Brokering in Systems Development

Investigating the Role of Third-Party experts in Requirements Elicitation and Translation

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Abstract

Contemporary organizations often deal with a procurements process when purchasing system solutions from different suppliers. Many of these organizations either lack the knowledge, experience, or the time needed to successfully manage procurements processes. This research addresses the role of brokers in such processes, i.e., organizations mediating knowledge between customers and IT suppliers. A main concern for these brokers is managing knowledge flow across boundaries between different stakeholders. The management of knowledge is particularly challenging in requirements engineering processes involving different stakeholders who have distinctive understandings and perspectives of information system development. This thesis presents findings from a single case study in which a consulting firm providing broker services for eliciting and translating client's requirements in procurement processes of system solutions has been investigated. The empirical investigation was conducted through interviews with seven consultants from the firm North Consulting. It focused on formal processes, perceived key challenges, and applied problem solving methods. The contributions of the thesis lie primarily in three important findings: identification of competencies required to successfully broker knowledge in procurement processes, challenges in managing such processes, and, explication of methods, tools, and documents applied to overcome the challenges.

Keywords: Requirements engineering processes, Procurement processes, Brokering, Knowledge transfer, System analysis, System design, System development

1 Introduction

Developing\(^1\) the right solutions and matching features for a client's organization is problematic for many organizations using Information Technology (IT) and a key concern in the field of Information Systems (IS) (Galbraith, 1973). A key concern in developing solutions is translating business needs into requirements representing the features requested of the solution, and, describing these features in an adequate way. Accordingly, Requirements Engineering (RE) is a core activity in analyzing the environment in which the developed solution will be integrated (Fuxman, Liu, Mylopoulos, Pistore, Roveri, & Traverso, 2004). It is, therefore, necessary in the feasibility phase to investigate the objectives, business processes, and interdependencies of different stakeholders to understand the structure of organizations' practical operations where the developed solution will be integrated. But, without well-defined requirements, it is easy to produce errors that create misunderstandings between stakeholders. Misunderstandings in early RE phases between stakeholders are common issues that are both frequent and can have a large impact on future costs when developing a solution (Kotonya & Sommerville, 1996; Boehm & In, 1996; Leffingwell, 1997; Avison & Fitzgerald, 2006). The elicitation and translation of requirements are important to ensure that the right solutions are developed for the client’s organization and they make it

\(^1\)The word development is used as a synonym for system development, i.e., the larger set of activities involving requirements analysis and process innovation as compared to the more narrow focus in software development.
important that the solution is both compatible and correctly used by the users in the client’s organization (Lawrence & Lorsch, 1967; Szulanski, 1996; Carr, 2003).

After the translation and elicitation phases comes the requirements specification in which the requirements are formalized as a representation of the client’s needs. The representation is then used for understanding and featuring what the solution requires before the suppliers start to develop the solution (Kotonya & Sommerville, 1996). Requirements are used in documentations to specify and prioritize the different features of what should be implemented in the client’s solution, making the requirements both crucial and elementary for describing what the client’s solution should feature and perform when implemented. The requirements ensures that an objective is successfully achieved (REQB, 2011). But, to define the requirements of a client is not an easy task, rather it is both time and resources demanding for the stakeholders involved in the elicitation and translation of requirements (Kotonya & Sommerville, 1996; Boehm & In, 1996).

Having successful RE processes is important when translating the client’s requests into documents, which are used to support business, development, and implementation processes of IT. The RE processes are used for identifying, prioritizing, documenting, representing, changing, managing, and maintaining the requirements for business, user, system, development, and implementation processes (Nuseibeh & Easterbrook, 2000; Wieggers, 2000; Berander & Andrews, 2005; Holmström & Sawyer, 2010). RE processes are there to ensure that all activities are well-coordinated and that the communication is functioning among the stakeholders (e.g., clients, the requirement team, the development team, etc.) (Goguen, 1993). Having good communication in RE processes helps streamline the various tasks that are performed by the stakeholders and helps the stakeholders work become more manageable, efficient, and organized. Making two key issues of requirement elicitation and translation relate to the importance of communication and knowledge management between stakeholders (Sommerville, 2011; Carlile, 2004). Having functioning communication and knowledge management in RE processes helps stakeholders ensure that the scope, costs, time, and quality of the developed solution become more visible in the business and development, testing, and implementation processes, etc. A better visibility helps the stakeholders become more aware of what features to prioritize when eliciting needs and translating them into requirements. Knowing how to prioritize requirements might decrease the chances of requirements creep or project escalation (Keil, 1995; Boehm & In, 1996; Jones, 1996; Keil, Mann, & Rai, 2000; Schwalbe, 2011).

However, nonprofessionals who possess limited knowledge about RE processes might have a hard time translating their needs into requirements that are outside their knowledge domain (e.g., system solutions) (Winter, 1987, Schön, 1983; Carlile, 2004). To ensure that the right needs are covered the nonprofessional must sometimes hire professionals with the right domain knowledge for developing solutions. The nonprofessionals then become clients of the professionals (Schön, 1983; Argote, 1999; Brown & Duguid, 2001). These professionals act as brokers to find the right solution for their client (Pawlowski & Robey, 2006). Depending on the extent to which the clients choose to hire a broker, the broker can perform everything from specifying their needs to managing the procurement processes completely. The broker’s knowledge about procurement becomes an important help for the nonprofessionals. With the knowledge about procurements, the broker becomes the person in charge of coordinating the elicitation and analysis activity, dealing with suppliers questions about requirements, evaluating suppliers’ solution and bid documents, etc. (Burt, 1992; Hargadon & Sutton, 1997;
Pawlowski & Robey, 2004). That responsibility requires the broker to possess a holistic overview of the procurement processes that are needed to facilitate the transferral, translation, and transformation of the requirements between stakeholders (Berg, 2001; Avison & Fitzgerald, 2006).

Unfortunately, the greater part of the RE research focus investigates the later phase of development and implementation of solutions, which Neglects to show how requirements affect both the business and procurement processes that start at the feasibility phase and end at the beginning of the implementation phase. Between these phases, information has been collected, which is information that is necessary for establishing requirements, evaluating suppliers’ solutions, and signing a contract between the supplier and the client. Against this backdrop, this research aims to address the gap that exists because the broker is a third-party expert in procurement processes.

**How can brokers facilitate elicitation and translation in Requirements Engineering processes?**

The aim of this study is to analyze the role of the broker in requirements elicitation and translation activity in public procurements, specifically how brokers balance the need for information to reduce uncertainty with expenditure of scarce resources. When dealing with procurements, the brokers have to create an understanding of the problem domain and functional requirements in the business process before publishing a formalized requirements document, which is included in the tender document in procurements. The brokers only have a narrow window of opportunity to elicit and define the requirements (Tyre & Orlikowski, 1994). During this window, the broker has to understand, categorize, and prioritize the needs of the client for evaluating a solution from the suppliers that fits their client’s needs into documents. The included documents set important frames and limitations on the client’s final solution.

To create a deeper understanding about requirements within procurement processes, I have conducted a single case study based on interviews with different brokers within the consulting firm North Consulting that is active in the northern parts of Sweden. The case study focuses mainly on procurement in public organizations since these processes are surrounded by extensive judicial concerns, making the translation of needs into formal requirements even more important. Since much of the communication is restricted to formal documents, the research context is well suited for examining knowledge transfer in procurement processes and the role of brokers in eliciting requirements. First, the thesis will describe different types of requirements and continue with describing the different activities of the RE process. Second part describes, the case study of the consulting firm North Consulting and the firm’s use of requirements in their business processes surrounding procurements processes is described. Third part is the description of the single case study comes the result section. The thesis will then end with a discussion and conclusion on the findings.

### 2 Related research

In the related research section, I review the literature on RE, define what requirements are and what types of different requirements exist (2.1), outline the RE process (2.2), explain in
detail the area of concern for RE that includes the activity of elicitation and analysis (2.3), and also describe how the management of knowledge across boundaries is done (2.4).

2.1 Requirements

Requirements specifications are developed to represent what a solution has to cover, which is desired when involving stakeholders in procurements (REQB, 2011). The requirements should be able to present a solution to the need for the stakeholders, but also provide a sense of achievement for the stakeholders. A stakeholder can be defined as anyone who has or would have a direct or indirect connection to the requirements in the solution (Sommerville, 2011). However, the stakeholder’s need does not automatically become a requirement since the need can be a request that is only based on one single stakeholder’s view of a problem needed to be solved. And, having a need not related to the solution can have an impact later in the implementation phase. Every need should not, therefore, be directly enlisted as a formal requirement before the need has been verified as a formal requirement. The definition of a formal requirement is a requirement that is necessary as a condition or capability to solve a problem or improve an existing function in the future solution (Kotonya & Sommerville, 1996; Nuseibeh & Easterbrook, 2000; Wiegers, 2000; Goldsmith, 2004; REQB, 2011). The requirements are represented as documents that are called the requirements documents (Sommerville, 2011).

Different types of requirements represent different objectives in the use context. These requirements can take various forms and are necessary to be understood by the different stakeholders involved in the RE process (Bahill, Bentz, & Dean, 1996; IEEE, 1998; Wiegers, 2000; Goldsmith, 2004; Glinz, 2007). Defining different types of requirements is difficult because it is not uncommon for professionals of today to experience problems with understanding the nature of requirements before the implementation phase. These problems appear because many stakeholders define requirements differently depending on what background the stakeholders have (Goldsmith, 2004). One of the most common reasons for these problems is that the types of requirements that technical people view important are not the same types of requirements that interest the business people and vice versa. Therefore, it is important that the requirements document contains knowledge about the different types of requirements involved in the RE process.

These are three of the most common types of requirements (Wiegers, 2000; Goldsmith, 2004; Sommerville, 2011):(1) Business requirements are often the descriptions of why a solution is being developed and may also identify what potential benefit and outcome there is for the client (Wiegers, 2000). Business requirements define the what kinds of business results, which have to be delivered for providing value for the client. The business requirement is often seen as a synonym for a user requirement, which is unfortunate because it should not be viewed this way (Goldsmith, 2004). (2) The difference is that a user requirement is captured in use cases, which make it more task-oriented and related to the actual work process of the users. The user requirement explains the processes required by the users and how the solution will be executed as an objective rather than presenting the result or outcome of the process like the business requirement does (Wiegers, 2000). (3) A system requirement describes the high-level design of how a developed solution should function (Goldsmith, 2004), making the system requirement a very detailed description of the solution of the systems functions, services, and operational constraints (Sommerville, 2011).
The different types of requirements can be specified in two different categories, either as functional or nonfunctional (Sommerville, 2011). Functional requirements help describe the specific developed solution behavior that must be implemented in the developed solution to solve the problem. The functional requirement describes the function that the developed solutions have to perform in the given situation (IEEE, 1998). The functional requirement is that defined as shall, while the nonfunctional requirement, on the other hand, represents the necessary attributes and the different constraints related to how a system behaves (Glinz, 2007). The necessary attributes and constraints are often associated with visualization, reliability, efficiency, usability, maintainability, and portability (Goldsmith, 2004; REQB, 2011). Sommerville (2011) characterizes nonfunctional requirements in three subcategories, namely, product, organizational, and external requirements.

With these different types of requirements and ways of representing them, it is not that big of surprise to hear that many of the software projects become failures if requirements are not correctly defined or are misunderstood (Keil, 1995; Keil, Mann, & Rai, 2000). The failures can be found especially nowadays when there is a greater need for tighter integration between software and its use context, a greater autonomy for software to adapt to its use context, and a greater increase in the globalization of software development (Cheng & Atlee, 2009). Therefore, we could see these trends as reflections of the changing needs that brokers of today are facing, which directly affect the brokers’ processes and practice in RE. These changing trends make it important to separate the different types of requirements that exist in both the development and the implementation of the solutions into different types. The categorizing of requirements leads to better visibility and traceability in the RE processes. Having good visibility and traceability in RE processes helps increase the chance that the elicitation of requirement is accurate towards the practical use of the solution, and it might also help create a better understanding of requirements. A better understanding of the requirements could result in decreasing the chance of both scope and requirements creep (Keil, 1995; Keil, Mann, & Rai, 2000; Sommerville, 2011; Schwalbe, 2011). A better understanding of the requirements might have a great impact on how to identify new opportunities, develop the market, and display that the developed solutions become reliable (Ebert, 2009).

2.2 The Requirements Engineering Process

The RE process consists of four main activities: feasibility study, requirements elicitation and analysis, requirements specification, and requirements validation. They all result in the production of documents (e.g., feasibility report, system model, user and system requirements, and the requirements document).

The RE process mainly builds on communication and should not be viewed as a purely technical activity (Wiegers, 2000). The RE process is executed to identify what features are required for the developed solution and to identify what constraints the solution has in the development and implementation process before being integrated into the client’s organization operations. These solutions can be based on the current or foreseeable conditions required for the solution in the future (Wiegers, 2000; Sommerville, 2011). The conditions of the solution can include both internal and external operations (Van Lamsweerde, 2001). Performing the identification, elicitation, purpose, analysis, and documentation of the stakeholders’ needs becomes an essential part of the process when integrating the solution (Nuseibeh & Easterbrook, 2000). The result is that the RE process becomes a critical stage.
for identifying errors that can lead to later problems with the design and implementation of the developed solution. The RE process usually involves three main groups of stakeholders: first are the representatives of the client’s organization (client); the second group is the requirement team (broker); and finally, there is the development team (supplier) (Goguen, 1993). There might also exist different types of subgroups that may overlap, and there may be other interested parties (e.g., regulatory bodies) that can be different depending on what type of developed solution the RE process handles. Goguen (1994) states that the classification of the three groups of stakeholders gives rise to different social issues that may complicate the elicitation of requirements. Figure 1 below shows the main activities of a general RE process (Sommerville, 2011). In RE processes there are different main activities and other subactivities related to the establishment of requirements.

Figure 1 The requirements engineering process (Sommerville, 2011)

The first main activity in RE is the feasibility study, which is the phase where estimations are made for comparing the identified needs of the stakeholders. Identifying the needs then helps to determine, by viewing the solution from a business perspective, if the proposed implementation of the solution will be considered profitable enough. The client’s needs also help determine whether the implementation of the developed solution can be done within the client’s requested time, cost, scope, and quality constraints (Sommerville, 2011; Schwalbe, 2011). These factors make the feasibility study become a phase that is usually done preferably quickly and at low-cost. The outcome from the feasibility phase is the feasibility report that decides if it is necessary to involve suppliers to assist the client’s request in the development of the solution.

The second activity of the RE process is requirements elicitation and analysis. During the elicitation and analysis activity, the focus lies in collecting the future solution features and functions through observation of current systems, workshops, discussions with stakeholders affected by the developed solution, etc. (Brown & Eisenhardt, 1995; Nuseibeh & Easterbrook, 2000; REQB, 2011). There exist various techniques for how to elicit requirements (e.g., interviewing, prototyping, JDM, SSM, ULRC, MUST, etc.) that can be used for generating and visualizing the integration of the solution into the client’s existing system architecture as a system model (Goguen, 1993; Coughlan & Macredie, 2002; Davis, Dieste, Hickey, Juristo, & Moreno, 2006). The requirements elicitation and analysis may also contain a set of tasks, activities, and tools to determine whether the stated (elicited) requirements are unclear, incomplete, ambiguous, or contradictory (REQB, 2011). Sommerville (2011) argues that requirements should be established in the following order: (1) business requirements, (2)
user requirements, and (3) system requirements. The goal is to create an understanding of how the solution will function and how the client’s needs should interact in the existing IS as a consistent system model that visualizes the client’s organization (Castro, Kolp, & Mylopoulos, 2002; REQB, 2011). Since the information collected in the elicitation and analysis activity is used for problem solving and identifying problem areas that might arise in the RE process, the requirements elicitation and analysis activity is a critical part of the RE process.

The third activity is the requirements specification, which is the process of translating the gathered information and stating the information in the requirements document together with other relevant documents (REQB, 2011; Sommerville, 2011). The requirements specification starts when the requirements have been specified as complete, precise, and having a verifiable structure. The structuring of requirements involves the design, behavior, and other important elements of the solution. The main function of the requirements specification is to document all necessary requirements that have been identified necessary to the solution. The specification of requirements should generally not be written in technical terms or contain assumptions about how the developed solution should function (unless these are parts of the requirements). One challenge with the requirements specification activity is how to manage the political and emotional aspects that may arise between the stakeholders when prioritizing the requirements (Wiegers, 2000; Bergman, King, & Lyytinen, 2002).

The fourth and last activity is the requirements validation, which deals with ensuring that the requirements are realistic, consistent, and completely defined when creating a reasonable estimation of the required size of operation and defining the needed resources for developing the solution (Wiegers, 2000; Sommerville, 2011). The requirements verification process exists to confirm that the design and construction of the developed solution meets the established requirements (REQB, 2011). The process of verification consists of performing various inspections, tests, and analyses throughout the life cycle that ensures that the designed system fulfills the specified requirements of the client. Requirements validation is basically the last activity to ensure that the future developed solution’s requirements are complete, correct, consistent, and clearly defined for the client and also for the broker to manage the changes that occur throughout the RE process (Wiegers, 2000; REQB, 2011).

The most important part of RE processes is to make sure that communication exists among the stakeholders. A working communication is necessary to ensure that the right features of the solution are included in the RE process and that the coordination of work is functioning. A big problem in RE is a lack of communication among the different groups of stakeholders when stating requirements, a problem that may make the interpretation of requirements become weakly defined. A weak definition of requirements will then affect the communication among stakeholders and can result in a final developed solution that becomes both unstable and inconsistent with the client’s needs. Therefore, the focus of the RE process is to ensure that communication works properly so that the client’s needs are satisfied. This goal is the ultimate standard of requirement in which all other requirements and solutions design originate (Grady, 1993).

For this reason, it is important that stakeholders understand that having a functioning communication in the RE process helps address the client’s needs by identifying the different requirements that have to exist in the implementation phase of the solution. Comparing the theoretical and practical views will show that RE is an iterative process in which all existing
activities in the process are connected instead of being separated (Sommerville, 2011). Depending on what kind of solution is developed, the solution decides the amount of time and effort used in each activity and iteration of the system that's being constructed. Early in the RE process there will be a focus on understanding the high-level requirements at different levels of detail. After eliciting and specifying business and user requirements, the RE process starts focusing on understanding and specifying the system requirements, which requires several iterations of the RE process. These iterations are necessary for evolving the requirements. The number of iterations depends on what type of solution is developed. After the requirements have been elicited and specified, the RE team begins the prototyping and reviewing phases that help confirm the validity of the requirements.

In every RE process, requirements are bound to change. The changing requirements are often the result of the stakeholders creating a shared understanding about what solution should be developed and what it should perform. The process related to the change of requirements is called requirements management. Requirements management deals with the continuous process of documentation, analyzing, tracing, prioritizing, communicating, agreeing on requirements, and managing the requirements’ changes (Gotel & Finkelstein, 1994; Karlsson & Ryan, 1997; REQB, 2011; Sommerville, 2011; Gräuler, M., Teuteberg, F., Mahmoud, T., & Gómez, J. M., 2013). The activity of requirements management is involved in every part of the RE process since the goal is to monitor the whole process (REQB, 2011).

2.3 Requirements Elicitation and Analysis Activity

The requirements elicitation and analysis activity begins after the feasibility study is done. It focuses on identifying the developed solutions domain, determining what types of features and functions the solution should provide, specifying the required performance of the solution, considering hardware constraints, etc. (Sommerville, 2011). Discovering this information usually involves much communication among different stakeholders who are associated with the client organization operations. To represent the information involved in the elicitation and analysis activity, a system model of the organization’s existing IS is created, which is the output of the elicitation and analysis phase. Viewing Sommerville's (2011) requirements elicitation and analysis activity (Figure 2) below shows what process steps are included in the requirements elicitation and analysis activity.

![Figure 2 The requirements elicitation and analysis process (Sommerville, 2011)](image)

The first step is the requirements discovery phase, which begins with an interaction among different stakeholders to find useful information to help identify requirements for the future developed solution. The interactions take place through interviews, observation, and the use of additional techniques that can create user-scenarios and prototypes to help the
stakeholders understand how the solution will function and interact in the client’s organization (Goguen, 1992; Coughlan & Macredie, 2002; Davis, Dieste, Hickey, Juristo, & Moreno, 2006; Sommerville, 2011). But understanding how the solution will function and interact with the stakeholders might be difficult to do since the stakeholders’ requirements differ from stakeholder to stakeholder (e.g., business vs. technical people). Therefore, it is important to take each stakeholder’s viewpoint into consideration when creating the requirements (Grady, 1993). Usually the requirements of the different stakeholders converge into a unified image as time moves on (Goldsmith, 2004; Sommerville, 2011).

After this process comes the second step, which is the requirements classification and organization step that structures the collected requirements and organizes them. In the requirements classification and organization process, the information that is gathered in the previous step becomes structured into coherent clusters (Sommerville, 2011). To help structure the requirements into coherent clusters, it is common to use a system model to visualize the system architecture where the developed solution will be integrated. The system model will help identify and connect each requirement to each subsystem of the solution, meaning that the RE process and architectural design of the solution cannot be separated during the requirements elicitation and analysis activity.

The next step is the requirements prioritization and negotiation process, which helps in prioritizing, identifying, and solving conflicts that revolve around requirement through negotiation (Wiegers, 2000; Bergman, King, & Lyytinen, 2002). This phase is a critical activity since the elicitation and analysis often involves many different types of stakeholders who have different perspectives of what should be prioritized (Goldsmith, 2004; Sommerville, 2011). Carrying out the requirements prioritization and negotiation step deals with meeting the different stakeholders and trying to find an adequate compromise.

The last step is a requirements specification that focuses on documenting the requirements into a unified system model that explains the interaction that the solution will have with the existing system architecture. This requirements specification is smaller, more internal, and is connected to the requirements and analysis activity in the RE process. This part, therefore, should not be compared with the RE process activity requirements specification since it is on a smaller scale than the requirements specification activity. Having a developed system model helps to facilitate the planning and later implementation of the developed solution.

The steps involved in the requirements elicitation and analysis activity are all iterative processes that continuously provide feedback from each activity to other activities in the RE process. It helps to improve the understanding of the stakeholders in the RE process on how to deal with the requirements by giving them an update after each elicitation and analysis cycle.

2.4 Managing Knowledge across Boundaries in Procurements

When brokers deal with the client’s requirements and the suppliers’ solution and bid documents, there exists many different types of information processes between the different activities of the RE process and the procurement process. This information process results in the brokers having to deal with several stakeholders that come from different backgrounds and possess contrasting domain-specific knowledge. This situation is bound to create various knowledge boundaries between stakeholders (Carlile, 2002; Carlile & Lucas, 2003; Carlile & Rebentisch, 2003). Managing the different types of knowledge boundaries for transferring,
translating, and transforming knowledge becomes important for the existing relationship between stakeholders in procurement processes (Carlile, 2004). Focusing on effectiveness when managing knowledge helps clarify different relationships that exist for sharing knowledge between both internal and external stakeholders in the client’s organization. But it also reveals how to evaluate each of the stakeholders’ domain-specific knowledge that is transferred, translated, and transformed by the broker (Carlile, 2002; Carlile & Lucas, 2003; Carlile & Rebentisch, 2003; Carlile, 2004). These three boundaries of knowledge are especially challenging to manage in the early development stages of the solution when the impact of the new requirements is hard to determine and can have major consequences in the future while integrating the supplier’s developed solution into the client’s organization (Carlile, 2004). Using the theoretical framework of Carlile (2004) helps illuminate three phases in which the knowledge boundaries of information processing in procurement processes takes place (Figure 3). Taking an information processing approach focused on the knowledge stored, retrieved, and interpreted emphasizes the importance of having a common idea between broker, client, and supplier about how to facilitate their shared knowledge. This step uses a political approach to acknowledge how different interests are disrupted when sharing information between stakeholders’ different domain-specific knowledge. The information processing approach helps to create a better understanding about the knowledge management of requirement elicitation and translation in procurement processes (Carlile, 2004). On a practical level the theoretical framework also helps describe the mismatches that occur between both the stakeholders and the different types of boundaries faced.

![Figure 3 The knowledge relationship and order between stakeholders in a general procurement process](image)

**3 Method**

This method section describes the research process in terms of the research site, the chosen research method, and the collected data and procedures for data analysis. Consequently, the first part of the section explains the research site (3.1). The second part outlines and motivates the choice of research method and why the selection of the case study as method is adequate for the case (3.2). The final part helps us understand how, in the course of the research, the data were collected and the procedure of analysis was carried out (3.3).

**3.1 Research Site**

The research involved a case study conducted in an IT consulting firm called North Consulting that, at the moment of the investigation, had several offices operating in multiple locations in the northern parts of Sweden. The clients of the firm managed organizations dealing with everything from public sector services, commerce, industry, banking, finance, and insurance, etc. Being a consulting firm, North Consulting had broad knowledge about
web-integrated solutions, document and invoice management, business-related consulting services, etc.

The research examined the firm’s business-related consulting services such as analysis, organization mapping, and investigation and project management of operational and implementation projects. The main focus of the research was on how the consultants provided brokering services in procurement processes of system solutions, which included an investigation of North Consulting and their business and procurements processes viewed from the perspective of the brokers in the firm. When North Consulting consultants were acting as brokers, they helped their clients to identify their needs and then to develop ways to translate their needs into requirements. The requirements were used to help suppliers develop solution and bid documents, which clients were then taught to evaluate. The brokers where in general often in charge of managing the procurement processes. Managing procurement processes requires that the consultants be able to organize, coordinate, and understand both the client and the suppliers participating in the procurement. Accomplishing all these things requires that the brokers be flexible and able to ensure that there is a working communication between the involved stakeholders. North Consulting handled both private and public procurements, but the research mainly focused on public procurements since these types of procurements follow a framework agreement, namely, the Swedish Public Procurement Act (SPPA). The framework agreement is an agreement between one or more contracting authorities and one or several suppliers, the purpose of which is to establish the terms for later contracts during a given period. SPPA includes descriptions on how to manage public procurement processes, which is not specified in private procurements to the same extent (Konkurrensverket, 2011; Kammarkollegiet, 2011). In public procurement, the procurement process has to follow the SPPA (2007:1091 – LOU), which is largely based on the EU Directive 2004/18/EC concerning public procurement. This directive makes public procurements processes an appropriate research context in which to investigate how brokers elicit and translate requirements.

The different interviews will be presented in detail in section 3.3 (data collection and analysis). The people interviewed about public procurement processes are all consultants who have experience in dealing with clients and suppliers when identifying the solution that must be developed for the clients.

3.2 Research Approach

Figure 4 The investigation process in the research approach

A qualitative research approach was adequate to use in the research since the encountered research opportunity existed within the social world of brokers’ knowledge of RE and between procurement processes, making the research opportunities become both complex and multidimensional. Using a qualitative research approach at this specific research site was compatible since the approach helped understand the context, diversity, nuance, and existing processes important for the broker’s work (Mason, 2002). The qualitative research approach also helped represent a broader view of the various challenges associated with what brokers face as third-party experts. In the broker’s role there are challenges in the processes of
identifying, assembling, and maintaining the needs of the client and translating them into requirements in procurement processes.

Investigating the brokers role was accomplished by examining how North Consulting’s brokers offered broker services in procurements and how the brokers used the procurement processes as a medium for North Consulting business processes, which then became the collected data (Figure 4). In addition, there were three reasons why I chose to conduct a case study (Bebensat et al., 1987; Meredith, 1998): (1) the phenomena of North Consulting were studied in a natural setting and meaningful environment, making the relevant theory, selected after creating an understanding through investigating the actual practice of the brokers, particularly suitable. (2) The case method allowed me to question why and how the broker was involved in the procurement process. The information provided from these questions allowed me to gain a better understanding of the nature and complexity of the complete phenomenon of RE. (3) The use of the case method helped me early in the process to explore the unknown variables and if the research phenomenon was even possible to be understood.

To interpret the broker’s role, the selected qualitative research approach showed the existence of different meaningful elements that were complex, multilayered, and embedded in the broker’s social world. The research, therefore, used a bottom-up approach to create a rough draft for the research design and data collection in regard to the issues of sampling and the methods of data collection (e.g., questionnaires, observation, documentation analysis). The design of questions led to the secondary area: What evidence do I need to collect? (De Vaus, 2001). Following this evidence throughout the data collection process, I was able to triangulate the different elements relevant to the research by using different data sources to navigate (Mason, 2002), making the research approach become strategically influenced, which was both flexible and contextually adequate to the research site’s processes (North Consulting’s business and procurement processes) and the phenomenon of RE (requirements analysis and translation).

Having a strategic approach that was both flexible and a contextual research strategy made me more aware of the decisions in the research and made the research approach sensitive and adaptable to the changing context and situations of the research site. This flexibility made the different elements located in the research process become more visible and eliminated the risk that the research would focus on only one specific element at a time (Mason, 2002). Having a visible and holistic research approach helped me examine a specific element’s relationship to the other elements during the investigation. Additionally, the strategic approach made it convenient to organize the different sections and parts in the research. The output of using a strategically adaptive approach ensured that the research strategy and design continued to develop during the progression of research findings, which helped me to triangulate the right research design to use when examining North Consulting and the aspects of requirements analysis and elicitation in procurement processes from brokers’ viewpoints as third-party experts.

Making the case study adequate for examining the time-dependent data of social processes, I found the complex narratives’ practice appropriate to use in organizational, managerial processes that the brokers faced daily in the knowledge boundaries of procurements (Yin, 1989; Manson, 2002). The case study method approach is also supported by Feagin, Orum, & Sjoberg (1991), who argue that case studies are methods used to make significant interpretations of real events or entities When they can be hard to define, case
studies can become an important unit of analysis in case research. Case studies make it possible to use different cases from the same firm to study different issues, or research the same issue in a variety of contexts in the same firm (Voss, Tsikriktsis, & Frohlich, 2002). But, because of the different uses of case studies, it is important that case studies not be viewed as a complete methodology for understanding the preliminary stages of theory development or that the tactical or explicit data collected be used as a design feature without having an imposing research strategy that can provide an observational richness. The cases must, therefore, be able to represent the manner of refutation or the extensions of the existing concepts investigated (Stoecker, 1991; McCutcheon, Handfield, McLachlin, & Samson, 2002). The examined case study in this research should, therefore, be viewed as a generalization that represents the intersection of theory, structure, and events related to the phenomena of the research site (Gubrium, 1988).

The application of the single case study method was used because it is a research approach that allows theoretical concepts to be combined with how the "real" world is viewed from multiple perspectives (Weber, 1947; Thompson, 1967; McCurcheon et al., 2002). The result was a generalized image of how the brokers viewed themselves as third-party experts. What resulted showed me that the case study method becomes appropriate for managing the analytical handling of the collected data, enabling me to make comparisons between different types of data and build explanations in distinctive ways (Manson, 2002). The data and the explanations were then used to organize the data around different themes, issues, and topics that would not have been possible if I had cross-sectionally examined the existing data. Because the sample was too small to be used to make a big generalization in the field of IS an adequate research approach for providing a generalization of the single case study of North Consulting.

### 3.3 Data Collection & Analysis

<table>
<thead>
<tr>
<th>Position in company group</th>
<th>Office</th>
<th>Type of interview</th>
<th>Number of participants</th>
<th>Length of interview (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultant manager (1)</td>
<td>A</td>
<td>Informal meeting</td>
<td>1</td>
<td>27</td>
</tr>
<tr>
<td>Consultant manager (1)</td>
<td>A</td>
<td>Face-to-face</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td>Senior Consultant (1)</td>
<td>A</td>
<td>Face-to-face</td>
<td>1</td>
<td>65</td>
</tr>
<tr>
<td>Business consultant (1)</td>
<td>B</td>
<td>Face-to-face</td>
<td>2</td>
<td>67</td>
</tr>
<tr>
<td>Business consultant (2)</td>
<td>B</td>
<td>Telephone interview</td>
<td>1</td>
<td>44</td>
</tr>
<tr>
<td>Consultant Manager (2)</td>
<td>B</td>
<td>Telephone interview</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>Senior Consultant (2)</td>
<td>C</td>
<td>Telephone interview</td>
<td>1</td>
<td>23</td>
</tr>
<tr>
<td>Senior Consultant (1)</td>
<td>A</td>
<td>Face-to-face</td>
<td>1</td>
<td>33</td>
</tr>
</tbody>
</table>

Table 1 Role of interviewees in the firm, what office they belonged to, the type of interview conducted, the number of participants in each interview, and the time span of each interview.

The data collection and analysis part of this thesis explains how the collection of data was accomplished, given that the research used a single case study approach. The data collection activity in this case study used semistructured interviews to discuss the research topic of the
brokers’ roles as third-party experts of requirements elicitation and translation in procurement processes. The respondents were all consultants that had experience as brokers. The interviews of the consultants were related to the different relationships between stakeholders, requirements elicitation and analysis, and management of knowledge in procurement processes (table 1).

Within these interviews the respondents were asked about what it meant to be a broker, how the other stakeholders’ relationships co-existed, and how RE was connected to procurement processes (see Appendix A, for interview guide). The answers from the brokers helped me gain a deeper insight into how the brokers viewed the relationships and the requirements elicitation and translation in the procurement process. The data collection activities in the case study were centered around one type of data, namely semistructured interviews that discussed North Consulting’s business processes on public procurement processes of developed solutions.

However, numerous and different data sources were used in the study to supplement the semistructured interviews to help triangulate the respondent’s answers. The other types of data sources were internal documents and on-site visits, e-mails, phone calls, and informal meeting sessions. The internal documents used as reference material were actual old requirements specification documents, requests of proposals, technical requirements documents, etc. During the research there were also a couple of on-site visits at offices A and B. E-mails, phone calls, and informal meeting sessions were used as different channels of communication for contacting the stakeholders related to North Consulting’s business processes of procurements. The person who was the most frequently contacted was the senior consultant (1) at office A, who was the appointed contact person at North Consulting. The time span of the semistructured interviews was between twenty-three and sixty-seven minutes. Every interview was recorded and transcribed, except for the discussions in the two first informal meetings. The participants in these informal meetings discussed information about North Consulting as a firm and what resources could be provided by North Consulting. The other interviews were either conducted face-to-face or as telephone interviews.

To analyze the collected data from North Consulting, a thematic analysis process was used (Braun & Clarke, 2006). The thematic analysis was influenced by an inductive approach, closely related to the theoretical foundations of both RE and managing knowledge boundaries. The theoretical freedom of the thematic analysis, yielded a flexible and useful research tool that provided a rich and detailed, yet complex, account of the data collected (Joffe & Yardley, 2004; Braun & Clarke, 2006). The first step was to become familiar with the data by transcribing, reading, and re-reading the collected data and thereby creating an overview of the data. Thereafter, the search for patterns of meaning, issues, and other potentially interesting aspects relevant to the research was initiated. The second step was the coding of the data into six different categories: (1) the role of the brokers, (2) brokers, clients, and suppliers relationships, (3) methods used by brokers, (4) tools used by brokers, (5) documents used by brokers, and (6) challenges of brokers. The coded data was sorted after the three phases of the procurement: prestudy, formalization, and conformation. In the third step, the procurement phases were used as potential themes to help summarize the stakeholders’ expressed opinions as quotes. The fourth step was creating a thematic analytical map of the stakeholders’ knowledge boundaries and investigating if each selected quote could, then, be double-confirmed at the end of the analysis. In the fifth step, I conducted an ongoing analysis that helped me refine the details of each theme, which
provided an overview of the procurement process by generating clear definitions and names for each of the four themes. In the final phase, I produced the result section, which allowed a final opportunity for analysis. Summing up, I conducted the thematic analysis as a structured search across the collected data until some reappearing patterns of meaning were found (Braun & Clarke, 2006).

4 Results

The following section provides a detailed account of North Consulting’s brokering in public organizations’ procurement processes. First, I describe the overall process (4.1) and its phases in detail before I examine the three brokering phases constituted by activities. After that come the three phases (4.2-4.4), in which I describe the documents produced, challenges, and methods for addressing the themes.

4.1 North Consulting’s Procurements Processes

The first part of the results section applies the terms of transfer, translation, and transformation from the theoretical framework of Carlile (2004) into North Consulting's business processes that surround a procurement process. In the procurement process there exist four lines: process, nonresponsive, output, and iterative lines (Figure 5). The process line describes the actual process of the procurement that has to be followed by the involved stakeholders. Then comes the nonresponsive line that attributes activities that are not addressable for the broker involved in a procurement process. The broker has no authority to influence the activities in the nonresponsive line as he does other activities in the procurement processes since it requires a request from the nonselected suppliers. After the nonresponsive line comes the output, which shows the produced material, templates, and documents related to the procurement process. The last line is the iterative line that indicates the need for several iterations to complete some of the activities in a procurement process. The procurement process builds on three different phases: prestudy, formalization, and conformation. In these three phases, there are eleven activities that are needed to complete a whole procurement process (View Appendix B for a summarized schematic table of the activities in a procurement process).

![Figure 5 North Consulting’s procurement process for brokers](image-url)
The first phase (1-3) is the pre-study phase that identifies the client’s needs and converts them into requirements that can be used in documents to describe what needs has to be solved. (1) The first activity investigates the client’s needs and involves the client and broker in a process in which the broker has to understand the client’s needs. The broker investigates the client’s knowledge about their organization operation’s needs by using process mapping methods, cost-benefit analysis methods, and workshops to generate knowledge about the client’s needs that is transferred to the broker. The knowledge is then translated into a feasibility report (A). (2) The broker and the client use the feasibility report to identify the different types of requirements needed for developing a system solution for the client’s problem. When the translation is done, the broker has to elicit the client’s needs into requirements. The requirements are evaluated by both the client and the broker to ensure that the requirements have been adequately specified and validated. The broker then implements the requirements in a requirements traceability matrix for structuring and prioritizing the requirements after the degree of importance. The requirements traceability matrix is included with different reports, system models, and other documents necessary for becoming a requirements document (B) that describes the problem that has to be solved. (3) The requirements document is included in a tender document (C), which contains information on how the client and broker will evaluate the supplier’s solution and bid documents, how to approve the delivery of the solution, how to approve the quality of the solution, and other additional documents for the suppliers to use when creating a proposed solution for the client’s problem. The transformed knowledge in the tender document becomes a refinement of knowledge that is a valuable resource for managing both the stakeholders and the novelty in the procurement process. These three activities of the procurement process are iterated until the client and broker are satisfied with the tender document. When the tender document is completed, the pre-study phase ends.

The first phase is then followed by the formalization phase (4-7), in which the suppliers develop their solution and get it evaluated by the broker and client. (4) The publication of the tender document is completed for the participating suppliers to review in order to reach an understanding about the client’s requirements. The publication of the tender document can be done on websites, procurement platforms, or with other types of publication tools. The publication of the tender document is the transferral of the broker’s and the client’s domain-specific knowledge about the requirements and procurement processes to the suppliers to use and follow when developing solutions and bid documents. (5) After the publication of the tender document, the suppliers start translating the tender document into a solution and bid document for the client’s problem. During the translation, the supplier is allowed to ask questions about the client’s requirements from the broker. The broker has to publish all questions received from the suppliers and answers given to the questions for other participating suppliers to inspect. The publication of answers is performed to not favor any specific supplier. When the supplier has finished with the development of the solution and bid documents, the supplier has transformed the translation of the problem into a solution and bid document. The supplier’s solution and bid documents (D) are then sent to the broker and client for evaluation. (6) When all participating suppliers’ solutions and bid documents have been received by the broker, the received solution and bid documents are the transferral of the suppliers’ domain-specific knowledge to the broker and client. A time protocol is written by the broker to show the time of arrival for the solution and bid documents. The time protocol ensures that the content of the solution or bid documents has not been changed
after being received. The information about the solution and bid documents from the suppliers are, after the arrival, treated as confidential by the broker. (7) The broker then starts translating the suppliers’ solution and bid documents, by asking specific questions about how each supplier has understood the requirements included in the tender document. In some cases, the suppliers are able to hold presentations for the brokers about their solution and bid. The broker and client then use the suppliers’ answers and submitted solution and bid documents together with the earlier developed evaluation template to evaluate each participating supplier’s solution by creating evaluation documents (F). During the evaluation, the translation is iterated until a supplier solution has been chosen. When a supplier has been selected, the formalization phase ends.

The conformation phase (8-11) of the procurement process begins with the presentation of the selected supplier who will be commissioned by the client. (8) When presenting the allotment decision of the selected supplier, the broker has to notify the other suppliers participating in the procurement by informing the other suppliers of how and why the chosen supplier was selected. Afterwards, the allotment decision is made public for the other participating suppliers not selected. The unselected suppliers have a ten- to fifteen-day agreement latch to oppose the broker’s and the client’s decision. (9) If there is any objection, the Administrative and Appeal will decide if the selected solution and bid are valid or not by translating the evaluation of the client and broker through the lens of the SPPA (Kammarkollegiet, 2011; Konkurrensverket, 2011). (10) But, if there are no objections when the agreement latch is over, a contract can be signed between the client and the selected supplier, transforming the supplier’s selected solution and bid into a contract. (11) The last phase of the procurement process is then officially ended, and the broker’s role is over. But if the client requests additional services from North Consulting, the broker can serve as a project leader that ensures that the selected supplier delivers the solution following the level of quality, delivery method, etc., that is specified in the tender document during the implementation.

4.2 Pre-study Phase

The pre-study phase involves examining the needs of the client and transforming the needs into a requirements document that is included with other documents to create the tender document. The different documents produced in activities (1-3) are first the feasibility report, then the requirements document, followed by the tender document and different document templates (e.g., evaluation, delivery, etc.). The challenge in these three activities is to create a tender document that is able to explain the client’s needs in an adequate way.

The senior consultant (2) describes that the most common situation faced when dealing with a client’s requested needs is how to support the client during the procurement process.

The most common situation is actually: We want to procure a financial system, how shall we do it? The client usually procures a new financial system every 10th year, so the client does not have any routines or the parts of the procurement visualized for them. However, I often know these larger parts to ask for when stating the requirements and what problems there usually are when stating the requirements.

The senior consultant’s (2) experience of dealing with clients is that clients usually have a specific formulated request of a solution (e.g., a financial system) to procure. The client usually knows what the requested solution has to solve but lacks the knowledge of how to
actually procure the solution. The lack of knowledge is the result of the client usually not having the routines for procuring a solution and that there usually is a large time span between each procurement. This deficiency makes the clients often unaware of how to proceed with the actual procurement since the client sees the procurement from a user perspective. Having a user perspective then makes it hard to follow the intangible, yet fixed process of a procurement and to know what to include in the tender document. The development of the tender document requires the broker to have the knowledge about procurements when both transferring and translating the client’s domain-specific knowledge about needs into different types of requirements. These types of requirements are used by the broker when eliciting and translating the requirements into an requirements document that will be included in the tender document to explain what type of solution is needed.

The business consultant (2) describes a specific phenomenon that recurs in these situations. The client often thinks they had already established every requirement needed before involving the broker. Sometimes when you arrive at a client, there is a common phenomenon that recurs: We have already made the requirements, the client will say when they have been sitting in some project group. This partly relates to getting the requirements done in the correct way. Then, when you see and ask the clients if they really have thought through these requirements well? And, get the response: Well we have really thought about the requirements a lot. Then, you have to start working there, and it always involves back tracking the process and looking closer at the client’s stated requirements.

The business consultant (2) experienced the same when starting to work with a client. The client often says that they have already elicited and translated the requirements in their internal project group. But, when the client states the requirements, they are usually formulated as business requirements that only explain what is needed to be produced in the end of the process and what values the procured solution should provide. The broker, however, has to translate the client’s requirements into several different types of requirements (e.g., user requirements, system requirements, etc.) and explain them using different approaches (functional and nonfunctional). The process of translation often reveals the various gaps that the client has missed when stating the requirements, making the broker have to go back and iterate the process until every necessary type of requirement has been explained when creating a tender document that provides an adequate explanation of the client’s request.

The senior consultant (1) describes the responsibility in the procurement and how to identify and decide whether a procurement is even necessary to perform. I am responsible for every phase of the procurement process. The first phase involves the different methods for analysis. In this phase, we work with different types of methods of analysis: process mapping, cost-benefit analysis, workshops, etc., to use to identify if it is profitable to procure a new solution for the client.

The senior consultant (1) is often the one responsible for the phases and activities in the procurement process. The consultant explained that in the prestudy phase, the brokers often use different methods to analyse the client’s needs. Some of the different methods of analysis the brokers use are: process mapping, cost-benefit analysis, workshops and similar methods.
The use of these methods helps determine whether a procurement is worth the effort needed to execute a public procurement process.

The senior consultant (1) also points out that the tender document is more than a document describing the requirements.

*The tender document is more than just the requirements; it also includes how to respond and, e.g., how the client intends to pay when the provider has been commissioned, how the client is going to test it, how the client intends to approve the delivery, and all those things are included in the tender document.*

The senior consultant (1) describes the tender document as something more than just a description of the client's requirements. The document also includes additional information about how the evaluation will be done, how the payment for the implementation of the developed solution will be made when a supplier has been chosen, how the client will test the design of the solution, how the client and broker will approve the delivery, and how the supplier’s solution will be integrated. Making the tender document becomes the very backbone of the procurements, and involved stakeholders have to follow.

When stating the client’s different types of need, the business consultant (1) emphasizes that the brokers need to have the ability of quickly creating an overview about the client’s operations to identify the needs.

*I would say that the competence needed is a sense of rapidly gaining an understanding about the client’s operations, needs, and work approaches; that is a good thing. Also, being able to ask the right questions and dig out information. I do not know what kind of skills these are, but the skills to understand and interpret are definitely needed. Since you do not always need to have the knowledge yourself, but if you are able to ask the right questions, the organization usually will have its own reflections.*

The business consultant (1) describes that the required qualification of being a broker of system solutions is to have the ability to identify clients’ needs and their domain-specific operation practices. That skill requires the broker to be able to ask the client the right questions in helping to identify what information is necessary to include in the client's tender documents. The broker should, therefore, possess the abilities of appreciation and interpretation. These characteristics are needed since the clients usually are themselves the ones who possess the knowledge about their organizations and operations. Such knowledge is something that the broker does not possess. Therefore, the broker needs to have a working communication with the client to ask questions about the organization that help the client identify what needs exist in their operations and how the broker should help the client in the procurement.

In addition the senior consultant (1) explains that the knowledge from earlier procurements helped facilitate the upcoming procurements.

*Since we have done this before we can provide the customer with a list of requirements that have been asked in previously conducted procurements, e.g., requirements for payrolls, document management, etc. The client can then sit with the gross list of requirements and underline the pertinent ones. We can of course sit together and go through the list, too. So in a way it is a unique process for an individual client or feels like that, but for us these are things that are repeated and come back from previous procurements.*
The senior consultant (1) describes that the earlier knowledge from former procurements is helpful when identifying requirements for new client's needs. Having the knowledge from former procurements supports the broker in identifying the client's requirements that need to be included in the requirements document. Depending on the client's preferences, the client can do the requirements document themselves or together with the broker. The senior consultant (1) indicates that clients might experience the procurement process as something uniquely adapted to the client's need, while the broker knows that the prestudy phase builds on earlier knowledge from previous procurements and often becomes a recurrence in every procurement process. But, since the client is the one with the domain-specific knowledge, the client becomes involved in the majority of the procurement processes.

The senior consultant (2) emphasizes the importance of having the client present ideas and thoughts throughout the decision making part of the procurement processes.

*The client should be present in a decision. The more involved the client is in the decision, the better the project usually gets as a consequence then. But, it happens that we get procurements where we have to twist and turn most of the pieces in our hands into a decision or a basic recommendation ourselves.*

Analyzing the senior consultant's (2) opinions of involving the client in the procurement process shows a desire to always engage the client as much as possible when making decisions in procurement processes. According to the senior consultant's view, it is good to try to involve the client as much as possible since it often helps facilitate the process of the procurement. But, in contrast to that scenario, the senior consultant (2) had experienced other procurements where the client’s attendance was low, often resulting in much more work for the broker in which the broker had to both single-handedly create decisions based on collected knowledge and translate that knowledge into adequate formulations (e.g. needs, requirements, evaluation templates, delivery models, etc.). Sometimes the decisions were not well-founded. Finally, the broker’s formulations can then either generate decisions or recommendations for how to specify and evaluate the solution requested by the client from the suppliers.

The development of the tender document marks the end of the pre-study phase.

### 4.3 Formalization Phase

The formalization phase involves the publication of the tender document to the suppliers, dealing with the suppliers’ questions about the requirements, the receipt of the suppliers’ solutions and bid documents, and finally the evaluation of the suppliers’ solutions and bid documents. The different documents produced in activities (4-7) are the suppliers’ solutions and bid documents followed by the development of the broker and client's evaluation documents. The challenge in these four activities is to make an objective evaluation based on the earlier produced tender document.

The consultant manager (2) explained that after the tender document has been published, the suppliers will then be given a time for asking questions of the broker about the tender document.

*After you have published the tender document, there comes a period where you have to wait for the solution and bid documents. The suppliers are during this time allowed to freely ask questions between a certain number of days before their solution and bid document is submitted. Or allow that the supplier has two or three times to submit their questions. But, there will always be some
rounds of answering questions during this time, before you get the solution and bid documents. Then, when you get the documents, there is the solution and bid documents opening and an evaluation of the requirements and so on.

The consultant manager (2) describes the time that comes after the publication of the tender document as a time of waiting for the suppliers to develop their solution and bid documents. During the development of the solution and bid documents the suppliers are allowed to ask the broker detailed questions about the tender document a few days before the suppliers must thereafter provide their solution and bid documents. Another approach is to give the supplier a specific number of rounds to submit their questions, either way the broker receives questions from the supplier to answer before receiving the actual solution and bid documents. After the receipt of the solution and bid documents from the suppliers, the broker starts the evaluation of how the suppliers have interpreted and solved the client's requirements.

The business consultant (1) provides an explanation of how the suppliers solution and bid documents are evaluated.

Then comes a phase of evaluation, where you and the client score all supplier solutions and bids. Here, the suppliers are asked questions so they can clarify their solutions and bids. Examples of questions are: What do you mean, how have you thought here and so on. There could also be presentations where the suppliers may come to present their bid and solutions possibly, and can be connected to an evaluation on the usability and so on.

The business consultant (1) explains that after the receipt of solution and bid documents from the suppliers, there is the activity of evaluation. In the evaluation activity the broker and client ask questions about the solution and bid documents from the suppliers. The answers from the suppliers are then used to help elucidate how suppliers interpreted the tender document. The questions asked are usually formulated as what and how questions. In addition to the questions, the suppliers are in some cases given the opportunity to hold presentations for the broker and client to explain their solutions and bid. These presentations are often linked to an evaluation of the usability of the solution, etc.

The consultant manager (2) emphasizes the importance of having an evaluation template to follow when evaluating the supplier solution and bid documents.

What defines a good or bad answer is nothing that you can twist and turn as you receive the solutions and bids after or before an evaluation. That which you shall of course know beforehand is things like: how you should evaluate them, how to develop the evaluation templates, and how the requirements will be solved. These are some of the things that must be clear before you send out the tender document when it comes to public procurements.

The consultant manager (2) states that the evaluation of the suppliers' solution and bid documents usually follows the evaluation template that has been developed in the previous prestudy phase. In public procurements, the evaluation of solution and bid documents is not something that can be changed after receiving them. The evaluation templates should be included in the tender document that has been developed before the receipt of the suppliers' bid and solution documents. Making the evaluation of the suppliers becomes very fixed since the evaluation factors of how to determine the solution and bid documents have been published before receiving the solution and bid documents in public procurements.
The senior consultant (1) explains that the evaluation activity of scoring helps show how and why the chosen supplier was selected.

When you're done with the evaluation of each supplier then you will make an evaluation template that demonstrates how each point was distributed to the supplier. The one supplier who gets the most points after the evaluation template is then selected for the contract signing. Then, there is an announcement to all participating suppliers about which supplier has been commissioned.

The description provided by the senior consultant (1) explains that the evaluation documents of the suppliers are executed by the broker and the client. The evaluation of each supplier's solution and bid documents are compared and scored by the broker and client. The supplier who gets the highest score is then selected for the commission. After a supplier has been chosen, there is an announcement for all the other suppliers participating in the procurement in which they are informed about the evaluation process and the allotment decision.

The completion of the evaluation activity is the end of the formalization phase.

### 4.4 Conformation Phase

The conformation phase involves the allotment decision, the potential appellate period, the signing of a contract and the beginning of the implementation of the supplier's developed solution in the client's organization. The document produced in the conformation phase's activities (8-11) is the signed contract between the client and the supplier. The potential challenge in these three activities is that the broker must ensure that the client both gets the services requested and that the developed solution is delivered on time.

The senior consultant (1) describes what will happen if there is an appeal from any of the nonselected suppliers in the procurement.

Once you have told the supplier that has been the selected contractor, then you have the ten days for objecting to the decision, which is called the agreement latch. When these ten days have passed, the signing of a contract will begin between the client and supplier, if none of the other suppliers has objected the decision. If there is an objection about the selected supplier, there will be a time period when the appellate administrative and appeal examines whether the decision is legitimate or not and what has been done right and wrong. One can say that when the agreement latch is over and no one has asked for a review, the contract can be signed and the procurement ends.

The description provided by the senior consultant (1) discloses that when the allotment decision has been made official for all participating suppliers, there is a ten day period for the other suppliers to object to the broker and client's decision that is called the agreement latch. If there is no objection from the nonselected suppliers within these ten days, the contract between the client and supplier can be signed. However, if there is an objection about the selected supplier, then there will be an appellate period. During the appellate period the appellate administrative and appeal investigates if the decision of the broker and client is valid or not. The senior consultant (1) states that when the agreement latch is over and the contract is signed between the client and supplier, the actual procurement process is finished.
The senior consultant (1) explains that when procurement processes have been completed, the implementation phase shortly begins.

Well then when the actual procurement process is complete, then it's a matter of a week or two until the delivery begins. And, then comes the next phase, to receive the supplier's solution, but then it might be a new organization that handles that.

The senior consultant (1) explains that when the procurement ends, the implementation phase is initiated to integrate the supplier's solution into the client's organization. Yet, perhaps this change will result in the client or another organization taking over the responsibility of monitoring the implementation phase, if the client has not requested for additional services from the broker related to the integration.

The business consultant (1) explains what these additional services might possibly be.

Then we have additional services afterwards for the introduction or implementation that we do as project managers or provide services that help ensure that the solution's quality is tested, that it is delivered on time and is done in the right way. There also are many other services that can be provided.

The business consultant (1) explains that the additional services that North Consulting can provide might be associated with managing the implementation or other services that help ensure that the supplier's solution follows the contract's regulations. These regulations can be about the quality of the solution, how to test the solution, how the delivery is made, and other types of services related to the implementation of the solution.

The conformation phase then usually ends either after the contract is signed or when the responsibility of the integration is transferred to another stakeholder (View Appendix C for an overview tablet of the challenges in different phases of the procurement process and the used methods, tools, and documents).

5 Discussion

The aim of this research was to investigate how brokers facilitate the elicitation and translation of requirements in procurement processes. This research used a single case study approach to investigate the research site, North Consulting, by interviewing different stakeholders working as system solution brokers. Investigating the different phases of procurement processes and the knowledge boundaries in these three different phases has shown what challenges there are for a broker (5.1), what kind of competence is required by the broker (5.2), and what methods, tools, and documents aid the broker (5.3).

5.1 Challenges in Procurement Brokering

The first contribution of this thesis is the identification of the brokers' challenges in brokering the procurement processes. These revolve around various project aspects (e.g., scope, time, cost, quality, etc.) related to the RE processes (Keil, 1995; Boehm & In, 1996; Jones, 1996; Mann & Rai, 2000; Schwalbe, 2011). Making the most of the major challenges and also knowing the common sources of problems in the RE process and procurement process relate to the development of the tender document.

The tender document is the hub of the procurement process that controls the transferal, translation, and transformation of information about the client’s needs while at the same
time acts as the supplier's foundation to use when developing the solution and bid documents (Carlile, 2004). The content of a tender document should, therefore, always be specifically tailored to the client's needs; accordingly, the content of the tender document in different procurements is never the same. Developing the tender document is often viewed as the most time-consuming and important part of the procurements from the broker's perspectives. The tender document always contains the requirements documents that are translated from the client's needs together with additional documents (e.g. organization description, evaluation template, delivery template, etc.) (Sommerville, 2011), making the tender document play a huge part for the stakeholders in the procurement process. There are various possibilities for how the broker should create the tender document.

Crossing the knowledge boundaries of the client is a time-consuming challenge for the brokers dealing with the elicitation and translation of the client's needs (Carlile, 2004). The brokers must continuously gather data, information, and knowledge related to the client's organization operations until the tender document is approved by both the client and the brokers themselves. The brokers must continuously search for knowledge until the tender document has been produced. But the document comes with the dilemma of how brokers should balance their resources. It is often solved when the brokers know what the client's priorities are in a solution and how much the client is willing to offer the supplier. Therefore, the brokers need to know how they should balance their resources in order to develop the tender document that is the most beneficial for the client (Carlile, 2002; Carlile & Lucas, 2003; Carlile & Rebentisch, 2003; Carlile, 2004). But, knowing the priorities of the client can sometimes be a paradoxical problem for the brokers to solve since the client may think that they need a product, while they do not have a need for it.

In some of the procurements, the brokers are able to recycle knowledge from earlier procurements. Using the earlier knowledge, the brokers are able to solve the different challenges that arise and that relate to the development of the tender documents (Burt, 1992; Hargadon & Sutton, 1997; Pawlowski & Robey, 2004; Carlile, 2004). This recycling of information requires that the broker store and update existing knowledge, which shows the importance of documenting what is happening in the different procurement phases and upcoming implementation phases (Berg, 2001; Avison & Fitzgerald, 2006). The research identifies two challenges brokers face in procurement processes: (1) when brokers develop the tender document to match the client's needs and (2) the need for brokers to balance knowledge in a suitable way against the client's requests and potential implementation phases.

5.2 Competence for Brokering in Procurements

The second contribution of this study is to help identify the role of the broker in system solution development by discussing what competence is required of the brokers. This research has identified that it is necessary to have a working communication between the different stakeholders that are participating in procurements.

The brokers are usually in charge of coordinating the whole chain of events in procurement processes, which puts major parts of the responsibility on the brokers' shoulders (Hargadon & Sutton, 1997; Pawlowski & Robey). The brokers' responsibilities are to organize and structure the activities related to procurements, making it necessary for the brokers to possess a holistic overview of the procurement process activities and collaborations between the client and suppliers. The collaboration involves the transferral of
different needs as information, the translation of requirements for having correct information when evaluating the suppliers’ developed solutions and bid documents, and transforming information into documents (Carlile, 2004; Sommerville, 2011). Having all these factors to take into consideration makes it hard for the brokers to ensure that the requirements are correctly formulated and to avoid confusion when introduced to all the stakeholders with their different domain-specific knowledge (Carlile, 2002; Carlile & Lucas, 2003; Carlile & Rebentisch, 2003). This situation is especially challenging when the stakeholders involved in the procurement do not possess the same type of knowledge about system solutions, which creates different knowledge boundaries, making it hard for the brokers to elicit and translate the requirements. There are a variety of ways and approaches for brokers to use when defining what is required by the needed system solution (Sommerville, 2011). The different ways of defining the requirements then creates a blurred image of what really defines a good requirement and how the requirements should be elicited and translated within the procurement processes. For the brokers to perform a successful elicitation and translation of the requirements, they are required to have the abilities to understand the client’s needs and translate them into requirements--requirements for the suppliers to use when they are developing their solution and bid documents that will be evaluated by the broker and client. This period creates small windows of opportunity for the brokers to both elicit and translate the requirements for the other involved stakeholders (Tyre & Orlikowski, 1994). It is in these three phases that the brokers carry out the management of knowledge. The brokers have to pay extra attention to make the procurement phases become successful.

The brokers are responsible for coordinating the intangible procurement process, which requires them to possess various types of competence. Some of these competencies are the abilities of understanding the client’s needs, translating needs into requirements, transforming requirements into solutions, and evaluating the suppliers’ solutions. As a result, the broker needs to possess both tacit and especially explicit knowledge about procurement processes (Schön, 1983; Carlile, 2002; Pawlowski & Robey, 2006). To complete their tasks, the brokers not only depend on documented knowledge but rely heavily on the articulated knowledge from previous procurement processes they have experienced.

Three abilities that brokers need to possess stand out in the analysis of required competencies: (1) to have a holistic overview of the procurement process, (2) to understand the client’s needs and translate them into requirements, and (3) to manage the knowledge change in the different procurement phases among the stakeholders.

5.3 Methods and Tools for Brokering

The third and final contribution of this study is in the identification of the methods, tools, and documents the brokers use in the three different phases to coordinate the activities in the procurement processes together with the client and suppliers.

In the analysis sections, different methods, tools, and documents are described. Depending on what the client needs in terms of knowledge and context, the brokers choose their methods, tools, and documents (Goguen, 1992; Coughlan & Macredie, 2002; Davis, Dieste, Hickey, Juristo, & Moreno, 2006). The chosen methods, tools, and documents are also selected according to the brokers’ personal knowledge and experiences. Important methods applied to gather and translate the client’s needs into requirements in the prestudy phase are: process mapping methods, cost-benefit analysis methods, and workshops. The
process mapping method is used to investigate the client’s operations in their organization. To decide if a procurement is profitable for the client, the brokers use the cost-benefit analysis for identifying whether the procured solution will be beneficial for the client in the long run (Wiegers, 2000; Goldsmith, 2004). The workshops are where the brokers and client interact and discuss reflectively with each other what is needed and then narrow down the list of needs of potential functions provided by the solution. The use of these methods help the brokers hone in on the client’s needs and create a unified understanding of what is needed in the system solution.

The tools used by the brokers are often: official procurement platforms, publication tools and, other communication channels. The official procurement platforms are the digital meeting places where the stakeholders exchange information during the procurements process with the other stakeholders. The procurement platform is either managed by the client or the broker. If there is no procurement platform, the brokers usually use some other kind of publication tool to manage the information flow of the procurement. These publication tools can be anything from a website to a written procurement notice in a paper, etc. The other communication channels in a procurement process can be e-mail, on-site visits, presentations, and various other ways of gathering information about the procurement.

Finally, the documents involved in the procurement are: the feasibility report, the requirements document, the tender document, the delivery template, the evaluation template, the suppliers’ solutions and bid documents, the broker’s evaluation documents, and finally the contract between the client and supplier. In comparison to the methods and tools, the documents are different in procurement processes since they are often modified or they evolve continuously in the process through the efforts of the brokers. The documents are the embodied form of knowledge throughout the procurement process. The documents are used for transfer, translation, and transformation of the different stakeholders’ knowledge, making them very adaptive to the procurement process character (Burt, 1992; Hargadon & Sutton, 1997; Carlile, 2002; Pawlowski & Robey, 2004). The adaptive nature of the documents provide variety in how the brokers use these documents.

In the end, the methods, tools, or documents used only provide a frame in which the brokers can apply their knowledge and experience. The adaptive nature of the procurement process makes the broker’s ability and judgment key elements in deciding how to work and what utilities to use. The research in this section identify what methods, tools, and documents are used by brokers and how they are applied for transferring, translating, and transforming knowledge in the three phases of procurements.

### 6 Conclusion

The aim of this research was to investigate what kinds of transferal, translation, and transformation of knowledge. Abilities, associated with requirements elicitation and translation of requirements within procurement processes, are needed. This research has three main contributions: (1) two different challenges relating to the brokers’ work, (2) three different competencies required of brokers in their work, (3) and, finally, three different areas of identification, namely, methods, tools, and documents and their roles in the brokering process. The elicitation and translation of RE processes requires that brokers be adept at organizing and structuring the procurement processes. This quality satisfies the
client’s needs both in the present and future system solutions. Furthermore, brokers use both tacit and explicit knowledge. Thus, the contributions of this research will help investigate the procurement process from the broker’s view, the challenges for the brokers, and the methods and tools that the broker uses to manage the procurement. It also explores the broker competencies required. These findings help provide a generalized understanding about how brokers of North Consulting facilitate elicitation and translation in the RE processes.
References


**Electronically sources of reference**


Interview Guide
The focus of this study is to investigate how developed IT solutions are created and how the requirement specification affects the procurement process. The outline in this guide is to investigate how brokers look at the procurement process within North Consulting, as well as to map the procurement process.

Rights of the person being interviewed
The respondent has the choice to stop the interview whenever he/she wants, and there will be no question about the reason for why the interview is stopped.

Anonymity
Information about each respondent will be coded so that the reader will not know who the respondent is. The information that will be mentioned in the research will be the interviewee's role within the organization and the length of the interview. No person other than me (Martin Jönsson) will be able to access or use the recorded material and notes that have been written during the conversations between the respondents and the interviewer. The material will be stored where no one else will have access to it. The purpose of recording the conversations is to transcribe the text and then systematically go through what has been said in the conversations between the respondents and me.

Interview Questions

1. Can you briefly describe what type of organization North Consulting is?

2. What is your role within North Consulting?

3. What kind of competencies are required in your role within the North Consulting?

4. What types of procurements does North Consulting handle?

5. What are the major activities of a public procurement process?

6. How does a public procurement process work within North Consulting? What are the components in a process?

7. What stakeholders are involved in a procurement process?

8. What is your area of responsibility in a procurement process?
9. What techniques, tools, etc., do you use to support your work in your area of responsibility?

10. What areas of responsibilities exist in a procurement process?

11. What are the difficulties in your specific area of responsibility within the procurement process?

12. How involved is the client in the procurement process, i.e., is the client continuously involved in reviewing the requirements in a procurement process or is the client only notified if there is anything that needs to be changed?

13. How specific are the client's requirements and descriptions? Is there much that is specified in advance or does that depend on what type of solution the procurement is about?

14. How much does the actual tender document affect the procurement? What are the challenges of describing the solutions that are based on a limited understanding of the user environment?

15. Do the clients do their own information gathering and requirements analysis, or does your advice only build on the tender documents you create?

16. How do the client's needs affect the tender documents, and to what extent are they the end result of the process? Is it so that a well-defined tender document often can lead to a better developed solution in the procurement?

17. What types of requirements are included in a procurement?

18. How is the existing knowledge of the requirements formalized within North Consulting?

19. How are personal details handled between these phases? Are they something you just have to accept or could they even be made formal?

20. When a tender document needs to be changed, how is this done and who is notified about the changes that are being made?
21. How is the actual knowledge transfer that takes place internally in North Consulting affected by a procurement process? E.g. how are the changes of requirements executed and how are they notified within North Consulting or between different stakeholders in the procurement process? Is it even possible to describe this system/ process?

22. What are the major challenges in requirements engineering in public procurement processes generally and specifically for North Consulting?

23. Are there any positive aspects of requirements engineering in formal procurement processes used by public sector organizations? What works well in North Consulting when using these framework agreements?
### Appendix B: Summerized schematic table of the activities in a procurement process

<table>
<thead>
<tr>
<th>Nr</th>
<th>Procedures of each activity in the procurement process</th>
<th>The different knowledge functions included in each activity</th>
<th>Different relationships between stakeholder in each activities</th>
<th>Documents produced in different the activities</th>
<th>Abbreviation letter for the documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Investigation of client's needs</td>
<td>Transfer, Translation</td>
<td>Client-Broker</td>
<td>Feasibility report</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>Development of the tender document</td>
<td>Transfer, Translation, Transformation</td>
<td>Client-Broker</td>
<td>Requirements Document</td>
<td>B</td>
</tr>
<tr>
<td>3</td>
<td>Evaluation of the tender document</td>
<td>Translation, Transformation</td>
<td>Client-Broker</td>
<td>Tender document and templates for delivery and evaluation of the suppliers’ solution and bid</td>
<td>C</td>
</tr>
<tr>
<td>4</td>
<td>The tender document is made officiell</td>
<td>Transfer</td>
<td>Broker-Suppliers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Supplier’s develop their solution and bid</td>
<td>Translation, Transformation</td>
<td>Suppliers-Broker</td>
<td>Suppliers’ solution and bid documents</td>
<td>D</td>
</tr>
<tr>
<td>6</td>
<td>Suppliers submit their Solution and Bid for Evaluation</td>
<td>Transfer</td>
<td>Suppliers-Broker</td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td>Supplier’s Solutions Become Evaluated by Broker</td>
<td>Translation, Transformation</td>
<td>Client-Broker-Suppliers</td>
<td>Broker’s evaluation document</td>
<td>F</td>
</tr>
<tr>
<td>8</td>
<td>The Allotment decision is presented</td>
<td>Transfer</td>
<td>Client-Broker-Suppliers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9)</td>
<td>Appellate period (only needs to be made if requested by the suppliers)</td>
<td>Translation</td>
<td>Suppliers-Administrative and Appeal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>A contract is signed</td>
<td>Transform</td>
<td>Broker-Client-Suppliers</td>
<td>Contract between selected supplier and client</td>
<td>E</td>
</tr>
<tr>
<td>11</td>
<td>Implementation of supplier’s solution begins at the client’s organization</td>
<td>Transfer, Translation, (Transformation)</td>
<td>Broker-Client-Suppliers</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Appendix Table B: Sequence of each activity, type of procedures, functional knowledge features included in each procedure, what stakeholder/s are involved in each activity, produced documents and the abbreviation of each produced document.
Appendix C: Overview table of used methods, tools, documents and challenges in the procurement process phases

<table>
<thead>
<tr>
<th>Phases</th>
<th>Function</th>
<th>Involved stakeholders</th>
<th>Methods, tools and documents</th>
<th>Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre-study</td>
<td>Client-Broker</td>
<td>Feasibility report</td>
<td>Challenges:</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Requirements document</td>
<td>Developing the tender document</td>
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<td></td>
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<td></td>
<td>Tender document Templates for delivery</td>
<td>Managing the knowledge in the procurement process</td>
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<td></td>
<td></td>
<td></td>
<td>Templates for evaluation</td>
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<td></td>
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<td>Process mapping methods</td>
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<td></td>
<td>Cost-benefit analysis methods</td>
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<td></td>
<td>Workshops</td>
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<tr>
<td>2</td>
<td>Formalization</td>
<td>Client-Broker-Suppliers</td>
<td>Suppliers solution &amp; bid documents</td>
<td>Challenge:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Brokers evaluation documents</td>
<td>Managing the knowledge in the procurement process</td>
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<td></td>
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<td></td>
<td>Official procurement platforms</td>
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<td></td>
<td>Publication tools</td>
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<td></td>
<td></td>
<td></td>
<td>Other communication channels</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Conformation</td>
<td>Supplier-Client-Broker</td>
<td>Contract of selected supplier &amp; client</td>
<td>(Potential challenge):</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Managing the knowledge in implementation process</td>
</tr>
</tbody>
</table>

Appendix Table C: Phases in procurement processes, phase name, used methods, tools and documents, which is followed by the challenges in the different procurement process phases