of their suggestions is to use indefinite delivery-indefinite quantity (IDIQ) contracts, also referred to as framework agreements/contracts. This type of contracts simplify the procurement process, since it enables public clients to sign contracts with one or several suppliers, to procure an uncertain quantity of goods or services during a multiyear period. When financing and specific requirements become clear, the public client make task orders to the firms within these contracts. Bausman et al. (2014) mean that the

time spent on task orders is one third, in comparison with the process time to handle normal tenders. However, it is also of importance to mention that procuring the framework agreement also is time consuming and resource demanding, which was not considered in their comparison. Furthermore, it could be challenging to make the framework contract broad enough to handle different future task orders and specific enough to contract the appropriate suppliers (ibid).

Bausman et al. (2014) studied best practices of procuring engineering services within several Department of Transports in the U.S. They found that framework contracts have to be handled with care to work properly. Since these contracts are usually quite general, in terms of scope, it could be difficult for small or niche firms to qualify and compete with larger companies. In addition, they address that there is a locked-in effect to consider, since these contracts exclude new firms ability to enter the market during the contract period. By using short contract length, this effect is reduced.

3.1.4 Service specification

It is argued to be difficult to specify services (Roodhooft and Van den Abbeele, 2006, Gallouj, 1996, Bryntse, 1996, Gelderman et al., 2015), especially since the client might not have the knowledge needed to formulate these (Gelderman et al., 2015, Folkeson et al., 2013). In addition, writing service specifications are particularly challenging due to services being heterogeneous and intangible (Wynstra et al., 2018). Despite that, it is considered to be important to use written (Bryntse, 1996, Brismar, 2004) and clear specifications (Folkeson et al., 2013). Furthermore, public clients are encouraged to interact with potential suppliers using market dialogues (Holma et al., 2020, McKevitt and Davis, 2015, Lenferink et al., 2012) and information from these could facilitate the formulation of the specifications (McKevitt and Davis, 2015, Lenferink et al., 2012).

In regards to specification, Witzell (2019) describes a paradox in procurement of physical planning. In order for the public client to tender out, the consulting assignment needs to be specified and calculable beforehand. However, such specification requires information that is part of the consulting assignment.

Another factor that is making service specifications complicated, is the fact that there are a number of internal stakeholders within the client organization that need to be coordinated (Bryntse, 1996, Holma et al., 2020). Gelderman et al. (2015) argue that it is of importance to jointly improve and finalize the specifications within the client organization.

When formulating the service specifications, there are different methods to choose from. Bryntse (1996) argues that it is a choice of detailed or functional specifications, whereas Gelderman et al. (2015) mean that there are four methods: input-oriented (which supplier resources/competences that is required), process-oriented (how the service should be produced), function-oriented (functionality of the service and the output) or outcome-oriented (monetary value of the outcome). The last mentioned methods will be referred to in the following text.

It has been argued that in working on the Environmental Impact Assessment (Ed. Note: which is one part of the physical planning) a broad representation of both specialists and generalists

as well as different expertise within the engineering firm is recommended (Antonson, 2011). In addition, it seems to be important to pose clear requirements on the consultants' experience and competence (Brismar, 2004). Hence, these could be seen as examples of input-oriented specifications when formulating engineering consultancy contracts for physical planning.

In addition to use multiple and cross-sectoral expertise (Antonson, 2011), there is a clear need for the engineering firms to have knowledge in holistic analyses, stepwise analyses and indirect environmental effects (Folkeson et al., 2013). Olwig (2007) addresses that, in general, the different practitioners/engineers involved in physical planning are not trained at the university to cooperate. Meaning that they do not necessarily speak the same language. Antonson (2011) argues that in order for the client to make incentives for the engineering consultants to work cross-sectoral, using holistic analyses, the (process-oriented) specifications in the procurement documents are of great importance. Hence, if the consulting assignment is divided into sub areas, such as culture and nature, the engineering consultant will deliver accordingly. Meaning that there is a risk of nobody taking responsibility of the entirety.

Apart from specifying the input or process needed, there also seem to be a need for more functional-oriented specifications. Antonson (2011) stress that landscape objectives and landscape definitions are important in the specification of a physical planning procurement. Further he shows in his empirical study that these tend to be lacking.

Furthermore, there are also some issues related to specifications worth mentioning. These include over-specification (Bogers et al., 2008, Roodhooft and Van den Abbeele, 2006), poor demand management and numerous changes (Roodhooft and Van den Abbeele, 2006).

Gelderman et al. (2015) argue that within public procurement, there should be a clear distinction between the phase of specification and the tender phase. Meaning that the specifications will not change after the phase of specification is over. However, some flexibility is preferred (Bryntse, 1996), also referred to as (de)stabilization of specifications (Gelderman et al., 2015), since requirements might change during the contract. Research conducted on ICT services has been linking contractual and relational governance with the (de)stabilization of specifications. It was found that the destabilization of service specifications is formalized contractually (having flexible terms in the contract) and then further developed relationally, in the interaction between the client and the service provider (ibid). Even though both ICT services (Gelderman et al., 2015, Kim and Brown, 2012) and engineering services (Kim and Brown, 2012) are considered complex, it could be questioned whether or not the findings of ICT services is comparable to the procurement of physical planning and design.

3.1.5 Contract design

In contract design three components are central: contract type, contract length and contract value (Kim and Brown, 2012).

Contract type

The compensation term, referred to as contract type, is one of the most important elements that need to be specified in a contract (Kim and Brown, 2012). The most common contract types are variations of fixed-price and cost-plus/time and materials based (Corts and Singh, 2004,

Bajari and Tadelis, 2001, Kim and Brown, 2012, Napier and Mishra, 2015). Thus, the following parts will mostly cover these two, even though incentive contracts (Suhonen et al., 2019) and target costs (Lahdenperä, 2010) also exists.

In fixed-price contracts, the compensation is tied to the output, whereas in cost-plus contracts it is connected to the input (e.g. time and materials) (Kim and Brown, 2012). Time-based compensation (cost-plus), which is made up of the engineers' time (including a markup for overhead costs and profit), is widely used when procuring engineering services (Parks, 2006, Sturts and Griffis, 2005). During the recent decades, the digitalization and automation of the engineers' work has dramatically reduced the time of production. However, by using time-based compensation, most of the savings have favored the client (Parks, 2006). This issue adds up to the discussion of services being seen as commodities. In order to regain the status of services being unique services and not standardized commodities, compensation based on value is suggested (Parks, 2006, Sturts and Griffis, 2005, Farr, 2001). This can be referred to as value-based compensation (Parks, 2006), value-bidding (Sturts and Griffis, 2005) or value-based pricing (Farr, 2001, Napier and Mishra, 2015). Napier and Mishra (2015) explain that "value-based pricing models is to enable the professional service firm to capture the largest possible proportion of the value created through the application of the firm's expertise (p. 25).

Farr (2001) describes the concept with the following equation:

$$(Value\ Y - Price\ Y) > (Value\ X - Price\ X)$$

Basically, the engineering firm that offers the best difference between value and price compared to the other bids will win the contract. The major challenge when using value-based pricing is to develop relevant quantifiable measures of value (ibid) as well as for the engineering firm to justify it towards the client (Napier and Mishra, 2015). Napier and Mishra (2015) also argue that in relevant literature value-based pricing is on the "wish-list" from the perspective of the engineering firms, not the clients.

In designing contract arrangements, there is a trade-off between *ex ante* incentives to reduce the costs and the *ex post* transaction costs due to changes. Fixed-price contracts create a stronger incentive to reduce the costs, than cost-plus contracts do (Bajari and Tadelis, 2001). On the other hand, when changes are needed, it is expensive and time consuming to renegotiate fixed-price contracts (Eriksson et al., 2019, Bajari and Tadelis, 2001), whereas cost-plus contracts are inherently flexible (Bajari and Tadelis, 2001). In turn, cost-plus contracts create a condition of moral hazard (Corts and Singh, 2004). Thus, more surveillance is needed (Malatesta and Smith, 2011).

According to Malatesta and Smith (2011) the questions of risk and responsibility between the parties, are central in the decision of compensation terms. Further they discuss that in fixed-price contracts, the engineering firm bears the financial risk as well as the responsibility to deliver the end product, whereas in cost-plus contracts the client bears the financial risk and the engineering firm is responsible for the delivery. When the public client should carry the risk and the quality of the delivery is important, cost-plus contracts should be used (Suhonen et al., 2019).

Complexity seems to be one of the factors that influence the client's choice of contract type. Research show that when projects are complex, there is a need of flexibility, hence cost-plus contracts are more used (Eriksson et al., 2019) and also considered more suitable than fixed-price contracts and vice versa (Kim and Brown, 2012, Bajari and Tadelis, 2001, Corts and Singh, 2004, Suhonen et al., 2019). It has also been argued that cost-plus contracts are the most suitable to facilitate innovation (Suhonen et al., 2019). However, it is worth mentioning that Kim and Brown (2012), unlike the other studies above, compared different types of products/services and not different complexity of the same type of product/service.

It has been shown to be less friction in cost-plus contracts than in fixed-price contracts (Eriksson et al., 2019, Bajari and Tadelis, 2001). Bajari and Tadelis (2001) argue that the reason, is that the asymmetric information between the parties does not play a major role in cost-plus contracts since they will be compensated for the time worked anyway. Hence, the *ex ante* incentives affect the *ex post* transaction costs.

Furthermore, there seem to be factors of uncertainty of the consulting assignment and defining the scope to be considered. In contracts with high uncertainty, cost-plus is argued to be the preferred contract type (Corts and Singh, 2004, Suhonen et al., 2019), even though another study show that there is no correlation between uncertainty and the choice of contract type (Eriksson et al., 2019). Furthermore, when the scope cannot be clearly defined, cost-plus contracts are appropriate (Wang et al., 2012). Due to the uncertainties and the difficulties to make the consulting assignment calculable beforehand, fixed price has been argued not to be suitable for physical planning contracts (Witzell, 2019).

Karrbom Gustavsson and Hallin (2015) describe the mode of a project having clear goals (referring to SMART-criteria) as *goal oriented*, whereas a project that are trying to specify their goals (referring to SMART-criteria) as being *goal seeking* instead. According to Eriksson et al. (2019) it could be argued that the physical planning phase is *goal seeking*, whereas the design phase is more *goal oriented* . The researchers further discuss that during the physical planning, the goal cannot be fully described since that is part of the assignment of the engineering consultant. In addition, the physical planning phase includes aspects that the engineering consultant cannot control such as the handling of stakeholders (e.g. land owners, municipalities, associations) in the compulsory public consultation hearings, as well as permission processes and other processes within different governmental authorities. On the contrary, in the design phase these aspects are less important, which makes the consulting assignment easier to control for the engineering firm. In order to make the right incentives for the engineering consultant to be fully *goal seeking*, the researchers argue that cost-plus contracts are more suitable for physical planning. In the later design phase, the goal is easier to define and the consulting assignment more *goal oriented*, hence fixed-price could be used instead (ibid).

In relation to complexity and uncertainty, Eriksson et al. (2019) show that there is a difference in how these terms are perceived by the project managers on the client side, compared to the ones at the consultant's side. Within the specific projects, the one on the client side perceived less complexity and uncertainty than the counterpart, respectively. The fact that the client has been working on the project several months before the consultant gets involved, could be one of the explaining factors. Hence, it could be seen as a question of asymmetric information. In general, since it is the client that estimate the complexity and uncertainty when designing the

contract, it seems to be important for them to understand that the engineering firm might assess these aspects differently, and thus the offers should be formulated accordingly. Furthermore, the study also show that from the engineering firm's perspective, fixed-price contract could also increase the perceived uncertainty of the project.

Contract length

In regard to engineering consultants, contract length is basically the time between signing the contract and the date when the finished physical plan or design should be delivered. According to Kim and Brown (2012) short-term contracts place the risk on the buyer and vice versa for long-term contracts. Furthermore, they argue that uncertainty of how long it would take to deliver the results wanted, is also a factor to consider.

In regards to contract length, there is also an effect of lock-in. Since resources from the engineering firm will be tied to the contract, this might reduce the ability for them to bid for other contracts in the future (Kim and Brown, 2012). This lock-in effect probably also exists in terms of width (e.g. number of fields of expertise) and size of contract. There is also a factor of locked-in for the client but in different terms. Crocker and Masten (1988) argue that there is a trade-off for the client between spending time and money on handling the procurement and the hazard of being tied to an inflexible contract.

Contract value

The contract value refers to the amount paid by the client to the engineering firm. The value is specified *ex ante* in fixed-price contracts and *ex post* in cost-plus contracts, hence both the contract type and the contract length affect the contract value (Kim and Brown, 2012).

Even though the requirements and terms written in the tender documents should be fixed, it has been showed that length and value is often modified during the contract phase. In addition, it is argued that there is a need for some discretion in order to response to external conditions (Kim and Brown, 2012). In relation to that, Crocker and Masten (1988 p.328) argue that "A central goal in designing contractual relationships, therefore, is to choose terms that maintain incentives for efficient adaptation while minimizing the need for costly adjudication and enforcement." In addition, there seem to be a connection between the complexity of the consulting assignment and the change in contract value, since the more complex, the more value in change orders it is shown to be (Kim and Brown, 2012).

In regards to contract design, Volker (2012) argues that the entire tender contract design process is uncertain for the public client, since they will have to make decisions about the future. In parallel with this, it has been argued that the most important aspects when designing an engineering contract is contract flexibility, as well as incentives to reduce costs, improve quality and the distribution of risk (Suhonen et al., 2019).

3.1.6 Future research

There seem to be a need for more studies covering how the governance of planning practices are affected by NPM and marketization (Sager, 2011, Witzell, 2019), as well as procurement of physical planning from other countries than Sweden (Witzell, 2019). In regards to category management, Apte et al. (2019) argue for more studies on that topic, also including data from

the supplier-side. Stanford and Molenaar (2018) highlight the importance of future studies to determine if there is a correlation between the restricted competition when using IDIQ contracts and increased costs paid by the client. Furthermore, they argue for more qualitative studies on these types of contracts.

Since it has been shown that clients need to improve their ability to write service specifications (Roodhooft and Van den Abbeele, 2006), the field of developing service specifications is in need of more research also studying different procurement procedures (Holma et al., 2020). It is also argued that there is a need for studying (de)stabilization of service requirements within other industries than ICT as well as the impact of culture (within the client) on the aspect (Gelderman et al., 2015).

Kim and Brown (2012) argue for more research needed to assess factors that drive decisions of contract design. It is also suggested to investigate how decisions of contract design affect performance of the consultant (Kim and Brown, 2012, Suhonen et al., 2019). There seem to be a need for empirical studies on the public clients' use of different contract types e.g. do the risk aversion and behavioral biases affect the public clients' choice of contract (Suhonen et al., 2019). Furthermore, Malatesta and Smith (2011) suggest that future studies should focus on governments' use of power in contracts, in order to understand and structure these contractual relationships, as well as assess their efficiency. They also argue for comparisons between private and public clients on the same topic.

In Table 2 there is an overview of the 31 articles and reports referred to in the pre-tender phase. The most common method used is the qualitative (42 %), whereas 35 percent of them were carried out using a quantitative method. All of the articles are having the perspective of the client.

The different colors in the tables 2-4 refer to which type of consultants/services that has been studied. Dark grey (e.g. Eriksson et al., 2019) refers to physical planning and design consultants in the same study, medium grey (e.g. Bausman et al., 2014) refers to design consultants/architects, light grey (e.g. Grange, 2016) refers to physical planning consultants and various other consultancy services are shown in white (e.g. Gallouj, 1996).

Empirical data from design consultants (39 %), planning consultants (26 %) and various consultancy services (32 %) seem relatively evenly distributed. Only one article covered both design and planning consultants. Furthermore, when analyzing some of the subsections this distribution differs. For example within service specifications most of the studies are carried out on various consultancy services (55 %) or planning consultants (29 %) and only 14 percent was carried out on design consultants, whereas within contract design most of the studies are on design consultants (55 %) or various consultancy services (36 %) and none on planning consultants.

Table 2: Articles and reports referred to in the Pre-tender phase.

Reference	Topic	Method
Antonsson, 2011	Specifications in Environmental Impact Statements	Qualitative
Apte et al., 2019	Category management of services	Quantitative
Bajari and Tadelis, 2001	Compensation terms	Quantitative
Bausmann et al., 2014	Best practices of service procurement	Qualitative
Bogers et al., 2008	Briefing documents and the communication between the client and the architect	Qualitative
Brismar, 2004	Specifications in Environmental Impact Statements	Quantitative
Bryntse, 1998	Procurement of services	Qualitative
Corts and Singh, 2004	Formal vs relational contracts	Quantitative
Eriksson et al., 2019	Compensation terms related to uncertainty, complexity and goal seeking/oriented	Combination
Farr, 2001	Value-based pricing and engineering service fees	Qualitative
Folkesson et al., 2013	Specifications in Environmental Impact Statements	Qualitative
Gallouj, 1996	How clients choose, evaluate and control services	Qualitative
Gelderman et al., 2015	Service definitions	Qualitative
Grange, 2016	Planner as a profession	Qualitative
Holma et al., 2020	Service specifications	Qualitative
Horns and Jenkins, 2011	Engineering service as a commodity	Industry article
Kim and Brown, 2012	Contract design	Quantitative
Malatesta and Smith, 2011	Dependency in relation to compensation terms	Quantitative
McKevitt and Davis, 2014	Supplier development using procurement	Quantitative
Olwig, 2007	Practice of landscape and planning	Conceptual
Parks, 2006	Engineering service as a commodity	Industry article
Roodhooft and Van den Abbeele, 2006	Procurement of consultancy services	Qualitative
Sager, 2009	Role of the planner	Conceptual
Sager, 2011	Planning theory in relation to NPM	Literature review
Sporrong, 2011	Consultant selection	Quantitative
Stanford and Molenaar, 2018	IDIQ contracts	Quantitative
Sturts and Griffis, 2005	Value bidding	Quantitative
Suhonen et al., 2019	Contract design	Conceptual
Wang et al., 2012	Cost estimation and payment schemes	Qualitative
Witzell, 2019	Procurement of physical planning	Qualitative
Wynstra et al., 2018	Comparing procurement of IT-services and IT-products	Quantitative

3.2 Tender phase

The tender phase in this study is defined according to Hoezen et al. (2010), hence between announcement of the tender documents until contract close.

There are a number of qualitative (e.g. Volker, 2012, Sporrong and Kadefors, 2014) and quantitative (e.g. Christodoulou et al., 2004, Lines and Shalwani, 2019, Tzeng et al., 2006) studies on awarding criteria of engineering consultants, which seem to be the most researched aspect within the tender phase. There are three contract award criteria that the client can choose from, where (lowest) price and best price-quality ratio are the most common and the ones being referred to in this study. In best price-quality ratio, the client rate non-price factors and then trade them off with price.

3.2.1 Contract award criteria

Traditionally within the construction industry, the construction contracts are awarded based on lowest price (Christodoulou et al., 2004, Stanford and Molenaar, 2018, Sturts and Griffis, 2005), whereas it seems to be more common to award engineering services using qualitative, non-price factors (best price-quality ratio) (Volker, 2012, Sturts and Griffis, 2005, Sporrong, 2011). On the contrary, a recent study on the Swedish Transport Administration (STA) show that 70

percent of the engineering contracts studied were awarded solely based on price (Eriksson et al., 2019).

The reason why it differs between the industries, might be because the scope of the construction works are considered better defined than the scope of the consultants (Christodoulou et al., 2004) or that the value of the engineering consultant cannot be measured monetarily (Kasma, 1987). The main stand point for using the contract award criteria price, seem to be that the engineering service you are buying will be the same no matter who provides it. Taking non-price factors into account, on the other hand, presupposes that since consultants are people and not commodities, the services will vary. Therefore, lowest price is not appropriate (Christodoulou et al., 2004).

During the past half a century in the U.S., Qualification-Based Selection (QBS), has been the most used procurement method by federal projects, when procuring architectural and engineering services. The method implies that the client awards the engineering consultants solely based on non-price factors (best price-quality ratio), whereas the price is negotiated afterwards (Chinowsky and Kingsley, 2009). It is worth noting that since QBS does not include the price factor in the awarding, this method is not consisted with the European public procurement legislation and the award criteria "the best price-quality ratio". Another difference between the U.S and the EU is, that using past performance as a non-price criteria is encouraged in the U.S and constrained within the EU (Gordon and Racca, 2014).

Sporrong and Kadefors (2014) found in their study on Swedish municipalities that resource constraints and inter-professional barriers within the client organization, lead to more contracts awarded based on lowest price, since it is a simpler, less costly and less resource demanding model. They argue that using such coping strategies could be vulnerable since it, in general, requires high competence to evaluate the quality of engineering services offers. In relation to that, preparing best price-quality ratio proposals also incur costs for the engineering firms (Tran et al., 2017).

Recently in the U.S, more and more public organizations have started to use price as one of the award criteria. This has been highly criticized by the engineering firms, who argue that this is a shortsighted view that leads to lower quality (Chinowsky and Kingsley, 2009). This is confirmed by Christodoulou et al. (2004), who show in their study that there is no significant correlation between cost savings in the design phase and low total project costs. Instead, most likely, the cost savings are offset by increased costs in the production phase. However, if the client insists to use price as one of the award criterions (mandatory according to the European legislation but not in the U.S.), it is recommended to limit the weight so that it will not be the dominant factor and to use a two-envelope system, meaning that the price is not revealed when evaluating the non-price factors (Lines and Shalwani, 2019).

Another aspect of best price – quality ratio is which non-price factors to use. The findings shown by Watt et al. (2009) indicate that technical and management capability, past experience, performance and the proposed method and technical solutions are the most preferred ones. Even though the empirical data was mainly from the private sector, it could still be relevant from a public sector perspective. In regards to that, another study within the public sector show that, in general, the evaluating committee put too much emphasis on person related issues, instead

of focusing on project organization and specific criteria in terms of the execution of the project and the design (Sporrong, 2011). Related to that, Gallouj (1996) argue that it is preferred to combine criteria focusing on both individual characteristics and organizational competences.

Another study on QBS was carried out by Chinowsky and Kingsley (2009). In their research of 42 engineering projects, it was found that 93 percent of the clients surveyed, rated the project outcomes when QBS was used as "high" or "very high". In addition, for high-risk projects QBS was identified as the preferred procurement method. Another survey examining the viewpoint of clients, architectural/engineering consultants and contractors, show that using non-price factors is more effective than using lowest bid, in terms of quality, satisfaction, time and dispute on fulfillment of contract. However, the perception is still that using non-price award criteria will lead to higher project costs (Tzeng et al., 2006).

3.2.2 Transparency

Using lowest price is inherently transparent, whereas evaluating non-price factors creates issues with transparency. Therefore, evaluation of non-price factors is criticized for being based on subjective judgments, and hence in need for a standardized and more objective process (Hsieh et al., 2004, Chow and Ng, 2010, Cheung et al., 2002, Tran et al., 2017).

Tran et al. (2017) studied factors to improve the use of best price – quality ratio. The study resulted in several recommendations. Firstly, to use an evaluation committee that partly consist of technical members with no personal interest in the project. Secondly, to train the committee and make sure everyone understands how to carry out the evaluation and awarding. Thirdly, to write detailed individual evaluation comments to use in the debriefings. Lastly, to have debriefings were the evaluation committee discuss rankings and points. All these factors were considered to increase transparency and fairness of the evaluation and awarding process.

3.2.3 Weights

Cheung et al. (2002) have studied factors affecting the weights when using best price-quality ratio. It was found that there is a difference between public and private clients. Public clients seem to put more emphasis on the design approach, whereas the private client focus more on price. The size of the client and the size of the project as well as the type of project, in terms of complexity and uniqueness, also affect the weights. In Swedish municipalities, results show that the procurement officers perceive that even though best price-quality ratio is used, too much emphasis (weight) is put on price (Sporrong and Bröchner, 2009, Sporrong, 2011), coupled with easily measured non-price criteria (Sporrong, 2011).

3.2.4 Organizational aspects

According to Volker (2012), the public procurement law assumes a quantitative evaluation and award process. In her study of procuring architectural services, she found that using qualitative measures (best price-quality ratio) were the most appropriate, though. When using non-price factors, the interaction between the staff within the evaluation committee is an important part of the decision process. Once they have the different bids they start to make sense of the alternatives. In this process they follow their intuition, trying to reach a consensus decision. Even though the decision make sense for the evaluation committee, it is difficult to legally justify it. Hence, Volker (2012) argues that there is a clash between the law and the decision

making rationality. Consequently, it seems like these arguments relate to the basic idea of services being services (which are difficult to quantify) versus thinking of services as commodities (which are easier to quantify). In addition, when using lowest bid there is a risk that the consultants will interpret the tender documents to a minimum scope and minimum quality, also estimating the salaries and expenses needed on a low level (Kasma, 1987). Hence, it seems to be a significant risk of too low prices.

Another aspect that is worth mentioning is the connection between construction works and engineering services. Sporrong and Kadefors (2014) mean that at the client side, project managers and technical staff are usually involved in both. Hence, in their study they found that the procurement methods of construction works affect how engineering consultants are procured, especially among project managers and technical staff that usually focus less on the procurement process and more on the contract phase. On the contrary, procurement staff are usually having a broader competence and knowledge of different procurement methods. In addition, it was found that the technical staff wanted to spend less time on the engineering contracts and also where used to award on lowest bid, since that is how construction works are traditionally awarded. On the other hand, procurement staff were usually more positive to use more advanced awarding criteria (best price-quality ratio) as long as they are legally certain.

3.2.5 Engineering firm perspective

In regards to supplier evaluation and selection, it is also worth mentioning that the client should consider their offer from the perspective of the engineering firm. In the same way as the client evaluate bids from different engineering firms, these also evaluate and compare different clients and projects (Gallouj, 1996). According to Løwendahl et al. (2001) it is of great importance for the Professional Service Firm (PSF) to win the "right" contracts, since it is through them they build competence and learn. Consequently, it is a strategic question for an engineering firm (which is considered being a PSF (von Nordenflycht, 2010)) to choose which projects to tender for that in turn affect the competition that most public clients want to increase.

3.2.6 Future research

Lines and Shalwani (2019) argue that more research is needed on how the submitted schedule and cost proposals are affected by the public clients' schedule and budget estimations. They also suggests more qualitative studies on the topic. Volker (2012) argues for more similar studies to hers in other countries, meaning to study decision making when using non-price factors in procuring engineering services. Furthermore, she suggests qualitative follow-up on quantitative research (e.g. Sporrong, 2011) of tender decisions related to procurement of engineering consultants.

In relation to evaluation of consultancy competence, Sporrong (2011) suggests to do a more thorough investigation of how that is defined and converted into awarding criteria. In addition, she argues that there is a need for future research to explore the connection between procurement practices and its context, in terms of the public procurement law, organizational aspects within the procurement function, procurement skills of staff and inter-organizational relations. When having better understanding of the context, studies of how public procurement can be developed to better suit engineering services can be carried out. Furthermore, Sporrong

and Kadefors (2014) suggest the need to study the relation between procurement strategies in individual projects and the permanent procurement function.

Since preparing a bid in best price-quality ratio is more costly for the engineering firms, compared to bids awarded on lowest bid, Tran et al. (2017) argue for future research to investigate how public clients can reduce these costs and still achieve a transparent competition.

In Table 3 there is an overview of the 19 articles and reports referred to in the Tender phase. The most common method used is the quantitative (63 %), whereas the share for qualitative research is 26 percent. All of the articles are having the perspective of the client. The studies on design consultants dominate this phase of the procurement process and none is based on data from physical planning.

Table 3: The articles and reports referred to in the Tender phase.

Reference	Topic	Method
Cheung et al., 2002	Weights of non-price criteria in supplier selection	Quantitative
Chinowsky and Kingsley, 2009	Qualification Based Selection	Quantitative
Chow and Ng, 2010	Non-price factors in supplier selection and performance evaluation	Quantitative
Christodoulou et al., 2004	Qualification Based Selection	Quantitative
Eriksson et al., 2019	Compensation terms related to uncertainty, complexity and goal seeking/oriented	Combination
Farr, 2001	Value-based pricing and engineering service fees	Qualitative
Hsieh et al., 2011	Non-price factors in supplier selection	Quantitative
Kasma, 1987	Consultant selection	Qualitative
Lines and Shalwani, 2019	Evaluation criteria	Quantitative
Løwendahl et al., 2001	Creating value within a PSF	Conceptual
Sporrong, 2011	Consultant selection	Quantitative
Sporrong and Bröchner, 2009	Procurement as a tool to achieve goals of sustainability	Quantitative
Sporrong and Kadefors, 2014	Internal (procurement) organization within the client	Qualitative
Stanford and Molenaar, 2018	IDIQ contracts	Quantitative
Sturts and Griffis, 2005	Value bidding	Quantitative
Tran et al., 2017	Best-value procurement	Quantitative
Tzeng et al., 2006	Best-value procurement	Quantitative
Watt et al., 2009	Selection criterias	Qualitative
Volker, 2012	Evalutation of architects	Qualitative

3.3 Post-tender phase

In this study the post-tender phase is considered to start after contract award and continues during the length of the contract, hence until the finished physical plan or design is delivered (Kim and Brown, 2012).

3.3.1 Controlling

In general, controlling of services is difficult due to the nature of services being challenging to specify (Gallouj, 1996, Bryntse, 1996). Gallouj (1996) refer to that information asymmetry lead to uncertainties for the client and that contracts are incomplete. In addition, since the output is difficult to isolate and quantify, it is almost impossible to control.

As a consequence of the uncertainty and difficulties in controlling, the client perceive a risk of moral hazard. According to Gallouj (1996) the risk can be described in two situations. First, the actions of the service firm cannot be observed by the client. Hence, there is an issue regarding if the consultant is doing enough. Second, the actions of the service firm can be observed by

the client, but unfortunately they lack the ability and competence to know if the actions are appropriate.

Chow and Ng (2010) argue that performance and evaluation measures of engineering consultants are not carried out in a systematic manner by the client. Usually individual value judgments by the assessors influence the decisions too much. Therefore, they claim that the clients should use quantifiable non-price factors such as number of submissions, fulfillment of technical/financial standards in the design solution, ability to mitigate project risks etc. However, it could be questioned whether "the best price-quality ratio" should elaborate more on quantitative than qualitative aspects.

3.3.2 Performance of the engineering consultants

In regards to the post-tender phase, there are a number of quantitative studies on performance of the engineering consultants (Chow and Ng, 2010, Ling, 2002, Oyedele and Tham, 2007). To begin with, what is a good performance? Several researchers have tried to find out which aspects are of most importance to the client. Ullman (2001) mean that a good engineering consultant should be able to suggest a design that is innovative, which improve quality and reduce cost and time. It has also been concluded that management ability, buildability, project communication and project integration are important (Oyedele and Tham, 2007) as well as the relationship with the client (Lam, 2017).

In relation to the contract type chosen, Eriksson et al. (2019) conclude that in fixed-price contracts the project managers from both the client and the engineering firm, are less satisfied with the execution and the performance compared to cost-plus contracts. One of the reasons behind that is that in fixed-price contracts, the project manager from the client side become more passive and less controlling than in cost-plus contracts, which make the engineering consultants doubtful on what to do. Furthermore, the contact/meetings between the parties takes place less frequent which makes it difficult to discuss and agree on certain aspects.

Lam (2017) studied the correlation between several performance outcomes and a number of performance factors in engineering contracts. It was found that the experience and expertise of project staff are the most significant factors influencing cost, time and working relationship performance. Competence of firm, which is related to past performance, also significantly affects time and working relationship performance. Design and management methods were found to be significant predictors for quality. Another predictor of quality, as well as for cost and working relationship performance, are trust and collaboration. It was also found that size of firm is negatively correlated to performance. The reason for that seem to be that large firms often allocate the most experienced and competent resources to the large projects, whereas smaller firms use their most competent consultants in, more or less, all their contracts. Consequently, the client are able to predict and influence the performance of the engineering consultants by evaluating tenders based on some of the performance factors mentioned. Furthermore, innovation was one of the other performance outcomes in the analysis. However, no significant correlation was found to any of the performance factors (competence of firm, experience by project staff, design and management methods, trust and collaboration, conscientiousness) studied.

3.3.3 Personal characteristics

In relation to performance, Ling (2002) created a model to predict the performance of an engineering consultant. In order to get the highest performance, it was found that three personal attributes where the most important: the consultant's speed in producing design drawings, the consultant's problem solving ability and the consultant's enthusiasm in taking on difficult tasks. Hence, there is an opportunity for the clients to affect the pre-requisites for a good performance, for example by using these attributes as non-price criteria in the awarding of the contract.

3.3.4 Future research

Both Chow and Ng (2010) and Lam (2017) argue for future research to develop more models to predict performance and assist in decision making.

In Table 4 there is an overview of the eight articles and reports referred to in the Post-tender phase. The most common method used is the quantitative (50 %), whereas the share for qualitative research is 25 percent. All of the articles are having the perspective of the client. Studies having empirical data from design consultants seem to be most common and no study based on data from physical planning was found.

Table 4: The articles and reports referred to in the Post-tender phase.

Reference	Topic	Method
Bryntse, 1998	Procurement of services	Qualitative
Chow and Ng, 2010	Non-price factors in supplier selection and performance evaluation	Quantitative
Eriksson et al., 2019	Compensation terms related to uncertainty, complexity and goal seeking/oriented	Combination
Gallouj, 1996	How clients choose, evaluate and control services	Qualitative
Lam, 2017	Prediction of performance outcome	Quantitative
Ling, 2002	Prediction of performance outcome	Quantitative
Oyedele and Tham, 2007	Performance of architects	Quantitative
Ullman, 2001	Decision making in engineering design	Conceptual

4. Conclusions

The purpose of this literature study was to describe and categorize what has been studied regarding procurement of engineering consultants within the public sector, as well as outline future research needs addressed in the literature.

To begin with, it became clear that there are articles covering all the three phases of public procurement, even though they are rather few, which Lines and Shalwani (2019) also have argued. Especially procurement of the entire physical planning process seem to be less studied, since only one article was found (Witzell, 2019). The other articles of planning consultants only studied one part of the process (e.g. Folkeson et al., 2013, Antonson, 2011, Brismar, 2004). Except from Eriksson et al. (2019) the articles covered either physical planning or design (or various consultancy services), not both. As a conclusion, few studies focus on procurement of the early stages of the construction phase and the combination of physical planning and design seem rare. Hence, more studies covering the early phases is needed as well as further exploring the packaging of physical planning and design.

Furthermore, in this study it was found that empirical data from design consultants are the most common, with a share of nearly 60 % of the total amount of articles and reports, whereas studies of physical planning only summed up to 15 %. In this study it was found that studies of physical

planning are only present in the pre-tender phase of the procurement process. On the contrary, studies of design consultants are extensively present in all the phases, in terms of number of articles (Pre-tender: 12, Tender: 17 and Post-tender: 5) as well as the share of the total (39 %, 89 % and 63 % respectively).

When comparing the number of studies within each phase it was found that the pre-tender phase is the most studied (31), the tender phase the second most (19) and the post-tender phase is the least studied (8). However, the reason why there were few studies found in the post-tender phase might have to do with the fact that search terms focused on the early phases of procurement, not explicitly performance and control. Another conclusion is that, within the tender phase, studies on award criteria was found to be the most common.

Even though the IHIP characteristics have been argued to be the most used basis in studies on procurement of services (Wynstra et al., 2018), it was not mentioned in any article regarding engineering consultants. However, contrasting products and services seemed common (e.g. Sturts and Griffis, 2005, Parks, 2006, Farr, 2001) as well as contrasting engineering services and construction works (e.g.Sporrong and Kadefors, 2014, Christodoulou et al., 2004, Stanford and Molenaar, 2018).

In regards to engineering services, the connection to construction works seem to be of importance. Even though the consulting assignment are completely different to the production phase, they still relate to each other. The engineering contract is usually followed by the construction contracts and the deliverables from the former, act as a base for the later. In addition, these different processes are handled by the same individuals at the client (Sporrong and Kadefors, 2014). However, in this study it was found that the connection seem to be most obvious in the tender phase.

Based on the literature, or the lack thereof, the question of governance and shift of authoritative power (*Consultocracy*) seem not to be as urgent for engineering consultants within design as within physical planning. This might be due to the extensive (public) regulations that surrounds the later and not the former, as well as the fact that the engineering consultant is part of the communication and interaction with the local citizens during the physical planning, but not within the design process. Hence, in physical planning contracts the engineering consultants are handling some of the authoritative power (democratic and bureaucratic process) that is part of the core of public sector (Witzell, 2019).

Another conclusion is that quantitative research is more common than qualitative within this field (46 % and 35 % respectively). However, in the pre-tender phase, it was found to be the other way around. Furthermore, the most common perspective in the studies is the clients', not the engineering consultants'.

Furthermore, even though articles cover the different stages of the procurement process, none was found to discuss the interdependence, in a similar way as Eriksson and Westerberg (2011) have done for construction works. Although the engineering services and construction works differ by nature, the similarities in terms of procurement process, legal frameworks and client personnel, indicate that there should be a need for developing an integrated framework for procurement of engineering consultants as well. In addition to the outlined need for future

research found in the literature, this is a potential field for further studies. More precisely, to explore what characteristics are decisive in physical planning and design projects and why they are decisive. Furthermore, based on the different characteristics, to investigate how the procurement, contractual and relational terms should be designed to support these.

In the literature, some key aspects, seen as autonyms, appeared across the different phases of the procurement processes. These are: complex/less complex, uncertain/certain, goal seeking/goal oriented, flexible/inflexible, contractual/relational, quantitative/qualitative, ex ante/ex post and individual/organizational. In the following text these will be referred to.

In this study it was found that a consulting assignment that is complex, uncertain or goal seeking by nature, is difficult for the client to specify ex ante. Hence, flexible contract terms, also referred to as (de)stabilization, as well as flexible contracts seem to be used and recommended. In addition to contractual governance, clients tend to/are recommended to use ex post methods and relational governance, including trust and cooperation, as a complement.

On the other hand, in this study it was found that when consulting assignments are less complex, certain and goal oriented, they are easier to specify ex ante. In this case the risk might be able to transfer to the engineering firm by using fixed price. Furthermore, this will make incentives for reducing costs. However, the incentives created by fixed price is most often offset by costly negotiations ex post regarding changes.

In regards to the tender and post-tender phase, in this study it was found that there is no ongoing discussion related to complexity, uncertainty, goal seeking, flexibility and ex ante/post. Instead quantitative/qualitative and individual/organizational are common topics found. The public procurement regulation is most obviously affecting the choices in the tender phase, compared to the other phases in the procurement process, which might not be that surprising, even though paragraphs covered in both the pre- and post-tender phases exist. Here the antonym qualitative/quantitative, is prominent in terms of award criteria based on best price-quality ratio or price. In regards to control, quantitative and qualitative measures are referred to. However, since all of the studies found are carried out using a quantitative method, the more qualitative measures and elaboration is scarce.

The more common antonym in the post-tender phase, which also exists in the pre-tender phase and tender phase, is the one contrasting individual and organizational. As a conclusion, it is preferred to focus more on the organization that is contracted, than the individuals. Even though there has been found some key personal characteristics that will lead to good performance (Ling, 2002), the overall organizational aspect is recommended to focus on when writing specifications and evaluating bids. The organization was also found to be a key factor of good performance.

Finally, in regards to the outlined need for future research, it could be concluded that there are a number of possibilities, both quantitative and qualitative, within every phase of the procurement process. However, it is difficult to find any similarities between the suggestions between the different phases or make any conclusions. Studies related to the internal organization/processes within the client and the use of the public procurement regulation, are two overall topics referred to in more than one phase though.

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