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Using a grounded theory approach for exploring software product management challenges

Sami Jantunen[a,*], Donald C. Gause[b]

[a] Technology Business Research Center, Lappeenranta University of Technology, FI-53851 Lappeenranta, Finland
[b] Binghamton University and Savile Row, LLC, Department of Bioengineering, Innovation Technology Center, Binghamton University, State University of New York, PO Box 6000, Binghamton, NY 13902-600, USA

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ABSTRACT

The traditional requirements engineering (RE) research paradigm, along with most engineering research and practice, is commonly seen to belong to the philosophical tradition of positivism, which construes knowledge as accruing through the systematic observation of stable and knowable phenomena. Consequently, RE methods tend to ignore social issues. However, due to the dominant role of the human being in RE, there has been an increasing need to rely on research methods of the social sciences, arts, and humanities for RE related findings. This paper illustrates one example of how social aspects in RE have been explored with a research method adopted from social sciences research tradition. Drawing heavily on the research reported in the doctoral thesis of the principal author, we describe in this paper: (1) how a study using a grounded theory approach was designed and conducted for exploring market-driven requirements engineering (MDRE) challenges in seven companies, (2) how the analysis eventually proceeded toward a proposed theory, and (3) our experiences of using a grounded theory approach within the discipline of RE.

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1. Introduction

The traditional requirements engineering (RE) research paradigm, along with most engineering research and practice, is commonly seen to belong to the philosophical tradition of positivism, which construes knowledge as accruing through the systematic observation of stable and knowable phenomena (Potts and Newstetter, 1997). Consequently, RE methods tend to ignore social issues (Goguen, 1993). Yet, the research challenges faced by the RE community are distinct from those faced by the general software-engineering community. According to Cheng and Atlee (2007), this is due to the fact that requirements reside primarily in the problem space, whereas other software artifacts reside primarily in the solution space. That is, "RE deals with defining precisely the problem that the software is to solve (i.e. defining what the software is to do), whereas other software engineering activities deal with defining and refining a proposed software solution" (Cheng and Atlee, 2007).

During recent years, criticism against the dominant position of the positivist perspective in RE has increased. As an example, Hinds (2008) argues that the "positivist perspective is at best detrimental, and at worst antithetical to the activity of engineering requirements". There is notable and growing awareness of the need to take into account social and contextual factors in RE (Potts and Newstetter, 1997). In order to address social and contextual factors in RE, we first need to understand current practices and their challenges. According to Davis and Hickey (2002), this is a task that many RE researchers fail to accomplish. As a result, the researchers risk creating new knowledge that has no practical value (Davis and Hickey, 2002). In a similar vein, Gause (2004) has argued that, due to the dominant role of the human being in RE, we need to rely more heavily on research methods of the social sciences, arts, and humanities for our findings. We must be tolerant and even encouraging of all forms of discovery within RE and embrace any form of research that offers even hints of promise (Gause, 2004).

This paper illustrates one example of how social aspects in RE have been explored with a research method adopted from social sciences research traditions. The paper reports, on a detailed level, (1) how a study using a grounded theory approach was designed and conducted for exploring market-driven requirements engineering (MDRE) challenges in seven companies, (2) how the analysis eventually proceeded toward the proposal of a theory, and

* Corresponding author. Tel.: +358 405025071.
E-mail addresses: sami.jantunen@lut.fi (S. Jantunen), dgause@stny.rr.com (D.C. Gause).

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(3) the experiences of using a grounded theory approach within the discipline of RE. The paper focuses on describing the research activities and experiences of the study. A more complete description of the study and its results can be found in the doctoral thesis, *Making Sense of Software Product Requirements* (Jantunen, 2012).

Due to the fact that this study was conducted within the interpretive research tradition, researchers were considered as knowledge workers, needing to confront with potentially conflicting demands. In their role as *instrument* they relied on their personal experience and subjective engagement with phenomena in the field to generate insights, whereas in their role as *scientist* they needed to convince the scientific community of the trans-situational and reliable nature of these very phenomena (Schulze, 2000). In this paper, the researcher's role as an instrument has primarily been conducted by the principal author, while the second author has been actively participating in the role of the scientist. For these reasons, this paper follows a *confessional* writing style through the voice of the principal author, exposing the researcher, and rendering his actions, failings, motivations, and assumptions open to public scrutiny and critique (Schulze, 2000).

The remainder of this paper is organized as follows. Section 2 describes how the research problem and research questions were initially shaped for this study. Section 3 then describes how the research setting was designed for the study. Section 4 provides an overview to the grounded theory approaches. Section 5 describes, on a practical level, the data collection and management. Details of data analysis that led to the development of a theory proposal are described in Section 6. Section 7 compares the proposed theory with related work. Section 8 discusses how a grounded theory could be assessed and, finally, Section 9 reveals our experiences while conducting the study.

2. The research problem and its shaping – a personal view

This section describes factors that have affected the choice of study, discusses their role in shaping the research problem and, finally, determines initial research questions for the study. It is written in the first person as these observations were discovered personally by the principal author as this process moved forward.

If I had to single out the most significant factor motivating this study, I would say that it was my past professional experience. For this reason, it was necessary to first address portions of my professional history and beliefs. This was important not only because it narrowed down the research topics I was motivated to study. It was also the starting point to address my prejudices in developing the research results. As Suddaby (2006) has argued: "in grounded theory approaches, researchers must account for their positions in the research process. That is, they must engage in ongoing self-reflection to ensure that they take personal biases, world-views, and assumptions into account while collecting, interpreting, and analysing data".

During my career, I have turned from a person firmly believing in the efficiency of current and recent past software development processes into a one that is critical and doubtful. In my past professional life, I remember often wondering why so many important product-related design decisions were left to be made by the software developers. To me, this was rather odd because the software developers almost never visited the customers and thus did not know well their customer's intended use of the products. It appeared to me that in the quest of being efficient, the organization actually systematically ignored most of the knowledge it possessed. I had gradually started to believe that, on occasion, the way we develop software products fits poorly with the design challenge. We seem to have a tendency to take software development processes for granted and accept them to be 'the professional way' without much criticism. These experiences motivated me to try to develop a better understanding of current software development practices and their shortcomings in the development of commercial products.

Research became reality only after the motivation met the opportunity. The research opportunity emerged in the form of the Global Network Management (GNM) research project that attempted to (1) investigate how a company can create and maintain successful business in a global environment that is based on technology, knowledge and partnerships, and (2) increase possibilities for successful business by transferring the research results to the companies in the form of best practices (GNM project, 2006). Being part of the GNM research project, I was restricted and guided by the project-level objectives. From the GNM project's four research themes, my focus was on research & development (R&D) and product management while investigating their relation to partner network management and business. These responsibilities in the GNM project fit well with my motivation to understand why current software development approaches do not seem to work well, at least, in certain situations.

My motivations and the boundaries set by the GNM project situated this study within the discipline of requirements engineering (RE), which operates at different levels, including the organizational, product and project levels, and is concerned with the critical problem of designing the right software for the customer (Aurum and Wohlin, 2005). Since my past professional experiences have made me critical and doubtful of the efficiency of existing software development approaches, I have started to believe that there are much more human nuances in software development than are currently acknowledged. This is why I decided to focus on human behavior in software development. Taking into account the factors affecting this study, the research problem was hence initially broadly defined as: *human aspects in software product companies' requirements engineering activities*.

"Even though there is merit in open-mindedness and willingness to enter a research setting looking for questions as well as answers, it is impossible to embark upon research without some idea of what one is looking for and foolish not to make that quest explicit" (Wolcott, 1982, p. 157). Hence, I took the suggestion by Miles and Huberman (1994, p. 25) to start with some general research questions. General research questions allow more clarity of what is in the current situation, generally speaking, of greater interest. They make the implicit explicit without necessarily freezing or limiting our vision Miles and Huberman (1994, p. 25).

When deriving initial research questions from the research problem statement, I focused on three constraints originating from the research problem definition. First, the research problem statement implied that I was working with companies offering a *software product*. This suggested that I needed to understand mechanisms of just how companies gather information about the markets and how they utilize the gathered information in their product development. Second, the emphasis on *human aspects* suggested focusing on human interaction in order to understand how collaboration occurs in the companies and how information is shared with different parties. Third, *requirements engineering activities* led me to investigate companies' current requirements engineering practices and the resulting challenges of following them.

Taking these considerations into account, my initial set of research questions came to be as follows:

1. How can the role of human interaction be described in the organizations' attempt to position their software product in the marketplace?
   a. How do software product development organizations develop understanding regarding the market?
   b. How do software product development organizations utilize the developed understanding of the market in their product development?

c. What are the challenges faced by today's software product development organizations?
2. How can the organizations' attempt to position their software product in the marketplace be supported?

3. Approaching the research design

Research design is about finding an appropriate fit between the components of a research effort, such as the paradigm, the research questions, the study design, the data collection procedures, and the data analysis procedures (Easterbrook et al., 2008; Edmondson and McManus, 2007; Lincoln and Guba, 2000; Punch, 1998, p. 22). Denzin and Lincoln (2000) have suggested five phases for defining a research process:

1. The researcher's position within the research tradition.
2. Research paradigms and perspectives.
3. Research strategies.
4. Methods of data collection and analysis.
5. Interpretation and presentation of findings.

I address each of these phases as follows. I will first provide an overview of research paradigms and perspectives in order to define my position within the research tradition (Section 3.1). Next, I will discuss how my choice of research paradigm has affected the choice of research strategy for this study (Section 3.2). I will continue by describing what methods of data collection and analysis the chosen research strategy implies (Section 4.1). The interpretation and presentation of findings will be discussed in Section 4.2.

3.1. My position within research paradigms and perspectives

"Beliefs limit what people see and how they inquire" (Weick, 1986). Assumptions about the nature of the world and the way in which it may be investigated affect the way scientists approach their subject (Burrell and Morgan, 1979). A professional community that shares similar kinds of assumptions about knowledge, how to acquire it and about the physical and social world, is called a 'paradigm' (Hirschheim and Klein, 1989).

Existing literature (e.g. Burrell and Morgan, 1979; Creswell, 1998; Deetz, 1996; Lincoln and Guba, 2000) recognizes numerous ways of distinguishing and labeling paradigms. I chose to approach this topic with Burrell and Morgan's framework (1979) because it focuses on social sciences and is intended to map one's own personal frame of reference with regard to social theory. Burrell and Morgan (1979) argue that it is convenient to map paradigms along two dimensions: *subjective-objective* and *regulation-radical change*. These authors have further decomposed the subjective-objective dimension into debates of ontology, epistemology, human nature and methodology.

The *regulation-radical change* dimension in Burrell and Morgan's (1979) framework relates to assumptions about the nature of society. According to Burrell and Morgan (1979) "the *sociology of regulation* is essentially concerned with the need for regulation in human affairs; the basic questions which it asks tend to focus upon the need to understand why society is maintained as an entity". Burrell and Morgan (1979) define the *sociology of radical change* to stand in stark contrast to the sociology of regulation in that "its basic concern is to find explanations to the radical change, deep-seated structural conflict, modes of domination and structural contradiction which its theorists see as characterizing modern society". According to the authors (Burrell and Morgan, 1979), sociology of radical change is "essentially concerned with man's emancipation from the structures which limit and stunt his potential for development. The basic questions which it asks focus upon the deprivation of man, both material and psychological".

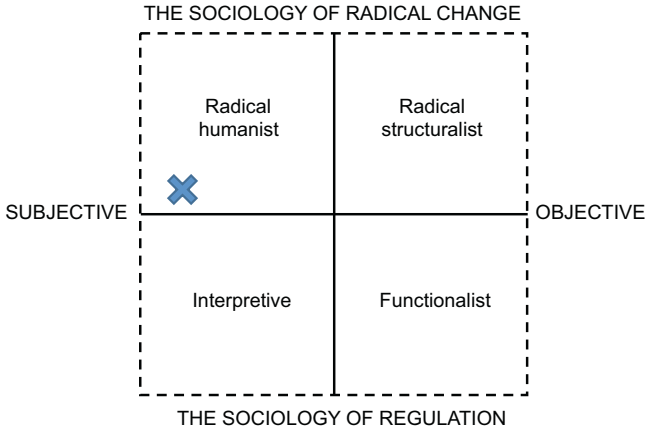

Fig. 1. Four sociological paradigms (Burrell and Morgan, 1979). My philosophical stance is marked with 'X'.

The subjective-objective and regulation-radical change dimensions define four distinct sociological paradigms: *radical humanist*, *interpretive*, *radical structuralist* and *functionalist.* These paradigms define fundamentally different perspectives for the analysis of social phenomena. They approach this endeavor from contrasting standpoints and generate quite different concepts and analytical tools (Fig. 1).

When situating myself among the research traditions (Fig. 1), I felt that I am not dogmatic with the choice of a paradigm. Instead, I believed that my choice of paradigm depends closely on the research problem. As the research problem in this case evolved to be a desire to understand better human aspects in software product companies' requirements engineering activities, it was relatively easy to situate myself along the subjective-objective dimension. In this research effort, I was inclined toward the subjective end of the spectrum. In other words, I saw the research area to be situated in a social world that (Burrell and Morgan, 1979):

1. assumes that the social world external to individual cognition is made up of nothing more than names, concepts and labels which are used to structure reality (*nominalist* view on ontological debate),
2. is relativistic and can be understood only from the point of view of the individuals who are directly involved in the activities which are to be studied (*anti-positivist* view on epistemological debate),
3. assumes man to be completely autonomous and free-willed (*voluntarist* view on human nature debate), and
4. can be understood only by obtaining first-hand knowledge of the subject under investigation (*ideographic* view on the methodological debate).

The regulation-radical change dimension was slightly more difficult for me. Even though I found interpretivists' desire to understand the essence of the everyday world appealing, I saw many things unnatural in current software development approaches. Therefore, I situated myself, with hesitation, within the *radical humanist paradigm*, which "has an interest to be released from the constraints which existing social arrangements place upon human development and to provide critism of the status quo" (Burrell and Morgan, 1979).

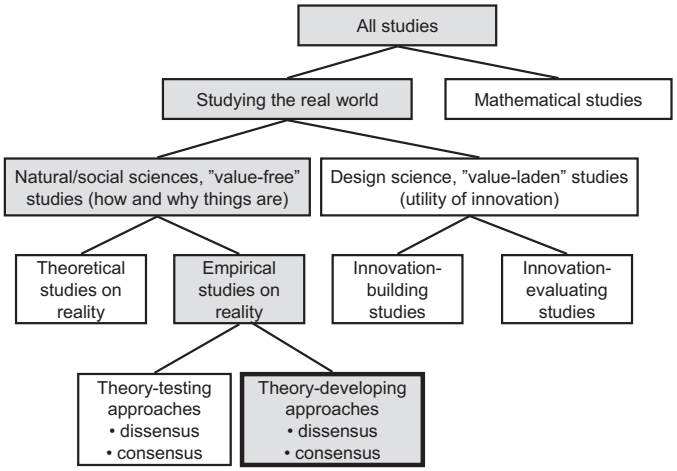

Fig. 2. Järvinen's classes of research approaches (Järvinen, 2008). The selected approach for this study is in gray.

3.2. Research strategies

The choice of a research paradigm has an effect on what type of research approach is suitable for a particular research effort. As I situated myself within the radical humanist paradigm, I had a tendency to favor the subjectivist approach to the social sciences. Furthermore, as a radical humanist, I tended to believe that existing theories do not provide a sufficient explanation to the phenomenon I want to study. When comparing my choice of a research paradigm with Järvinen's (2008) classification of research approaches, this research effort can be defined as one that attempts to understand what is reality with a theory-developing and empirical approach (Fig. 2). Such a research approach fits the research area defined earlier as *the human aspects in software product companies' requirements engineering activities*.

The choice of theory-creating approaches typically suggests qualitative research (Punch, 1998, p. 16). The principal advantage of using qualitative methods is that they force the researcher to delve into the complexity of the problem rather than abstract it away, resulting with findings that are richer and more informative (Seaman, 1999). However, even though the choice for my research approach was now considerably narrowed, I was still left with a number of approaches to choose from: the ethnographic method, grounded theory, phenomenography, contextualism and discourse analysis, to name a few (Järvinen, 1999).

I chose a grounded theory approach for this study because it fit the nature of the research problem and my background. Grounded theory approaches have been claimed to be effective and appropriate means of researching emerging phenomena in their own organizational and human context (Locke, 2001, p. 95; Orlikowski, 1993), valuing the professional experience of the researcher (Locke, 2001, p. 95; Strauss and Corbin, 1990, p. 46). Choosing a grounded theory research approach comes with risks. Potential problems in following a grounded theory approach have been reported to be (Robson, 2002, p. 192; Seldén, 2005): (1) the impossibility to avoid pre-existing theoretical ideas and assumptions, (2) tensions between the evolving and inductive style of a flexible study and the systematic approach of a grounded theory analysis, (3) difficulties in practice to decide when categories are 'saturated' or when the theory is sufficiently developed, (4) existing prescribed categories of the theory which may not appear appropriate for a particular study, and (5) the break from context during the early steps of analysis.

4. Overview to the grounded theory approaches

The initial grounded theory approach was developed in the early 1960s by Barney Glaser and Anselm Strauss. Glaser and Strauss came together at a time when they both had in common a strong dissatisfaction with the nature of theorizing that prevailed in sociology, and a conviction that theory needed to be intimately connected to rich observational data (Locke, 2001, p. 29). The development of the original grounded theory approach was their reaction against the exclusive insistence on theory verification research, especially in the American sociology of the 1950s (Punch, 1998, p. 166).

A formal description of their grounded theory approach, *The Discovery of Grounded Theory* (Glaser and Strauss, 1967), was published in 1967. As originally stated, Glaser and Strauss characterized this research approach as one oriented toward the inductive generation of theory from data that have been systematically obtained and analyzed (Glaser and Strauss, 1967, p. 1). The research process they articulated provided the means to achieve the development of more empirically grounded theories of everyday action in context (Locke, 2001, p. 30). Since its foundation, the use of the original grounded theory approach has been extended to several disciplines such as management and business studies (Locke, 2001), information systems (Urquahart et al., 2010) and software engineering (Adolph et al., 2011).

The distinctive feature of a grounded theory approach is its commitment to research and "discovery" through direct contact with the social world of interest coupled with a rejection of a priori theorizing (Locke, 2001, p. 34). The rejection of pre-conceived theories is argued vehemently by Glaser and Strauss specifically because pre-conceived theories may come between researchers and the subjects of their study, potentially obstructing the development of the theory. According to Strauss and Corbin (1990, p. 49) "the objective in grounded theory studies is to explain phenomena in light of the theoretical framework that evolves during the research itself". Thus, it is not desired to be constrained by a previously developed theory that may or may not apply to the area under investigation Strauss and Corbin (1990, p. 49). With the emergence of the analysis, the understanding about research questions and related literature also evolves.

In other words, grounded theory studies do not start with a conceptual framework, but rather aim to end up with one (Miles and Huberman, 1994, p. 298). They do not start with a ready set of research questions, but attempt to hasten slowly to understand what it is that needs to be found out (Punch, 1998, p. 38). They are studies where the literature coverage is deliberately delayed until directions emerge from the early analysis of data (Punch, 1998, p. 43). Researchers may not even know which literature is relevant until the analysis is well advanced (Glaser, 1992, p. 32). However, this stance is part of the approach only in the beginning. "When the proposed theory seems sufficiently mature, then the researcher may begin to review the literature in the substantive field and relate the literature to his or her own work in many ways" (Glaser, 1992, p. 32). "Slowly, as the grounded theory analysis emerges with strength and formulation the researcher can start to switch at a commensurate pace to the related literature" (Glaser, 1992, p. 36).

Interestingly, as Locke (2001, p. 2) points out, just what constitutes a grounded theory approach is currently by no means an unequivocal or an uncontested issue. Since writing the original monograph (Glaser and Strauss, 1967), the initial grounded theory approach has evolved and adapted as the originators, their students, and other methodologists have further articulated and extended its research practices (Locke, 2001, p. 2). These subsequent texts (Glaser, 1978, 1992; Strauss and Corbin, 1990) also express key differences in the authors' styles of processing their grounded theory approaches. Generally speaking, Glaser's

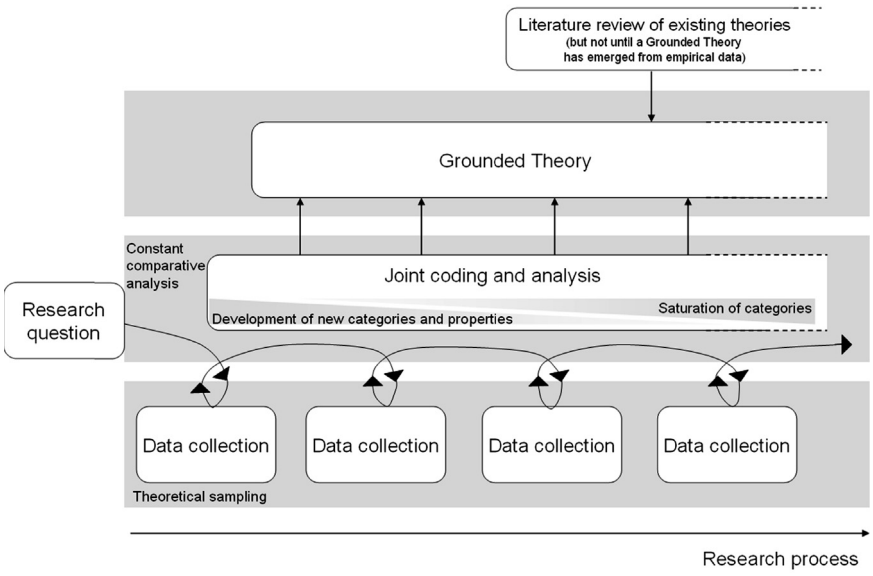

Fig. 3. Basic process of a grounded theory approach (Wagner et al., 2010).

interpretation of the necessary operational practices tends toward more openness, flexibility, and more parsimony, while Strauss' interpretation of the approach tends toward increased prescription and formal elaboration of operational procedures (Locke, 2001, p. 64).

One source of debate between the originators of the grounded theory approach has been the role of the research problem. Strauss and Corbin (1990, p. 34) advise the researcher to begin the grounded theory study by defining a research problem. However, Glaser (1992, p. 22) argues that "the grounded theory researcher moves into an area of interest with *no* problem. He or she moves in with the abstract wonderment of what is going on and how it is to be handled". According to Glaser (1992, p. 21), the underlying principle in his grounded theory approach which leads to a researchable problem with a high yield and relevance is that the research problem and its boundaries are discovered as the analysis begins.

The debate on the role of the research question takes a similar course. According to Strauss and Corbin (1990, p. 38), "the research question in a grounded theory study is a statement that identifies the phenomenon to be studied, telling what you specifically want to focus on and what you want to know about this subject". Glaser (1992, p. 25) on the other hand argues that: "the research question in a grounded theory study is *not* a statement that identifies the phenomenon to be studied. The focus for the research and questions regarding the problem emerge as the analysis proceeds". Since research questions do not usually come out right the first time, several iterations are often required. We reach an answer to the question 'what are we trying to find out?' only after careful thought (Punch, 1998, p. 38).

It has been suggested that every researcher who chooses to use grounded theory as their research approach should critically investigate this divergence between the founders of the initial grounded theory approach (Goede and de Villiers, 2003; Smit, 1999). My stance toward the debate on the research problem and research question was closer to Glaser's point of view. For this reason, I approached the research area with caution and shaped the research problem definition and research questions little by little.

4.1. Methods of data analysis

Grounded theory is both an approach for research and a way of analysing data (Punch, 1998, p. 163; Robson, 2002, p. 191). Grounded theory has also been referred to being the resulting theory that emerges by following a grounded theory approach. For the sake of clarity, we shall in this article refer to the grounded theory research strategy as a *grounded theory approach*, method of data analysis that leads to a grounded theory as a *grounded analysis*, and the resulting theory as *the grounded theory*. Due to the fact that there are disagreements on the grounded theory approaches and grounded analysis methods, we have deliberately avoided the use of definite article 'the' in our use of the term *grounded theory*.

The basic process of a grounded theory approach is depicted in Fig. 3 (Wagner et al., 2010). A grounded theory approach is built upon two key concepts: *constant comparison*, in which data are collected and analyzed simultaneously, and *theoretical sampling*, in which decisions about which data should be collected next are determined by the theory that is being constructed (Glaser and Strauss, 1967, p. 45). As Suddaby (2006) points out, both concepts violate longstanding positivist assumptions about how the research process should work. Constant comparison contradicts the myth of a clean separation between data collection and analysis. Theoretical sampling, on the other hand, violates the ideal of hypothesis testing, because data collection is not determined by a priori hypotheses, but by ongoing interpretation of data and emerging conceptual categories (Suddaby, 2006).

The contradicting characteristics of a grounded theory approach against what has dominantly been considered as the conduct of good science does not mean that a grounded theory approach lacks rigor. A grounded theory approach sets down a stringent regime of rigorous steps for the interpretation and presentation of findings (Fernández et al., 2002; Glaser, 1978, p. 2).

A grounded theory study involves going out into the field and collecting data (Robson, 2002, p. 191). Although interviews are the most common data collection method, other methods such as observation and the analysis of documents can be and have been used together with a grounded theory analysis (Robson, 2002, p. 191). The set of research practices that comprise a grounded theory approach are designed to help researchers derive conceptual categories from gathered data and to delineate the ways in which the categories relate to each other (Locke, 2001, p. 37). Thus, grounded theories are made up of a number of conceptual categories that are organized in terms of their relationship to each other. Glaser and Strauss describe theoretical accomplishments with terms such as 'categories,' 'core categories,' 'properties,' and 'generalized relations' or 'hypotheses' (Locke, 2001, p. 39).

Central to a grounded analysis are two basic operations, *coding* and *memoing*. Coding is an operation "by which data are broken down, conceptualized, and put back together in new ways" (Strauss and Corbin, 1990, p. 57). "Coding moves the analysts away from the empirical level by fracturing the data, then conceptually grouping it into codes that then become the theory which explains what is happening in the data" (Glaser, 1978, p. 55). While coding is considered as a way of analyzing, at a concrete level it can be defined as the process of putting tags, names or labels against pieces of the data (Robson, 2002, p. 493). The second basic operation, memoing, links coding with the development of propositions (Punch, 1998, p. 207). "A memo is the theorizing write-up of ideas about codes and their relationships as they strike the analyst while coding, constantly comparing, coding and analyzing" (Glaser, 1992, p. 108). Memoing is essential, for without it the researcher would have no written record of his or her analysis (Glaser, 1978, p. 89).

The essential idea in discovering a grounded theory is to find a core category, at a high level of abstraction but grounded in the data, which accounts for what is central in the data (Punch, 1998, p. 210). This is done in three stages (Robson, 2002, p. 493):

1. finding conceptual categories in the data;
2. finding relationships between these categories;
3. conceptualizing and accounting for these relationships through finding a core category.

The analyst begins the conceptualization with *open coding*, which is "the part of analysis that pertains specifically to the naming and categorizing of phenomena through the close examination of data" (Strauss and Corbin, 1990, p. 62). This is largely accomplished by asking questions about data and making comparisons for similarities and differences between each incident, event, and other instances of phenomena (Strauss and Corbin, 1990, p. 74).

It should be noted that Glaser and Strauss have differences in their coding procedures. Glaser distinguishes two types of coding processes, *substantive* (comprising open and selective coding) and *theoretical*. Strauss and Corbin (1990) described three: open, axial, and selective. The approaches to open coding are similar, although Glaser places more emphasis on the importance of allowing codes and a theoretical understanding of the data to emerge than Strauss and Corbin do (Kendall, 1999). In Glaser's view, substantive codes conceptualize the empirical substance of the research area (Glaser, 1992, p. 62), whereas theoretical codes "conceptualize how the substantive codes may relate to each other as hypotheses to be integrated into the theory" (Glaser, 1978, p. 55). Without substantive codes, theoretical codes are empty abstractions (Glaser, 1978, p. 72).

The main controversy involves Strauss and Corbin's addition of an intermediary set of coding procedures called axial coding (Kendall, 1999). Axial coding is defined by Strauss and Corbin (1990, p. 96) as "a set of procedures whereby data are put back together in new ways after open coding, by making connections between categories. This is done by using a coding paradigm involving conditions, context, action/interactional strategies, and consequences". Glaser argues that although this kind of conceptual elaboration is easy to do, it will not result with a grounded theory (Glaser, 1992, p. 62). Glaser further argues that "if you torture data enough, it will give up!" (1992, p. 123). Glaser insists that the codes used should be driven by conceptual interests that have emerged from the data and not "forced" into any particular scheme (Kendall, 1999). This is why Glaser (1978) has detailed eighteen theoretical coding families so that analysts may be sensitized to possible connections between categories and properties. Theoretical codes are essentially discovered through a process of theoretical sorting, which begins to put the fractured data back together (Glaser, 1978, p. 116). According to Glaser, theoretical codes can be discovered as sorting proceeds by asking theoretical questions of the substantive codes, such as: "Is this a condition or a context? Is it a matter of degree or two dimensions?" (Glaser, 1978, p. 118).

Glaser and Strauss disagree also on the process of selective coding. Strauss and Corbin see selective coding to occur toward the end of the grounded analysis as a process of "selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development" (Strauss and Corbin, 1990, p. 116). Glaser, on the other hand, sees selective coding to occur earlier in the grounded analysis, during which the analysts cease open coding, delimiting coding to only those variables that are related to the core category, in sufficiently significant ways to be used in a parsimonious theory (Glaser, 1992, p. 75).

Goulding (2001) summarizes the key differences between these two approaches as follows: "Glaser's approach may be seen as risky and unfocused by many who are reluctant to give themselves up to the data and wallow in the creative process. Strauss and Corbin, on the other hand have been accused of stifling creativity by making the methodology overly mechanistic, highly formulistic and inflexible". In order to avoid confusion over terminology and procedures, it is hence important to recognize the differences between these two approaches (Goulding, 2001). The data analysis of this study has followed Glaser's coding procedures.

4.2. Writing grounded theory

Suddaby (2006) has captured the essential challenge of reporting a grounded theory study with the following statement:

> "In pure form, grounded theory research would be presented as a jumble of literature consultation, data collection, and analysis conducted in ongoing iterations that produce many relatively fuzzy categories that, over time, reduce to fewer, clearer conceptual structures. Theory would be presented last. Presenting a grounded theory in this pure form, however, would be neither efficient nor comprehensible to the majority of researchers who work in the positivist paradigm."

Documenting the study with a theory-generating structure demands considerable powers of exposition and analytic grasp if it is not only to be theoretically convincing but also to demonstrate a rigorous approach to data analysis and interpretation (Punch, 1998). While it is certainly necessary to explicate the developed theoretical framework, it is also vital to persuade the audience of its plausibility and its relevance. Miles and Huberman (1994, p. 304) have offered general guidelines for reporting a qualitative study:

1. The report should tell us what the study was about or came to be about.
2. It should communicate a clear sense of the social and historical context of the setting(s) where data were collected.
3. It should provide us the "natural history of the inquiry," so we see clearly what was done, by whom, and how. More deeply than in a sheer "methods" account, we should see how key concepts emerged over time; which variables appeared and disappeared; which codes led into important insights.
4. A good report should provide basic data, preferably in focused form (vignettes, organized narrative, photographs, or our data displays) so that reader can, in parallel with the researcher, draw warranted conclusions. (Conclusions without data are a sort of oxymoron.)
5. Finally, researchers should articulate their conclusions, and describe their broader meaning of the worlds of ideas and action they affect.

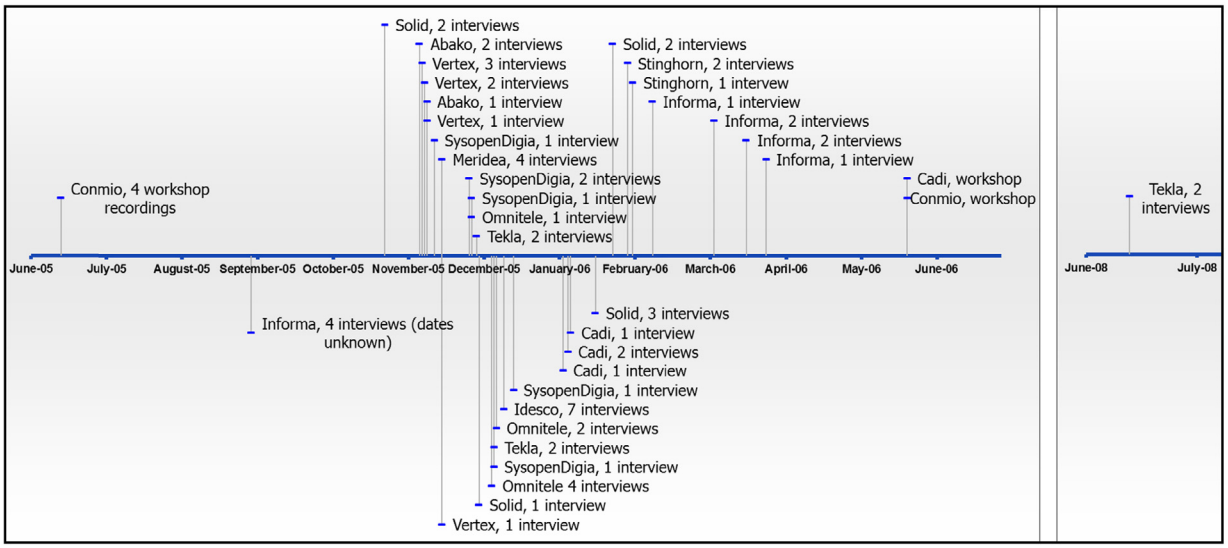

Fig. 4. Approximate timeline of the conducted interviews.

The challenge to authors then is to illustrate data and link them to the theoretical points. Typically, this is accomplished through a style of presentation that moves back and forth between extensive theoretical presentation and illustrative 'live' excerpts from the setting, alternating between 'telling' and 'showing' (Locke, 2001, p. 116). The grounded theory analysis, including coding techniques and category creation, needs to be made apparent to the reader (Suddaby, 2006). Furthermore, it is necessary to document how the analysis proceeded in the course of time by producing a thorough report of a carefully reasoned set of consistent choices, after consideration of the alternatives. In the written report, the writer is, among other things, telling the reader about the decision path taken through the research, and taking the reader down that path (Punch, 1998, p. 278).

5. Focusing and bounding the collection of data

It was decided within the GNM project that data are primarily gathered with semi-structured interviews. A semi-structured interview has predetermined questions, but the order can be modified based upon the interviewer's perception of what seems most appropriate. Question wording can be changed and explanations given; particular questions which seem inappropriate with a particular interviewee can be omitted, or additional ones included (Robson, 2002, p. 270). This decision fit well with the objectives of this study because semi-structured interviews have been found to be "particularly suitable in situations where a study focuses on the meaning of particular phenomena to the participants and where individual perceptions of processes within a social unit – such as a work-group, department or whole organization – are to be studied prospectively, using a series of interviews" (Robson, 2002, p. 271). In addition to the interviews, documents relevant to the interview topic were gathered. In the case of this study, such secondary data included organizational charts, product development related memos, process descriptions and design artifacts.

The companies taking part in the GNM project were explored from several perspectives. A set of interview questions was developed on the topics of business, internationalization, judicial issues and partnerships. Such a holistic exploration of each company has helped in building a rich understanding of the context in which the phenomenon under study has been situated. The questions relevant to the research questions of this paper were added to the interviews concerning partnerships in practice. These questions explored, in particular, collaboration and sharing of information both within the organization and between the company and partners.

5.1. Conducting interviews

The primary source of data has been the twelve companies that participated in the GNM project. A common denominator for all twelve companies was the fact that they operated in the software business and each had a strong interest in strengthening their global activities.

In order to gain a holistic understanding of each of the companies, several interviews were conducted from different perspectives in each of the companies (Fig. 4). Typical interviewees included management-level representatives responsible for business, marketing, partnerships, legal issues or product development. The interviews were, in most cases, conducted in the company's premises by two out of the four GNM project's researchers. Almost all of the interviews were conducted in Finnish. Almost all interviews were audio taped and transcribed. The interviews were always transcribed by one individual. Some of the interviews were transcribed by the researchers and some were transcribed by a professional third party. The transcriptions have focused on capturing the spoken meaning of the interviews. Gestures and facial expressions have often been left undocumented. In total, 71 interviews were conducted within the companies participating in the GNM project. On an average, the interviews lasted roughly 1.5 h.

The great majority of the interviews were conducted during late 2005 and early 2006 (Fig. 4). The project-level decision to gather large amounts of data at the very beginning of the GNM project contradicts, to a certain extent, with the concept of *theoretical sampling*. However, according to Glaser and Strauss (1967, p. 71), theoretical sampling can also be performed with previously collected research data. Nevertheless, this effort requires a large mass of data to draw on in order to develop a theory of some density of categories and properties. This has been the case in the data analysis of this paper. As the GNM project has produced vast amounts of rich data, it has been possible to go back to the transcribed interviews and re-analyze the data in light of the improved understanding of the phenomenon under study.

5.2. Data management

Since the data collection was a group effort by four of the GNM project's researchers, it was necessary to manage the data

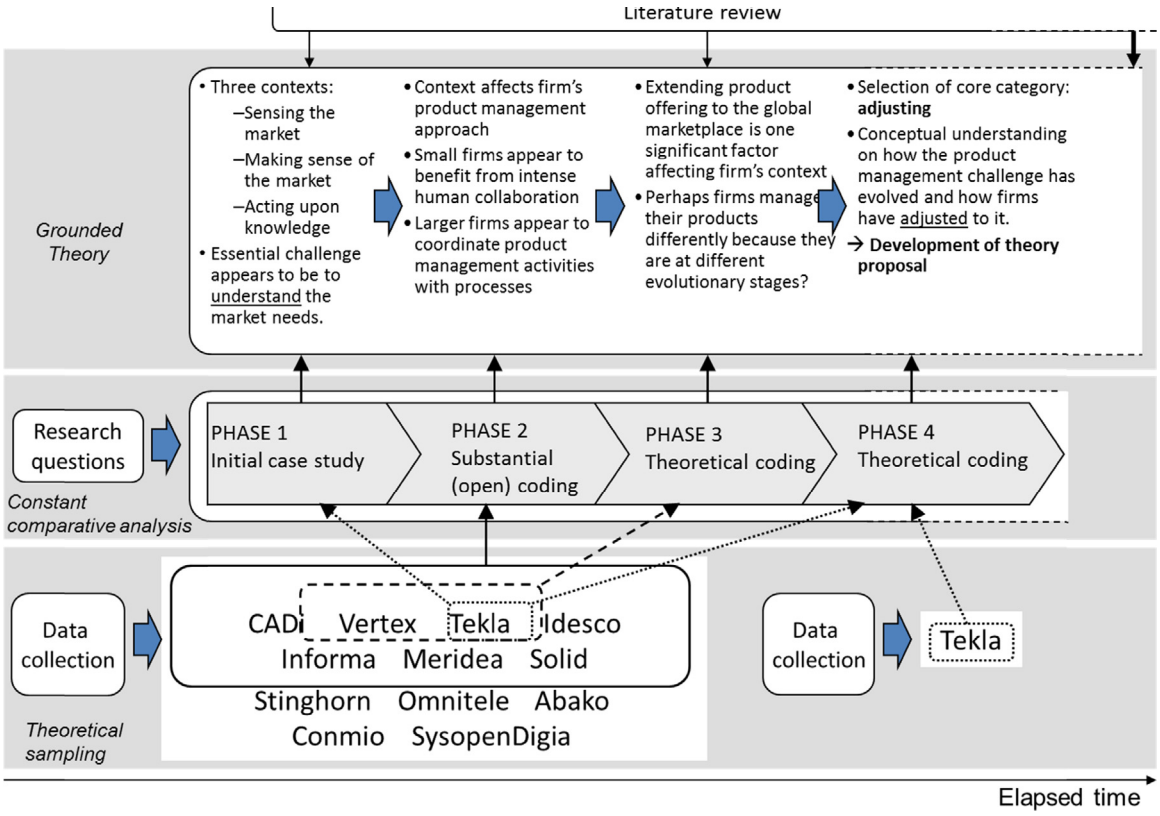

Fig. 5. Overview of the research steps.

collection at the project level. For such a purpose, a set of spreadsheet pages was set up in order to gather details on the data collection activities within each company and to provide a summary of the data gathering activities. These spreadsheet pages kept track of the following details related to each interview:

1. Date and time of the interview
2. Name(s) of the interviewee(s)
3. Name(s) of the interviewer(s)
4. Location of the interview
5. Topic of the interview
6. Status of transcription (ready/under progress/not assigned yet)
7. Person responsible for transcription
8. Format of the audio file

For the purposes of this study, I extended the data management practices further by keeping track of the length of the interviews and by writing *contact summary forms*, as suggested by Miles and Huberman (1994, p. 51). The contact summary forms can be used in several ways (Miles and Huberman, 1994, p. 52): (a) to guide planning for the next contact, (b) to suggest new or revised codes, (c) to help with coordination when more than one field-worker is involved in the study, (d) to reorient yourself to the contact when returning to the write-up, and (e) to help with further data analysis. I then further organized the gathered data by creating a *data accounting sheet* to keep track of the extent each interview provided data to my research questions (Miles and Huberman, 1994, p. 80).

The data management has been most active in the early part of the research. Although I see value in the efforts to manage the data, these practices have eventually faded as the analysis advanced further and became more independent from the more specific project-level activities.

6. Data analysis

> "[The analysis of qualitative data] is sometimes boring, often tedious, and always more time-consuming than expected. However, the alternative to data analysis (which, unfortunately, is sometimes practiced even in published work) is to simply write down all the researcher's beliefs and impressions based on the time they have spent in the field collecting data. This alternative pseudoanalysis method is attractive because it is certainly easier than rigorous analysis, and most researchers feel that they "know" a great deal about the setting they have studied. But it is neither scientific nor reliable, and this practice is largely responsible for the skepticism about qualitative methods that is so prevalent in our field (Seaman, 1999)."

An overview of the research steps is presented in Fig. 5. Gathered data were analyzed in four phases, each of which constantly deepened the understanding beyond the previous analysis (Glaser, 1978, p. 6).

6.1. Phase 1: developing an initial understanding

Following the commonly given advice to analyze early (Glaser, 1978; Miles and Huberman, 1994, p. 50; Strauss and Corbin, 1990), the data analysis began with a study of a single *revelatory* case (Yin, 1994). Nine persons were interviewed in one case company, Tekla Ltd., during December 2005. The interviewees represented different functions within the organization, including product management, marketing management, product development, and general management. All interviews were tape-recorded and transcribed. The total amount of recordings added up to 10 h 32 min. In addition, documents relevant to the research area were gathered from Tekla. These documents included presentation slides, product development process descriptions, organization charts and design artifacts.

The gathered data were analyzed and conceptualized guided by the initial research questions. As one of the early results, gathered data suggested three distinct sets of activities in the organization's effort to determine what functionality shall be implemented in the product's forthcoming versions: (1) *sensing the market*, (2) *making sense of the market*, and (3) *acting upon knowledge*. These three activities formed a basis for more detailed data analysis of all of the gathered data at later steps of analysis.

Despite the advice of *not* reviewing existing literature early in the study (Glaser, 1992, p. 31), the initial findings were compared with what was considered to be the substantive area of this study, requirements engineering (RE). Reviewing RE-related literature at such an early phase of analysis was not considered harmful because my exposure to RE practices in the past had already resulted in beliefs that were more doubtful than assuring. Thus, I was not searching for preconceived concepts, but rather wanted to understand how the findings from Tekla fit with existing RE literature.

An examination of RE-related literature revealed that Tekla's approach to managing its product-related requirements closely resembled the process of market-driven requirements engineering (MDRE). However, MDRE-related literature did not appear to address the challenges that were found most essential within Tekla – the challenge of knowledge creation and communication. This finding raised questions whether RE literature actually is the substantive line of literature on which to draw. While RE literature seemed largely to ignore the role of tacit knowledge in positioning the product in the marketplace, the fourth generation of R&D management (Miller, 2001) did address such a topic by adopting ideas from knowledge management and behavioral psychology. The dynamic theory of organizational knowledge creation (Nonaka, 1994) appeared to be particularly relevant to the findings. However, further analysis of knowledge management and behavioral psychology literature at such an early point of analysis was not pursued, as "the data analysis must be free from the claims of related literature and its finding and assumptions in order to render the data conceptually with the best fit" (Glaser, 1992, p. 32).

6.2. Phase 2: exploring the research area

The initial conceptual understanding of the research area created a stronger foundation for the full-scale data analysis. Based on the richness of the product development-related empirical data available, seven out of the twelve companies participating in the research project were selected for further analysis (Fig. 5), reducing the number of transcripts to be analyzed to 37 interviews. Companies that were excluded from further data analysis either: (1) did not focus primarily on the product business, or (2) the gathered data did not focus on product development related issues. Out of the 37 interviews, I have personally conducted 27 interviews. Almost all interviews existed before the grounded analysis begun. Although we had gathered data as a project activity, I conducted the analysis for the 37 interviews alone. The data analysis was conducted by using Atlas.ti (Scientific Software Development, 2004), which is a software specifically intended for qualitative data.

Glaser (1978, p. 58) advises analysis of the data line by line, with constant coding of each sentence. "The line by line approach forces the analyst to verify and saturate categories, minimizes the possibility of missing an important category, produces a dense rich theory and gives the feeling that nothing has been left out" (Glaser, 1978, p. 58). Furthermore, "focusing on small portions of the data at a time helps to ensure that none of the analyst's 'pet themes' will be incorporated into the theory unless they have an emergent fit with the data" (Glaser, 1978, p. 58). The mandate of open coding is that the analyst starts with conceptually nothing – no concepts (Glaser, 1978, p. 39). When researchers begin the process of naming data incidents, their aim is to open up the data fragments to a wide range of possible interpretations – to be creative and comprehensive in articulating the different ways in which the data might be understood. Thus, when researchers are urged initially to label or code a data incident in more than one way, creating multiple categories to hold it, they are constrained to think in terms of multiple possible interpretations (Locke, 2001, p. 69).

Hence, I began open coding by scanning the data line by line and assigning labels to those sections of data that I found relevant to the research area. I looked for multiple meanings assigning each interpretation with its own code name. Even though both originators of the grounded theory approach have explicitly warned against creating and trying to work with too many codes (Locke, 2001, p. 73), I began open coding with no attempt to limit the number of codes. My primary concern was that, in an attempt to limit the amount of codes, I would be forced to move to an abstract level too soon. I feared that giving abstract codes to portions of the data would, in fact, lead to a loss of important contextual information. I first wanted to reduce the data (Miles and Huberman, 1994, p. 10) while still capturing enough information into the code names to be self-descriptive. Thus, I started the analysis by just labeling an act, which, in fact, is not a method in grounded theory analysis (Glaser, 1978, p. 42). It is merely an early step for conceptualizing a pattern among many incidents (Glaser, 1978, p. 42). The use of Atlas.ti has provided me the means to cope with a large amount of codes. I have further improved the possibilities managing the codes by adopting a hierarchical coding scheme, in which the assigned label begins with one of the three primary activities as identified in the initial case study (*sensing the market*, *making sense of the market* and *acting upon knowledge*).

The following shows a translated excerpt of a transcript after labeling incidents using Atlas.ti:

Transcribed interview	Assigned codes
Q: From which sources do you receive information that is likely to have an effect on the product's future versions?	
A: We have a dedicated system for collecting the feature requests. The requests are gathered by a product management team that has resources in our offices all around the world. This team knows well the requests originating from the customers particularly because many of them have a background in providing technical support to the customers.	Sensing the market: A dedicated system is being used for gathering market needs. Sensing the market: The product management team is responsible for gathering the needs regarding the future product. Sensing the market: Helpdesk experience is considered good in building an understanding of customer's needs.
Q: So, the product management team largely consists of technical engineers?	
A: Actually, in some offices, we also have resources whose backgrounds are closer to marketing. Their responsibility is to collect requirements on everything they see and hear. Not just what originates from the existing customers. Some of the ideas originate from sales cases. In addition, they may attend exhibitions and follow what competitors have done. We also follow, to a certain extent, what is happening in adjacent segments.	Sensing the market: There is a need to be sensitive to the surrounding environment (not just customer needs). Sensing the market: Source: Existing customers. Sensing the market: Source: Potential customers. Sensing the market: How: Attending exhibitions. Sensing the market: How: Analyzing competitors. Sensing the market: How: Monitoring adjacent segments.

After the essential sections of gathered data were assigned with codes, the analysis proceeded to the next phase in which the

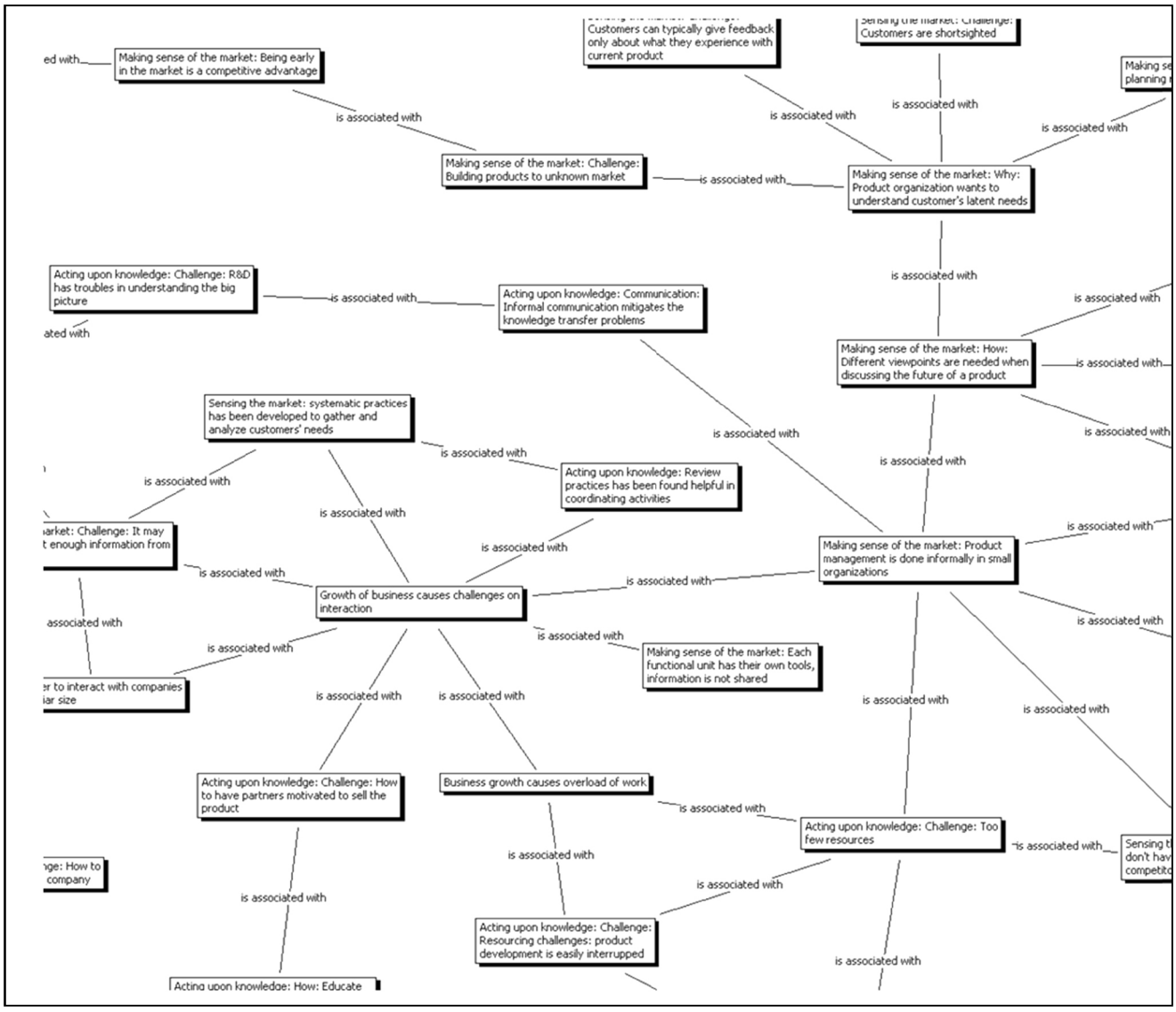

Fig. 6. Partial example of an organization-specific network diagram created with Atlas.ti.

relationships between the identified codes were in focus. The purpose of this phase was to move the analysis to a more abstract level while maintaining the link to the gathered data. This phase was also conducted with Atlas.ti (2004). The codes from all interviews of a particular organization were exported to one organization-specific network diagram, where each of the codes was represented as individual boxes. The analysis proceeded from there by visually organizing and connecting codes until the organization-specific network diagrams formed maps of clearly definable interconnected clusters with similar codes next to each other (see Fig. 6 for an example). Hence, based on my interpretation, associations were added between codes and similar codes were moved closer to each other. Such network diagrams can be considered as knowledge maps, a visual display of captured information and relationships (Vail, 1999). A knowledge map can serve as an inventory. It is a 'picture' of what exists in an organization or a 'network' of where it is located (Egbu and Suresh, 2008). Knowledge maps have been reported to be an excellent way to capture and share explicit knowledge in organizational contexts (Wexler, 2001), helping to support cognitive processing by reducing cognitive load and enhancing the representation of relationships among complex constructs (O'Donnell et al., 2002). Each way that one organizes information can create new knowledge and understanding. This new understanding results from the organizational context that knowledge maps can provide (Eppler, 2001).

These organization-specific diagrams have then been compared with three types of questions. The most general question, "*What is this data a study of?*", continually reminded the researcher that the original intents of what the analyst thought he was going to study just might not be, and usually is not (Glaser, 1978, p. 57). The next vital question, "*What category does this incident indicate?*" forces coding that earns its way into the theory by its grounding in the data (Glaser, 1978, p. 57). Lastly, the analyst asks continually: "*What is actually happening in the data?*" keeping the substantive directions in tractable focus, as they force the generation of a *core* category (Glaser, 1978, p. 57).

The comparison of the organization-specific network diagrams suggested that the analyzed companies can be claimed to belong to one of two distinct groups: (1) *indigenous designers*, who follow a flexible style of developing software but often face challenges in executing plans, or (2) *product engineers* who seek to develop software in a systematic way, but often face challenges of comprehension and communication. The findings from this phase of analysis suggested that changes in an organization's product

development context create challenges for the product development activities. Organizations tended to rely on human collaboration as long as the number of product development related workers remained in a manageable scale. Once the organization grew larger, it was forced to introduce processes in order to continue the same levels or even increase the newly required levels of coordination. However, such a change in the product development approach created new challenges. With processes, workers tended to specialize and share information in an increasingly explicit manner. The specialization of the workers has led to diminishing opportunities to utilize tacit knowledge, which has, in turn, created challenges particularly when making sense of the market needs.

In addition to the organization's growth, the data analysis revealed another potentially significant change causing new challenges in the organization's product development activities. Two of the analyzed organizations showed particularly similar challenges with existing literature describing MDRE practices and the related challenges. One common denominator with the two companies was the fact that both of them had already extended their business into a global marketplace. This was the lead I took in focusing the study further. Thus, in the next step of analysis, the purpose of analysis was to understand better how the move into a global marketplace changes the challenges when people are *sensing the market*, *making sense of the market* and *acting upon knowledge*. When articulating the purpose of the next step in terms of the research problem statement, the question became: *How do human aspects in software product companies' requirements engineering activities change when the company begins to offer its product in a global marketplace?*

6.3. Phase 3: determination of how market expansion of a product changes requirements engineering activities

Through theoretical sampling (Glaser, 1978, p. 37), the analysis now focused on two companies that had demonstrated similarities with each other and with existing MDRE literature. A common property for both of the companies was the fact that the major part of their business was based on software products that assist modeling and design activities within various engineering domains. Furthermore, both companies had in recent years extended their product offering outside of their home market. One of these companies was Tekla Ltd., which was already analyzed as an initial case study. Tekla's model-based software products were used at the time of analysis in more than 80 countries (Tekla, 2009a,b). The other company, Vertex, developed products for technical design and data management. Compared to Tekla, its internationalization history was shorter, but it had already started the process, especially in Europe and North America. Their products, at the point of analysis, were being sold in 31 countries.

The data analysis was conducted by analyzing Tekla- and Vertex-specific network diagrams that were created in the previous phase of analysis and by revisiting a total of 11 interviews involving a total of 16 interviewees. The average length of the interviews was approximately 2 h. Altogether, the 11 interviews lasted more than 20 h and produced more than 130,000 words of transcribed text. The interviewees in both companies represented various functions in their organizations, including product management, marketing management, product development, and general management. In addition to the interviews, data were also collected from documents given by Tekla and Vertex, revealing details of the companies, their products and the processes they followed.

The results of this phase of data analysis revealed that the market expansion of a product introduces and intensifies the product development related challenges in many ways (Jantunen and Saarenketo, 2007; Jantunen et al., 2007). When moving into new market areas, the product's stakeholder network increases and becomes more diverse. This introduces several new challenges in the contexts of *sensing the market*, *making sense of the market* and *acting upon knowledge*. Furthermore, the decision to utilize partners in entering a new market area forces the product organization to increase product related communication across company boundaries. Co-operating with partners introduces risks due to the fact that partners first and foremost act in their own interest. Thus, many of the challenges of market expansion and the way organizations have responded to these challenges are strongly related to human interactions. Despite the acknowledged importance of human interaction in RE research (Nuseibeh and Easterbrook, 2000), it appears to us that this topic may still be undervalued.

The analysis conducted up to this point suggested that changes in the organization's operating environment may be a significant source of the perceived product management challenges. Evidence for such a claim was first introduced when the challenges caused by organizational growth were discussed. This round of analysis identified the market expansion of a product as another potentially disruptive moment for the organization's product development activities. Then, what is the gathered data a study of? What is actually happening in the data? These fundamental questions in grounded theory analysis (Glaser, 1978, p. 57) are eventually answered in the following section leading, finally, toward a theory.

6.4. Phase 4: Toward a theory

The goal of a grounded theory approach is to generate a theory that accounts for a pattern of behavior which is relevant and problematic for those involved (Glaser, 1978, p. 93). The generation of a theory occurs around a *core category* that *integrates* the theory and renders the theory *dense* and *saturated*. This leads to theoretical *completeness* – accounting for as much variation in a pattern of behavior with as few concepts as possible, thereby maximizing parsimony and scope (Glaser, 1978, p. 93). Discovering the core category is the grounded answer to the perennial research problem of "which focus" (Glaser, 1978, p. 94).

Upon choosing a core category, the first delimiting analytic rule of a grounded theory analysis comes into play: only variables that are related to the core will be included in the theory. Another delimiting function of the core category occurs in its necessary relation to *resolving the problematic* nature of the pattern of behavior to be accounted for (Glaser, 1978, p. 93). The analyst should consciously look for a core category when coding his or her data. The analyst is constantly looking for the "main theme," for what the main concern or problem is for the people in the setting, for what sums up in a pattern of behavior the substance of the what is taking place in the data, for the essence of relevance reflected in the data, for gerunds (a noun made from a verb by adding "-ing."), which bring out the process and change (Glaser, 1978, p. 94). The core category must be proven over and over again by its prevalent relationship to other categories, thereby integrating them into a whole (Glaser, 1978, p. 94).

Certainly deciding on a core category tests the analyst's skill and abilities. If the analyst acts too fast on a thin amount of data, he or she risks ending up with a large array of loosely integrated categories, and an undeveloped, undense theory with little explanatory power (Glaser, 1978, p. 95). It is helpful to sum up the criteria by which an analyst can make his or her judgment as to the core category (Glaser, 1978, p. 95):

1. It must be central, that is related to as many other categories and their properties as possible and more than other candidates for the core category.
2. It must reoccur frequently in the data.

3. By being related to many other categories and reoccurring frequently, it takes more time to saturate the core category than other categories.
4. It relates meaningfully and easily with other categories. These connections need not be forced; rather, their realization comes quick and richly.
5. A core category in a substantive study has clear and grabbing implications for formal theory.
6. Based on the above criteria, the core category has considerable carry-through. It does not lead to dead ends in the theory nor leave the analyst high and dry. Rather, it gets the analyst through the analyses of the processes he or she is working on by its relevance and explanatory power.
7. It is completely variable. Its frequent relations to other categories make it highly dependently variable in degree, dimension and type. Conditions vary it easily. It is readily modifiable through these dependent variations.
8. While accounting for variation in the problematic behavior, *the core category is also a dimension of the problem*. Thus, in part it explains itself and its own variation.
9. The criteria above generate such a rich core category that in turn they tend to prevent two other sources of establishing a core which are not grounded, but without grounding could easily occur: (1) sociological interest and (2) deductive, logical elaboration. These two sources can easily lead to core categories that do not fit the data, and are not sufficiently relevant or workable.
10. The above criteria also generate a false criterion yet which indicates it is core. The analyst begins to see the core category in all relations, whether grounded or not, because it has so much grab and explanatory power. This logical switch must be guarded against, while taking it simultaneously as a positive indicator of the core.
11. The core category can be any kind of theoretical code: a process, a condition, two dimensions, a consequence and so forth. When it is a process, additional criteria also apply.

A popular type of core category can be theoretically modeled as *a basic social process* (BSP) that accounts for most of the variation in change over time, context, and behavior in the studied area. BSPs are ideally suited to generation by grounded theory from qualitative research which can pick up a process by field work continuing over time (Glaser, 1978, p. 97). They are labeled by a "gerund" ("ing") which both stimulates their generation and the tendency to overgeneralize them (Glaser, 1978, p. 97).

A process is something which occurs over time and involves change over time. These changes ordinarily have discernable breaking points. Therefore, they can be treated as theoretical units in themselves, with conditions, consequences, other properties, and so forth, which are unique in form to each particular stage (Glaser, 1978, p. 97). There must be a minimum of two clear, emergent stages. If not, the stages collapse conceptually and there is no BSP (Glaser, 1978, p. 97). The stages, then, function as an integrating scheme with which to tie together various sets of conditions, properties, etc., in a manner which allows for a high amount of densification and integration. At the same time, it allows for conceptual grab and tractability (Glaser, 1978, p. 99). The transition from one stage to another is ordinarily contingent upon one or more events taking place. This contingency may be in the form of a *critical juncture* – a period of time between stages when the occurrence or non-occurrence of a particular critical event will determine whether a new stage is entered (Glaser, 1978, p. 99).

Earlier rounds of data analysis suggested that the organizations' product-related requirements engineering activities show distinctively different characteristics under different circumstances. While smaller organizations relied on human collaboration, larger ones were forced to establish more formal work practices. Furthermore, organizations' decisions to move into the global marketplace appeared to introduce new challenges. One potential explanation for the perceived differences could be that the companies are at different evolutionary stages. This would imply that the core category of this study may take the form of BSP.

What, then, would be the core category? The interviews conducted largely investigated current practices and challenges related to the organizations' efforts to make sense of product-related requests and needs. However, the gathered data suggested that the core category is more abstract than the organization's challenge of sensemaking. The data was not about making sense of requirements for a particular product release. Rather, the data was more about organizations' efforts to find effective ways to deal with the design problem at hand. Following the rule (Glaser, 1978, p. 108) of turning a substantive noun or verb into a gerund, the core category was thus defined to be *adjusting*. Hence, I was finally ready to state what I believed this study primarily dealt with:

> This was a study of organizations, each of which is adjusting its behavior to the ever-changing design problem in order to make sense of what its new product requirements are.

The assumption that the core category takes the form of BSP guided the final round of data analysis to search for stages and critical junctures and to define their properties and conditions. This, in turn, led to the decision to take a historical perspective to more than 40 years of software development within a company that is currently delivering its products to a diverse set of customers throughout the world. The purpose of such data analysis was to understand:

1. how the nature of the design problem has evolved in the course of time;
2. what factors in the organization's operating environment have changed the nature of the design problem;
3. what the critical junctures and their properties are;
4. what actions the case company has taken in its effort to adjust to the changing problem.

The target of this final round of analysis was Tekla Ltd. We had gathered data from Tekla in December 2005, soon after Tekla had reorganized its product-related activities. The interviews conducted and documents gathered contained rich data describing the origins triggering the organizational realignment and the actions Tekla had taken to adjust its behavior. Tekla reorganized again in 2008. The previously gathered data were then complemented with two new interviews and additional documents addressing the latest reorganization. The two interviewees were managers of newly formed teams. One was responsible for product development, whereas the other's responsibilities were closer to product management. The interviews continued to focus on the origins triggering the organizational change and on the measures Tekla had taken. Our empirical data were thus situated into the two latest moments in time when Tekla adjusted its behavior in order to deal more effectively with its design problems. The understanding of Tekla's past was then expanded by complementing the empirical findings with Tekla's published history covering the years from 1966 to 2006 (Tamminen, 2006; Tekla, 2009a,b).

Even though the proposed theory is developed in the final stage of analysis with an analysis of Tekla's history, it is important to keep in mind that the proposed theory must fit with *all* gathered data. In addition, the results of this stage of analysis were compared with related RE-literature. Such comparison revealed that Tekla's product management practices and corresponding challenges evolved in a notably similar manner with the findings of RE-related literature.

PHASE:	BESPOKE DEVELOPMENT	PRODUCT DEVELOPMENT	COLLABORATIVE DEVELOPMENT
Nature of the design challenge:	•Emphasis on calculation and algorithms. •Problems are explicitly definable.	•Requirements originate from a diverse group of customers. •Requirements need to be examined from many angles (e.g. strategy, product vision, competition) in order to build a holistic basis for decision-making.	•Conflicting views. •Multiple meanings. •Difficult to comprehend the problem as a whole.
Problem-solving approach:	•Rational and systematic software development processes aiming at the efficient utilization of resources.	•Establishment of roadmapping, release planning and requirements prioritization practices (MDRE).	• To be defined.
Environmental factors forcing the working methods to evolve:	•Advancements in technology allow increasingly complex systems to be built. •Software is packaged as a product.	•Diversity and the number of the product's stakeholders increase. •Turbulence in the business and technological environment.	•To be defined.

CRISIS:	REQUIREMENTS ELICITATION	REQUIREMENTS PRIORITIZATION
Symptoms:	•Detachment from a single customer. Requirements need to be interpreted or invented from a number of existing or potential customers.	•Difficulties in determining the value of requirements. •Difficulties in selecting the best possible set of requirements to be implemented in the product's next versions. •Difficulties to understand the 'big picture'. •Bottlenecks begin to form in the organization.

Fig. 7. Summary of findings.

The analysis of forty years of Tekla's software product management practices and corresponding challenges resulted with an identification of stages of evolution, each followed by a crisis (critical juncture). The key findings are summarized in Fig. 7 (please see (Jantunen, 2012) for full report).

These findings were eventually developed to a following theory proposal (Fig. 8) (Jantunen, 2012):

PROPOSED THEORY:

Many of the software product companies are constantly facing the challenge of adjusting their problem-solving approaches to fit with the changing nature of the problem to be solved. During the early days of computing, the design problems closely resembled the characteristics of a *tame* problem (Rittel and Weber, 1973) that could be stated with an exhaustive formulation containing all information that the problem-solver needs for understanding and solving the problem. As a result, organizations have initially learned to believe that the effectiveness of software development is embodied in explicit knowledge and its processing. The task of a software development organization has become the job of designing and implementing the software that models the single reality that all stakeholders share. Product developers of such organization learned to see themselves as being *experts* in technologies, tools, software development methods and project management (Hirschheim and Klein, 1989).

The sense of professional conduct in Software Engineering has started to take shape at the moment in history when the beliefs and

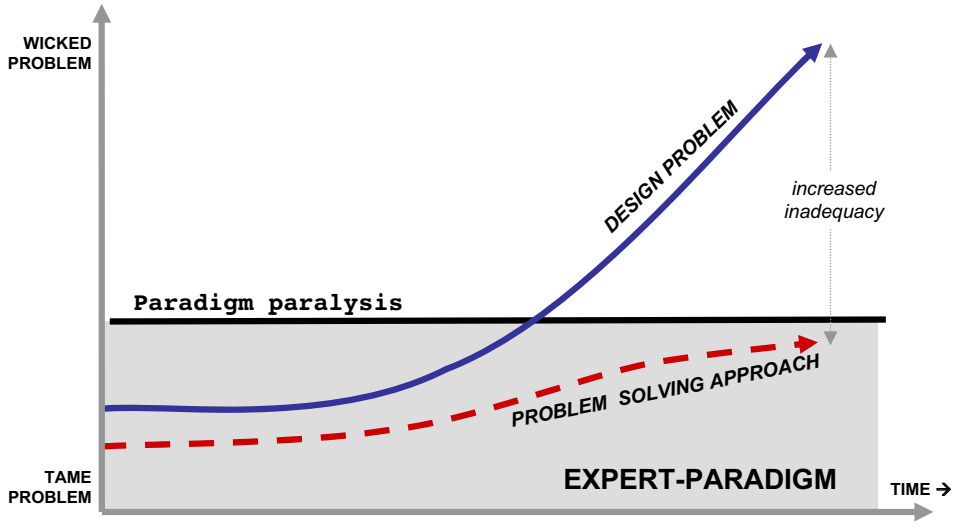

Fig. 8. Theoretical development of the findings.

actions belonging to the *expert paradigm* have responded well to the problem to be solved. The initial success in applying the expert paradigm's beliefs in organizing software development activities has strengthened the position of the expert paradigm. Therefore, for historical reasons, the expert paradigm has gained a dominant position within Software Engineering.

In time, the opportunities of technology have increased, leading to significant increases in the potential user base of software. This, in turn, has altered the design problem to resemble more and more the characteristics of a *wicked* problem (McCaskey, 1982; Rittel and Weber, 1973). As the software product organization's design problem has evolved to be more difficult to comprehend, the tools, techniques and methods belonging to the expert paradigm have begun to lose their effectiveness. Yet, many software product development organizations have been tempted to hold on to the actions that were once successful. Thus, in the time of a *paradigm shift*, research and practice have, to a certain extent, suffered from *paradigm paralysis*. Requirements elicitation crises and requirements prioritization crises are symptoms of such paradigm paralysis.

The inadequate fit between the nature of the design problem and the problem solving approach continues to increase until the beliefs and assumptions of the expert paradigm are questioned and a new paradigm is adopted.

7. Related work

> "When the theory seems sufficiently grounded in a core category and in an emerging integration of categories and properties, then the researcher may begin to review the literature in the substantive field and relate the literature to his own work in many ways" (Glaser, 1992, p. 32).

In order to integrate the proposed theory with existing literature, we conducted a literature review that focused particularly on those topics that were found central in the gathered data - the process area of *release planning* and its sub-process *requirements prioritization*. Our review of reported release planning challenges (Jantunen et al., 2011) revealed that software product companies often dealt with wicked problems, as suggested by Carlshamre (2002). According to the reported release planning challenges (e.g. Carlshamre, 2002; Karlsson and Ryan, 1997; Lehtola et al., 2004; Ruhe, 2010): (1) the stakeholders often have differing interpretations and value orientations regarding the gathered information, (2) the understanding of how requirements are related with each other is insufficient, and finally, (3) the criteria for a successful release continuously changes (Jantunen et al., 2011).

Our review of existing release planning approaches (Jantunen et al., 2011), on the other hand, revealed that there often is an inadequate fit between the characteristics of the assumed problem and the problem in reality. Assumptions about the release planning challenge have led research and practice to prefer continuation of existing *linearly prescriptive approaches involving authoritative strategies*. This can be seen in the tendency to emphasize processes that attempt to prepare gathered requirements one by one for rational decision making (Jantunen et al., 2011).

According to Roberts (2000), linear and authoritative strategies are *taming strategies*, that "diminish the level of conflict inherent in wicked problems by putting problem solving into the hands of a few stakeholders who have the authority to define a problem and come up with a solution". Instead of dealing with the full wickedness of the problem, stakeholders attempt to simplify the problem in various ways in order to make it more manageable and solvable (Conklin, 2006). However, when problem solving is left solely to experts, they tend to search for solutions within their narrow bandwidth of experience, potentially missing other important issues and considerations (Roberts, 2000). Consequently, the product's other stakeholders can become further and further distanced from the important product related issues (Conklin, 2006).

As techniques and methods become increasingly complex with the goal to provide more help for practitioners, the results are seldom used in industry (Berander and Andrews, 2005). On the contrary, "as turbulence increases, so too does the use of intuition and heuristics" (Weick, 1995b, p. 88). In the absence of information necessary for decision making, people begin to rely more on tacit knowledge. The risk for organizations is that those who are making the decisions do not possess the right kind of tacit knowledge that is necessary to make good decisions (Jantunen, 2012). In order to mitigate known challenges with existing release planning approaches, release planning approaches need to be expanded with new ones that support the utilization of a wider spectrum of knowledge that the organization possesses (Jantunen, 2012).

Discussions, similar to the proposed theory, can be identified also within a wider context of RE. In a recent doctoral thesis, using grounded theory as one of the research approaches, Sean Hansen (2011) argued that much of the requirements-related difficulties are due to the fact that the research community has struggled to keep pace with changing contingencies within RE practice. Currently, RE research has developed a multiplicity of formal and computational models for reasoning about requirements, but has remained largely atheoretical in its view of RE as a socio-technical endeavor (Hansen, 2011). In a similar vein, several studies (e.g. Ramos and Berry, 2005; Thew and Sutcliffe, 2008) have discovered that soft issues, such as politics and people's feelings are often cited as problems to be avoided in the RE process.

Our tendency to view RE as a formal and an engineering science, relying strongly on the traditional scientific paradigm, may be partly caused by our assumptions that we rarely make explicit:

> "Large scale software development is treated as the production of a set of programs designed to meet fixed requirements, proceeding in a sequence of separable stages. These views are based on several important assumptions. One is that of an objective reality providing us with well-defined problems to start from. Another is our ability to understand these problems completely in advance, at least in principle, in order to write the specification. A third one is that we can abstract from the specific properties of the technology we use while deriving the correct program. A fourth one is that the cognitive processes involved can be broken up into predefined stages. And lastly that we need to take no notice during development of the human context, where the program is to be used. Many software developers, however, educated in traditional programming methodology, experience a painful clash between trying to adhere to their teachings and what actually seems sensible to do. Even less are they prepared for the social role they find themselves in. Computer programs emerge as the outcome of complex human processes of cognition, communication and negotiation, which serve to establish the problem to be dealt with and to anticipate the meaningful embedding of the computer system in its intended use context" (Floyd, 1991).

The growing concern about the validity of these assumptions has been reported already decades ago (Floyd, 1991; Rittel and Weber, 1973). Yet, the theory proposed in this paper suggests that these assumptions are frequently unquestioned, resulting with a desire to analyze, to abstract and to elaborate correct models that *match* the objective reality as faithfully as possible (Floyd, 1991; Ramos et al., 2005).

As a response for such concerns, a new understanding of science is gaining ground, which is sometimes characterized as a new paradigm (Floyd, 1991). It embodies an awareness that perceived reality depends on how the questions are asked, what answers we

get and how we interpret them (Floyd, 1991). The assumption that reality is socially constructed has implications for the practice of RE (Ramos et al., 2005). It guides us to pay more attention to the human aspects of RE such as knowledge creation (Nonaka, 1994), sensemaking (Weick, 1995b), creativity (Maiden et al., 2010), and emotions (Ramos and Berry, 2005).

8. Assessing the proposed theory

The theory I have proposed is based on what I know systematically from my observations of the data we have gathered. This is what I have studied and lived through. These are my perceptions, my personal experiences and my own hard-won analyses. My confidence in the proposed theory does not mean that my analysis is the only plausible one that could be based on the data.

Several aspects of the presentation enter into how the reader judges the credibility of the theory. First of all, if the reader becomes sufficiently caught up in the description so that he or she feels vicariously that he or she was also in the field, the reader is more likely to be kindly disposed toward the researcher's theory than if the description seems flat or unconvincing (Glaser and Strauss, 1967, p. 230). Second, the reader's judgment of credibility also rests upon his or her assessment of how the researcher came to his or her conclusions (Glaser and Strauss, 1967, p. 230).

The challenge of assessing the credibility of a scientific work is that every mode of discovery develops its own standards and procedures for achieving them. Hence, in order to ensure that the work is evaluated with criteria appropriate for the context, it is important that all of these criteria are made explicit (Strauss and Corbin, 1990, p. 250). Section 8.1 makes such criteria explicit by discussing the nature of theory in science. Subsequently, Section 8.2 discusses the criteria for evaluating the trustworthiness of interpretive qualitative studies and particularly a grounded theory study.

8.1. What is a theory and how to evaluate it?

The purpose of science is theory (Bacharach, 1989; Kerlinger, 1979). However, despite the wide recognition of the need for theory development, there is still little agreement about what constitutes strong versus weak theory (Bacharach, 1989; Colquitt and Zapata-Phelan, 2007; Gregor, 2006; Sutton and Staw, 1995). Such lack of consensus is problematic because it hinders the very fundamental purpose of science, the development of strong theories (Sutton and Staw, 1995).

It appears that differences in views on theory depend to some degree on philosophical and disciplinary orientations (Gregor, 2006). One view originating from the physical or natural sciences sees theory as providing *explanations* and *predictions* and as being *testable* (Gregor, 2006). Samuel Bacharach (1989) has taken such a view in his work to define criteria for evaluating theories. Building his thoughts on those of philosophers such as Karl Popper, Ernest Nagel and Carl Hempel, Bacharach states that the two primary criteria upon which any theory may be evaluated are a) falsifiability and b) utility. Falsifiability determines whether a theory is constructed such that empirical refutation is possible. Utility refers to the level of usefulness of theoretical systems (Bacharach, 1989).

Bacharach makes a clear point of distinguishing description from theory, claiming that the primary goal of a theory is to answer the question of *how, when, and why*, unlike the goal of description, which is to answer the question of *what* (Bacharach, 1989). In particular, he characterizes categorizations of raw data, typologies and metaphors as not theories (Bacharach, 1989). In a similar vein, Sutton and Staw (1995) have added items to the list of what theories are *not*, such as references, data, lists of variables or constructs, diagrams and hypotheses. Sutton and Staw acknowledge that such items are important in theory building, a point that is presented even more strongly by Weick (1995a,b,c), but these items do not alone provide the explanatory power that theories should possess.

Gregor (2006) has argued that it is important to examine the nature of theory in a given discipline. She takes the discipline of Information Systems (IS) as an example claiming that IS is at the intersection of knowledge of the properties of physical objects (machines) and knowledge of human behavior (Gregor, 2006). Therefore, the discipline of IS needs to draw not only from natural sciences but also *social sciences* and what has been termed *design sciences* (Gregor, 2006). It thus appears that, in some disciplines, a broader view on theories than in natural sciences is necessary.

One dimension that broadens the view on theories originates from the interpretivist tradition, where the primary goal is not to develop theory that is testable in the narrow sense (although its validity or credibility may still be assessed), but in understanding the complex world of lived experience from the point of view of those who live it (Gregor, 2006). As a response to the recognized need for greater diversity in theories and theory building in IS, Gregor proposes five different types of IS theory, namely (1) theory for analyzing, (2) theory for explaining, (3) theory for predicting, (4) theory for explaining and predicting, and (5) theory for design and action. Some of these labels for theories are explicitly stated as *not* theories by Bacharach (1989).

Karl Weick (1986) shares Gregor's concern of broadening the view on theories in the discipline of IS. Weick adopts Kling's taxonomy of organizational theories (Kling, 1980) and identifies two basic theories used to analyze computing in organizational settings – *systems rationalism* and *segmented institutionalism* (Weick, 1986). Systems rationalists tend to see organizations as rational units. Segmented institutionalists, on the other hand, assume that conflict is more common than consensus, that definitions of the situations are multiple, that goals are diverse, that implementation is affected by vested interests and power, that relevant social forms consist of much more than task groups, and that technology can take on a variety of meanings (Weick, 1986). Just as Gregor (2006), Weick (1986) acknowledges that to theorize about technology and organizations is to relate two quite different domains. Weick claims that Management Information Systems (MIS) researchers need to adopt organization theories to which they are not accustomed in order to see something other than common-sense rational processes (Weick, 1986). Researchers in MIS usually expect to see rational systems, and they usually find them. What they fail to see is that additional processes and variables affecting the technology impact lie outside their rational combination (Weick, 1986).

In a way, Weick appears to widen the criteria of what can be accepted as a good theory. Theories should not only have the explanation and predictive power, theories should also *delight* (Weick, 1995a). Writers should feel free to use *theory* whenever they are theorizing (Weick, 1995c). Research results often labeled as not theory (Sutton and Staw, 1995) may, in fact, represent the interim struggles in which people intentionally inch toward stronger theories (Weick, 1995c). To label these research results as "not theory" makes sense if the problem is laziness and incompetence. However, ruling out those same five may slow inquiry if the problem is theoretical development still in its early stages (Weick, 1995c). Weick (1995c) notes that research products that are labeled theories are really approximations of them. Furthermore, Weick (1995c) argues that such approximations are entirely consistent when you view theory as a process and the resulting theoretical elements as in-process accomplishments. From Weick's process perspective, theory work can take a number of forms, and it includes such activities as abstracting, generalizing, relating, selecting, explaining, synthesizing and idealizing (Weick, 1995c). The emergent products of these processes may not be formal theories. Nevertheless, they do have a value in summarizing progress

made toward understanding a phenomenon, in providing direction for inquiry, and in serving as place markers (Locke, 2001, p. 38).

Similar discussions on the role of theory and theorizing have emerged in recent years also within the discipline of RE. Similarly to Weick's view (1995c), Gause (2004) sees interim research results as important elements toward gaining deeper scientific knowledge. There has been a rising concern within the RE discipline about losing opportunities by being too "fact-driven" and too critical of "unscientific" research and development approaches (Gause, 2004) while still producing research results that are largely ignored by practitioners (Davis and Hickey, 2004). Adopting the idea from evidence-based medicine, Gause (2004) proposes a levels-of-evidence concept as an enabling tool. This allows the RE community to communicate potentially useful findings while still in the uncertain or incomplete state:

Theory – Fact based. Supported by axioms, universally accepted models, well understood and defined mechanisms or a consensus of all generally accepted authorities.
Experiment – Empirically based. Supported by well-designed, rigorously controlled events.
Observation – Empirically based. Supported by well-documented observations of many events. The elements of design and control are missing.
Anecdote – Experience based. Supported by an individual event or small numbers of events. Not necessarily well-documented. Usually occurs without warning or planning.
Hunch – Intuitive based. Supported by general impressions too weak to understand, explain or even rationalize.

This study has drawn on social sciences with an observational research approach. It has adopted the view of theory as eyed from the interpretivist research tradition. Although the paper has developed a *theory of explaining and predicting* (Gregor, 2006), in terms of Gause's levels-of-evidence (2004), the results of this paper are largely at the *observation* level.

8.2. Evaluating trustworthiness

The basic issue in relation to trustworthiness is simple: How can an inquirer persuade his or her audience (including oneself) that the findings of an inquiry are worth paying attention to, worth taking into account? What arguments can be made, what criteria invoked, what questions asked, that would be persuasive of this issue (Lincoln and Guba, 1985, p. 290)?

Conventionally, inquirers have found it useful to pose four questions to themselves (Guba, 1985, p. 290):

1. *Truth value:* How can one establish confidence in the "truth" of the findings of a particular inquiry?
2. *Applicability:* How can one determine the extent to which the findings of a particular inquiry have applicability in other contexts or with other subjects?
3. *Consistency:* How can one determine whether the findings of an inquiry could be repeated if the inquiry were replicated with the similar subjects in the similar context?
4. *Neutrality:* How can one establish the degree to which the findings of an inquiry are determined by the subjects and conditions for the inquiry and not by the biases, motivations, interests, or perspectives of the inquirer?

Within the conventional paradigm, the criteria that have evolved in response to these questions are termed "internal validity", "external validity", "reliability", and "objectivity" (Lincoln and Guba, 1985, p. 290). Although criteria from the positivist approach are widely accepted for the evaluation of quantitative empirical research, they do not fit qualitative research that is based on interpretive studies (Klein and Myers, 1999; Wagner et al., 2010). Lincoln and Guba (1985, p. 294–301) suggest replacing the traditional notion of internal validity with *credibility*, external validity with *transferability*, reliability with *dependability*, and objectivity with *confirmability* as follows (Wagner et al., 2010):

1. *Credibility* is achieved if the results are believable from the perspective of the subjects under investigation.
2. *Transferability* deals with the question of whether findings from a research sample can be transferred to a broader population or to a more general theoretical proposition (Lincoln and Guba, 1985, p. 290). Lee and Baskerville (2003) have presented a framework for clarifying the concept of generalizability, helping to avoid the improper assessment of generalizability on the basis of statistical sampling-based criteria.
3. *Dependability* refers to the repeatability of a study with respect to two aspects: whether it is possible to replicate the study, and whether this will lead to the same results (Wagner et al., 2010).
4. *Confirmability* is the naturalist substitute for objectivity. Based on the assumption that all research is influenced by the researcher's personal perspective, confirmability is the degree to which the interpretations and findings of a study can be confirmed by others. Confirmability can be increased by rigorous craftsmanship during the research process.

Wagner et al. (2010) add a fifth criterion of a*pplicability* that refers to the context in which a method should be used. Thereby, the researcher's goal and the character of the research question to be examined determine the appropriate research method.

These general criteria have been reported to be appropriate for evaluating the results of an interpretive study. However, more specific criteria have been developed for evaluating a grounded theory. Strauss and Corbin (1990, p. 252–253) have provided detailed criteria for evaluating the research process and grounding on the data:

1. How was the original sample selected? On what grounds?
2. What major categories emerged?
3. What were some of the events, incidents, actions, that pointed to some of these major categories?
4. How did theoretical formulations guide the data collection? After the theoretical sampling was completed, how representative did these categories prove to be?
5. What were the hypotheses pertaining to conceptual relations (that is, among categories), and on what grounds were they formulated and tested?
6. Were there instances when hypotheses did not hold up against what was actually seen? How were these discrepancies accounted for? How did they affect the hypotheses?
7. How and why was the core category selected? Was this collection sudden or gradual, difficult or easy? On what grounds were the final analytic decisions made?

Strauss and Corbin (1990, pp. 254–257) have also provided criteria for the empirical grounding of the study:

1. Are concepts generated and grounded in the gathered data?
2. Are the concepts systematically related with each other and are such linkages grounded in the data?
3. Are there many conceptual linkages and are the categories well developed? Do the categories have many properties that are dimensionalized?
4. Is much variation built into the theory or does the study report only about a single phenomenon and establish only a few conditions under which it appears?

5. Are the broader conditions that affect the phenomenon under study built into this explanation?
6. Has the process been taken into account? Identifying and specifying change or movement in the form of process is an important part of a grounded theory research.
7. Do the theoretical findings seem significant and to what extent?

Glaser (1992, p. 118–119) argues that such criteria are of the adequacy of the researcher, not of the theory or method by which it was arrived. According to Glaser (1978, p. 134), the credibility of the theory should be won by its integration, relevance and workability, not by illustration used as if it were proof. The assumption of the reader, he should be advised, is that all concepts are grounded and that this massive grounding effort could not be shown in writing. Also that as grounded they are not proven, they are only suggested.

In addition to the evaluation criteria, the existing literature also proposes techniques for increasing the trustworthiness of a study. Lincoln and Guba (1985, p. 301) propose five major techniques for such a purpose:

1. Activities that make it more likely that credible findings and interpretations will be produced (prolonged engagement, persistent observation, and triangulation);
2. An activity that provides an external check for the inquiry process (peer debriefing);
3. An activity aimed at refining working hypotheses as more and more information becomes available (negative case analysis);
4. An activity that makes it possible to check preliminary findings and interpretations against archived "raw data" (referential adequacy);
5. An activity providing for the direct test of findings and interpretations with the human sources from which they have some – the constructors of the multiple realities being studied (member checking).

These techniques are important, because the influence of one's beliefs cannot be avoided when interpreting data. We can, however, try to increase the chances that the interpretations are grounded to gathered data in a believable way. To this end, the following techniques have been followed in this study:

- *Prolonged engagement*: The research has lasted for five years and consisted of several phases and data collection rounds. The primary researcher has good relationships with the key persons in the companies and can speak openly with them.
- *Triangulation*: Several researchers have participated in the data collection (observer triangulation). In some interviews, the other researchers have gathered data together with me, and in other cases they have conducted the interviews independent of me. The primary instrument for data collection has been interviews, but also written documents have been used and observations made in meetings and workshops (data triangulation).
- *Peer debriefing*: The research has consisted of regular meetings with research participants where the preliminary results have been presented and openly discussed.
- *Referential adequacy*: All interviews have been recorded and transcribed. The notes and memos of the study have been preserved and the data coding and analysis results are available through the analysis tool used, ATLAS.ti.
- *Member checking*: The interpretation of the data has been confirmed by presenting the results to the company participants. There have been numerous meetings and presentations in the organization where the results have been discussed. The feedback has been positive without exception.

9. Experiences of using a grounded theory approach

Choosing a grounded theory research approach is full of risks. Hence, it is useful to share some of the experiences of following a grounded theory approach so that a researcher considering a similar research path has a better opportunity to understand where he or she may be heading and the kind of risks that might reasonably be expected to be anticipated.

First of all, upon considering conducting a grounded theory research, one needs to be confident in one's own abilities to conceptualize data. Furthermore, it is important that the research area is one that has room for new insights. Otherwise the researcher is taking the greatest risk of all – the risk *not* resulting with a theory that is novel, conceptually dense, general, controllable and understandable.

It has proved to be difficult simultaneously (1) to meet the expectations of a reader who is used to the conventional structure that has long been familiar to quantitative researchers, and (2) to document a grounded theory study as it proceeds in reality. I chose to report the study with an organization that follows the course of a grounded theory study. It followed from this decision that I needed to pay particular attention to addressing the reader's expectations. In practice, I have needed to show that the deviations from the expected style of reporting are not mere accidents, but deliberate choices. It has been important to demonstrate how my thinking has evolved from the beginning toward the proposal of a theory and its integration with existing literature.

Generating a grounded theory *takes time*. It is above all a *delayed action* phenomenon (Glaser, 1978, p. 18). Significant theoretical realizations come with growth and maturity in the data, and much of this is outside the analyst's awareness until it happens (Glaser, 1978, p. 18). It is therefore vital that that the analyst learns to take the attention to detail and patience required to complete the discovery process, and that he learns to take this time in a manner consistent with his own temporal nature as an analyst (Glaser, 1978, p. 18). Generating a grounded theory does not, however, take *all* of the time of the analyst. On the contrary, focusing solely on the grounded theory study could stultify analyst's creativity. "Crash programs or unreasonable deadlines do not work. In taking the time it takes, to grow with the data and its analysis, to increase theoretical sensitivity, to allow the out-of-awareness processing to go untrammeled, the analyst must focus on other matters; other work and solid recreation" (Glaser, 1978, p. 18).

When the analyst watches his or her own temporal pacing to emerge during a research project, the analyst begins to develop a personal recipe for pacing the research so as to be consistent with his or her temperament and energizing of the project. Glaser argues that this recipe is crucial for many reasons: "It helps to establish realistic deadlines and to avoid imposed, paralyzing ones. It insures to a great degree that the analyst will finish the theory before he or she becomes fatigued, disaffected or grabbed and derailed by another "more" interesting project. It becomes a self-pacing mechanism that prevents (or reduces) susceptibility to being paced by others, especially superiors and supervisors, who can easily be inimical to generating" (Glaser, 1978, p. 19). If we do not know our own pacing, we will always be paced by others. The personal recipe allows us to *tell* others (when necessary) where we are, where we are going and where we will probably arrive (Glaser, 1978, p. 19). Therefore, the personal recipe is a claim to professional autonomy which other colleagues should respect. Without this claim, the analyst is himself claimed by others, usually then aborting part of the discovery process for reasons extraneous to research (Glaser, 1978, p. 19). When the discovery method is paced well, it works with life, not against it. This is of course vital to keeping the research energized to its conclusion in a writing (Glaser, 1978, p. 19).

If time is an issue, the only way to speed up the research is collaboration. A working culture filled with curiosity and patience for the theory to emerge will help significantly. With a collaborator, an analyst can move considerably faster (Glaser, 1978, p. 59). Collaboration is, of course, a dangerous game. Incompatibility is typical and its brutality is often discovered too late to revise the project and its fundings. In contrast, Glaser argues that when collaboration works, its energizing potential is fantastic, because:

> ". . .each usually stimulates the others' thinking faster, keeps the others on their toes and can encourage them during periods of depression, decompression and stagnation. A project can be completed better, faster and more easily, since good collaborators contribute to the solution of each other's problems during research, such as writer's block, the inability to finish the work or conduct interviews with certain people, difficulties in facing certain aspects of the research, and so forth. One can conceptualize while the other talks about data, thus working at two levels simultaneously with maximum energy. The researchers can continually sensitize each other to the theory in the data. They can keep each other moving through the self-pacing stages, as they develop their mutually integrated recipes for the research" (Glaser, 1978, p. 29).

The grounded theory approach has always been open for others to take it into new directions (Glaser, 1978, p. 158). Already in the first published book on the grounded theory approach, Glaser and Strauss stated their principal aim as to "stimulate other theorists to codify and publish their *own* methods for generating theory" (Glaser and Strauss, 1967, p. 5). Over the years, the founders of the grounded theory approach have evolved the approach along separate paths. Studying the differences between these two approaches is important in order to make well-founded decisions on one's own research. In this study, I made an effort to examine such differences and document my decisions on the path I have taken. Generally speaking, my grounded theory approach has been closer to Glaser's approach with a tendency toward more openness and flexibility. This decision has worked for me. In following Glaser's grounded theory approach, I have resulted in a theory proposal that helps organizations to understand the origins of their current challenges in determining requirements to be implemented for their forthcoming product releases. These origins of perceived challenges are sometimes difficult for the organizations themselves to see because the focus of their thinking tends to be on the pragmatic level, solving product-related problems on a daily basis.

Regardless of the detailed advice on memoing (Glaser, 1978, pp. 90–91; Strauss and Corbin, 1990, pp. 199–203), both founders of the original grounded theory approach also say that each analyst must develop his or her own style for memoing and diagramming. Strauss and Corbin (1990, p. 200) claim that "the method you choose is not important, as long as it works for you. What is salient, however, is that your memos and diagrams remain orderly, progressive, systematic, and easily retrievable for sorting and cross-referencing". In a similar vein, Glaser (1978, p. 91) states that "the analyst must always be flexible with memoing techniques. The analyst's techniques should serve him, not hinder or enslave him. Each analyst has a personal recipe for memoing, and this is always emerging and forcing to change techniques".

My way of memoing has been considerably different compared to the advice given (Glaser, 1978, pp. 90–91; Strauss and Corbin, 1990, pp. 199–203). Even though it is recommended (Glaser, 1978, p. 90; Strauss and Corbin, 1990, p. 201) to stop all other activities and write a memo as soon as an important idea occurs, insights about the data do not appear to come to me as sudden flashes. Furthermore, I tend to think in visual terms. Hence, instead of writing memos in verbal form, I have advanced my thinking on the codes and their relations by creating visual diagrams. Often such diagrams have resulted in independent research papers (Jantunen, 2010a,b; Jantunen and Saarenketo, 2007; Jantunen and Smolander, 2006a,b; Jantunen et al., 2007). These papers can be considered as written memos on the larger research effort. I do not consider the fact that I am memoing in a different way harmful for this study. I still obtain mid-level results that bind the data and theory together.

I have made an effort to derive conclusions from the data we have gathered. However, at the end of the research when I have integrated the results with existing literature, I have identified similar thinking from other studies. These sources have largely been new to the discipline of this paper (RE). Nevertheless, parts of my conclusions are not new. They are, to a certain extent, introduced to a new context and assembled in a new way. My attitude toward this finding is similar to what Glaser has advised:

> "The proper attitude is simply to accept having discovered ideas. And if the analyst discovers that one of his many ideas has already been used elsewhere, the proper attitude is "he (the other author) discovered it too". The essential point to remember is that the discovered idea is relevant because of its connections to other variables which make up a theory which accounts for variation in a pattern of behaviour" (Glaser, 1978, p. 137).

Although full of risks, a grounded theory approach also holds a promise for high rewards. For me, it has offered an opportunity to systematically know more about the challenges I have experienced while I was working in industry. The theory that resulted from this study has helped me to understand my past experiences conceptually. I now know better what was happening and where to look for remedies.

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Sami Jantunen received the master's degree in technical physics from Helsinki University of Technology (HUT), Finland, in 1998. He completed his doctoral dissertation, Making Sense of Software Product Requirements, in 2012 at the Technology Business Research Center (TBRC) in Lappeenranta University of Technology (LUT), Finland. Prior to joining LUT, he worked in the software industry for 8 years. During that time he has headed software development organizations in Beijing and Kuala Lumpur. His research interests include software product development, globally distributed software development, utilization of social media, and human aspects of software engineering.

Donald C. Gause is currently Research Professor of Bioengineering and Professor Emeritus of Systems Science in the Thomas J. Watson School of Engineering, State University of New York at Binghamton. Over the years he has been an adjunct member of IBM's Systems Research Institute (SRI), a visiting scholar and academic guest at many European and Pacific Rim universities and has had the sponsorship of the New Zealand and Australian Computer Societies, the Austrian Cybernetics Society and has been a National Lecturer for a number of professional societies including the Association for Computing Machinery (ACM).