Practical Insights into Recurring Issues of Requirements Elicitation

The potential of systems analysis in addressing these issues

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Abstract

Requirements elicitation has been identified by researchers as a highly critical and error-prone phase of IT development projects. Many challenges are rooted in the human and social dimension of this phase, which requires intensive communication activities between stakeholders with different backgrounds and perspectives. The conduct of a systems analysis supports stakeholders in reaching a shared understanding about crucial elements. The aim of this paper is to identify and describe recurring issues in requirements elicitation, and to better understand the potential of systems analysis efforts for addressing these issues. While literature provides plenty of high-level categorizations of requirements elicitation issues most often the argumentation is not complemented with concrete, real-world examples. Therefore five interviews with IT practitioners have been conducted in order to back-up a theoretical framework of problem areas elaborated by Saiedian and Dale (2000) with practical insights. This approach enabled a thorough analysis of four major issues in requirements elicitation covered by this research: Problem Perspective Differences, Resistance, Poor Communication and Articulation/Expertise Problems. Finally, a first linkage between a specific systems analysis method, the Work System Method, and its potential for addressing these problem areas has been established.

Keywords: Requirements elicitation, systems analysis, Work System Method;

1. Introduction

“Requirements elicitation is all about learning and understanding the needs of users and project sponsors with the ultimate aim of communicating these needs to system developers”. (Zowghi & Coulin, 2005, p. 21)

While this definition of requirements elicitation is specifically related to information systems (IS) development it can be said that mankind has been plagued with issues to correctly identify requirements beyond this area, and that since many years.

Avison and Fitzgerald (2006) refer to the old Egyptians as being early victims of incorrect requirements elicitation, because until today archeologists are trying to figure out why an unfinished burial chamber can be found at the base of the world famous Pyramid of Cheops. It is believed that during the construction phase a new requirement has surfaced, namely the need to bury a pharaoh in a wide stone sarcophagus instead of as initially planned in a smaller, wooden one. Unfortunately, this new requirement could only be met by building new, larger chambers higher up in the pyramid. Apparently the poor constructors and planners of the pyramids had to struggle a lot to correctly identify and keep up with the changing needs of their project sponsors, and in this concrete case it resulted in an unfinished and unused burial chamber.

Interestingly, there can be found similarities between two distant worlds, the one of the old Egyptians and the one of IS development of today. Kotonya and Sommerville (1996) consider poorly formulated requirements and draw on a survey conducted by the US...
Government Accounting Office about IS development projects. According to this survey 47% of the invested money was spent on software that has never been used. Further 29% was spent on software that was not even delivered, and 19% was invested in software which had to be reworked completely or abandoned after delivery.

The crucial importance of eliciting real business needs can be backed up by crude numbers, and the next chapter will provide more insights on the financial impact of missing or inaccurate requirements. But most often simplified descriptions help us to understand the reach of certain failures. Roberts (2011) refers to the elicitation phase and reminds that each incorrect requirement can potentially result in 10 wrong design statements, which can further lead to 100 incorrect coding statements. This might be considered an oversimplified illustration, but making errors in the elicitation phase can be compared to stirring up a hornet’s nest.

There seems to be a longstanding awareness among researchers dealing with challenges of requirements elicitation about the social and human dimension of this phase (Goguen & Linde, 1993; Nuseibeh & Easterbrook, 2000; Saiedian & Dale, 2000; Coughlan & Macredie, 2002; Zowghi & Coulin, 2005; Holmström & Sawyer, 2011). Based on the awareness about the social aspects and the high costs caused by incorrect requirements a variety of specific techniques and tools have been invented to support the elicitation phase. It is further not surprising that many techniques and tools have been directly taken over from disciplines of the social sciences (Nuseibeh & Easterbrook, 2000; Zowghi & Coulin, 2005).

However, despite the introduction of innovative techniques and tools issues in requirements elicitation prevail, and are often explained by a lack of shared understanding between the systems analyst or developer, and the user (e.g. Macaulay, 1996; Saiedian & Dale, 2000; Coughlan & Macredie, 2002; Zowghi & Coulin, 2005). This lack of shared understanding persists, although it is acknowledged that the elicitation phase encompasses some form of organizational or systems analysis (Christel & Kang, 1992; Kotonya & Summerville, 1996; Nuseibeh & Easterbrook, 2000; Goldsmith, 2004; Zowghi & Coulin, 2005). Systems analysis helps to achieve a major goal of requirements elicitation, which is to identify what problems need to be solved, and thus to determine the scope of a system (Nuseibeh & Easterbrook, 2000). Zowghi and Coulin (2005, p. 23) underline: “It is important to remember that requirements elicitation does not occur in a vacuum. It is strongly related to the context in which it is conducted and specific characteristics, of the project, organization, and environment.”

It is the aim of this thesis to identify and describe recurring issues in requirements elicitation, and to better understand the potential of systems analysis efforts for addressing these issues. In order to reach the aim of this thesis I am going to examine two research questions: What are recurring issues in requirements elicitation? How can they be addressed by systems analysis efforts?

While the literature provides plenty of high-level categorizations of requirements elicitation issues most often the argumentation is not complemented with concrete, real-world examples. This thesis consolidates theoretical knowledge with practical insights on requirements elicitation by backing up the theoretical framework of recurring issues elaborated by Saiedian and Dale (2000) with practical examples from IT projects.
By answering the research questions, I will attempt to contribute to a clearer picture of how many issues in requirements elicitation are caused by stakeholders not having common ground on basic elements, like the existing problems of a current system, or the goals and purpose of a future system. An initial, high-level clarification of these basic elements can help to create a connection between the developer or analyst and his client true to the motto: “I don't understand you. You don’t understand me. What else do we have in common?” (Ashleigh Brilliant)

2. Related Research

Conducting a thorough literature review is an initial task of a research project. When it comes to requirements elicitation the first contact with the abundant work about issues in this area might support the impression that you have to deal with a *mission impossible*. This feeling does not even appear that far-fetched if you consult academic textbooks to acquire a first overview. In the textbook *Information Systems Development* (Avison & Fitzgerald, 2006, p. 98) it is acknowledged as already mentioned that even the old Egyptians were troubled with requirements issues when building the famous pyramids, and the authors conclude that “perhaps the notion of solving the requirements problem is an unachievable objective, given that it has been attempted for so many thousands of years.”

Nevertheless, this seemingly challenging starting position shall not deter us from reviewing related research of the last two decades dealing with the human dimension of requirements elicitation (2.1) and from looking at soft approaches for systems analysis (2.2).

2.1 Requirements elicitation and its human dimension

“A system isn't likely to be better than its requirements.” (Goldsmith, 2004, p. XV)

This statement sounds very simple, but the importance of eliciting requirements in the early phase of a development project can be backed up with concrete figures. The costs of correcting a requirement error when a system is already in use are about 15 times higher of what it would cost if this error is corrected in the requirements phase (Kotonya & Sommerville, 1996). Avison and Fitzgerald (2006) point to studies which show that an error corrected in the requirements phase costs around 80 to 100 times less than when it is corrected in the implementation phase. The relationship, between the phase in which a requirement error is detected or corrected and the costs for correcting this error, has been illustrated manifold in literature over time (e.g. Boehm, 1984; Boehm, 1987; Nakajo & Kume, 1991; Westland, 2000; Goldsmith, 2004). McConnell (1996) provides a graphical representation of the relative costs of fixing requirement issues retrospectively.

Before we are going to analyze the contribution of literature to requirements elicitation issues we should remind ourselves what the overall objective of this phase is. Zowghi and Coulin (2005, p. 21) state: “Requirements elicitation is all about learning and understanding the needs of users and project sponsors with the ultimate aim of communicating these needs to the system developers.” This objective underlines the notion
that requirements need to be elicited or discovered rather than just captured or gathered (Nuseibeh & Easterbrook, 2000; Coughlan, Lycett & Macredie, 2003; Zowghi & Coulin, 2005; Davis, Fuller, Tremblay & Berndt, 2006; Holmström & Sawyer, 2011). By doing that the elicitation phase requires stakeholders to engage actively in negotiations and conflict resolutions (Holmström & Sawyer, 2011), sometimes also referred to as mutual learning process (Garrity, 2001; Davis et al., 2006).

Many research efforts have been dedicated to requirements elicitation issues over the last two decades, which often have highlighted the human and social dimension of this phase.

Goguen and Linde (1993) note that large projects fail due to poor requirements and link this shortcoming mainly to social, political and cultural factors. This notion further prompts the authors to suggest the usage of techniques, like conversation, interaction or discourse analysis, for the purpose of requirements elicitation. These techniques were not commonly used for this particular purpose in that time, but they were more suitable for addressing social issues. The authors’ message back then is already very clear (p. 153): “The problems of requirements elicitation cannot be solved in a purely technological way, because social context is much more crucial than in the programming, specification and design phases.”

Saiedian and Dale (2000, p. 419) underline previous mentioned concerns: “The success of our products and systems are largely determined by our attention to the human dimensions of the requirements process.” They refer to four major problem areas of requirements elicitation: Problem Perspective Differences, Resistance, Poor Communication and Articulation/Expertise Problems. The authors further remind that the success of different elicitation techniques, like interviews, questionnaires or observations, ultimately relies on how well different stakeholders communicate with each other. Coughlan and Macredie (2002, p. 2) also detect shortcomings of communication in the area of requirements elicitation: “(...) effective communication has been notoriously difficult to achieve and is a recurring problem in the elicitation of requirements.” They distinguish between two different viewpoints of systems design: a rationalistic problem-solving perspective (structured methodologies), and a user-centered problem-finding perspective (socio-technical methodologies). Consequently they consider the potential of both types of methodologies to foster communication between stakeholders, and finally argue for the usage of socially-oriented methodologies for requirements elicitation in order to improve the user-designer interaction. Their argumentation is based on their characterization of the systems design processes in general (Coughlan & Macredie, 2002, p. 4): “Systems design, especially at the requirements stage, is a social and communicative activity.”

Holmström and Sawyer (2011) argue that there has been a longstanding awareness about the social aspects of requirements elicitation in research, but these aspects seem to have had less impact in practice so far. Instead practitioners have rather kept focusing on the artifact and less on the social dimension of this phase. Specifically, the authors have studied the phenomenon that developers intentionally ignore the complexities involved in requirements elicitation with the aim to simplify their work. Consequently also their practices are shaped according to this objective. This attitude undermines the notion of eliciting requirements as a process of social learning, where negotiation and conflict resolutions between stakeholders are desired. In order to incorporate the ideas of social learning in requirements elicitation
developers need to have adequate analytical approaches which shall support them in evaluating domain and systems challenges. Besides, they need to develop the required social skills to engage in negotiations with users.

To conclude, there seems to be a longstanding awareness about the social and human dimension of the requirements elicitation phase. Nevertheless, problems related to these dimensions seem to persist although many techniques and tools have been introduced to address these problems.

### 2.2 A soft approach towards systems analysis

“It is important to remember that requirements elicitation does not occur in a vacuum. It is strongly related to the context in which it is conducted and specific characteristics, of the project, organization, and environment.” (Zowghi & Coulin, 2005, p. 23)

This simple notion helps to understand why systems analysis efforts are needed in the requirements elicitation phase, which has been underlined in many research papers (e.g. Christel & Kang, 1992; Kotonya & Summerville, 1996; Nuseibeh & Easterbrook, 2000; Goldsmith, 2004; Zowghi & Coulin, 2005). Researchers use various terms for referring to systems analysis efforts in the elicitation phase (organizational and context analysis, fact finding, context and groundwork, etc.) and propose a different form and extent of such an analysis. While a different form or extent might be suggested, there seems to an agreement about the basic tasks and objectives of systems analysis efforts. Nuseibeh and Easterbrook (2000, p. 38) state: “RE [requirements elicitation] also encompasses work on systems analysis. (...) One of the most important goals of elicitation is to find out what problems need to be solved, and hence identify system boundaries.” The identification of boundaries, goals and problems of a system can be considered as the main task of a systems analysis. Mittermeir (1990, cited in Christel & Kang, 1992, p. 8) pictures consequences of neglecting systems analysis efforts in requirements elicitation:

“If requirements elicitation begins without an appreciation for organizational context, then a number of restricting assumptions are made due to misconceptions, management politics, technical ignorance, mistrust, established practices, personnel resistance, ...”

The analysis of an organizational system can be a challenging task, because systems are usually complex. The complexity of organizational systems can be explained by systems theory principles described by Avison and Fitzgerald (2006). Firstly, organizational systems are influenced by human beings who are compared to computer programs much less predictable. Secondly, organizations are open systems which are not closed or independent. They are characterized by a tight relationship with their environment and influenced by external factors like customers, competitors and governmental policies.

Avison and Fitzgerald (2006) provide a categorization of methodological approaches for systems analysis which includes object-oriented methodologies (e.g. Object-oriented analysis), blended methodologies (e.g. SSADM - Structured Systems Analysis and Design Method), people-oriented methodologies (e.g. ETHICS - Effective technical and human
implementation of computer-based systems), and organizational-oriented methodologies (e.g. SSM - Soft Systems Methodology). These approaches have deviating ideas about the nature of systems. In general it can be distinguished between hard and soft approaches towards systems theory. Hard approaches are characterized by their highly structured procedures and its tendency to look at the domain from a single perspective. Soft approaches apply a people-oriented perspective and in contrast to hard approaches do not suppose that a system exists as such, but is rather a way of viewing at it in order to understand complex real-world activities (Avison & Fitzgerald, 2006). It cannot be said that any of the two approaches, soft or hard, are more suitable for the whole process of systems development in general. The systems development process rather entails different tasks and phases that encompass both perspectives (Avgerou & Cornford, 1993).

However, there is evidence that soft approaches are more suitable for addressing problems on organizational levels, because of their embodied culture, concepts and language. The emphasis on the role of people in organizations, who often have conflicting goals, perceptions, and attitudes is an important feature of soft approaches. Soft systems approaches are more likely to help achieving a true understanding of complex organizational problems than structured, data-oriented approaches which focus more on hard aspects (Avison & Fitzgerald, 2006). In a similar direction argue Coughlan and Macredie (2002) by stating that approaches with a human-centered perspective (which incorporate the ideas of soft approaches) are more suitable for the particular purpose of requirements elicitation.

The Soft Systems Methodology (SSM) and the Work System Method (WSM) can be regarded as examples for methodological approaches applying a soft perspective towards systems analysis. While the SSM stands for a well-known example for an organizational-oriented methodology, the WSM, which resembles the SSM in many ways (Alter, 2013), has not been used in practice to the same extent. Besides its usage in settings of education and IS research it seems that there is hardly any documented evidence of its application to real-world issues of IS analysis (Alter, 2010).

3. Requirements elicitation and systems analysis

The chapter 2.1 has drawn our attention to ongoing issues in requirements elicitation and the human and social dimension of this phase. Indeed, practitioners of today can fall back on accumulated knowledge and lessons learned which have been gathered over the last decades. As already mentioned there seems to be a longstanding awareness in research about the social and human dimension of requirements elicitation. Many problems outlined in chapter 2.1 can be linked to a lack of shared understanding and ineffective communication between the user and the analyst. This appears to be a common thread in related literature. The high amount of communication and interaction involved in requirements elicitation is further not surprising and can be explained by the notion that requirements are not gathered or collected, but rather have to be elicited and negotiated (Nuseibeh & Easterbrook, 2000; Coughlan et al., 2003; Zowghi & Coulin, 2005; Davis et al., 2006; Holmström & Sawyer, 2011). This notion has emerged over many years and has been expressed repeatedly. Holmström and Sawyer (2011, p. 38) state:
“(…) requirements are not things that exist, or have been clearly articulated, ready to gather, in an organization. Rather, requirements are generated through negotiation and conflict resolution among the different actors involved in the project.”

The need for entering into negotiations and conflict resolutions for requirements elicitation also requires that involved actors have a common understanding of basic elements. This is highlighted by Coughlan and Macredie (2002, p. 4):

“Requirements in fact emerge and are negotiated and, indeed, at the heart of effective communication lies a shared understanding, which is an essential part of the successful working of multidisciplinary design teams. This, however, can be seen as somewhat of an elusive ideal.”

While achieving a shared understanding between different stakeholders might seem to be an elusive ideal it needs to be targeted, because without a common ground stakeholders will not be able to communicate efficiently during the negotiation of requirements. A systems analysis therefore plays a major role in this context, because it deals with defining many important aspects, like goals, scope and problems, at the beginning of the elicitation stage. It can be seen as a major contribution to clarify initial misunderstandings and to reach a first common ground for subsequent negotiations.

Interestingly, soft systems approaches by their characteristics already incorporate the idea that for analyzing systems, negotiations between stakeholders are required. Avison and Fitzgerald (2006, p. 508) explain: “Understanding is achieved in soft systems methods through debate with the actors in the system. Emphasis is placed on the ‘what’ as well as the ‘how’ of the system.” Inherently, analysis methods with a soft approach may support elicitation processes by setting a climate for negotiation between stakeholders.

Looking at the multitude of research papers published about elicitation issues, it seems that the majority has focused on proposing techniques and tools for requirements elicitation as a response to ineffective communication between users and analysts (Zowghi & Coulin, 2005). A variety of specific techniques and tools have been invented to support the highly communicative tasks and it is further not surprising that many of these techniques originate from the social sciences (Nuseibeh & Easterbrook, 2000; Zowghi & Coulin, 2005). Still, there are concerns if the mere usage of certain methods and techniques will guarantee a shared understanding as expressed by following statements:

“We often focus on actions to take-interviews, questionnaires, and observations. However, the success of all these activities ultimately depends on how well people communicate and work together.” (Saiedian & Dale, 2000, p. 419)

“Requirements definition conversations often center around steps to do, techniques to use, or methods to follow. (…) But all aspects of requirements definition ultimately succeed or fail based on how well people can work
Besides above citations there is evidence that effective communication in requirements elicitation is also linked to tacit factors, like an underlying philosophy and principles, or the applied language and notation (Nuseibeh & Easterbrook, 2000). Nuseibeh and Easterbrook (2000, p. 38) emphasize: “(…) RE [Requirements elicitation] needs to be sensitive to how people perceive and understand the world around them, how they interact, and how the sociology of the workplace affects their actions.”

As we could see in chapter 2.2 many papers have highlighted the importance of a systems analysis for requirements elicitation and underlined the necessity to perform such analysis at the start of this phase. However, to my knowledge there has been hardly any concrete linkage of systems analysis efforts to recurring issues of requirements elicitation.

The aim of this thesis is to identify and describe recurring issues in requirements elicitation, and to better understand the potential of systems analysis efforts for addressing these issues. We therefore are going to dedicate subsequent parts of this research to find an answer to the following research questions: What are recurring issues in requirements elicitation? How can they be addressed by systems analysis efforts?

Empirical research has been conducted to find answers to the research questions. The research approach will be explained in more detail in the following section (Chapter 4), while the results section is dedicated to present the collected data (Chapter 5).

The underlying structure of the results section is based on a categorization of four problem areas of requirements elicitation as identified by Saiedian and Dale (2000): Problem Perspective Differences, Resistance, Poor Communication and Articulation/Expertise Problems. This framework proved to be the most appropriate tool for structuring the empirical findings. The four themes defined by Saiedian and Dale (2000) cover a comprehensive range of recurring issues in requirements elicitation which can be found across many relevant scientific papers (see chapter 2.1). This categorization provided a good clarity and compactness gained by the integration of a multitude of relevant aspects into four major themes. A strong motivation for choosing this specific framework was also its clear emphasis on recurring issues with roots in the human dimension of requirements elicitation, which distinguishes it from other frameworks. Besides, as Saiedian and Dale (2000) are claiming in their paper, the purpose of their research was to provide a rather informal guideline for practitioners, and it has been written from the perspective of IT analysts and developers. This has supported the overlap and matching of categories identified in the empirical findings and the themes identified in the paper.

4. Research Method

This section describes the motivation for choosing a certain research approach (4.1), how the research data has been collected and analyzed (4.2), and the methodological limitations (4.3).
4.1 Research approach
The aim of this thesis is to identify and better understand recurring issues in requirements elicitation, and to explore how conducting systems analysis efforts can support in addressing these issues. While there are many research papers available dealing with issues in requirements elicitation, it was necessary to collect and generate further research data in order to establish a context between certain experienced issues and how systems analysis has been performed in projects. It was therefore a major aim of this research to gain thorough insights into real-world situations where issues of understanding have occurred. As will be explained in sequence in more detail I came to the conclusion that qualitative research was most likely to support my research objectives.

It is recognized in general that there is no single way of doing qualitative research. How a researcher conducts a study rather depends on several factors, including the individual ontological and epistemological beliefs, personal position and environment, the specific purpose and objectives of the study, the characteristics of the research participants and other factors (Snape & Spencer, 2003). I have formulated my personal requirements towards the research approach as following:

- to identify and explore concrete situations in real-world settings where stakeholders were experiencing issues of understanding in the requirements elicitation phase
- to understand the background and environment of these situations
- to have a possibility to follow-up on narratives dealing with issues of understanding to gain a better picture of possible root causes
- to understand how efforts of systems or organizational analysis have been performed in specific projects (for instance, if it was conducted in a structured or unstructured form, or on a high or granular level)

I concluded that the conduct of a quantitative method, like a questionnaire or survey, would not be sufficient, because it would not enable me to capture the broader social context in which issues of understanding are happening. In my opinion quantitative methods are too rigid and structured for this purpose. As Mason (2002) states, qualitative research is capable of offering methods for data generation which are flexible and sensitive to the social context in which data is produced. It further supports the researcher in gaining a well rounded understanding based on rich and contextual data.

Finally I have opted for a qualitative research approach using in-depth interviews because I considered this the most suitable way for addressing the above outlined expectations.

4.2 Data collection and analysis
Lewis (2003) distinguishes between two choices for data collection: naturally occurring data and generated data. Naturally occurring data can be collected by means of methods like observation, documentary analysis, conversation analysis and discourse analysis. Methods used for generated data are in-depth interviews and group discussions. While in methods for collection of naturally occurring data the researcher takes up the role to draw out meaning from research data, generated data collection methods like in-depth interviews assign this role to the participant. In depth-interviews provide participants with the chance to express
individual meanings and interpretations through their input, whether this input comes unprompted or as a response to a concrete question of the researcher.

Mason (2002) highlights a particular, pragmatic purpose of qualitative interviews which was an apparent motivation in my research as well: to gain data which is not yet readily available. While the literature provides plenty of high-level descriptions of issues in requirements elicitation most often the argumentation is not complemented or backed-up with concrete, real-world examples. By interviewing experts I was expecting to gain a better understanding of requirements elicitation issues by analyzing their practical experiences.

By choosing a semi-structured form of interviewing my research objectives (outlined in chapter 4.1) could be addressed most adequately. This interview form further helped to achieve many desired characteristics, for instance the combination of structure and flexibility (Legard, Keegan & Ward, 2006). By that I could ensure that key issues of requirements elicitation were covered during the interview, but still left the respondents enough space to choose a sequence of covering these topics and to come up with unprompted, novel insights.

To achieve my research aim I have conducted five interviews with practitioners working in IT development projects. The interviews were conducted in a semi-structured form based on an interview guide, which has been prepared upfront the interviews (see appendix). The guide did not foresee any sequence of how various themes shall be covered. However, it included themes which rather entailed more open questions and were consequently mainly used to initiate the interview. For instance, a description of the project environment and characteristics were covered at the start of the interviews in order to have a smooth start, but also because this information could be linked to many aspects which appeared later. Other themes required more concise and detailed responses, for instance if certain methods and techniques have been applied in a specific project.

The interviews have been conducted over a period of nearly one month (between 21/04/2013 and 15/05/2013), and their length varied between 40 and 90 minutes. The average duration of an interview was 56 minutes. The respondents were chosen based on their working experience in IT development projects. For pragmatic reasons, snow-ball sampling was used to gain access to specialists in the field of requirements elicitation. It was agreed with the respondents at that the beginning of each interview that all names of individuals and projects will be referred to by pseudonyms in the thesis. Each respondent has participated in requirements elicitation projects either as a systems analyst or as a system developer, or both. In some occasions throughout the text the term IT professional is used, and no distinction between different roles, like analyst or developer, is being made. All of the respondents are working in IT consultancies, and their individual background is explained now briefly, which shall help to get a rough picture of each interviewee:

Anton has 16 years of working experience as an IT consultant. The typical projects he is involved in are dealing with the implementation of an off-the-shelf ERP-system. During the interview he has shared experiences from an ongoing project, where he has held requirements elicitation workshops. The project will be later referred to as “Process Harmonization Project”.
Ben has gathered experience working in different roles in IT projects for 12 years including four years in requirements elicitation. He has shared his experiences dealing with articulation and expertise problems of users.

Carla has 15 years of working experience in IT projects. Most findings presented in the results section are experiences from a project dealing with the implementation of a new IT system at a Swedish university, which supports the hiring process of technical and academic staff. This project will be referred to as “Job Application Project”.

David has been working in IT projects for 12 years. He has been involved in projects applying methods like Domain-Driven Design or Behavior-Driven Development and has shared his impressions about these methods during the interview.

Erika has been working in the area of requirements elicitation for 8 years. Similar to David she has been involved in projects applying methods like Domain-Driven Design. The interview mostly covered her experiences from a project later referred to as “Vocational Education Project”, which purpose was the development of a web-based system for higher vocational education in Sweden.

In order to gain an understanding of concrete problem situations in requirements elicitation, it felt most natural for some interviewees and for me to focus in huge parts of an interview on a single project. This step also helped to prevent that the conversations were held on a too general level. Some more characteristics about the three projects introduced briefly above will be provided in respective passages within the results section.

After conducting the interviews the data analysis phase was initiated. This phase consisted of three steps. First, the audio-recorded interviews have been transcribed and read through. Second, in each interview conflict situations, misunderstandings and issues experienced by the interviewees in the requirements elicitation phase have been identified and labeled with categories. Third, all categories found in the collected empirical data were linked to the problem areas of requirements elicitation defined by Saiedian and Dale (2000): Problem Perspective Differences, Resistance, Poor Communication and Articulation/Expertise Problems.

4.3 Methodological limitations

The research sample is limited to IT professionals, like analysts and developers working in IT development projects, with different educational backgrounds, years of working experience, and gender. Besides, the theoretical framework of Saiedian and Dale (2000), which has been used for structuring the results section, covers problem areas in requirements elicitation viewed from the perspective of IT analysts and developers. Therefore it can be said that this thesis captures the perspective of IT professionals on recurring issues in requirements elicitation, but the perspective of users has not been integrated into this research.

While it was one goal of the sampling procedure to find respondents with relevant working experience in the area of requirements elicitation, another goal was to ensure that the interviewees could contribute to this study with experiences from a variety of IT development projects with distinctive features. For instance, the interviewees shared experiences about projects of different scope and purpose (e.g. company-wide harmonization of a process landscape versus the improvement of a singular work process),
with deviating underlying business problems and goals, staged in a different environments (e.g. governmental and private organizations), and diverging general project background (complete development of an IS from the scratch versus the implementation of off-the-shelf software). The input from interviewees about how systems analysis has been performed in these different types of projects has enabled the identification of patterns and may help to determine the space for systems analysis methods in different project environments.

5. Results

The purpose of the results section is to show the empirical findings of this research in a structured way. The underlying structure of this section is based on a categorization of problem areas in requirements elicitation as identified by Saiedian and Dale (2000). These problem areas include Problem Perspective Differences, Resistance, Poor Communication and Articulation/Expertise Problems. The empirical findings have been categorized and linked to the relevant problem areas.

5.1 Problem Perspective Differences

An ongoing challenge in requirements elicitation concerns deviating perspectives of different stakeholders, like users, analysts and developers, on the actual problems of an organization, and the overall goals and purpose of a project. This subsection aims to describe major themes related to perspective differences.

A first major task in requirements elicitation is the capture of various problem perspectives of different stakeholders. The multitude of deviating and sometimes conflicting perspectives within projects can be illustrated by means of the “Job Application Project”. The “Job Application Project” deals with the introduction of an information system at a Swedish university. The implemented information system now covers the whole hiring process of applicants, including academic and technical personnel. Before the introduction of an information system the administrative work of a hiring process has been mostly done manually. In the “Job Application Project” many stakeholders have been involved, like the university management, department administrators, or members of an expert panel. Their different perspectives are briefly outlined by Carla:

“So depending on where you are in the organization, you have the university management, they are mainly interested in statistics and information that can be extracted from the system. While the administrators, now I’m generalizing, are mainly interested in how the documents are handled by the system. The decision-makers are mainly interested in good functions for prioritizing the applicants. The panel is mostly interested in not seeing any other information than they are supposed to be looking at, and that it is easy to access.”

This example shows that within the group of internal stakeholders deviating expectations and requirements towards an information system can be found. Another example also related to the “Job Application Project” highlights the often conflicting expectations between
different internal stakeholders (like department administrators and the university’s marketing department), and external stakeholders (like job applicants):

“Applicants and the marketing department are interested in making the application process as easy as possible. So if you are applying for a job here, it should be easy and hassle-free. The administrators, for them it’s very important that each application document is categorized, and in a specific order, that each application has the same structure. This is a conflict, because then we need the applicants to write the applications in an exact manner, whereas they would have looked for a position at another university where they want applications to be structured in another way, and now they have to re-do it.”

As already mentioned earlier, requirements elicitation never occurs in vacuum. In order to ensure that different influences are considered, project teams often consist of various domain experts mostly with different backgrounds and roles. In the “Job Application Project” the requirements elicitation workshops included a representative of each of the four university faculties, representatives of various departments involved in recruitment processes, and representatives of different user-levels, like managers, administrators, and technical personnel assigned with the maintenance of the future system. Therefore it is only a logical consequence that with different actors involved a multitude of perspectives about the problems of an organization and the goals of a project exist.

Another aspect is the relationship between users and IT professionals, like analysts or developers, and their diverging *worldviews*. This relationship and the clash of different perspectives are described by David:

“The end-users are living in their world, in their environment. On the other hand, the technical people, they can say, this is the best way to solve the problem technically, this is going to be efficient, it’s going to be easy and cheap to maintain in future, and easy for new developers to understand. You can see it that way, but that’s no value to the end-users. The end-users do not care about this. I have seen so often these two perspectives colliding. For the developers it is very hard to think and see things like the end-users, and the end users they do not care about the developer’s perspective. I have seen this many times.”

David points to a critical task for systems analysis in the elicitation phase. It can be challenging for users to put a structure in explaining and analyzing their work and its environment. Besides, some users might require support to overcome a limited perspective on actual problems and opportunities. David offers an idea why it can be difficult for IT professionals to understand users:

“In my opinion, this is mainly because often the users, living in their environment, it’s very hard for them to describe it in a way that can be understood by some who is not, because they get what we call routine-blinded. (...) They see things in a way, which is without them knowing, directed by the
current systems, and current processes. It’s very hard for them to see the whole process and the whole system in a different way.”

Regarding organizational-blindness David adds that especially for people working in large organizations it can be difficult to reflect on actual problems and opportunities. This is due to the way how these organizations work, and the often limited responsibility or narrow scope of an individual’s specific role or assignment within this organization. David expresses that users need support for analyzing and describing their work environment:

“So that is one thing that you need to help them with to describe it [the status quo]. They are very good at noting when something is differing. If you say then it works like this, then they say: No, no, no. It does not. But it is very hard for them to describe, it works exactly like this, and then put in a structured way.”

Equally Carla underlines that it is very important to help the users to reflect on problems and opportunities in their organizations, and to help them to understand the overall purpose of a project. An understanding of the overall purpose also supports the users to think constructively about improvements as Carla explains:

“I have met a lot of users who do not know the overall purpose of what they are doing, and why they are doing it. (...) The overall purpose, and meaning of why it is done, is not always clear. This inhibits I think the possibility of thinking creatively and if steps can be done in a more efficient or even better way.”

An important aspect is therefore the formalization and communication of the overall purpose and goals of a project. David notes that if there is an organizational problem the introduction of an information system is often one of many possible ways to address this problem. However, it seems in many projects the initial problems of an organization are detached from the main purpose assigned to a project. Many problems would be better addressed by organizational changes without the necessity to implement a new information system as David states:

“If you start analyzing, then sometimes it’s only an organizational change you need, or just some change in processes. But usually many organizations say: ‘Okay, we need a change, we nominate a project leader and we give him certain money to get an IT system.’ And here I would say this is a big mistake, made very early, because usually very often it is not an IT system you need. You need some change in your organization.”

In this context David refers to Specification by Example, a method for requirements elicitation which assists organizations in identifying the impact of what should be achieved by the initiation of a project. He explains the main purpose of this method, and emphasizes previously mentioned shortcomings in practice:
“This method is exactly used for this, what impact you want to make in your organization. (...) it can help organizations to find out what they really need. Then they can save a lot of time and money. But usually it goes like this: the project leader says I need to buy a new system. I’m going to make some requirements elicitation. But then you are doing the requirements elicitation on wrong assumptions. You buy an IT system that solves in best case only a part of the problem, but usually not all the problem.”

The extent to which systems analysis efforts have been conducted to capture relevant problem perspectives has varied in the projects covered by the interviews. The “Job Application Project” entailed a more comprehensive analysis of the organizational environment beyond the directly concerned work system (which can be described as the handling of job applications to the university), although no specific method or framework for analysis has been applied. For instance, other internal university departments, like the marketing department, which are not directly involved in the hiring process, provided input on how the future system should look like. As universities are in a direct competition for talented academic personnel certain goals influenced by idea of employer branding were communicated to the project team. Equally, the legal environment had a major impact on the requirements of the future system, because the university as a state-run organization has to comply with stricter laws than private organizations usually have to.

There can be reasons for a conducting a systems analysis with a limited scope. Erika reflects upon the “Vocational Education Project”, where she could build on domain knowledge she had collected by working in similar project environments over many years:

“For developing a small system that has not much impact or connections to anything else, a method [for systems analysis] would take too much time. It also costs money for the customer and is delaying the start of the project. For such very small systems with few connections to other systems I think its better not to use it. (...) Maybe that’s a wrong start, maybe you should do this background check, but the question is if the customer is willing to pay for it.”

This subsection has illustrated perspective differences between various actors involved in the requirements elicitation phase. The lack of shared understanding about actual problems, and the overall goals of a project, can be caused by contrasting worldviews of business and IT professionals, and the organizational-blindness of users.

### 5.2 Resistance

Much has been said about the human and social dimension of requirements elicitation, and the need for negotiations and conflict resolutions between involved actors. Resistance expressed by users can be seen as a natural part of the requirements elicitation phase. This subsection addresses how different IT professionals have experienced resistance in projects, and how it has been approached.
Anton explains how resistance has been expressed in the “Process Harmonization Project”. This project deals with the organization-wide implementation of an ERP-system at a large company in Austria. Many sub-projects have been initiated to implement particular modules of the ERP-system in respective departments. Anton has been organizing requirements elicitation workshops in the frame of one of these sub-projects, and acknowledges that change management plays a crucial role in projects of this type. Very often the large-scale harmonization of processes in an organization can mean substantial changes to the work environment of an individual employee. Not surprisingly Anton perceives user resistance in many projects:

“The participants [of requirements elicitation workshops] have an operational agenda to do every day, and usually they like to maintain this agenda, they don’t want changes a lot. (...) Most important for them also is that their work load does not increase after the new system has been implemented.”

Anton refers also to more powerful participants, like department heads, and their role in requirements elicitation workshops:

“They [the department heads] are often very dominant people, and during workshops they may try to lead you astray. They are experts in their own area, and are very curious to know about any changes, but usually they do not attempt to see beyond their own noses.”

As in the “Process Harmonization Project” very often the consultancy in charge of the ERP-system implementation not only needs to cooperate with users of different departments within the client’s organization, but as well with their IT personnel. In many cases the IT personnel of the client’s organization is actually employed by an IT-Outsourcing partner. Often the IT-Outsourcing partner and the consultancy in charge of the ERP-system implementation are competitors in many areas. While there were no negative effects on the cooperation experienced in the “Process Harmonization Project”, Anton noted that the relationship could potentially be affected by the competition between the involved organizations. After all, the IT-Outsourcing partner relies on future orders from his client and might fear that the consultancy will use the project to win the favor of their client.

David underlines the resistance often expressed by users: “The users are not always happy to be in the project, and be involved in the project. I mean they have their daily work to do. Sometimes they could also be scared.” Domain-Driven Design, which incorporates the idea that natural language is used for systems analysis and design, has been mentioned by David as one possible way to approach resistance:

“You describe and model the system, and you write a code in a way that describes the user’s domain. You do not use technical terms, but words which are familiar to the user. It’s called ubiquitous language. You have a common language, the developers and the end users refer to the system in the same way, using the same terms and words.”
Carla reflects on the “Job Application Project” and highlights the role of the elicitation workshops to address resistance among users. While the workshops were primarily used to elicit and document requirements, they also offered a way to ensure that future users felt integrated into the project. Carla explains her view on the purpose of these workshops:

“The workshops were for me, as much as they provided the actual documentation and requirements, and the actual prioritization, that was just one part of it. What we gained was the feeling of we [the project stakeholders] have been in this from the beginning and have been a part of this process.”

In the “Job Application Project” the requirements were gathered from different stakeholders and assigned with concrete business values as a base for the prioritization of requirements. At the same time the limits of commercial off-the-shelf (COTS) software were made clear from the start, and the consequences were outlined to the stakeholders. This transparent approach was regarded by Carla as an appropriate way for addressing resistance:

“When the prioritization is made commonly, it’s easier to deal with resistance. We ended up with a huge list, let’s call it wishes, and it is very clear since we are buying off the shelf, we won’t get everything. Some of it we’ll get, some of it we won’t get. Different people will be happy or sorry about different things. But we’ve been taken all their wishes under consideration and we agreed on the most important parts all together. That is a way of working against resistance.”

In the “Job Application Project” the prioritization of requirements was based on commonly defined business values. This democratic approach laid the ground for a strong legitimization from the inside which is explained by Carla as following:

“Mainly for me it was about creating positive attitudes, and giving thorough understanding of what it means to buy a system off-the-shelf. What it means to unite around a requirements specification. That we actually have to negotiate between different interests. That this is not made by project management, these negotiations were not made by management or the HR department, they were actually negotiated within this project group, amongst the users themselves.”

The workshops were also seen by Carla as a chance to communicate important aspects via the workshop participants to their respective departments and colleagues. She explains the role of the workshop participants and how they could support to address resistance in the organization:

“We have now 15 good ambassadors in the organization, who will talk positively about the system when it will be integrated into the organization, who will answer questions, who will be able to meet resistance from other users, and
As another way to deal with resistance David refers to the importance of communicating high-level goals of the project, and highlights the difference between the plain information, and the communication of these goals:

“The main thing is that it [the project goals] needs to be communicated. But there is a difference between information and communication. The goals should not be informed. The users should not feel to be told: ‘These are the goals’. You need to make them participate in specifying these goals, you need to involve them, so they feel like ‘we are part of this’. Then it is much easier in the future to have them on your side. If you cannot ensure involvement and acceptance in the organization for the change, a project is doomed to fail.”

This subsection has dealt with an ongoing challenge of the requirements elicitation phase, which is resistance of users. The usage of certain systems analysis and design methods, like Domain-Driven Design, and a democratic procedure to prioritize requirements based on commonly defined business values, have been identified as possible ways to address resistance.

### 5.3 Poor Communication

In the chapters 2.1 and 3 it has been underlined that requirements elicitation involves highly communicative tasks. This subsection is dedicated to present findings in the empirical data connected to poor communication between different actors involved in the requirements elicitation phase, especially users, analysts and developers.

Communication has been identified as the key to success in several interviews. Erika concluded about requirements elicitation challenges: “The hardest part is communication and earning the trust of the customer.”

The aim to achieve a common understanding between involved actors about basic elements, like project goals and scope, depends a lot on communication as David points out:

“(…) getting shared understanding is all about communication. You can use many different methods, some kind of ‘cool’ methods, that are very much advertised right now, but for me it is simple: make people work together, make them sit together, discuss it, and build a shared understanding. That also helps with defining the project scope and goals, because if you sit together, you have a much better chance to get a shared understanding about the scope and goals.”

A challenging aspect in the requirements elicitation phase is that information gets re-interpreted by different actors at many points along the communication chain. This
phenomenon and its consequences can be described best in comparison to the well-known game *Chinese Whispers*. David describes the communication chain:

“They [the analysts] were writing requirements and then handing them over to developers. Then there were some transition meetings, where it was tried to get a shared understanding between the analyst and the developer. (...) Then when the developer has written the code, and it is delivered to the testers, they take the requirements what the analysts have specified and they compare it to the code. Then the tester made his or her translation. So it’s a huge communication issue, because what the requirements specification really said was not always what the analyst wanted to tell. (...) It is all about a communication problem.”

The geographical distance between various involved stakeholders of a project has an impact on communication as well. Erika uses the “Vocational Education Project” to describe this particular challenge. The purpose of this project was the development of a web-based system for higher vocational education in Sweden, which enables educational organizations and students to access relevant information. In this case the majority of customers were located in Southern Sweden and the company responsible for developing the system was located in Stockholm. The IT consultancy where Erika is employed, located in the North of Sweden, took over the responsibility for requirements elicitation and analysis in this project. Erika remembers that the communication with the developing company proved to be a big challenge, because the developers have not been involved in the earlier project phase of requirements analysis at all. The developers faced issues to understand many requirements that were communicated to them, and interpreted them based on their own understanding and domain knowledge. Erika concluded that it would have been beneficial to integrate the developers much earlier in the project. A similar notion has been expressed by other interviewees based on their personal experiences from other projects as well.

Erika reminds that especially for methods like Domain-Driven Design a very close cooperation and communication with the customer is required. This is because in Domain-Driven Design the modeling of the project-specific domain takes in a pivotal role. Erika comments in this context:

“We make Skype-conferences several times a week, but you really see the difference when the clients visit us, and we sit together and we talk, and we draw. It is so much easier. I think the key to any successful project is how good you can communicate, and that involves the customer, the requirements analyst, the developer and the tester.”

This subsection has shown challenges related to the chain of communication in the elicitation phase, where a multitude of different actors, sometimes geographically dispersed, are involved.
5.4 Articulation and Expertise Problems

In this subsection findings in the empirical data linked to articulation and expertise problems will be described. Difficulties for users to articulate needs and ideas contribute to a challenging environment for IT professionals, who are trying to understand the user and his environment in order to elicit requirements.

Anton shares experiences from several requirements elicitation workshops held in projects of similar character as the “Process Harmonization Project”. It can be difficult to elicit typical problems of a specific work system, because users often primarily focus and express few a-typical problems, which have happened recently or appear most pressing to them. Anton notes difficulties when trying to elicit overall problems of a work system:

“Usually such a requirements workshop runs like this: you hear relatively soon that somewhere there is a problem. But this can be only one problem out of a hundred. So they mention the 10 or 20% of unusual processes, where they have experienced problems. But not the other 80% of processes which I’m more interested in, because at the start I would like to get a good overview and catch the mainstream. Not only things which might happen maybe once a year.”

Carla who has been involved in the “Job Application Project” acknowledges that users in this project did not face issues to adequately articulate on a high-level what their overall work is all about. However, when it comes to figuring out how specific operational tasks are done Carla perceived challenges to elicit the true motivation or reasons why people were doing their work in a specific way:

“What I kind of miss sometimes (...) they explain the process from their perspective, not from a systems or functional perspective. It can sometimes be difficult to talk about, like objectify what you are talking about. Sometimes it was unclear, what needs to be done because it ‘has to be done’, because of regulations and laws. And what is done because this person’s specific boss told him to do so. And what is done just because you have always done it like this, but it could be done another way. We spend some time trying to sort that out, what is merely done by habit and what has to be done.”

Erika notes that it is not always clear what the motivation behind certain input from users is. She suggests what kind of questions different actors should try to focus on in the elicitation phase. This notion has been expressed in similar form by Carla and David as well. Erika comments:

“Sometimes customers know exactly what they want. Then they write the requirements in a narrow way, like ‘I want to have this in the database, please put in this column’. But then the question is: Why? Why should you have it there, and what is the purpose of it? The developers are professionals and probably..."
better in designing a system. The customer should focus on ‘what’ they want and ‘why’ they want it. The ‘how’ is for the analysts to figure out.”

These three examples have covered incidents where analysts and developers have faced issues to understand needs or ideas articulated by users. The following examples rather focus on the user’s struggle with technical notation often introduced by IT professionals, like object-oriented methods, used for systems analysis and design. This struggle sometimes leads to frustration of the users. Ben recalls customers expressing frustration when they were lacking the expertise to communicate a systems demand or wish.

Erika states that customers often urge for support from developers when they have to work with methods for requirements documentation: “I heard it several times: ‘we thought the developers should help us with this. That we do not need to write the requirements’.”

Across all interviews it has been unanimously agreed that the IT professionals should take over the technical documentation of requirements, not the user, who generally lacks the required knowledge to take over this task. In this regard Carla adds: “I am not saying that the people in the organization cannot write use cases. But I think they need training (...) or suggestions on how to document use cases.”

Ben remembers a project where the implementation of a system has failed, because the requirements were lacking basic details. They have been specified independently by the users in form of use cases. Ben describes the consequences: “So when the developers got the use cases, there was no chance in the world to make an implementation. It was written too general, too less information.” Consequently it was decided that multi-functional teams, consisting of user representatives, developers and testers, start with the specification again from the scratch. Ben recalls that the users were relieved to receive support from the IT professionals:

“My impression is that it was a perceived as a ‘welcomed change’ from the users. Because it’s not their profession, and it can be quite frustrating to have a systems demand or wish and not being able to communicate it.”

In order to overcome these obstacles certain approaches to systems analysis and design favor natural language over a technical notation. David points to the advantages of Domain-Driven Design, which supports users with the application of their natural language:

“Traditionally the developers look at the system in a technical way, but the users do not care about technical stuff. They address the system in their language. The point with Domain-Driven Design is to have the user’s language as the language for all, the developers also. It’s hard for the developers to start thinking in this way, but when they get used to it, then it works.”

In the last part of this subsection we are going to focus on challenges for IT professionals to understand a specific terminology and jargon often applied in their customer’s organization, especially if they lack experience in this domain. In this context Anton remembered a quite trivial, concrete example from the “Process Harmonization Project”.
Perhaps every business professional has an idea what materials management is in general all about. Still, its scope and the assigned tasks might be different depending on the individual organization. In most organizations materials management comprises the supply of direct materials, which are used for manufacturing a final product, and indirect materials, which are required to support the manufacturing. The customer organization involved in the “Process Harmonization Project” had a specific, quite narrow definition of their corporate function materials management as it only included the supply of indirect materials. Anton and his colleagues rather had their own view on the scope, and on which tasks and processes should be covered by materials management. Their definition was rather guided by the conception of the specific ERP-system they were going to implement at their client’s organization, and according to this definition materials management included the supply of direct and indirect materials. The different interpretation of a trivial term, and the resulting perspective differences about the scope of the materials management process led to many instances during the requirements elicitation workshops were representatives of the client organization and Anton have been talking at cross purposes.

The final subsection has revealed challenges for IT professionals to elicit requirements due to the way users are articulating needs and expectations. Additionally, the struggle of users with technical notation, and the need for a common language in systems analysis has been described. Finally, misunderstandings between business and IT professionals caused by deviating interpretations of a trivial term have been described by means of a concrete example.

6. Conclusion

It is the aim of this thesis to identify and describe recurring issues in requirements elicitation, and to better understand the potential of systems analysis efforts for addressing these issues. To reach this aim the following research questions have been examined: *What are recurring issues in requirements elicitation? How can they be addressed by systems analysis efforts?*

Five in-depth interviews with IT professionals have been conducted during this research project. There has been a clear overlap between the issues identified in the analysis of empirical findings and a framework of requirements elicitation issues compiled by Saiedian and Dale (2000). It seems that the four problem areas defined by these authors capture many essential challenges of requirements elicitation still experienced by IT professionals today. While one motivation for conducting the interviews was to show that many issues are still relevant and pressing until now, a further contribution of this thesis was to back-up the problem areas with specific real-world examples from IT projects. With the help of these practical examples it is easier to get to the bottom of each problem area, and to outline the potential of systems analysis efforts to address these problems.

*Problem Perspective Differences* constitute a major challenge which includes aspects like the multitude of deviating and often conflicting perspectives of stakeholders, the clash of fundamental viewpoints between business and IT professionals, the user’s sometimes limited view on actual problems and opportunities due to organizational-blindness, and a
lack of shared understanding about the overall purpose of a project. Systems analysis is used in different form and extent to support the identification of stakeholders, to capture their perspectives, and to support IT professionals in gaining an overview of the concerned problem domain.

Resistance has been identified as another recurring issue. The challenge lies in ensuring user participation throughout the elicitation phase, and to create a positive attitude towards a new system among the users. Systems analysis efforts can help to deal with resistance by giving users a tool for identifying business goals and values, which enables a democratic approach for the prioritization of requirements. Besides, methods for systems analysis and design, which place an emphasis on the users’ domain and apply a natural language instead of technical notation, can be seen as another way to address resistance.

Poor Communication is a common obstacle in the requirements elicitation phase, and inevitably linked to the multitude of communication interfaces which usually exists in IT projects. For aspects of this problem area few concrete linkages to systems analysis efforts have been arising during the interviews.

Articulation and Expertise Problems include challenges for analysts to elicit requirements based on the user’s articulation of needs and expectations, the struggle of users with technical notation applied for systems analysis and design, and misunderstandings between stakeholders due to deviating interpretations of specific terminology. It has been shown that the usage of certain analysis and specification methods, for instance use cases and user stories, may overwhelm and frustrate users, and can ultimately lead to inadequately formulated requirements.

In literature the importance of conducting systems analysis efforts during the requirements elicitation phase has been underlined several times (see chapter 2.2 and 3). At the same time there can be found evidence that in requirements elicitation structured methods are most often not used in practice, or followed only partly (Coughlan & Macredie, 2002; Coughlan et al., 2003; Holmström & Sawyer, 2011). The insights the respondents have shared about how systems analysis has been conducted in real-world projects correspond with that notion. While efforts to analyze systems and their organizational environment have been evident in all projects covered by the interviews, no specific method for systems analysis has been applied or followed during these projects.

7. Discussion

With the support of a literature review and in-depth interviews with IT professionals recurring issues in requirements elicitation have been identified, and backed up with practical examples. These issues include Problem Perspective Differences, Resistance, Poor Communication and Articulation/Expertise Problems. Many aspects of these issues are linked to the social and human dimension of the elicitation phase, which has been described in chapter 2.1 and is an important theme in relevant research papers (Goguen & Linde, 1993; Nuseibeh & Easterbrook, 2000; Saiedian & Dale, 2000; Coughlan & Macredie, 2002; Zowghi & Coulin, 2005; Holmström & Sawyer, 2011).
In particular the crucial role of communication in the requirements elicitation phase has been highlighted in some form in every research interview by the respondents, and it has also been identified as the hardest challenge by some. Indeed, communication is an essential aspect integrated into all the four problem areas of requirements elicitation defined by Saiedian and Dale (2000). Many research papers refer to communication as the central theme of requirements elicitation issues (Nuseibeh & Easterbrook, 2000; Coughlan & Macredie, 2002; Davis et al., 2006; Roberts, 2011). Coughlan and Macredie (2002, p. 11) underline its significant role: “(...) in terms of requirements elicitation, any activities are communication activities.”

As outlined in the chapters 2.2 and 3 the requirements elicitation phase integrates some form of systems analysis work, and communication is required to close the gap of knowledge and understanding between business and IT professionals during the conduct of the analysis. One purpose of systems analysis is to help different actors reach a shared understanding about basic elements, like actual problems of an organization, and the goal and scope of a project. However, it is the focus of this research to look critically on systems analysis work performed in the elicitation phase and to identify its potential to contribute to the successful elicitation of requirements beyond the mere sharing of information and knowledge between various actors. Rather it is the goal to establish a linkage between systems analysis and four urgent, recurring issues of requirements elicitation, and to better understand the potential of systems analysis efforts to prevent these issues. Communication plays a crucial role for eliciting requirements, and it suggests itself that a systems analysis method used in the elicitation phase should contribute to foster the communication between different involved actors.

On the basis of this awareness the following lines will deal with the discussion of one specific systems analysis method, the Work System Method (WSM), which incorporates a claim that deems to be highly relevant for supporting the elicitation of requirements. The aim of the WSM is to connect business and IT professionals by providing a shared language for describing and analyzing systems in organizations (Alter, 2010). In chapter 2.2 it has been argued for the usage of soft systems approaches for requirements elicitation. The WSM, as one representative of such soft approaches, and its adequateness for addressing the four recurring issues of the elicitation phase will be discussed now briefly.

The WSM includes features which help to address issues identified in chapter 5.1 as Problem Perspective Differences. For instance, it foresees a comprehensive analysis of a work system by using a framework consisting of nine elements. Two amongst these nine elements of a work system analysis, labeled as participants and customers, deal with the identification of essential stakeholders, and the capture of their concerns, expectations and perspectives in relation to the work system, its products and the involved work processes. As shown in chapter 5.1, the perspectives of various involved stakeholders might be conflicting. Nevertheless, it is of high importance to identify and understand these deviating perspectives, because main efforts in the elicitation phase entail negotiations and conflict resolutions which arise from different stakeholder viewpoints.

In addition, the WSM offers pre-formulated questions and steps dealing with the analysis and evaluation of the current performance of a work system. These steps promote the usage
of quantifiable performance indicators for assessing the current status of a work system and the suggestions for improvements. The rigorous conduct of this analysis in combination with the integration of external perspectives (e.g. from an IT consultant) may support users to overcome organizational-blindness. Besides, the framework integrates aspects like the analysis of the work system’s environment, the available infrastructure and the overall strategy of the entire organization. The consideration of these high-level aspects helps the users to gain a bigger picture on actual challenges and opportunities, which has surfaced during the interview as an obstacle.

As David has highlighted very often decision makers are opting for the implementation of an information system as a response to actual organizational problems without considering alternative ways of addressing these problems. For instance, the mere change of a work process or organizational changes might be sufficient in some cases as well. Consequently, also the overall purpose of a project is not always clear. The WSM puts the actual business problem in the center of the systems analysis. With the definition of high-level business goals the WSM has the potential to ensure that the overall purpose of a project has a clear context to the underlying business problem. This may also help to increase acceptance of the implemented system by the future users.

Resistance is another recurring issue affecting the elicitation phase, and the respondents have expressed the need to integrate users actively in projects. Participation has been identified during the interviews as an important way to address resistance. In this regard a link to research on user participation in IS development and implementation can be established, and has been suggested by Alter (2009, 2010 & 2013). Markus and Mao (2004) describe the psychological effects of participation (“psychological buy-in”) on system success. At the same time they highlight that not all participation activities allow users sufficient freedom of action to influence decisions (“true participation”). Participation activities which cannot provide such active user involvement can have counterproductive effects. Markus and Mao (2004, p. 516) explain: “In the absence of such ability, participation is a sham and is likely to leave user participants feeling cynical and manipulated as it is to promote the experienced sense of buy-in.”

The WSM has been invented for business professionals who want to participate more actively in IT projects (Alter, 2006). It gives users a chance to perform systems analysis in their own language with or without the help of IT professionals. This approach to participation deviates from what Coughlan and Macredie (2002, p. 7) refer to as “traditional question and answer type process of extraction” often occurring between users and IT professionals.

Nuseibeh (2000, p. 38) underlines that “the context in which RE [requirements elicitation] takes place is usually a human activity system and the problem owners are people.” The usage of the WSM in the elicitation phase provides the problem owners with a tool that puts their business problems in the focus, and empowers them to participate actively in systems analysis efforts.

Poor Communication as another major challenge of requirements elicitation is closely intertwined with many aspects covered in the other three problem areas. The interviews revealed that the multitude of communication interfaces which usually exists in projects lead
to a lack of shared understanding between different involved actors. These issues are similar to challenges involved in the game *Chinese Whispers*, which deals with the loss and misinterpretation of information along a communication chain. The Work System Snapshot is a one-page document containing the most important information about crucial elements of a work system. It is a cornerstone of the WSM and may help to promote a shared understanding by providing one central point of reference about elementary information to all project stakeholders. However, as Saiedian and Dale (2000) acknowledge effective communication is also linked to *how* people are communicating, not only *what*. As argued in chapter 3 effective communication in requirements elicitation cannot only be achieved with the application of a particular method or technique (Holtzblatt & Beyer, 1995; Saiedian & Dale, 2000). This notion is equally reflected in the following statement of David: “You can use many different methods, some kind of ‘cool’ methods, that are very much advertised right now, but for me it is simple: make people work together, make them sit together, discuss it, and build a shared understanding.”

While the application of a particular method might not automatically lead to effective communication and cooperation between involved actors, there is evidence that so-called soft systems approaches are suitable for requirements elicitation (see chapter 2.2). According to Coughlan and Macredie (2002, p. 9) socially-oriented approaches, can help to improve interaction between IT professionals and users: “Socially-oriented approaches to elicitation force a collaborative role-play that elevates the user to an equal footing with the designer so that joint decision-making is possible as well as the satisfaction of both parties.” The WSM could be an adequate tool to contribute to an *equal footing* between different involved actors, and by that enable a more effective communication and cooperation.

Articulation and Expertise Problems constitute another challenge of requirements elicitation. The interviews have revealed that for users it is sometimes challenging to describe their work and its environment in a structured way. The underlying framework of the WSM provides users with a structure to analyze several important elements of a work system in a systematic and comprehensive way. A rigorous systems analysis may help the users as already mentioned to reflect on the work system’s environment, and to overcome organizational-blindness.

Many respondents have shared experiences about users feeling overwhelmed by technical notation applied in the elicitation phase, which can lead to frustration. In this regard Erika has highlighted that users should “focus on ‘what’ they want and ‘why’ they want it” and she adds that “the ‘how’ is for the analysts and developers to figure out.” This notion can equally be found in literature (Nuseibeh & Easterbrook, 2000; Goldsmith, 2004; Roberts, 2011), and has been repeated by further interviewees. The WSM equips the users with a tool, which provides a systematic framework and is based on natural language, to help them find answers to so-called *what* and *why* aspects of requirements elicitation. The *how* should be addressed by IT professionals who have the required technical expertise.

A common language helps to connect users and IT professionals, and supports them in reaching a shared understanding. David has highlighted the benefits of applying the user’s natural language instead of a technical notation for all actors including IT professionals. Likewise Roberts (2011, p. 129) argues that IT professionals “need to be proactively
encouraged to adopt the terminology of the business client“, and Goldsmith (2004, p. 35) suggests that “it is the job of those of us on the development side to learn the business language.” The WSM is based on natural language and does not revert to any technical terminology for systems analysis. By that, it may help to foster a better connection between the users and IT professionals.

The final part of this thesis has been dedicated to the discussion of one specific method for systems analysis, and it’s adequateness for addressing recurring issues of requirements elicitation. The purpose of this discussion has been to establish a first linkage between the potential of the WSM, and recurring issues of the requirements elicitation phase on a rather theoretical and general level. Further research is required to evaluate the adequateness of the WSM for addressing these issues on a more practical and specific level. By conducting further research in the suggested direction two major challenges need to be solved.

Firstly, more empirical data about the concrete application of the WSM in real-world situations needs to be gathered. Alter (2013) provides a comprehensive overview of the current diffusion of the WSM in education and research. However, besides its usage in settings of education and research it seems that there is hardly any documented evidence of its application to real-world issues of IS development. Although Alter acknowledges that the WSM is directly concerned with systems analysis efforts at the very beginning of IT development projects (Alter, 2012), and that inadequate requirements are a major reason for IS failures (Alter, 2013), this has not yet led to a dedicated discussion of the WSM and its usefulness for the purpose of eliciting requirements. For this discussion also shortcomings and limits of the WSM need to be identified.

Secondly, the need for using many different methods and techniques within the requirements elicitation phase has been expressed in many research papers (Macaulay, 1996; Maiden & Rugg, 1996; Nuseibeh & Easterbrook, 2000; Hickey & Davis, 2004; Zowghi & Coulin, 2005). Further research might need to consider the usefulness of the WSM to complement other methods and techniques typically applied in this phase (for instance, a requirements elicitation workshop), and analyze how the WSM can contribute to a better understanding between users and IT professionals. Besides, it has been shown in literature that the extent to which methods and techniques are followed in the requirements elicitation phase varies a lot (Coughlan & Macredie, 2002; Coughlan et al. 2003; Holmström & Sawyer, 2011). Zowghi and Coulin (2005) remind that most often activities in the elicitation phase are guided by time and costs constraints. This notion has been confirmed during the interviews, and further research is required to determine a potential place or role for the WSM within the requirements elicitation phase.
Interview guide

(A) Description of the typical project environment

- Type of system (custom-build vs. COTS)
- Purpose of project
- Role of respondent
- Size of project (stakeholders involved, time, etc.)

(B) Common challenges and pitfalls in Requirements elicitation

(What comes to mind first?)

(C) Were these following issues experienced? How were they addressed?

- Different understanding of actual problems, or scope of a project
- Different understanding of project goals
- Lack of domain knowledge
- Communication issues

(D) What are specific methods, techniques or tools mostly used in projects?

Why is this technique chosen? (Possible motivations: application of a specific methodology-driven approach, “because the analyst only knows this one”, intuition, etc.)

How was it performed and to which extent has it been applied?

(E) Were methodologies for organizational or systems analysis used in projects?

(F) Are there experiences with the following elicitation techniques?

- Uses cases or user stories
- Apprenticing, user observation, prototyping or ethnographic approach

(G) What were the specific, observed shortcomings/challenges with techniques/tools?
References


Appendix 2: List of references


