EXPLORING THE EFFECTIVENESS OF REQUIREMENTS ELICITATION PROCESS DURING INFORMATION SYSTEMS DEVELOPMENT: A MULTI-PERSPECTIVE APPROACH

By

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To the Faculty of Washington State University:

The members of the Committee appointed to examine the dissertation/thesis of SURANJAN CHAKRABORTY find it satisfactory and recommend that it be accepted.

Chair

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"Sometimes the light's all shining on me
Other times I can barely see
Lately it occurs to me
What a long strange trip it's been" – Grateful Dead

It has indeed been a long and yet a deeply fulfilling journey. A journey that has been made special because of a number of wonderful and extraordinary people, without whose support I would not be where I am today.

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ABSTRACT

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The aim of this dissertation is to explore the effectiveness of a mission critical activity within information systems development (ISD) - requirements elicitation (RE). The dissertation presents three articles that represent research conducted to explore and add to the cumulative knowledge about this important phenomenon in field of information systems.

The first article takes an inductive Grounded Theoretical approach to build a process theory of requirements elicitation based on qualitative data obtained from a multinational information services organization. The process theory is embedded within a framework of knowledge transfer mechanisms and elaborates in depth the manner in which RE unfolds in multiple collaborative states between the diverse stakeholders of this process. The theoretical perspectives also provides a set of enablers and inhibitors that facilitate or impede the RE process.

The second article focuses on one of the most critical actors of the requirements elicitation process and proposes a contingent theoretical model for understanding system analyst effectiveness. Specifically the article conceptualizes and elaborates on the nature of a gestalt fit construct – *analyst-problem fit*. In addition the article also presents an illustrative strategy of how

the gestalt fit perspective may be used to resource systems analysts to information systems projects.

The third essay employs an innovative role-play simulation involving business students to provide empirical justification of the contingent gestalt fit based theory of analyst effectiveness. The findings of this study provide indications that analyst effectiveness is indeed contingent on analyst-problem fit. The findings of this study also results in an extension of analyst-problem fit, where the importance of consistency in level analyst capability dimension is emphasized. Overall the empirical findings suggest that a satisficing sufficiency-based strategy may be an effective approach for organizations to optimize their resource allocation issues.

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CHAPTER ONE

1. INTRODUCTION

Requirements elicitation (RE) is a critical phase in information systems development (ISD), having significant impacts on software quality and costs. This dissertation presents three research endeavors that investigate how effectiveness can be achieved in this extremely important ISD activity utilizing different theoretical as well as methodological perspectives. The first essay adopts an inductive qualitative methodology and proposes a process theory of how knowledge transfer and collaboration unfolds during a RE activity. The second essay shifts its focus on the system analyst, acknowledged to be a pivotal actor in the RE process. This essay is theoretical in nature and proposes a contingent theory of analyst effectiveness, based on a gestalt fit perspective. The final essay utilizes an innovative role-play simulation involving students to empirically investigate the contingent theory proposed in Essay2. Below we provide brief summaries of each of these essays

Essay 1 Summary

The criticality of the RE phase during ISD has made it a key topic of interest for IS researchers. However, a review of the existing literature suggests that there has been an over-emphasis on developing variance models surrounding the key success factors of this phase, with very few studies examining how the process of RE unfolds. Further, prior literature acknowledges that this process involves collaboration between RE participants (e.g. user-reps and systems analysts) where knowledge regarding the system requirements is shared, absorbed and co-constructed, such that shared mental models of the requirements can form. Not surprisingly, the RE process and the associated collaboration and knowledge sharing has been characterized as tenuous in the literature, given that these two distinct groups of participants bring in very different kinds of knowledge into this activity, and trust among the two parties cannot be guaranteed at any point. Nevertheless, we are not aware of research that has attempted to understand in-depth how the RE process unfolds. Using data from two different organizations and inspired by GTM (an adapted Strauss and Corbin version), this study provides a process-based understanding of how collaboration occurs during RE. The study's findings suggest that RE is not a monolithic stage (as viewed in much of the existing ISD literature), but is composed of four different collaborative states. The study elaborates on the four states, highlights certain impediments/enablers for each state, and identifies important factors that tend to trigger transitions from one state to another.

Essay 2 Summary

The effectiveness of systems analysts has been viewed as a critical success factor for information systems development (ISD) projects. Consequently, analyst effectiveness has been a key of topic of interest for IS researchers. A review of the past literature suggests that researchers have tended to take an isolationist perspective, focusing solely on identifying key analyst capabilities, and implicitly assuming that identification of an ideal analyst (with certain skills) is sufficient for analyst effectiveness. In this manuscript, we adopt a more integrative view by arguing that capabilities of analysts are necessary, *but not sufficient conditions* for effectiveness. Our theory surrounding analyst effectiveness proposes that it is contingent on a "fit" construct – analyst-problem Fit. Our model further proposes that the relationship between analyst-problem fit and analyst effectiveness is moderated by the nature of the ISD project environment. In this manuscript, we also elaborate on the specific dimensions of analyst capability and project characteristics, and argue that analyst-problem fit be conceptualized as a "gestalt" fit. The article concludes with an illustrative example of how the gestalt fit perspective may be used by organizations in identifying the level of core skills possessed by each analyst, and allocating them to appropriate ISD projects. Overall, we believe that our fit perspective contributes to the literature by introducing a non-deterministic, contingency-based theory of analyst effectiveness.

Essay 3 Summary

This article reports an empirical study that attempts to validate the gestalt fit based theory of analyst effectiveness proposed in Essay 2. A role-play simulation of requirements elicitation involving university students was the chosen methodological approach. The results and the subsequent post-hoc analysis provide indication that analyst effectiveness is indeed contingent on analyst-problem fit. Further our post hoc analyst indicates that analyst-problem fit is obtained by a simultaneous achievement of match between analyst capabilities and problem characteristics as well as an internal consistency (or matching) among the analyst capability dimension levels. The patterns of relationship between analyst effectiveness and the analyst-problem fit configurations indicates the concept of fit proposed in the article may be used to drive a satisficing sufficiency-based resourcing strategy to optimize resource allocation in organizations.

CHAPTER TWO

2. ESSAY 1

An Exploration into the Process of Requirements Elicitation:

A Grounded Approach

Introduction

In recent years, due to an increasing perception that information systems (IS) are critical to the success of organizations, there has been a rapid increase in the demand for new IS (Bresnahan, Brynjolfssen and Hitt, 2002; Sambamurthy and Kirsch, 2000), and also IS modifications. As a result of this demand, organizations are constantly involved in information systems development (ISD) projects. However, as this boom in ISD projects continue due to increased IS usage, both researchers and practitioners have observed that a majority of these ISD projects fail, and such abandoned/failed ISD projects result in significant costs to organizations (Pitt and Brown, 2004; Browne and Rogich, 2001; Guinan, Cooprider and Faraj, 1998). One of the reasons for failed ISD projects is the inability of the IS to accurately meet user requirements, often resulting from the collection of an incomplete and inaccurate set of information requirements during the requirements elicitation (RE) phase (Mathiassen, Tuunanen, Saarinen and Rossi, 2007;Bostrom, 1989; Byrd, Kossick and Zmud, 1992). Specifically, incomplete requirements result in major post-implementation changes, thereby costing organizations much more than originally estimated (Pitts and Browne, 2004). Given its significant impact on software quality, and costs, RE has been considered as one of the most critical phases of an ISD project (Curtis, Krasner and Iscoe, 1988). Consequently, RE has been an important domain for IS research (e.g. Hickey and Davis, 2004; Pitts and Browne, 2004; Davidson, 2002; Marakas and

Elam, 1998; Schenk, Vitalari and Davis, 1998). A vast majority of IS research (as we shall establish in our subsequent literature review) has adopted a variance approach towards exploring this phenomenon. Such research has provided us with valuable insights about the skill requirements of the participating actors (e.g. Misic and Graf, 2004; Wynekoop and Walz, 2000; Hunter and Palvia, 1996) and techniques/methods for eliciting requirements (e.g. Browne and Rogich, 2001; Moody, Blanton and Cheney, 1998). However there have been very few studies that have taken a process based approach towards understanding intricacies of the RE activity. We feel that this is a gap in the literature. Our study attempts to address this issue and presents a process based investigation that examines RE from ***the perspective of knowledge sharing and sense making within a collaboration context, specifically focusing on the subtle nuances of, and the dynamics within the RE process (involving user-representatives and systems analysts).*** In addition, we also attempt to understand the specific enablers/inhibitors of the RE process in an effort to give more directed guidance to both researchers and practitioners involved with this important stage of ISD.

The rest of the manuscript is organized as follows: In the next section we present a discussion on existing research on RE. After, that we describe our methodological approach followed by a discussion of the boundary conditions of our study. The following section presents a discussion of our theoretical sensitivity, or the theoretical ideas that informed, (not drove) our theorizing. Next, we provide an elaborate discussion of our process model, including states, triggers, and enablers/inhibitors. Finally, we conclude with the limitations of the study and its contributions to both research and practice.

Review of literature on Requirements Elicitation

A large proportion of studies focusing on requirements elicitation have adopted a variance approach, and many have examined *factors that affect the effectiveness of a systems analyst*. Specifically, analyst effectiveness has been considered to be contingent on the capabilities or the skill sets possessed by a system analyst (e.g. Misic and Graf, 2004; Wynekoop and Walz, 2000; Hunter and Palvia, 1996; Hunter and Beck, 1996; Chau and Ng Tye, 1995; Green, 1989; Maxwell, 1988). Researchers have also attempted to understand analyst effectiveness by examining mental models and cognitive processes employed by the analysts (e.g. Pitts and Browne, 2004; Butterfield, 1998; Marakas and Elam, 1998; Schenk, Vitalari and Davis, 1998; Watson and Wood-Harper, 1996), and the amount of education and training possessed by them (e.g. Jenkins, 1986; Smith and Kozar, 1977; Heiker, 1974), among other factors.

Another substantial body of research, generally adopting a variance approach, has focused on identifying the factors that help improve the RE process. Ocker, Hiltz, Turoff, and Fjermestad (1995) and Ocker, Fjermestad, Hiltz, and Johnson (1998) examined the role that different communication technologies play in enhancing the communication between the key stakeholders during requirements collection. On the other hand, some scholars have studied the effect of user involvement and participatory design during RE (e.g., Lynch and Gregor, 2004; Hirschheim, 1985; Barki and Hartwick, 1989). Adopting a somewhat broader more philosophical approach, scholars have called for the need to understand the fundamental systems development paradigms in an effort to improve the ISD processes (e.g., Iivari, Hirschheim, Klein, 1998).

More recently, Mathiassen, Tuunanen, Saarinen, and Rossi (2007, p. 570) have proposed a “risk-strategy model” of requirements elicitation, which is based on the assumption that effective requirements elicitation and documentation “depend on the way in which techniques are applied to resolve risks." In addition, Tuunanen (2003) has discussed certain contextual, cognitive, and model-driven techniques that enable analysts to "reach" or address the systems requirement needs of "wide-audience end-users."

Additional techniques-focused research has also identified other mechanisms such as novel interviewing techniques (Browne and Rogich, 2001; Moody, Blanton and Cheney, 1998), modelling techniques surrounding innovative use of CASE tools (Martinn et al., 1995), improved conceptual modelling (Wand and Weber, 2002), Delphi approaches (Perez and Schueler, 1982), strategic options development and analysis (SODA) (Bryant, 1997), application of precision model (Bostrom, 1989), GSS-aided JAD sessions (Liou and Chen, 1994), cognitive mapping techniques (Siau and Tan 2006), discordance detection techniques (Kaiya, Shinbara, Kawano, and Saeki 2005), computer-based interviewing tools (Hands, Peiris, and Gregor 2004), "pragmatics-based creativity-fostering techniques" (Mich, Anesi, and Berry 2005), ensuring a fit between the RE method used and characteristics of the task (Agarwal, Sinha and Tanniru, 1996), and the use of comprehensive methodologies that can facilitate information system design (Iivari and Koskela, 1987), among others, that improve the quality of the RE phase. We summarize these studies in Table 2.1

Table 2.1 - Prior Studies on Requirements Elicitation			
Theoretical Paradigms	**Category of Research**	**Sample research**	**Comments**
Variance Based Approaches	**Focus:** Analyst Capabilities/Effectiveness **Agenda:** The fundamental assumption of this stream of research is that the analyst is the dominant and primary actor during this phase of the ISD. This body of research attempts to explain RE effectiveness through analyst effectiveness and attempts to enumerate the important analyst capabilities that contribute to such effectiveness	Canavan (1980); Chau & Ng Tye (1995); Chen (1985); Lerouge, Newton and Blanton (2005); Bassellier and Benbasat (2004); Graf and Misic (1994); Misic and Graf (1993); Misic and Graf (2004); Green (1989); Pare and Jutras (2004); Hunter and Beck (1996); Hunter and Palvia (1996); Wynekoop and Walz (2000); Maxwell (1988); Nord & Nord (1997); Taylor, McWilliam, Gresty and Moynihan (2004); Butterfield, (1998); Watson & Wood-Harper, (1996); Marakas & Elam, (1998); Pitts & Browne, (2004); Schenk, Vitalari, Davis (1998); Heiker, (1974); Jenkins, (1986); Scharer,(1982);Smith & Kozar, (1977); Wood-Harper, Corder, Wood and Watson, (1996); Kirs, Pflughoeft and Kroeck (2001)	This body of research tends to ignore the importance of multiple stakeholders during the RE phase of ISD.
	Focus : Techniques/Methods of conducting RE **Agenda:** This stream of research has primarily examined the instrumental means that result in enhanced RE effectiveness. Research in this category has offered a variety of solutions such as the use of appropriate communication technology, GSS, user involvement, participatory design, modeling techniques, Delphi approaches, among others, in an effort to improve RE effectiveness. In addition research on this area has also examined contingent selection of RE techniques and weaknesses/limitations of existing RE techniques	Mathiassen, Tuunanen, Saarinen and Rossi (2007); Tuunanen (2003); Davis and Monroe (1987); Haumer, Pohl and Weidenhaupt (1998); Haley, Laney, Moffett and Nuseibeh (2005); Mich, Anesi and Berry (2005); Kaiya, Shinbara, kawano and Seki(2005); Siau and Tan (2006); Hands, Peiris and Gregor(2004); Niu and Easterbrook (2007) Hirschheim (1983); Hirschheim (1985); Majchrzak, Beath, Lim and Chin (2005); Watson and Frolick (1993); Orman (1987);Montazemi and Conrath (1986);Barki and Hartwick (1994); Wand and Weber (2002); Browne and Rogich (2001); Ocker, Hiltz, Turoff and Fjermestad (1995); Liou and Chen (1994); Ocker, Fjermestad , Hiltz, and Johnson (1995); Moody , Blanton and Cheney (1998); Agarwal, Sinha and Mohan (1996); Ahituv, Munro and Wand (1981); Perez and Schueler (1982); Jain and Purao (1991); Bryant (1997); Bostrom (1989);Alter (2004); Iivari and Koskela (1987)	This stream of research does not shed light on the process of eliciting requirements, or how collaboration between the different stakeholders unfolds.

Process Based Approaches	**Focus:** Process of ISD **Agenda:** This stream of research has focused on examining how the entire ISD process unfolds (as opposed to focusing specifically on the RE phase). This body of literature has specifically attempted to examine the ISD process in terms of the sequence of events and episodes that take place, dynamics of control mechanisms involved the nature of conflict inherent in the process, and effectiveness of the different methodologies used for systems design and development.	Newman and Robey (1992); Levina (2005); Sambamurthy and Kirsch (2000); Kirsch (2004); Robey and Farrow (1989); Iivari, Hirschheim and Klein (2000), Iivari, Hirschheim, and Klein (1998)	This body of research adopts a processual perspective, but the focus is on the entire ISD process, as opposed to the RE phase alone. As a result, the body of literature fails to contribute towards an in-depth understanding of the RE phase in particular.
	Focus: Process of RE **Agenda:** This stream of research has focused on the process of RE. Investigations in this area have sought to draw attention to similarities between RE and other processes such as knowledge acquisition, examined the effect of culture on the RE process, and on the communicative interactions between the analysts and clients.	Byrd, Cossick and Zmud (1992); Urquhart (1997); Thanasankit (2004); Gasson (2006); Davidson (2002); Hickey and Davis (2002); Browne and Ramesh (2002); Jarke and Pohl (1993)	This stream of research examines the RE phase from *either* a collaborative/communicative or a knowledge exchange perspective. However, it does not attempt to integrate these two perspectives within a single unifying process framework in an effort to provide a holistic understanding.

While undoubtedly this body of research has made significant contributions to our understanding of the factors that enhance the effectiveness of the RE phase, as mentioned earlier, the studies discussed above are largely variance-based. Given that requirements elicitation has been inherently considered to be “a problematic process,” where the two participating groups (i.e., analysts and users) bring in “unfamiliar language that is domain specific”[1] into this activity (Urquhart, 1997, p. 150), it is important to understand the intricacies of the process. Consequently, some research has also focused on developing process-based models surrounding this key phase of ISD. Part of this body of literature has taken a more macro-level view, focusing on the sequence of events and episodes, dynamics of the control mechanism involved, the

[1] Specifically, the users/user-representatives are considered to be storage entities for descriptive, procedural and reasoning knowledge about business processes while the analysts viewed as repositories of knowledge related to systems development process and their applications.

effectiveness of the different methodologies used for systems design, among others (see Table 2.1). It is worth noting that this body of literature provides limited (or no) insights on micro issues "such as just how and when" different aspects of RE come into play (Marakas and Elam, 1998, p. 38).

There are of course some studies adopting a process-based approach that have attempted to describe the process of RE in further detail. For example, Byrd, Cossick, and Zmud (1992) compared the requirements analysis process with the knowledge acquisition process for designing expert systems. Gasson (2006), drawing on the actor-network theory, examined how different perspectives (of the stakeholders) on the nature of the business problem being addressed by the new information system affect the trajectory of the design process. Using a longitudinal case study, Urquhart (1997) examined the user-analyst interaction patterns, and the techniques used by the stakeholders for developing a shared frame of reference during requirements elicitation. Browne and Ramesh (2002) proposed a three-stage descriptive model of the RE process, and identified four classes of difficulties in determining the system requirements at various stages of the process. Davidson (2002) developed a socio-cognitive process model of sense-making during RE. Hickey and Davis (2002) propose process based model of RE that characterises it as an iterative process requiring different techniques during each iteration. Pohl (1993) attempted to understand the requirements engineering process in terms of the main goals and developed a framework that proposed three dimensions of the RE activity – *specification, representation* and *agreement.* Continuing on the same direction Jarke and Pohl (1993, p. 3) incorporated the importance of "context" in RE, proposed a "framework of four worlds of information systems modelling as a prediction for role-based context influences". We summarize these studies in Table 2.2

Table 2.2 - Process-Based Studies in RE				
Citation	**Summary**	**Levels of analysis employed in the study**	**Process Metaphor**	**Depth/granularity of RE characterization**
Gasson (2006)	The article looks at how differing perspectives on the nature of the problem situation and the scope of design inquiry and analysis affect the trajectory of design process	Actor-Network perspective (multi-level, multi-stakeholder)	"Actor-Network", specifically, a trajectory of human interactions, mediated and stabilized by non-human intermediaries such as documents, technology artifacts and formal procedures.	In terms of episodes – states of equilibrium that were punctuated by disruptions in which design goals were redefined. Each episode is characterized by: * Inscription/boundary object * Translation of interests * Boundary object role
Thanasankit (2004)	The article investigates the impact of Thai social status and hierarchical decision-making processes during Requirements Engineering (RE) in business information systems development projects. The paper provides evidence that indigenous culture informs the RE process by impacting behavioral patterns of the actors involved	Influence of national culture, cultural norms and values on RE methodology	Dialectic between the objective rational, ordered view of RE vs. subjective socially constructed view of the RE process	The objective "front stage" of RE that consists of the describable formally modelled rational and ordered set of process The subjective "backstage" that epitomizes the socially constructed RE process influenced by underlying subjectivist social concepts, power, control, legitimacy, privilege, justice and equity in addition to factors like existing technology, IS discipline, organizational context
Brown and Ramesh (2002)	The paper discusses a three stage descriptive model of the requirements determination process. In addition four classes of difficulties in determining system requirements are used to organize particular problems specific to each stage of the process. Finally, the paper proposes certain techniques to address the problems identified.	Information processing barriers at an individual level	Each stage characterized by - *Input-Task objective-Output* The task –objective characterizations are: * Information gathering * Representation * Verification	Process differentiation based on three distinct task objectives Enumeration of specific problems faced at each stage
Davidson (2002);	The paper develops a socio-	Socio-cognitive	Technology Frame	In terms of technology

	cognitive process model of sense-making during RE. The research uses the concept of technology-frames and explains sense-making during RE as dynamic process of frame shifts and changes in frame salience.	interpretations of individual stakeholders assessed through the analytic lens of technology frames	shifts	frames
Hickey and Davis (2002)	This article presents a uniform model of the Requirements Elicitation process. RE is characterised as an iterative process requiring use of specific techniques for each iteration	Description of an iterative evolution of a variance based model of RE triggered by incremental understanding of requirements and selection of diverse elicitation techniques based on fit	Requirements belong to a static unchanging problem and solution domain. Process iteration characterized by evolution of an (objective) state of knowledge about the system requirements	RE proposed to consist of iterations in each of which two activities dominate *Capturing and understanding requirements * Selection of specific elicitation techniques Shifts between iterations are triggered by changes in selected elicitation techniques. Selection of new elicitation techniques result in improvement in the knowledge state of requirements
Urquhart 1997	This article presents a case study of analyst-client interaction during requirements gathering. The results of the case study analysis describes the interactional tactics used by both stakeholders in gaining a shared understanding of the agreement about the proposed information system	Collaborative interactions between clients and analysts at an individual level	Collaboration dynamics based on * Variation of interaction tactics * Evolution of conceptualization of information system	RE process broken down into the following interaction tactics * Reframing * Imagining * Props * Rapport building * Changing conceptual schemas about the IS through concepts like Actions, processes. & information
Jarke and Pohl (1993)	This article presents a process model of requirements determination that is explained as a juxtaposition of the *vision* about the information system and its *context.*	The interaction between diverse social and cognitive viewpoints of stakeholders (four-worlds) involved in a ISD within a three dimensional space characterising the	Social/Cognitive viewpoints of stakeholders Three dimensions characterizing RE activity	Four worlds – *usage, subject, system* and *development.* Three dimensions of RE activity – *specification, agreement* and *representation*

		requirements engineering activity		
Byrd, Cossick and Zmud (1992)	The article compares the process of Knowledge Acquisition (KA) for designing expert systems and the Requirements Analysis process for development of information systems. This is done by comparing representative techniques grouped according to elicitation modes across three dimensions – 1) communication obstacles 2) nature of understanding gained and 3) locus of control.	Dyadic interaction between analyst(s) and users(s). No distinctions made between group or individual interactions	Task-based sequence of activities	Task-based sequence of activities Iterations over a linear chain

Our review of the in-depth process-based studies on RE suggest the following: 1) RE inherently involves a collaborative activity between multiple stakeholders; 2) RE is similar to a knowledge acquisition/sharing process; 3) depending on the context, RE could be iterative; and finally, 4) RE involves some degree of sense-making. However, we would like to note that to our knowledge, the four characteristics of RE identified above have generally been studied in isolation (and to a limited extent), which has prevented us from understanding the "subtle nuances" of this important phenomenon. It has been specifically argued that the RE process is "chaotic, nonlinear and continuous" (Davidson, 2002, p. 330), with the various characteristics (mentioned above) playing different (and dynamic) roles. Thus we feel that it is important to describe and understand the RE process with greater granularity, and by simultaneously focusing on the interplay of the different characteristics. We believe that in this particular study we make some advances towards this objective. In the next section we introduce the reader to our methodological approach.

Methodological Approach

Our objective in this study was to develop an in-depth processual understanding of the RE phenomenon that is derived based on the experiences of the human participants (Glaser and Strauss, 1967). Grounded theory methodology (GTM) (Glaser and Strauss, 1967; Strauss and Corbin, 1990) provides a "family of methods" (p. 11) with "heuristics and guidelines rather than rules and prescriptions" (Bryant and Charmaz 2007, p. 17) that can enable IS researchers to "systematically derive theories of [IS-related] human behavior from empirical data" (Urquhart 2001, p. 106). GTM is particularly beneficial when the motivation of the study is to take a fresh look at a phenomenon, rather than to verify/incrementally revise existing substantive theory (Strauss and Corbin 1990).

Before describing how GTM heuristics were utilized in this study, it may be useful to acknowledge that GTM is "contested" terrain, where the question of what is "core" to the methodology cannot be "easily resolved" (Bryant and Charmaz 2007, p. 3). There appear to be at least three well-recognized variants of GTM (i.e., the Glaserian school, the Strauss and Corbin school, and the Constructivist school) today, though noted qualitative scholars such as Denzin (2007) have "listed seven different [though overlapping] versions of GTM: 'positivist, postpositivist, constructivist, objectivist, postmodern, situational, and computer-assisted' " (pp. 10-11). Indeed, as with other methodologies such as action research, with the maturing of GTM, a variety of "strands, some of which [are] vastly different from the original" have appeared, and we observe that "the progenitors of GTM have changed, modified, or eliminated major methodological strategies themselves" (Bryant and Charmaz 2007, p. 9). Thus, while scholars acknowledge some common traits of grounded theory, they tend to reject the orthodoxy associated with the application of specific GTM coding procedures (Hood 2007). Urquhart (2007, p. 354) notes that "GTM is a living body of knowledge and it is up to us as information researchers to render GTM as it is appropriate for our discipline." In the end, GTM may be viewed as "a general methodology, a way of thinking about and conceptualizing data" (Strauss and Corbin 1994, p. 275) that seeks to provide "a route to see beyond the obvious and a path to reach imaginative interpretations" (Charmaz 2006, p. 181). Strauss and Corbin (1990) offer the methodological elements of open, axial, and selective coding, along with the paradigm model and the conditional matrix, to support the process of theorizing. It is worth noting that researchers have found different aspects of the coding procedures to be futile or unproductive in practice, and thus, adaptation and improvisation of the set of procedures is often needed (e.g., Bryant and Charmaz 2007[2]; Dey 2007; Sarker, Lau, and Sahay 2001). As recommended by methodologists, our empirical approach utilizes *the logic of* open, axial, and selective coding procedures (viewed as "recipes"), much like "cooks can develop their own version of the recipes" (Bryant and Charmaz 2007, p. 12). Thus, we would characterize our approach as ***adapted version of the Strauss and Corbin's GTM.***

In Appendix A.1 we provide a detailed discussion on the exact nature of the GTM approach adopted by us. In the next section we describe our data collection methodology

Data Collection

We collected qualitative data, primarily through interviews, from two organizations. Our motivation to collect data from two different organizations was guided by the following considerations: First, the pattern that would emerge from two different organizations would enable us to identify characteristics that are specific to the RE phase, and not idiosyncratic to a particular organization. Second, prominent qualitative researchers advise the collection of data from multiple sites whenever possible. In order to make sure that we obtain maximum benefits

[2] For example, Bryant and Charmaz (2007, p. 9), in their editorial introduction to the *Sage Handbook of Grounded Theory* state, "we have not found axial coding to be a productive research strategy… In addition, we have serious reservations about the conditional matrix in either of its forms".

by collecting data from two organizations, we ensured that the organizations differed significantly from each other, both in terms of the magnitude and scope of their operations, as well as in terms of the composition of their ISD teams. One of the organizations was an international software services company specializing in IT offshore outsourcing (we refer to this organization as TechSource in the manuscript), and another was a university IT services organization focusing on systems development for local clients (we refer to it as UnivTech).

TechSource is the global, technology services division of a multinational organization. It has over two decades of IT experience, and specializes in ISD projects for offshore clients, providing seamless solutions to leading organizations around the world. Currently the organization has about 348 clients, 138 of which are Fortune 1000 or Global 500 companies. It is also considered as one of the top 10 players in the North American IT offshore outsourcing market.

UnivTech, on the other hand, is a university IT organization, and its goal is to provide “high quality technology and customer services to a diverse … community.” As opposed to TechSource, analysts in UnivTech work on ISD projects for clients who are located in the same geographical location as the analysts.

Any collaboration requires mutuality (Sarker & Sahay, 2003), and we realize that in order to fully understand the nature of the collaboration, it is important to understand the points of view of the different stakeholders involved. In the context of our study, we thus sought to understand the view of both the analysts and the user representatives. Specifically, we gathered qualitative data from ten analysts/project leads (from TechSource and UnivTech) as well as three user representatives (one of them interviewed twice) from TechSource and one user representative from UnivTech. Table 3 summarizes the sample of our study. Where we were unable to interview users (due to restrictions posed by the organizations), we asked explicit questions about the role and nature of user involvement to the analysts. As Table 2.3 highlights, our sample included systems analysts, ISD project managers, and/or leads of ISD projects, and user representatives.

Table 2.3 - Interview Design

Organization Name	Details	Nature Of Project	Interviewee Designation
TechSource	Multinational IT services vendor engaged in projects with a US based utility Company specializing in generation and distribution of electricity	Customer Service System Work asset management Systems	1 Project Lead 5 Analysts 3 Users-representatives (from the client organization)
UnivTech	Public University based in the north-western region of US	Payroll-related systems Web-based Learning System	1 Project Lead 3 Analysts 1 User representative

The rich contextual nuances of collaboration during RE was captured through extended semi-structured interviews. The interviews were designed with the intent of eliciting from the participants a rich account of how requirements elicitation unfolded in their current project. A pre-defined structure was retained more with the intent of acting as a guide to the interview process, than to constrain the interviewee in any manner. The duration of the interviews ranged from 40 – 60 minutes. The interviews were tape-recorded and most of them were professionally transcribed. The transcriptions were read multiple times, and were coded using the prescriptions of the grounded theory methodology. To retain the focus on the theory that emerged, and not disrupt the flow of the paper, we have discussed our application of coding procedures in Appendix- A.2. In the next section we discuss in detail the boundary conditions and related theory that provided us with the theoretical sensitization.

Background for the Process Model

Boundary Conditions

Before presenting our processual depiction of RE, it may be useful to establish some of the *key assumptions* and *boundary conditions* of our investigation. First of all, the requirements elicitation process can involve a wide range of stakeholders, and it is important to specify the type of stakeholders that a requirements elicitation study is focusing on (e.g., WestFall 2005). Typically, any software requirements process involves "customers," that is, individuals who "request" and perhaps even pay for the system, users who use the systems, systems analysts who are responsible for "eliciting the requirements from the customers, users, and other stakeholders" (WestFall 2005, p. 100), and even developers in some cases. The users can further be composed of the "end-users, who actually use the product directly or use the product indirectly" (WestFall 2005, p. 100), and user representatives. In large organizations, it is fairly common to have user-representatives who are domain experts (i.e., those who not only have an intricate knowledge about the users' business processes, but are also somewhat familiar with systems analysis techniques) (e.g., Tuunanen 2003). On similar lines, Fraser, Kumar, and Vaishnavi (1991) suggest that the role of this business domain expert is usually to "mediate" between the user group and the analysts/designers, to transmit necessary system requirements to the analyst/designer; these are usually individuals who have demonstrated a deep "understanding of the system." In this study, we focus on requirements elicitation processes that involve user-representatives (representing the business organization) and systems analysts (representing the technology providers). We represent this focus of our study in Figure 2.1. In general, in this study we focus on the interactions between the user-representatives (as a group) and the analysts (as a group), and do not theorize about intra-group dynamics.

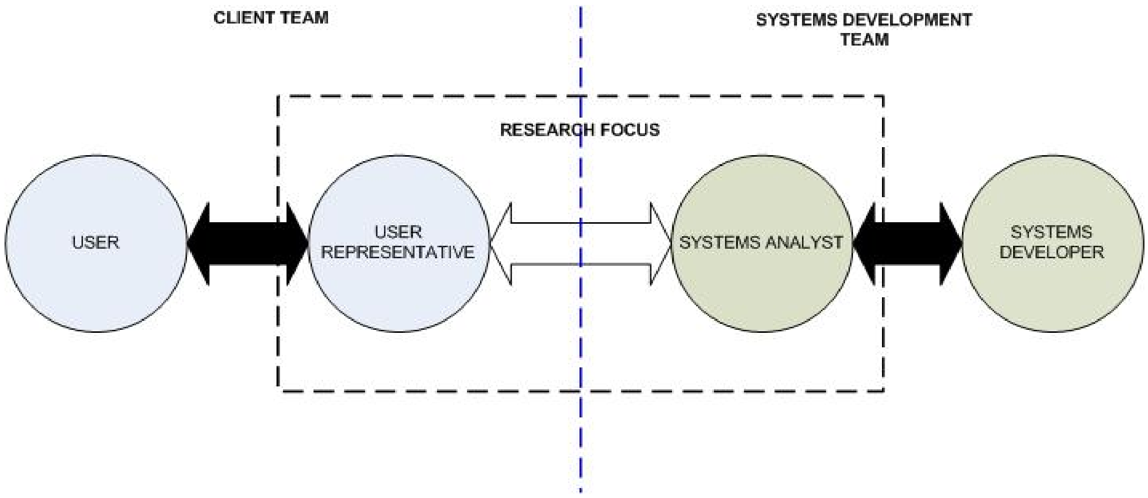

Figure 2.1 The primary RE participants in this study – user representatives & systems analysts

Second, a variety of specific elicitation techniques/approaches may be used to collect system requirements in different situations (e.g., Tuunanen 2003; Davis and Monroe 1987). For example, a user may state to the analysts the following: "I can't really tell you what I need; work something up and let me have a look at it. If I see it, I'll know it" (Davis and Monroe 1987, p. 105). Such a scenario may prompt the use of prototyping approaches to elicit the requirements. Prototyping, which assumes that "requirements frequently do not become apparent until a system is in use" (Budde et al. 1991, p. 134), can enable such users to express their system-related needs once they have had the chance to interact with the prototype. Similarly, other techniques such as group elicitation and protocol analysis (e.g., Tuunanen 2003) can also be used. In a more recent review of literature on requirements elicitation, Mathiassen, Tuunanen, Saarinen, and Rossi (2007, p. 577) suggest four different types of requirements elicitation techniques: discovery techniques, prioritization techniques, experimentation techniques, and specification techniques. Each of these techniques involves certain specific kinds of activities. For example, unlike the other three, specification techniques are more "formalized," and "document-centric," and focus on the use of "defined concepts and notation schemes with precise semantics." While acknowledging that requirements elicitation falls primarily within these four above-mentioned concepts, Mathiassen et al. (2007, p. 577) suggest that often, the most commonly used techniques “do not naturally fall into a single category of techniques.” We adopt a similar perspective in this study. In an effort to keep our process model general across multiple approaches, we avoid associating our model with a technique. We assume a traditional requirements analysis process where the user representative(s) have some knowledge and understanding of the system requirements, and the analysts use techniques such as interviews, focused group meetings, review of organizational documents, etc. to arrive at those requirements. We believe that such an approach enables us to focus on the overall knowledge transfer and group collaborative efforts, as opposed to getting tied down in ensuring that the proper protocols associated with a specific technique were being used faithfully.

Finally, Mathiassen et al. (2007, p. 575) argues that one of the key risks in requirements elicitation is “requirements volatility,” which refers to the “stability of requirements,” and the pace at which the requirements changes. Often, market and environmental factors cause the requirements to change rapidly, which could trigger very different dynamics within the requirements elicitation process. While acknowledging that “software evolves over time and requirements therefore inevitably change [may be not greatly]” (Mathiassen et al. 2007, p. 575), we assume relatively stable requirements (i.e., has low volatility).

Theoretical Sensitivity

In the methodology section, we had highlighted the fact that contemporary grounded theorists, including Strauss and Corbin (1990), express the need to be sensitive to and be *inspired by bodies of work* in the literature, even when developing a “grounded” theory or model. Consistent with this perspective, we provide an overview of some of the streams of thought that informed our theory-building. In some cases (e.g., McGrath’s TIP), we merely borrowed labels from the theory; in others (e.g., “ba” in the knowledge transfer literature), we were sensitized to look for certain patterns in our RE data.

Epistemology and Meta-Theoretical Perspective Adopted in Developing the Process Model

Traditionally, knowledge transfer research has been characterized by three different epistemological stances (Venzin, von Krogh, and Roos, 2000): cognitivistic (e.g., Venzin et al. 2000), connectionistic (Kogut and Zander, 1992) and autopoeitic (Maturana and Varela, 1973). The *cognitivistic* approach views knowledge as similar to data that is fixed, “universally stored in computers, datastores,” and can be unproblematically shared (Venzin et al., 2000, p. 39). The connectionistic approach perceives knowledge to be contextual, and views knowledge transfer as being a sense-making process, enabled through social interactions, and inherently problematic. This epistemology focuses on relationships and interactions, and views communication to be the primary mechanism through which knowledge is shared and transferred. The third epistemology, autopoeitic, views knowledge as being history dependent, which is usually only converted, and not shared (Nonaka and Takeuichi, 1995). In this study, given our focus on the collaboration and interactions amongst the user representatives and analysts during RE, and the problems encountered with respect to their collaboration, we adopted a connectionistic epistemology. This epistemological stance enabled us to focus on the themes that were evident through our open coding process: *knowledge-related communication*, *relationships*, and *dynamics of the connections (such as collaboration, trust, and frames of reference)* amongst the key stakeholders during RE.

Other Theoretical Perspectives -- Collaboration

Our work is informed by a collaboration framework called the Time, Interaction, and Performance (TIP) theory (McGrath’s 1991). The TIP theory presents an understanding of the “nature of groups and of their interaction and performance” (McGrath 1991, p. 150).

Specifically, TIP emphasizes on the "temporal patterning of interaction and performance" in groups. TIP argues that each group involves in "one or another of four modes of group activity." These modes (see McGrath, 1991, p 155 –156) are characterized by their different goals/ objectives of collaboration. The four modes identified by McGrath, characterize the start up activities, identifying the "most appropriate means" of achieving goals, resolution of conflicts or differences arriving from "conflicting preferences, values or interests within the group," and finally attainment of the goal and creation of some "end product." These modes of activity are argued to apply to every group situation. McGrath (1991, p. 153) warns group researchers that these modes are "potential, not required, forms of activity." That is, while each group's endeavour must begin with the start-up activities characterized by the first mode and end with the creation of an "end-product" or goal attainment, groups may choose to skip the other two modes depending on the situation (or complexity of the group task). McGrath (1991, p. 158) specifically argues that the "direct path" from mode I to mode IV is the "default path for...most group projects." He adds that groups will tend to always use "the least complex path that its purposes, resources, and circumstances will allow" (p. 158).

Knowledge transfer

Knowledge transfer researchers characterize the process as one where a "complex, causally ambiguous set of routines" is "recreated and maintained" in a "new setting" (Szulanski 2000, p.10). Knowledge transfer is also seen as a "process through which one unit (e.g., group, department, or division) is affected by the experience of another" (Argote and Ingram 2000, p. 151). Other researchers (e.g., Boisot 2002; Davenport and Prusak 1998) view knowledge transfer as requiring "resonance" between the source and the recipient. In other words, it not only involves the sharing of knowledge from the source to the recipient, but the absorption of that knowledge by the recipient. The importance of knowledge transfer within the requirements elicitation process has been specifically highlighted by Curtis, Krasner, and Iscoe (1987) who describe an ISD project as a process of communication and learning, and argue that to successfully build a large and complex system, analysts need to learn about the intricacies of the customers' requirements, and the user representatives need to learn about different technological issues such as the architecture and capabilities of the new system. Similarly, Ehn (1993) asserts that requirements elicitation is a "learning process where designers and users learn from each other."

Any type of knowledge transfer requires a shared context (Nonaka, Toyama, and Konno 2001, p. 22). This shared context is referred to as the "ba." The term originates from the Japanese word, and refers to a "shared context in cognition and action." Researchers cautions that "ba" does not refer to a physical space only, but a space where "participants with their own contexts can come and go, and the shared context… continuously evolves" (Nonaka et al. 2001, p. 22-23). Others view "ba" as the "context which harbors meaning," or the "shared space that serves as a foundation" for knowledge transfer and creation (Fayard 2003, p. 26). The key to understanding the concept of "ba" is to view it through interactions and relations. Fayard (2003) argues that "exchanges of data, of information and opinion, collaboration and mobilization on a project" conveys the "ba within an organization." In the context of our study, thus, "ba" could refer to the context of requirements elicitation that provides the platform for knowledge sharing and transfer between the analysts and the user representatives.

Different types of "ba" need to be considered while examining knowledge transfer within the RE process: originating ba, dialoguing ba, and exercising ba. Originating ba refers to a mode where individuals "share their experiences, feelings, emotions, and mental models" (Nonaka et al. 2001, p. 24). It reflects the initial socialization, and forms the basis of later knowledge conversion and internalization. The dialoguing ba refers to deeper interactions where individual mental models are not only shared, but slowly begin to merge into common terms and concepts. This ba ensues through continued dialogues or interactions between individuals, and often knowledge is internalized in such a ba, and "further articulation [of knowledge] occurs through self-reflection" (Nonaka et al. 2001, p. 25). Finally, exercising ba synthesizes all of the different components of knowledge into a unified form, and puts it into action. It appears that in the context of requirements elicitation, where knowledge transfer and development of a shared frame of reference is critical, the three types of "ba" mentioned above may play an important role.

Trust

Trust is the glue that holds together any collaborative and knowledge transfer effort. The literature on knowledge transfer has maintained that trust plays a critical role in the extent of knowledge transferred between a source and a recipient (e.g. Joshi and Sarker, 2003; Szulanski, 1996). Similarly, the general literature on requirements engineering have also indicated the important role played by trust within this process.

Trust has been defined as the "willingness of a party to be vulnerable to the actions of another party, based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (Mayer, Davis and Schoorman 1995, p. 3). Trust has also been defined as the expectation that an individual or groups can be relied upon even when there is a possibility of opportunism (Zaheer, McEvily, and Perrone 1998). Trust can be examined within a dyadic relationship (between two people) or within and between groups of individuals (Knoll and Jarvenpaa 1998).

A review of the literature reveals many different streams of thought on trust. The three types of trust that have been viewed to be the most dominant are: 1) personality-based trust (that develops due to a one's trusting nature); (2) institutional-based trust (that is a function of one's belief in institutional norms/procedures); and 3) cognitive trust (that develops from social cues and impressions that an individual/group receives from others) (e.g., Sarker, Valacich, and Sarker 2002).

Personality-based trust researchers have shown that this trust often develops during infancy when one seeks and receives help from one's caretakers (Bowlby 1982), and for many individuals, this results in a general propensity to trust others (Rotter 1967). De Vries (1999) suggests that such a form of trust develops in one's childhood, when parents invoke a positive attitude within their children, which ultimately leads to them developing a basic propensity to trust others. The role of personality-based trust is specifically important when examining trust within a dyadic relationship as opposed to within a group or when examining trust between collectives (as in our study).

The *institutional approach to trust*, drawing on institutional theory, holds that norms and rules of institutions (such as organizations) guidelines individuals' trust-related behaviors. One of the proponents of institutional theory, Scott (1992) suggests that in the modern world individuals hold strong beliefs about the nature of the world and the way things happen in it. Such beliefs are also displayed in organizations where bureaucratic administrative structures represent "proper procedures, orderliness, predictability and an attitude of moralized anonymity" (Berger, Berger, and Kellner 1973), and ensures that everyone behaves in a trusting way. Further, Scott (1992) argues that organizational members are aware of some of the norms that are in practice within their organizations. This belief, that the institution demands conformity to rules from organizational members, makes individuals trust each other.

Cognitive trust can be best described by drawing on Lewis and Weigert (1985, p. 970) who state that "we cognitively choose whom we will trust in which respects and under what circumstances, and we base the choice on what we take to be 'good reasons,' constituting evidence of trustworthiness." As individuals get to know others, they gain more information about them. This information is processed through a sequence of stages in their minds, such as attention, recognition, evaluation, categorization, organization and storage retrieval, integration, and judgment (Feldman 1981). The processed information is then turned to schemas and stereotypes, which are cognitive structures that represent the knowledge about a concept or a type of stimulus (Fiske and Taylor 1991), and, within a collective, are used to store information about the fellow members. Drawing on the cognitive perspective, it may be argued that within organizations, as interactions amongst members increase, they are able to gather sufficient cues and information to make decisions regarding trust (Coutu 1998; McAllister 1995).

McKnight, Cummings, and Chervany (1998) suggest that when individuals interact with each other, they use three types of categorization processes to develop trusting beliefs: unit grouping, reputation categorization, and stereotyping. Unit grouping refers to the fact that when there is a general perception that the parties involved in the relationship share common goals, then they tend to view each other positively and trustingly (Kramer, Brewer, and Hannah 1996). Reputation categorization suggests that individuals with good reputation are generally trusted (McKnight et al. 1998), while stereotyping suggests that in social encounters individuals form impressions about others based on physical appearances or other interaction modes (Baldwin 1992). Positive stereotypes lead to trusting behaviors.

In today's competitive era, where groups often work with very tight deadlines, and work under tremendous time pressure, "swift trust" has also been proposed to be an important component of trust that needs to be addressed (Jarvenpaa and Leidner 1999, 794). The proponents of "swift trust" argues that in today's hypercompetitive world, individuals or groups do not have the time or opportunity to focus on "relationship building" and develop trust, and consequently, needs to "import trust." Formation of this swift trust can group to start their collaboration on a solid foundation. However, as groups continue with their task performance, different actions (engaged in by the stakeholders) can help maintain the high level of trust, or hinder it thereby driving the levels of trust downwards (Jarvenpaa and Leidner 1999).

Mental models and cognition

The object of knowledge transfer is to create, share and refine mental models of stakeholders. The role of cognitive processes in ISD has been well documented in the literature (e.g., Orlikowski and Gash 1994; Curtis et al. 1988). It has also been acknowledged that the cognitive processes and mental models are especially important during the requirements elicitation phase, where the user representatives and designers/analyst bring different models into the process, and the goal of the requirements elicitation process is the development of a shared mental model regarding the system specifications (e.g., Browne and Ramesh 2001; Kirs, Pflughoeft, and Kroek 2001). The problem is especially important during the requirements elicitation phase since during this phase since the cognitive "schemas and heuristics constitute behavioral patterns which dictate" the way in which the analysts and users approach the problem (Kirs et al. 2001, p. 153). The concept of "technology frames" has been used to understand the cognitive processes that play a role during systems development (Davidson 2002; Orlikowski and Gash 1994). Three different technology frames have been proposed: nature of the technology (understanding the requirements and features of the technology), the strategy behind the technology development and implementation, and "technology-in-use" (assumptions about training, resources, etc.). Among these, "nature of the technology" plays a more critical role in requirements elicitation. Other cognitive biases and cognitive processes related to the mental models of the stakeholders (e.g., "satisficing" heuristics) can play a role during requirements elicitation.

A Process-Based Theory of Collaboration during RE

Next, we discuss our theoretical framework (Table 2.4, Figure 2.2 and Table 2.5). As discussed earlier, we view our framework through the "state transition" perspective, composed of the different states, the enablers/inhibitors of each state, the transition s between the states, and the triggers that initiate the different transitions. Further, within each state, we also discuss the role of the three primary components: the nature of the knowledge transfer, trust, and mental models/cognition.

Table 2.4 - An Overview of the States in the RE Process

	Commencement	**Sense-Making**	**Dissension**	**Termination**
Objectives	Formal breaking of the ice; ceremonial start of the RE process; users engage in initial articulation of the broad business needs/goals of the information systems to the analysts	Understand the problem boundaries, and develop a shared a shared frame of reference regarding the system requirements	Resolve conflicts (both issue-based and interpersonal), that may have arisen during the sense-making state	Create the specification document, and get user representative sign-off on the document
Knowledge Transfer	Reflects an "originating ba;" sharing of the core issues related to the systems requirements; set the foundation for the sharing of more complex and tacit knowledge later on	Reflects a "dialoguing ba;" attempts at conscious co-construction of requirements; bi-directional sharing of knowledge ("push"), and continuous tapping into each other's knowledge bases ("pull")	Reflects a "dialoguing ba;" explicit sharing and transfer of knowledge to detect the nature of the discordance, and also help in understanding the other's point of view	Reflects an "exercising ba;" explicit knowledge about the system specifications shared by the analysts to the user representatives
Trust	Institution-based trust; "swift trust;" reputation categorization-based	Relatively stable levels of trust; primarily cognitive trust based on	Low levels of trust between the two groups; formation of negative stereotypes, and attempts at	High levels of trust; based on unit grouping

	trust	stereotyping	recategorizing these stereotypes by relying upon interactional cues and contractual agreements	
Mental Models	User representatives and analysts have their own "separate" mental models and heuristics; often, these mental models are "inconsistent with each other	Less asymmetry in the mental models of the user reps and analysts; several cognitive biases of both the user representatives and analysts (e.g., overconfidence, recall bias, satisficing) are in play	Significant discordance in the mental models of the two stakeholder groups; attempts at reducing discordance through techniques such as direct or indirect prompting	Shared frame of reference established

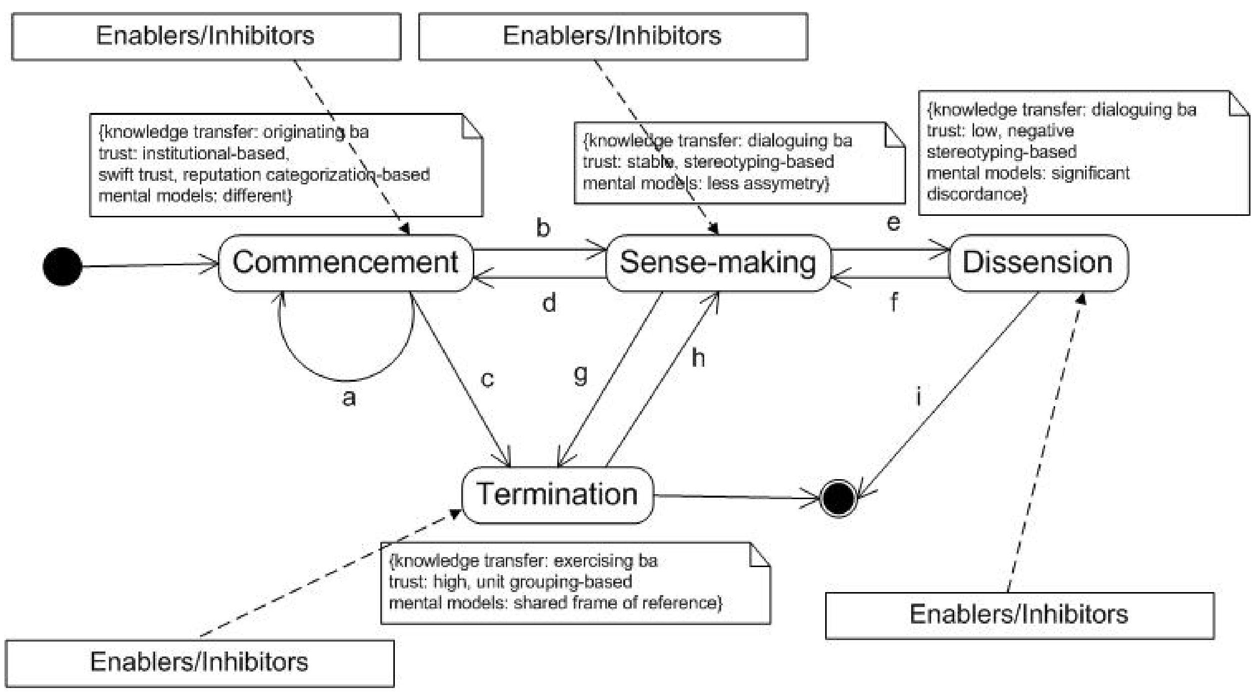

Figure 2.2: A Process Model of Requirements Elicitation in terms of States and Transitions

Table 2.5 - Triggers of the Transitions between the States		
State Transitions	**Description**	**Some Triggers Identified**
a	Recursive transition to the commencement state.	• User reps' lack of clarity (or an incomplete understanding) regarding the broad needs of the proposed system • Perceptions of a lack of feasibility of the system • Lower levels (or lack) of "swift trust"
b	Logical progression from commencement to the sense-making state.	• Ground-rules and working relationship between user-reps and analysts established • Feasibility of the system requirements established • High viscosity of the transfer of broad system requirements
c	Transition from the commencement state to the termination state.	• The business need is a simple/trivial system enhancement such as changes to the interface or some basic functionality o Further deliberation for getting detailed understanding is thus not necessary
d	Reverse transition from the sense-making state to the commencement state to redefine their broad business objectives.	• Need to redefine overall business objectives • Need to develop more clarity on the definition of the problem boundaries • Impact analysis results that indicate the need to "broaden/condense" the problem definition.

e	Transition from the sense-making to the dissension state.	• Issue-based conflict
		  o Disagreement about (or conflicting interests surrounding) the functional specifications
		  o Disagreement about the choice of technology platforms
		• Interpersonal conflict
		  o Political issues within the group

f	Transition from the dissension back to the sense-making state.	• Resolution of issue-based conflict has been reached, and group now needs to turn attention to the other "unfinished" business • Solution to political problems has led to the recognition of new requirements that need to be made sense of
g	Transition from the sense-making to the termination state with the goal of objectifying the requirements within the specification document and getting client sign-off.	• Shared frame of reference surrounding the requirements of the new system. • Requirements elicitation is perceived as complete by the participants
h	Transition from the termination state to	• Complex business problems where by

	the sense-making state with the goal of "filling in" the perceived gaps within the detailed business specifications.	user representatives and analysts perceive gaps within the objectified requirement specifications
i	Unnatural termination from the dissension state	• Failure to resolve conflicts • Complete break-down of trust

The Collaborative States of RE

Analysis of our data confirmed that requirements elicitation is a collaborative activity between user representatives and analysts, success of which lies not only in the ability of the two groups to develop a shared frame of reference, and also to developing the ability to work together. Echoing this sentiment, an analyst at UnivTech asserted that it is important to "work … as a group, and get their requirements as a group." Another analyst at TechSource also suggested that the RE phase involves "a group interaction."

In addition to confirming that RE is a collaborative activity, our selective coding phase also identified certain characteristics of this collaboration. In particular, it revealed that collaborative process underlying RE is not composed of a fixed temporal sequence of stages (such as the development stages identified in prior group literature), but that the collaborative process may be categorized into states based on a number of factors, which we discuss below. The states identified through the data analysis had some resemblance with McGrath's (1991) conceptualization of the different collaboration modes that groups engage in for task performance and goal achievement.

The Commencement State

Nature of knowledge transfer

This state is characterized by a predominantly unidirectional transfer of knowledge about business needs/goals as perceived by the user representatives *to* the analysts. Enthusiastic about the prospects of a new IS, the user representatives engage in a "push" strategy of knowledge transfer, where they voluntarily share their knowledge regarding the business problem to the analysts. A user representative from TechSource emphasized this unidirectional knowledge transfer in this state, noting that "… the business clearly says that these are things I want to implement or this is my objective…"

The user-reps attempt to clarify their needs, while the analysts attempt to absorb and internalize the problem statement. A TechSource analyst explained:

first thing that happens is, it starts with a lot of meeting, okay… you involve different people [user representatives], from the different groups…

In addition, formal business case documents provided by the user representative, or even formal questionnaires submitted by the analysts are also used for knowledge transfer purposes during this state. In essence, the commencement state of RE characterizes a formal "breaking of the ice," a ceremonial start of the RE process where the user representatives engage in initial articulation of the problem domain (i.e., the user representatives articulating the business needs of the system) for the analysts, and attempt to get to know each other in an effort to develop a working relationship.

In terms of knowledge transfer, this state may be viewed as an "originating ba," where the context is set, and an initial socialization between the stakeholders take place. The "originating ba" enables the sharing of all the core issues related to the systems requirements, and forms the foundation for the sharing of more complex and tacit knowledge, and the conversion of the different strands of knowledge into one unified whole later on. For example, the user representatives sensitize the analysts about the business processes, compliance needs due to the regulatory demands of the external world, and so on. A UnivTech analyst characterized the nature of information provided by the user-reps during this state:

…What are the business functions that are involved here and what are the flow of data amongst these business functions..

A TechSource analyst also made a similar point::

…you need a subject matter expertise whom, what I call a process lead. They understand the business process. They tell our people how it is going to work.

Trust

Our analysis of the data also suggests that trust is an extremely important component of the requirements elicitation phenomenon. It is viewed as the important ingredient that "glues" the interactions in this state (O'Hara-Devereaux and Johansen, 1994). An analyst highlights this issue:

I strongly believe that this entire business is running on trust… if the ..users [i.e., the user representatives] cannot trust the analysts … then actually we are going no where.

While overall, trust is required in the all the states within the requirements elicitation process, we found that the bases of trust in each state tended to differ. During the commencement, trust between the two stakeholder groups (that is, user representatives and analysts) was primarily institutional-based. Apart from contexts where there had been a significant history of interaction between the user representative group and the analyst group, this state typically involves initial contacts between these two groups. Thus, there is insufficient information available to form any stereotypes regarding the others' trustworthiness. In the absence of such cues, trusting occurs due to faith in the institution, and the security that one feels due to guarantees within an organization (Zucker, 1986). An analyst from TechSource stated:

[there is] official trust, in the sense that he is the business analyst, officially designated and the IT person officially designated.. and that's why I am trusting him because he is the official BA [business analyst]

Specifically, structural assurances, defined as the belief that success is likely because such contextual conditions as promises, contracts, regulations, and guarantees are in place (McKnight et al. 1998). Further, prior reputation of the analysts (say, ones known to have great expertise), and the user representatives (as being knowledgeable about their domain, being extremely participative and supportive) were found to elevate the initial levels of trust in this state.

Mental Models

In this state, the user representatives and analysts bring in their own heuristics and cognitive processes into the requirements elicitation process. The user representatives bring their domain knowledge and their heuristics about how the system should work, while the analysts bring in their domain knowledge about the applications and technology, and a very broad idea about the nature of the system. In other words, their nature of the technology frames held by the analysts is different, and in some cases, "inconsistent" with the frame of the user representatives (Kaiya et al. 2005; Davidson 2002). This is consistent with the connectionistic view of knowledge and knowledge transfer (the epistemology adopted in this study), which argues that individuals, owing to residing in different organizational networks, have "different pictures" of the pre-given world (Venzin et al., 2000, p. 41).

The following quote from a user representative in Techsource highlighted this issue:

IT …don't always you know…[they need to figure out] here's what the business needs to see you know, this is what the business user needs to see.

Sense-making State

Knowledge transfer

The second distinct state of collaboration during RE is characterized by a struggle between the two parties (i.e., the analysts and the users-representatives) to understand the boundaries of the problem from their own perspectives, and attempt to gain better understandings by tapping into the knowledge base of the other party. This state may be viewed as a "dialoguing ba." In this state, these project goals are investigated and scrutinized at the micro-level through a series of interactions (or "dialogues") between the two stakeholder groups, in order to develop an in-depth understanding of the problem domain, and appropriately scope it. In the words of a TechSource analyst:

We basically sit down at a table…we organize some sort of a meeting… and it sometimes takes even more than three or four meetings for this group…this initial group of people just to figure out what they really want…

Consistent with the concept of the "dialoguing ba," attempts to develop a shared frame of reference are made through extensive interactions, conscious co-construction of requirements, and sharing of mental models (Nonaka et al. 2001). The dialoguing ba proceeds in a bi-directional nature with both stakeholders trying to share knowledge (i.e., push), and tapping into the other's knowledge base (i.e., pull) in an attempt to make the learning process more efficient. Given the differences in the knowledge bases of the user representatives and the analysts, the understanding of the problem boundary is accomplished (or new knowledge regarding the system specifications is created) only when there is a successful merging of these two knowledge bases, and " mutual synchronizations" in their knowledge "rhythms" (McGrath, 1991, p. 164).

In certain situations, even the detailed requirements may not provide enough information to the analysts in order for them to develop a complete understanding of the problem. In such cases, the analysts may require concrete examples or more vivid symbols to achieve the shared understanding, as highlighted in the following quote by a user representative from TechSource about the queries put to them by the analysts:

[The analysts ask:] Do you want this to happen first… do you want this to happen in all states, do you want this to happen for all customer ties? [etc.]

Drawing on the additional information that such investigation provides, the analysts then attempt to "pull" more information regarding the requirements by posing more detailed queries to the user representatives. The culmination of the interaction (if it has been successful) leaves the analyst and the user representatives with a better understanding (and new knowledge about) the system requirements.

Trust

In general, one expects trust to remain at a relatively stable level within this state as the analysts and user representatives continue their quest at understanding the problem, and making sense of the overall requirements. However, the bases of trust differ from those in the commencement state. The sense-making state, unlike in commencement, witnesses a high degree of interaction between the two stakeholders groups. Through these interactions, stakeholders are able to gather cues from each other, which lead to the formation of stereotypes, and positive stereotypes tend to accentuate their trust on the other. For example, given that the user-reps often hold the key to relevant information at this stage, if the cues received by analysts leads to negative stereotypes of user-reps, efforts must be made to "re-categorize" them by drawing upon alternate "stocks of knowledge." If this does not happen, the user-reps concerned lose credibility and the analyst team may seek out alternate sources for information. An analyst from TechSource highlighted this issue in the following quote:

> Sometimes you may not be really convinced…with the response…you may feel that it is being done differently in such cases you may contact somebody else in the business…

Mental models

Consistent with the perspectives of the connectionists, our data analysis also suggests that this state witnesses the "sharing of a common stock of knowledge, both technical and organizational" (Kogut and Zander, 1992, p.389), and through this exercise overcome the initial asymmetry that exists between the analysts and user-rep groups in terms of their mental models, and proceed towards the creation of a shared mental model.

This is an extremely challenging phase that is affected by several cognitive processes and biases. For example, user representatives may suffer from "overconfidence" regarding their knowledge of their business domain, or they may have "recall bias," which can hinder the elicitation of the requirements or the development of a shared mental model, as suggested by Browne and Ramesh (2002). Similarly, “deficient mental models” or “faulty reasoning” resulting from an incomplete understanding of the application and technologies concerned can also make the sense-making process challenging. The goal of the analysts during this state appears to be to collect as much information as possible by tapping (in detail) into the domain knowledge of the user representatives. The following quotes from different analysts support this view:

Analyst 1:
We ask what exactly do you need done … we try to nail down you know, what are you really looking to get out of this. What is the benefit of this?

Analyst 2:
I know that in the system there could be other KW [Kilowatt] components also, not just this KW. There could be, “On KW,” that is also demand component, [and] there could be “Off KW,” that is also demand component, so **I went ahead and asked do you want this reporting also**.. because I understand that they are talking about demand component in which they are interested.. **Or, if they talk about KWh, component, then I can talk further.**

On the other hand, the analysts may have a tendency to “use heuristics and seek satisfactory rather than ‘optimal’ solutions to problems” (Browne and Ramesh, 2002, p. 628). Thus, the user representatives need to consciously “push” as much information as possible in an effort to ensure that analysts seek the most optimal solution, and are on track to developing a shared understanding of the problem. A user representative from TechSource described this as follows [emphasis added]:

I would guess that you …need to make sure that you are giving them a **complete understanding** of the business process.

Another user representative at TechSource also echoed a similar sentiment:

We want to provide them [the] maximum amount of information that we can.

In some cases, even during the process of developing a shared understanding, a participant may feel the need to *push* more information during the discussions/negotiations surrounding the system requirements. For example, analysts might want to make the user representatives cognizant of some inherent problems with their (i.e., the user representatives') conceptualization of the system requirements and re-direct them as necessary, as described:

Then I would try to steer them away and try to explain to the user like no, no, no, no, you don't want to do that. Okay? Changing the fundamentals is not, it is too drastic. You don't need to go there. Okay? What about this and what about that

The Dissension State

Knowledge transfer

This state also reflects a "dialoguing ba." However, instead of the co-construction of a new and shared knowledge, this state is focused on resolving the differences/disagreements that may have emerged during the sense-making state. Prior research on requirements elicitation highlights that dissension between the stakeholders can originate due to "discordances in interpretation" or "discordances in evaluation" (Kaiya, Shinbara, Kawano, and Saeki 2005, p. 291). Discordances in interpretation refers to situations where the same requirement may be viewed or interpreted differently by the two stakeholders, while the discordances in evaluation refers to differences in preferences of the two stakeholder groups regarding a particular requirement. In the context of knowledge transfer, discordances in interpretation and evaluation are both extremely important, since such discordances are resolved only through the conveyance of knowledge between the different stakeholders (Kaiya et al. 2005). A TechSource Analyst illustrates this:

We keep talking discussing but, parties don't agree, we don't think that it can be done and, business thinks that it has to be done, or, business thinks that, it should be done differently and we see differently...

With explicit sharing and transfer of knowledge between the two stakeholder groups, not only will the nature of the discordance be discovered (Kaiya et al. 2005), but this explicit transfer of knowledge through continuous dialogue and interactions, would help in understanding the other's point of view. A UnivTech project lead illustrates this:

Sometimes you ask the question several times. Or we come out at several different ways to get the answer till everyone is on the same page. Because really, at the end of this requirements process that is one of the goals that everyone is on the same page. Everybody has the same understanding of what we want out of this.

Finally, through this dialogue process, resolution regarding the conflict that ensued during the sense-making state is resolved, and new knowledge regarding the nature of the system specifications is born amongst the user representatives and the analysts.

Trust

The dissension state results due to conflicts over some aspects of the requirements or specifications that may have arisen during the sense-making state. As a result of this conflict, the level of trust between the two stakeholder groups in this state can be very low. Since the sense-making state usually allows for prolonged interactions between the two parties, it presents several opportunities to all RE participants to gather cues and form stereotypes about the other. In many cases, formation of negative stereotypes can result in a transition to the dissension state. An analyst from TechSource, for example, described the situation where the user-reps were skeptical about the capabilities of the analyst team, in part due to the fact that TechSource did not have the same level of brand recognition as other consulting firms such as Accenture. This led to a number of disagreements and discordance, which were resolved only when the analyst team from TechSource was able to convince the user representatives, through their interactions and intermediate RE artifacts, of their competence.

The dissension state needs significant recategorization by both the stakeholder groups to elevate intra-group trust levels. When all forms of interactional cues lead to negative stereotypes, recategorization can be achieved sometimes by relying on the institution (organizational/departmental reputation), and on the contractual agreements binding the two parties. It can also be accomplished by the intervention of a powerful individual, with sufficient reward and legitimate power (French and Raven 1957), who is able to coerce the stakeholders to restore their prior levels of trust. Coutu (1998) refers to this trust as the deterrence-based trust, where members will trust simply because of fear, that if they do not trust, they will be punished. If none of these strategies can be implemented, then the requirements elicitation may suffer from an unexpected termination (which fortunately did not happen in the cases we encountered.). The importance of individuals with hierarchical power in resolving conflicts is illustrated by a user representative from UnivTech

If we get to the point where we discussed and discussed and everybody made their point but we are still at a standstill, **the director [the individual with the position of power] would step in and say okay I will have to make a decision**

Mental models

During the dissension state, there is a significant discordance or inconsistence in the mental models of the two stakeholder groups. We would like to note that such conflicts need not be hostile - it could be a productive disagreement, which depending on the context, ultimately results in resolution or reconciliation. The analysts and user-reps have their own isolated understanding of the issues, and therefore tend to perceive the problem from their respective lenses. Often such perspectives lead to divergent conceptualization of the requirements. As an analyst from TechSource elaborates

I have seen the disagreements happening between different, groups…some group comes up with a project or comes up with new kinds of requirements, … there'll be disagreements from some other group…so there'll be, lot of arguments, and disagreement and all those things would happen

Such conflicts or dissensions are generally resolved through the use of several techniques (especially by the analysts) that help in mitigating the cognitive biases, and in reconciling mental models of the two sides. For example, a common technique used by analysts is to engage in "direct prompting techniques," especially the use of "directed questions" that are "context-dependent" (Browne and Ramesh 2002, p. 634). In our study, analysts attempted to ask the same questions in a variety of ways in an effort to reduce their level of dissonance. The dissension can also be resolved through the use of "indirect prompting techniques" such as knowledge maps, flowcharts, etc, as suggested by an analyst from TechSource

It is using a bunch of sticky notes and putting all these concepts together and say what are the different things you want and then arranging it documenting it, rearranging it on a white board.

The Termination State

Knowledge transfer

This state can be viewed as an "exercising ba," where consensus has been achieved between the two parties with respect to the requirements, and this new knowledge is now put into action (Nonaka et al. 2001) through the creation of the system specification document, and then the detailed knowledge regarding those specifications is transferred from the analysts to the user representatives for sign-off. An analyst at TechSource highlighted this issue:

So once when you come up with the final requirements document, you send it to them, walk through the entire document with them to see if they understand... and both the parties agree then you sign off the document and freeze the requirement.

During the exercising ba of the requirements elicitation, it is assumed that shared knowledge has been created. The knowledge transfer is thus a mere formality where explicit knowledge (about system specifications) is conveyed by the analysts to the user representatives, and legitimized through the sign-off.

Trust

This state is a result of successful sense-making surrounding the requirements, typically ensues when consensus has been reached regarding the specifications of the system. Trust in this state is usually high and largely based on the unit-grouping component of cognitive trust. According to this form of trust, those who are grouped together tend to share common goals and values, and thus tend to perceive each other in a positive light (McKnight et al. 1998). In our context, it suggests that, in this state, there tends to be a general feeling of unit grouping among the analysts and the user representatives, that they all working together for a successful completion of the requirements elicitation and the creation of the specifications document. This perception of solidarity will help to keep their levels of trust on each other high. For example, the project lead from UnivTech mentioned:

They know you are on their side, for their benefit and you are really a member, you are on this team with them…. It just changes the whole dynamic, because it's a positive…

Mental models

This state usually witnesses a shared frame of reference, where the technology frames of the two stakeholder groups have merged in a unified whole, such that (in a TechSource analyst's words) "...everyone is on the same page." A similar view was echoed by a TechSource analyst as well:

…at the end of requirement capturing process, we definitely come up with a document on which everybody says that okay, this is the final document , this is going to be built into the system.

Triggers for Transitions between States

As discussed earlier, our process model not only includes states, but also incorporates triggers that lead to transition from one state to another. While we have tried to unearth relevant triggers from our data, naturally we cannot (and do not) claim to provide a comprehensive set based on our study of RE in two organizational settings – we invite future work in refining the definition of states, and identifying other potential triggers.

Transition from Commencement-to-Commencement State

This is a recursive transition which is in evidence when a need is felt by the RE participants (i.e., analysts and user-representatives) to "restart" the commencement process.

Many different triggers can initiate this self-transition. Sometimes, there may be *a lack of clarity among the user-representatives themselves* regarding the broad business needs of the system.

This lack of agreement can make the transmission of this information to the analysts even more difficult, thereby initiating the transition back to the same state. On similar lines, a TechSource user representative said:

> And so if it is something that is pretty specific, okay, and it is not something that I feel very comfortable with representing the client totally, then I will pull in the client to make sure that they are in there that I don't end up answering something for them to IT that leads IT to the wrong path in looking at solutions.

Such a transition can also occur when a general perception among commencement participants emerges that *the system requirements being articulated (during the commencement state) are simply not feasible,* and need to be re-examined afresh.

Relationships among the user representatives and analysts are initiated during the commencement state. Given that in many instances the two groups (i.e., analysts and user-reps) may not have had a history of working together, in an effort to get the collaboration started on the right track so that deadlines can be efficiently met, there needs to be a high level of "swift trust" formed within the team. This types of trust is not "developed," but "imported" by team members in an effort to expedite the "relationship building" process (Jarvenpaa and Leidner 1999, p. 794). Swift[3] trust enables the collaboration to set the ground rules, and the tone of the environment. Inadequate levels (or a lack) of swift trust during this state can also result in the collaboration reverting back to the commencement state instead of progressing to the sense-making state. On a related note, the return back to the commencement state can also reflect the emerging realization among participants that the assumptions underlying the project and the ground rules governing the relationships among user representative-analyst-and-other-project-stakeholders need to be revised or revisited. As an analyst from TechSource points out

[3] We must acknowledge here that, based on past (negative) experiences of the RE participants, swift trust may not form in some cases. In this case, the teams would need to rely on trust based on past reputations of the RE participants/groups or institutional-based trust in order to effectively proceed through this state.

they did talk back quite a bit, made snide remarks and all…we just let that slide. We did act appropriately, like, we did tell our sponsors. We had sponsors in the client's position as well. We did get them involved and made sure they were present at all the meetings so that things didn't get out of hand

Transition from Commencement to Sense-making State

This is a state transition that captures the logical progression from the commencement to the sense-making. This transition reflects the fact that the *broad boundaries* of the information systems requirements have been understood and agreed upon by the user-reps and analysts, and this marks a shift to the initiation of efforts to get a *much more detailed understanding* and enumeration of the business specifications. This transition is triggered if it is perceived that: a) *the broad requirements are feasible given the time frame of the project and other macro considerations*; b) *the user-reps and analysts share a satisfactory set of ground rules* (and working relationship) to move forward and c) there has been a *high level of viscosity*[4] *in the transfer of broad system requirement related information* for both stakeholders to have reached an agreed shared understanding. A user representative from TechSource pointed out

You know you have [at] a high level, this is what the business wants… you then have to break it down even further.

Transition from Commencement to Termination State

In some cases, the systems development project may involve simple enhancements to existing systems in the form of changes to the interface, or some other basic functionality. In such contexts, more detailed information or negotiations regarding the functional specifications are not required. Based on some initial interactions, the analyst team can get to a point where they can inscribe the requirements onto a specification document, and get the user representatives' sign-off. In other words, *trivial requirements or simple enhancements* can lead to the transition directly to termination stage. An analyst from TechSource discussed a similar scenario:

[4] Here *viscosity* refers to the extent to which there is a lack of congruence between the requirements articulated by the users and the understanding of the analyst (Davenport and Prusak 1998)

when there is the report or change in the screen, or a change in a small way, there is not much involved actually, the user also understands that this how it has to look and this is how it has go

Most RE processes (as indeed, most collaborative processes) would be expected to use this transition or "least effort" path if it was possible. However, since RE initiatives often do not deal with trivial enhancements, this transition is not a very common occurrence.

Transition from Sense-making to Commencement State

` While trying to comprehend the specific nature of the business process and requirements of a system, in some cases, the collaborative team reverts back to discussions surrounding the broad objectives of the system. This can be interpreted as a transition from sense-making to commencement. Such a transition can be triggered if while discussing the specific details of the requirements, the RE participants feel the necessity *to revisit the fundamental premises and boundaries of the project and to redefine the business objectives of the proposed system (or features).*

Transition from Sense-making-to-Dissension State

This transition from sense-making to dissension reflects the need for the RE participants to resolve conflicts that may have arisen during their sense-making of the requirements. This transition may be triggered by *the emergence of both issue-based conflict and interpersonal conflict amongst the group members* (e.g., Jehn and Mannix 1991). For example, a user representative from TechSource described how disagreements arose during sense-making:

everything is questioned, sometimes there is arguments, on fairly regular basis there are arguments..and we go over things

In terms of issues-based conflict, dissension amongst the group members can arise due to misaligned interests regarding the requirements of the system, choice of the technology platforms, etc. An analyst from TechSource explained:

differences could be based on the implementation, how do you implement, what technology do you use, disagreements would be there at that level..

On the other hand, interpersonal conflict could arise due to political problems within the team. As an analyst from UnivTech pointed out the following:

..you know, people may have their pet peeve that they want in there and the group as a whole, the user committee as a whole, not so much the technical people kind of scope that out… I think that is where you know conflicts arise.

On similar lines, he added:

one person who wanted control would not let go of that, did not want the project to go there. And kind of dug in her heels and so there was a really potential conflict.

Transition from Dissension to Sense-making State

In this transition, having resolved their temporary dissension, the RE participants revert back to the sense-making state, with the objective of sharing, absorbing, and co-constructing the requirements. Such a transition can be triggered by many reasons, for example: 1) the RE participants may have resolved their issue-based conflict, and *needed to get back to the unfinished aspects of their requirements definition,* or 2) *the negotiation and eventual resolution of conflict may have led to the recognition of new requirements* (hidden behind political walls) that needed to be understood and clarified. A project lead from UnivTech illustrates this point:

it is the group as a whole, you come to consensus… there can be tension but the group works through it and you get to the resolution that way.

Transition from Sense-making to Termination State

This transition occurs when the RE participants have developed a shared frame of reference regarding the nature and specific contents of the requirements. It reflects the fact that there is congruence among the analysts and user-reps about the requirements, and that the final set of features/functionalities agreed upon is complete, and can readily be objectified within a specifications document.

Transition from Termination-to-Sense-making State

In some cases where the problem being investigated is inherently complex, and when the group gets ready to document detailed requirements, the RE participants may need to transition back to the sense-making state. Such a transition is typically triggered when *the analysts or the user representatives perceive the need to "fill in" the gaps that exist within the specifications.* The following quote from an analyst from TechSource organization highlights the transition back to sense-making:

…if I have documented all the requirements, in many … cases.., what happens [is] that people tend to miss one or two clients… let us [say] that there are three people A, B and C, three clients and we've got the sign-off , and we have got the approval from these three people… Client D comes and says that actually the requirement, should be a different, in that case, we might need to go through the [sensemaking] process again…

Unnatural Termination from Dissension State

This transition describes an unnatural termination of the requirements elicitation activity without reaching its logical culmination. This transition is triggered in situations where the participants are unable to reach an agreeable solution to the various disagreements about the requirements for the information system. The disagreement or conflict therefore gets escalated and leads to *premature termination* of this phase. In very extreme cases such disagreements could lead to situations of complete *breakdown of trust* that accelerates such a termination. While we did not actually come across a case during our interviews, there were indications that such situations were not uncommon, as pointed out by one of the analysts from TechSource

so one dept. might say that, if you do this this is going to break this thing of mine, I wont let you do it, or one dept. might say that I want to do… its kind of ' tug of war ' situation, also in many cases… requirement capturing might stop

Table 2.6 - Enablers/Inhibitors of the Four Collaborative States					
Factors		**Commencement**	**Sense-Making**	**Dissension**	**Termination**
Key Analyst-based Factors	**Application Domain Knowledge**	PE	PE	PE	
	Systems Development Process Knowledge	PE			
	Technology Knowledge		PE	SE	
	IS Application Knowledge		PE	SE	
	Experience	PE	PE	SE	
	Absorptive Capacity	PE	PE		
	Communication (C) and Negotiation (N) Skills		SE (C)	PE (C and N)	PE (C)
Key User-Representative based Factors	**Organizational Domain knowledge**	PE	PE	PE	
	Hawthorne Effect	PI	PI		
	Communication Skills	SE	SE	PE	SE
	Absorptive Capacity		PE		PE
Key User Rep-Analyst Relationship based Factors	**History of relationship**	PE		PE	
	Mutuality of Communication		PE	PE	
	Lack of Viscosity of Knowledge Transfer	SI	PI		SI
Key Problem based Factors	**Complexity**	SI	PI	PI	
	Tacitness	SI	PI	PI	

Enablers/Inhibitors

As we have discussed earlier, different enablers/inhibitors affect the progress within each state. Enablers refer to the “capabilities, forces, and resources” that contribute to the progress of an "entity, program, or project" in a desired direction (BusinessDictionary.com). Inhibitors, on the other hand, are viewed as the opposite of catalyst, a factor that slows down the process (BusinessDictionary.com). Our data, examined in light of past literature, revealed four categories of enablers/inhibitors during RE: analyst-based, user representative-based, user representative-analyst relationship based, and ISD problem-based. Within each of these categories, based on our interpretation of the data, we identify primary enablers, secondary enablers, primary inhibitors, and secondary inhibitors. Further, we found that different sets of inhibitors/enablers affect the different states. We summarize these enablers/inhibitors, and the prominence of their roles in the different states (see Table 2.6). Of course, we recognize that the roles (and importance) of the identified enablers/inhibitors on the different states can be different in other contexts, and we invite future work to invite these issues further. Below, we discuss the roles of the enablers/inhibitors in further details.

One of the primary enablers affecting the commencement, sense-making, and dissension states is *domain knowledge*. Iivari, Hirschheim, and Klein (2004, p. 318-319) have identified five components of domain knowledge of RE participants, which might include both analysts and the user representatives participating in the requirements elicitation. The five components are: 1) technology knowledge (that is, knowledge of the types of hardware and software), 2) application domain knowledge ("knowledge of the application domain for which an information system is built"), 3) systems development process knowledge (that is, knowledge of the tools and techniques for systems development), 4) organizational knowledge (that is, knowledge about the "work processes in the organizational context to be supported by the IS"), and 5) IS application knowledge (that is, knowledge of It applications, their functionality, features, etc.). In the context of our study, the analysts brought knowledge types 1, 2, 3, and 5 into the process, while the user representatives were the source of knowledge type 4.

During the first three states (i.e., commencement, sense-making, and dissension), the analysts attempt to elicit and internalize broad knowledge about the system requirements from the user representatives, which requires them to have sufficient “application domain knowledge.” Such knowledge not only enables analysts to understand the business requirements better (and more efficiently) but also to assess the technical challenges involved. An analyst echoed this rationale:

If you are a person who has got lot of expertise in this particular domain... requirements gathering would be much more simple.

Further, during the commencement state many of the housekeeping details such as the nature of the methodology to be followed for systems development; the types of tools or techniques to be used for design (e.g., prototyping) are also negotiated upon. Thus, analysts' *systems development process knowledge* appears to contribute to progress in this state.

On the other hand, during the sense-making state, analysts' *technical knowledge* and *IS application knowledge* enable them to better understand the system requirements provided by the user representatives, and “visualize” the design and architecture of the new system. An analyst from TechSource explained:

… if you have to do a good RG about a project in a particular application or a domain, the person should have a good background about the system

A user representative from UnivTech also highlighted the importance of technical knowledge of the analyst for the project:

Because he [analyst] was instrumental in ensuring that we did not get into a situation where we would get …many tech support issues…he had to make sure the content server solution was technically robust

These factors are also important during the dissension state, as such knowledge could be brought to bear to resolve conflicts, but have slightly less salience, as compared to the sense-making state. The primary reason is that conflict resolutions are essentially brought about through compromise and negotiations that depend a lot more upon the *perceptions of reliability* that the user-representative has of the analyst's knowledge than his/her actual knowledge in real terms.

Similarly, the prior *experience* of the analyst also acts as a primary enabler for the commencement and sense-making states, as it allows him/her to appreciate the subtle nuances of the business rules as well as the possible technological pitfalls, as an analyst from TechSource indicated:

I'll say if the person is more exposed to the system, if the person has actually worked along with Business, he will do a better job.

On similar lines, a user representative from TechSource stated:

Experience is a big one.. I guess particularly for us as we have a lot of different systems that we use for different things and so experience is really important.

Experience of the analyst is a secondary enabler for the dissension state, because it has an indirect impact by acting positively on the perceptions of reliability the user representative has with regards to the analyst

The absorptive capacity *of the analysts served as a primary enabler during the commencement and sense-making where the majority of the system requirements were communicated to the analysts by the user representatives. In the words of a TechSource analyst:*

… if the person is quite intelligent, if he can learn it quickly .. better appreciate the business needs…[then the understanding of the problem is successful]

A *high absorptive capacity* would allow the stakeholders to absorb the knowledge efficiently, gain a better understanding of the problem domain and the technological challenges involved. An analyst (in UnivTech) provides the following viewpoint:

I think the person who's doing requirements should be able to grasp many things and … easily understand…what the user is trying to say.

The communication capability of the analysts (as well as of the user representatives) is extremely critical during requirements elicitation (e.g., Urquhart 1997). While communication is important during the sense-making state, its salience increases in the dissension state, since it is through "communication and negotiation" that the collaborative members are able to co-construct the system requirements, and resolve their disagreements (Fisher and Ellis, 1990; Roloff, Putnam, and Anastasiou, 2003). A user representative from TechSource highlighted the importance of communication, as below:

… you should be able to communicate properly to the user, your understanding, at the same time you should be able to … clearly make out what the user is trying to say…

Another noted:

Communication is important because of course …dialogue is important so we need to be able to communicate our thoughts and views and where we think something needs to go…

Given that the primary goal of the termination state is to essentially communicate the final agreed upon set of system specifications, the communication skills, specifically, in the words of an analyst—"documentation and communication skills," which enable them to capture and document the necessary details about the specifications with precision, is a primary enabler:

You should be able to communicate properly…if you are talking about the soft skills, documentation and communication are very important.

Iivari et al. (2004) had indicated that the *organizational domain knowledge* of the user representatives is critical since it reflects their ability to articulate the intricacies of the business processes pertaining to the system being developed. Participants in our study indicated the same, especially during the sense-making state when the requirements of the new systems are being specified and internalized by the analysts. In the words of a TechSource analyst:

…you need a subject matter expert whom, what I call a process lead. They understand the business process. They tell our people how it is going to work.

Further, consistent with past literature on knowledge transfer (e.g. Joshi and Sarker, 2003; Szulanski, 1996), our data revealed that the process of knowledge transfer is severely inhibited if the analyst does not perceive the user representative to be *reliable* or *credible*, and affected by the so-called "*Hawthorne effect*" (Browne and Ramesh 2002). Such an effect refers to the user representatives' (dysfunctional) inclination to articulate what is expected from him/her in the organization as opposed to the actual requirements of the system. Prior research has acknowledged this issue to be an important inhibitor of requirements elicitation, since it tends to slow down the process significantly. As a remedy, the analysts may need to spend extra time accessing other individuals in an effort to corroborate what the user representative had articulated, contributing to an inefficient RE process, as explained by a TechSource analyst:

Sometimes you may not be really convinced…with the response…you may feel that it is being done differently in such cases you may contact somebody else in the business…

The *absorptive capacity* of the user representatives is critical during the sense-making state as the they have to readily grasp the system based arguments provided by the analysts and map them up to the business functionalities in order to comprehend what the detailed business requirements should be. As one user representative from TechSource pointed out:

I have to go in and figure out often times the business process side of it because I don't know all of them because there is so many of them. So of course I learn more digging through…I really have to learn what is being done to make the change you know so I learn more about how our system is actually set up. Is it something that is a domain table change or do we actually have to go in and change a cap or how many caps do we have to change?

This factor remains important during termination states, since this state requires their sign-off on the requirements specification document, which cannot proceed till the user representatives have been able to absorb the entire set of requirements described by the analysts. The criticality of this is evident from the fact that the user representatives have to again be able to map the detailed functional requirements to the original business needs to assess if the final requirements are indeed correct.

Several factors related to the relationships between user representatives and analysts also affect the different collaborative states. As one of our interviewees from UnivTech indicated, *a history of interaction* between the analysts and user representatives enables an efficient knowledge transfer during the commencement state, and can thus be viewed as a primary enabler:

... the capturing process should be faster, if you interact with the same person a number of times…

Specifically, positive past interactions between the analysts and user representatives can potentially enable the knowledge transfer and collaboration in the following ways: First, the personal acquaintance resulting from such interactions minimizes the need for the initial socialization, thus allowing both the set of actors to focus directly on the issue at hand (i.e., understanding the system requirements). Second, prior interactions provides user representatives and analysts knowledge about the working styles of the other, therefore, eliminating the need to discover each other's working styles (a key ingredient of a successful collaboration). An analyst from UnivTech suggests:

.. we took six months of the front of the project because they had worked together; they knew where I was headed with facilitating the requirements gathering.

A history of interaction can also enable the resolution of dissension as the past relationship would increase the mutual trust they have for each other, thus enabling them to comprehend or accept the other's point of view and reach speedy resolution of the conflict.

One of the primary objectives of the requirements elicitation process is the development of the shared frame of reference, especially during the sense-making state. Thus, a l*ack of the viscosity* of the knowledge transfer (i.e., the extent to which there is a lack of congruence between the requirements articulated by the user representatives and the understanding of the analyst (Davenport and Prusak 1998)), acts as a primary inhibitor for this state.

The viscosity of the knowledge transfer from user representatives→analysts during the commencement state, and the analysts→users representatives during the termination state also tends to act as inhibitors, albeit to a lesser degree.

It has been widely acknowledged that the nature of the relationship between the user representatives and the analysts affects the process of requirements elicitation. The symbolic interaction theory, which addresses the issue of social processes of relationships, refers to three types of communication (and responsiveness) that plays an important role during collaboration (Couch 1989). They are: unidirectional communication, where the different collaborative parties show a lack of reciprocity in their communication, bi-directional communication, where the parties talk "past" each other, without respecting the other's goals or objectives, and mutuality of communication, which refers to an unison amongst the different parties in terms of goals, objectives, and understanding. The extent to which there is *mutuality of communication* between the user representatives and analysts significantly affects progress in the sense-making and the dissension states. A user representative from TechSource emphasized the fact that the analysts and the user representatives have to draw from their respective knowledge base about the system (technical and function) and achieve mutuality in their communication to get at the best solution:

> We have to really take both perspectives and bring them together because of course neither one of us has the full solution, because of course what we're talking of this process is that they have to meet those business requirements but yet we also need to look at the system and what is available and these have to come together and we need to find the best solution.

Two factors related to the business problem (underlying the RE effort) were also found to play a significant inhibiting role during the first three states of the process. One of them is the inherent *complexity of the business knowledge* involved. The nature of the business process and the number of business processes to be encapsulated into the new and proposed system often indicates the complexity of the business knowledge. The efficiency and effectiveness of the passage through the collaborative states are impeded by this complexity, as such knowledge is difficult to transmit and absorb. An analyst from TechSource echoed this point, when he stated:

I won't say it's more difficult, just that it's more complicated…just the requirement itself is big so we need [to] put more effort…

We would like to note that the *complexity of the business knowledge* involved may play a role during the commencement phase as well; however, its salience is higher during the sense-making and dissension states, as it is during these states that the participants are focused exclusively on grasping the problem-domain, developing a vision for the system, and resolving conflicts surrounding the conception of the new system requirements. Complexity in the business knowledge (as highlighted above by the analyst) makes these above activities more cumbersome and time consuming.

Finally, the *tacitness of the knowledge*, that "incorporates so much accrued and embedded learning that its rules may be impossible to separate from [the individual]," and cannot be "described in words" (Davenport and Prusak 1998, p. 70), significantly hinders the requirements elicitation process especially during the sense-making and dissensions states. However, to construct a superior system, it is important to acquire both the explicit knowledge that is "embedded in procedures or represented in documents and databases," but also the tacit components of that knowledge (Davenport and Prusak 1998, p. 95). An analyst from TechSource highlights the impediments caused by the tacitness of the problem domain

when somebody is trying to automate the whole manual process into something else. We clearly do not know, initially the Business user is also not aware of how this is going to work out.. his objective is to change the manual work into automatic one, but how, what, what is going to be involved, how are they going to do that, what are the hardware structures they require, all those things are very unknown at the higher level.

Contributions, Limitations, and Conclusion

In this manuscript, using a grounded theory methodology, and applying the lens of collaboration, knowledge transfer, trust, and shared mental models, we provide an integrative process-based understanding of requirements elicitation, which has been relatively unexplored in the existing literature. Below, we discuss the specific research and practical contributions that this study attempts to make.

Research Contributions

One of the primary research contributions of this study is the fact that it investigates RE from a process perspective. As our literature review highlights, while requirements elicitation has remained an important area of research within the IS discipline, much of this attention has focused on the development and validation of variance models (e.g. Browne and Rogich, 2001; Moody, Blanton and Cheney, 1998; Bryant 1997), with relatively fewer attempts at understanding the process. A process-oriented approach (such as the one provided in this study), is important since its "strength lies in the uncovering a rich understanding of the ISD process over time" (Sambamurthy and Kirsch, 2000, p. 9). Adopting a variant of Strauss and Corbin's GTM, the study *provides a process-based model, unearthing some of the subtle nuances of RE*.

Further, prior process-based studies on RE have highlighted the notion of collaboration between RE participants (e.g. user-reps and systems analysts), where knowledge regarding the system requirements is shared, absorbed and co-constructed, such that shared mental models of the requirements can form. Not surprisingly, seamless collaboration and viscous knowledge sharing has been characterized as tenuous in the literature, given that these two distinct groups of RE participants bring in very different kinds of knowledge into this activity, and trust among the two parties cannot be guaranteed at any point. This study is among the first to *integrate the different facets of RE (discussed above) within one dynamic framework.*

While some researchers have acknowledged that the RE phase is composed of multiple tasks (e.g., Siau and Tan, 2006), prior literature has largely viewed RE as a monolithic phase within ISD. Our study suggests that a *monolithic view of RE may provide an incomplete* understanding of RE, thus providing limited insights regarding the enhancement of effectiveness of this critical ISD phase. In fact, our study provides evidence that the *RE process is composed of four distinct collaborative states*. These collaborative states differ in terms of 1) their objectives, 2) the nature of the knowledge transfer and trust among the primary stakeholders (i.e., the analysts and the user representatives), and the level of congruence in their mental models, and 3) the primary and secondary enablers/inhibitors. Further, the RE process may evolve iteratively, as groups transition back and forth between these different states, or even skip a particular state, depending on the nature of the project (e.g., the complexity in the business problem). The study *not only identifies the states*, and describes them (in terms of the knowledge transfer, trust, and mental models), but also *provides the specific triggers that initiate transitions between the states*.

We believe that our study also contributes by *illustrating the depiction of process models as state transition diagrams*. There is a lot of interest in modeling processes; yet, scholars appear to be divided in deciding upon useful strategies for process depiction, and the current paper provides a tangible illustration of process theorizing. Further, in the context of grounded theory methodology, where there have been *calls for alternatives to the paradigm model* (Strauss and Corbin 1990), we are hopeful that our strategy will resonate with future grounded theory researchers who do not feel "comfortable" with <u>one received way</u> to model process.

Finally, this study also contributes to the literature through the *explication of factors that act as primary and secondary enablers/inhibitors in each of the states*. Previous literature (e.g. Szulanski 1996; Szulanski, Cappetta, and Jensen 2004) has indicated that various personnel, process and knowledge-related factors inhibit or enable the knowledge transfer process in general, and specifically during ISD. Similarly, prior literature on collaboration has also highlighted different stakeholders' interaction-related variables that may affect the nature of the collaboration (e.g., McGrath 1984). This study explicitly identifies a wide range of enablers/inhibitors that can potentially affect the different states of RE. Through this, the study demonstrates that the impacts of these factors gain or lose salience as the RE participants transition through the different states.

Practical Contributions

Our study also attempts to make a number of practical contributions. The study highlights the idea that RE unfolds through several states, identifies the different triggers that cause the transitions between the states, and maps out the different paths (and the most efficient path) that RE collaborative groups might take. The detailed descriptions of states and triggers provide the analysts and user representatives, and other stakeholders with the understanding to detect the state they are in, or the state they are about to enter, and thereby take the necessary actions to ensure that the state is completed effectively.

The other practical contribution of this study is with respect to the skill sets of the analysts and the user representatives. Specifically, the set of inhibitors and enablers of the knowledge transfer process identified in this study can provide insights into the capabilities that the analysts need to possess in order to ensure that the collaborative states terminate successfully. For example, an analyst with higher application domain knowledge and systems development process knowledge would need to take leadership roles during the commencement state, while the dissension state would require an analyst who has high communication and negotiation skills, such that he/she is able to resolve the differences that may have emerged between the stakeholder groups during the sense-making state. On the other hand, our study also highlights that user representative' can be influenced by the so-called "hawthorne effect" while articulating the system requirements. This implies that analysts need to be on guard, avoid taking everything at face-value, and attempt to triangulate the information received from one set of user representatives with other sources.

While the study makes a number of contributions, like any other study it also has some limitations. We discuss them in further details below:

Limitations

While the focus of our study was both the analysts and the user representatives, the proportion of analysts in our interview sample turned out to be more than the proportion of the user representatives. In this respect, it could be argued that our study reflects a slight bias towards the systems analysts in terms of our data collection efforts. However, we believe that since our objective is not to examine whose role (i.e., whether analysts' or user representatives') is more critical to the RE process (in which case a more stricter balance in the number of user representatives to analysts interviewed would have been necessary), and our model incorporates an almost equal number of user representative and analyst-based factors, we believe that this difference in the proportion does not significantly taint the results.

Another limitation arises from the fact that this study examines the interaction between *analysts* and *user representatives* only, and thus the results may not be generalizable to other situations with interactions between other types of stakeholders in the RE process. While we believe that our study is representative of a large number of RE processes (which often involves between the user representatives and analysts), prior research suggests that the RE process could also involve other stakeholders such as the end-users themselves. Given the difference in the knowledge bases between the end-users and the user representatives/domain experts (i.e., unlike the users, domain experts not only have an intricate knowledge about the users' business processes, but are also somewhat familiar with systems analysis techniques (e.g., Iivari et al. 2004; Tuunanen 2003), involvement of the end-users in the RE process can give rise to different kinds of dynamics in terms of collaboration, knowledge transfer, and development of a shared mental model with the systems analysts. Future research involving analysts and end-users need to be undertaken to get a more in-depth understanding of the RE process.

Finally, in this study, we have focused on examining the RE process through the lens of knowledge transfer, collaboration, trust, and development of shared mental models only. While prior literature has suggested these to be the key and salient components of the RE process, it can be argued that given the complicated nature of RE, viewing it through just four components may provide only a limited understanding. However, adding more components would also increase the complexity of the conceptualization, and thus, we sought to achieve a right balance between complexity and parsimony.

Conclusion

Requirements elicitation has remained a key topic of interest for IS researchers, however much of the existing literature has focused on developing variance models surrounding the key factors affecting the effectiveness of this ISD phase. Using data from two different organizations and applying the grounded theory methodology, this study provides a more process-based understanding of this phenomenon depicting the process as being composed of different states, with specific triggers initiating the transitions between the states. In light of recent views about RE being a collaborative Endeavour involving knowledge sharing, the study highlights how collaboration unfolds amongst the user representatives and analysts during RE, and how knowledge related to the system specifications is effectively shared among them in an effort to develop a shared frame of reference regarding the problem domain, and reach consensus regarding the system requirements. As ISD continues to be important for organizations, and increases in complexity (owing to globalization and offshore outsourcing), we hope that our study provides an understanding of some of the subtleties involved in one of its core phases, requirements elicitation, and would encourage future researchers to continue their investigation of this critical issue.

3. ESSAY 2

An Integrative and Contingent Theory of Systems Analyst Effectiveness: A Gestalt Fit Perspective

Introduction

A fundamental phase of information system development (ISD) projects is the requirements elicitation (RE) phase, in which boundaries of the problem domain of the proposed information system are objectified. Previous research (e.g. Agarwal, Sinha & Tanniru, 1996; Guinan, Cooprider & Faraj, 1998; Boland, 1978; Davis, 1982) acknowledges that it is a problematic process, and its success or failure has a significant impact on the success of the overall ISD project. Specifically, unsuccessful RE has frequently affected the downstream project phases, in terms of quality, productivity and budget (Curtis, Krasner & Iscoe, 1988). Given the importance of this phase and the ubiquitous nature of the problems associated with it, significant research has been conducted in assessing the key determinants of success/failure of the RE phase. For example investigations of systems analyst skill or capability requirement (e.g., Green, 1989), ontological assumptions about the problem domain (e.g., Lewis, 1994), methodological issues (e.g., Iivari, Hirschheim & Klein, 1998; Chatzoglou & Macaulay, 1996), conceptualization of innovative methodologies (e.g., Weaver, 1992; Cockburn & Highsmith, 2001), user participation (e.g., Barki & Hartwick, 1989; Hunton & Beeler, 1997; Hirschheim, 1985) have been conducted.

The review of this literature suggests there are several core contextual elements of the RE phase. They are: the systems analyst (representing the ISD team), the business user (representing the client organization), the problem domain or the project, and the methodology by which RE is performed. For the purpose of this article we focus on the *systems analyst*. The systems analyst has been acknowledged as the key player of the RE phase (Coughlan, Lycett & Macredie, 2003), with a number of studies examining the analysts' role, and the skill requirements for their task (e.g. Green 1989; Lerouge, Newton & Blanton 2005; Nord & Nord, 1997). There has also been further acknowledgement that performance of the system analyst or *analyst effectiveness* is an important factor determining the effectiveness of RE during ISD (e.g. Hunter and Beck 1996). Previous research has indicated that there are important skill requirements or capabilities that are essential for an analyst to perform his/her task successfully and has enumerated of important analyst capabilities (e.g. behavioural skills, knowledge based capabilities etc.) (e.g. Green 1989).

While such research has contributed considerably in allowing us to identify the analyst capability set that an analyst needs to possess in order to perform his/her task successfully, there are some important limitation. The first limitation concerns the implicit assumption that the set of analyst capabilities is a sufficient indicator for understanding analyst effectiveness. Though this assumption is not wholly inaccurate, it is perhaps guilty of oversimplification and ignores the effect of a number of other contextual variables such as environmental factors and task-based factors. The second limitation lies in the assumption that possession of certain generic capabilities would make analysts universally effective for any kind of ISD project. The current nature of increasingly complex and enterprise wide implementation of information systems with demand for highly specialised skills belies the appropriateness of such an assumption. We would like to argue that the particular set of skills that would enable analyst effectiveness would be contingent on the nature of the ISD project. This argument finds support in the resourcing literature where job performance has been explicitly tied to the fit the individual has with a particular job (i.e. person-job fit (Kristoff 1996)). Therefore in this article we propose analyst effectiveness is contingent on the analyst's capabilities, and the context created by the specific project. In other words, while there may be analysts with the requisite capabilities, their effectiveness will be realized only if the right people are deployed for the right project—that is, if a fit exists. Thus, in this manuscript, we attempt to develop a theory surrounding the *nature* (and dimensions) of the fit, and *how* this fit leads to analyst's effectiveness. Further, we also provide an understanding of *how* this fit may be extended to the *resourcing of ISD teams*. In other words our primary research question is

RQ1: *What is the nature (and dimensions) of the fit that lead to analyst effectiveness during RE?*

The rest of the manuscript is organized as follows: First we provide a brief review of past research in the area of systems analyst effectiveness and resourcing. Next, we elaborate on how analyst effectiveness may be explained from a fit perspective and introduce our theoretical model. After that, we elaborate on the exact structural and associative nature of the fit construct. Next we propose two alternative approaches for the empirical evaluation of the theoretical model. We follow this up with an illustration of how the fit perspective may be utilized to resource ISD projects. Finally the practical and theoretical contributions of this research are discussed.

Prior Research

Research on the Effectiveness of Systems Analysts

The systems analyst is one of the most influential and important actors in the ISD project and especially during the RE phase (Saiedian & Dale, 2000; Graf & Misic, 1994). Consequently, a number of studies have focused on the factors leading to analyst effectiveness. A majority of such research has attempted to explicitly identify the relevant skill sets that the analysts need to possess in order to be effective (e.g., Green 1989; Hunter & Beck, 1996; Lerouge et al. 2005). For example, Green (1989, p. 115) concluded from his empirical study that analysts should possess "behavioural skills for effective development." Lerouge et al. (2005) argue that systems analysts play a socio-technical role, and thus it is more important for them to possess interpersonal skills and system development skills, rather than just technical skills. Similarly, Hunter and Beck (1996) investigating the profile of an "excellent systems analyst" concluded that he/she needs to have the right attitude, and knowledge, and be able communicate effectively. While the studies have put forth a number of such traits or characteristics, (and have also highlighted perceptual differences in the perception of relative importance) they are essentially similar and can be categorised in terms of expertise or knowledge of Business/functional or technological domains, inherent capability in terms of analytic or intellective ability and interpersonal skills (Nord and Nord, 1997).

Another body of literature has focused on the cognitive or functional processes that are employed by the analysts during RE. For example, research in this area has looked at mental models and cognitive activity (Butterfield, 1998; Pitts & Browne, 2004), interaction and communication as tools of learning (Coughlan et al., 2003; Urquhart, 1999), and problem-solving approaches employed (Schenk, Vitalari & Davis, 1998), among others. Butterfield (1998) examined how analyst's view complex projects and attempt to understand the nature of the complexity. His study suggested that the analyst would be better off by trying to comprehend the system in terms of dimensions beyond the general systems perspective of input, processes and output. Pitts and Browne (2004) examined how analysts determine the sufficiency of information gathered during the elicitation of requirements. They termed these as stopping behaviours and provide a classification of stopping rules used by analysts. Their study indicated that analysts experience had an effect on the choice of stopping rules and that the choice of the stopping rules had an effect on ISD success. In a similar vein Watson and Wood-Harper, (1996) propose a deconstructive strategy that "relies on terms of existing oppositions in conceptual frameworks but seeks to displace the limitations they impose on how we conduct inquiry" as means for analysts to effectively understand requirements. Schenk et al (1998), also pursues a similar investigative theme and examines the differences between the problem solving approaches of novice and experienced analysts and proposes these as useful starting points for analyst training.

Alternatively, some researchers have focused on the social interactive processes, rather than the cognitive processes. For instance, Coughlan et al (2003) examined the nature of communication problems during requirements elicitation and provided a theory based categorisation of these problems by providing a four dimensional framework on the nature of communication. Urquhart's (1999) research embeds analyst effectiveness deeper in to the socio-interactive context by trying to understand how analyst-client communication interaction develops over time. Her research provides insight by providing contextual themes of requirements elicitation that underlies the importance of the analysts' capability in leveraging/facilitating social interactions. This body of research as has been exemplified have attempted to move beyond identification of analyst skills and have tried to understand analyst effectiveness in terms of social and cognitive dynamics.

Additional research, surrounding the education and training of analysts (Heiker, 1974, Jenkins, 1986), core roles and activities of systems analysts, (Miller, 1981), and evaluating analyst performance (Scharer 1982) have also been conducted. We summarize prior research on systems analyst effectiveness in Table 3.1.

Table 3.1: Research investigating System Analyst effectiveness	
Category of Research	**Sample research**
Focus: Analyst Capabilities **Agenda:** This body of research examines and attempts to identify the set of capabilities that allow systems analysts to successfully perform RE	Canavan (1980); Chau & Ng Tye (1995); Chen (1985); Lerouge, Newton and Blanton (2005); Bassellier and Benbasat (2004); Graf and Misic (1994); Misic and Graf (2004); Green (1989); Pare and Jutras (2004); Hunter and Beck (1996); Hunter and Palvia (1996); Wynekoop and Walz (2000); Maxwell (1988); Nord & Nord (1997); Taylor, McWilliam, Gresty and Moynihan (2004); Butterfield, (1998); Watson & Wood-Harper, (1996); Vitalari (1985)
Focus : Cognitive and functional processes used by analysts **Agenda:** This stream of research has primarily examined the cognitive and functional processes that systems analysts use such as stopping heuristics, problem solving processes etc.	Butterfield, 1998; Urquhart, 1999; Watson & Wood-Harper, 1996; Coughlan et al., 2003; Marakas & Elam, 1998; Pitts & Browne, 2004; Schenk et al., 1998; Davidson, 2002
Focus: Contextual factors **Agenda:** This stream of research has focused on various contextual factors that affect the effectiveness of a system analyst. Factors investigated in this stream of research include organizational factors, education, training, interpersonal environment etc.	Heiker, 1974; Jenkins, 1986; Miller, 1981; Misic & Graf, 1993; Scharer, 1982; Smith & Kozar, 1977; Wood-Harper et al., 1996

Our review of prior literature, reveals some patterns: First, existing research has primarily focused on identifying analysts' capabilities; Second, even if studies have investigated other issues (such as cognitive processes/techniques), in general there has been a tendency to adopt an "isolationist" approach with only a particular dimension being investigated at a particular time. There have been very few identifiable attempts (e.g. Byrd, Turner & Lewis, 2004) at viewing analyst effectiveness as being context-dependent, or emerging out of the interactions of multiple dimensions. We believe that this gap in the literature propagates an assumption that identification of an ideal analyst (with certain capabilities) is sufficient for analyst effectiveness. We argue that *while these skills are necessary, they may not be sufficient*. Our attempt at theorizing addresses this void by proposing an alternative lens that adopts the perspective of 'fit' to understand analyst effectiveness. Specifically, we view analyst effectiveness as a "resourcing" problem, where an individual with certain skills (i.e. the systems analyst) needs to have a "fit" with the characteristics of the specialised task (i.e., requirements elicitation). In the next section, we thus provide a discussion of prior research on resourcing.

Directions in Resourcing Research

Prior research has often viewed resourcing in terms of a form of "optimal fit", between the individual and the environment (Judge and Ferris, 1992). However other fit aspects such as person-vocation fit (e.g. Holland, 1985), person-organization fit (e.g., Kristoff, 1996), and person-job fit (e.g., Edwards, 1991) have also been proposed. Specifically, selection of a particular fit approach depends on the level of analysis that one is interested in. Given that our focus is on the *analyst* (a person), who is expected to perform a specific *job* (requirements elicitation) within an ISD project environment, we view the fit between the analyst capabilities and the context as a person-job fit.

Person-Job Fit research examines the compatibility of individuals with specific jobs. Edwards (1991) defined person-job fit as fit between the abilities of a person and the demands of the job or the desires of a person and the attributes of a job. Edwards proposed a model of person-job fit based on a review of ninety-two industrial/organizational psychology and organizational behaviour studies that was empirically associated with positive outcomes of job satisfaction, psychological and physical health, performance and turnover. Person job fit has since then been operationalized in terms of knowledge, skills, ability, interests, job characteristic and personality. Knowledge, skills, ability or KSA has evolved into dimensions on which the fit of an individual and a specific job is examined. Research investigating person-job fit has indicated that this fit leads to positive outcomes in terms of affective variables like job satisfaction, physical stress symptoms and job ambiguity (Caldwell and O'Reilly, 1990). Job-person fit has also been found to result in positive job performance (Kolenko and Aldag, 1989).

While we draw inspiration from such research in our theorizing, we believe that there are certain important distinctions between our approach and existing research that needs to be articulated. First, the person-job fit literature characterises job in terms of a more macro conceptualisation. Examination of resourcing for the RE phase requires a much more micro-level focus. Second, as mentioned before, the ISD project also represents a socio-technical climate within which the work is performed; a fact that has not been explicitly taken into consideration by prior research on person-job fit. Thus, we feel that in the context of the study, there is a need to conceptualise new fit constructs that extend beyond the domains of a person-job fit or person-organization fit. In the next section, we attempt to theoretically develop this new fit perspective.

Theory Development

As we have mentioned earlier in the article, we are interested in proposing a contingent theory of **analyst effectiveness** in the context of RE**.** It would therefore make sense at this juncture to clearly state what we mean by term **analyst effectiveness**. For the purpose of our research and context of this paper, we propose that

> Analyst Effectiveness is the extent to which an analyst is able to capture accurately and completely the underlying business functionality and technological requirements of an Information System during the performance of the requirements elicitation activity.

An important aspect of our contingent theory is the thesis that **analyst effectiveness** may be better understood through the concept of "fit". Therefore a critical aspect of our theory building endeavour is the conceptualisation and elaboration of fit construct However, before progressing with the development of a theoretically grounded conceptualisation of a fit construct it would make sense to clearly identify the components that are pertinent for this fit construct. In the next section, we try and identify what these possible components are

Identifying the Fit Components

Prior research indicates two important components of RE – the **analyst,** and the specific **project** (which represents the task at hand, as well as the working environment) Typically, an ISD **project** has two dimensions: the **problem domain** (functional requirements of the specific information system being developed), and the **project environment** (which provides the situational context in which the stakeholders interact) (Jiang, Klein and Means, 1999).

Each of the above components of RE also have certain dimensions that needs to be considered. They are: 1) the set of generic capabilities that the analyst needs to possess (**Analyst Capability**), the characteristics that define the problem for the particular project (**Problem Characteristics**), and the **Project Environment.** Previous research involved in the conceptualization of Fit as a theoretical construct have stressed on the importance of understanding very clearly the antecedent variables associated with the fit construct (e.g. Venkatraman 1989). In the context of this research therefore, it would make sense to clearly understand the nature and dimensions of the key constructs – **analyst capability, problem characteristics** and **project environment.** In the next section we attempt to attain clarity about these constructs

Dimensions of Fit Antecedents

A recurrent theme within the body of literature on core analyst's skills (e.g., Green, 1989; Lerouge et al., 2005) has been that analyst capabilities are multidimensional and encompass various elements ranging from skills related to the job at hand to socio-political skills. In Appendix A we provide a tabular representation of the different analyst capabilities identified in a sample of such literature. Drawing on this literature, we propose a taxonomy of analyst's skill requirements. These are ***job related skills*** and ***individual-specific skills***. The job related skills are ***technical knowledge,*** and ***business knowledge*** (e.g. Lee et al. 1995; Hunter and Beck 1996). The skills arising from individual characteristics are ***analytic ability,*** and ***interpersonal skills*** (Hunter and Beck 1996; Wynekoop and Walz 2000). Further, interpersonal skills are composed of political skills, communication skills, and management skills (e.g. Bassellier and Benbasat 2004; Lerouge et al 2005).

The problem domain for an information system includes both the business perspective, and the technological perspective (Ratbe, King & Kim, 1999). For RE to be successful the problem domain needs to be clearly and unambiguously described in terms of both these perspectives. The understanding of both the business and technology perspective is contingent on the inherent complexity of the problem in hand. Therefore, we define ***business complexity*** and ***technological complexity*** as two dimensions of the problem. We differentiate between these two types of complexities, as the complexity of the technological domain may be independent of the nature of the business specifications. For example, the generation of a business report could pose different technological challenges based on the underlying infrastructure of the organization. It could become a technologically challenging task if the underlying system is based on mainframe computers, and a trivial task if it is a client-server based system.

An ISD project is typically conducted by a group of individuals, where "the central feature, the essence of the group lies in the interaction of its members – *behaving together,* in some recognised relation to one another" (McGrath, 1984, p. 12). Thus, we believe that the *group interaction process* is the centrepiece of the project's social environment. The importance and centrality of the group interaction process becomes even more evident during the RE phase, which has been viewed as a *collaborative* activity (Akshawi & Al-karaghouli, 2003). Previous literature suggests that the collaboration in a group environment is a function of the ***socio-political environment*** such as the intra group conflict, cohesion, and clarity with regards to the political goal (McGrath, 1984). We argue that the nature of the socio-political environment would impede or facilitate the extent of collaboration within the project, and propose it to be a critical dimension of the project environment. In Table 3.2, we provide a summary of the definitions of Analyst Capability, Problem Characteristics, and the Project Environment Characteristics. In the next section, we elaborate on the nature of the fit construct.

Table 3.2: Dimensions of Fit antecedents

Analyst Capability	**Definition**
Business Knowledge	Knowledge of business processes that facilitates understanding of the business problem and allows the analyst to align information technology with the Business Objectives (Lee, Trauth & Farwell, 1995)
Technical Knowledge	Knowledge of software, hardware, programming techniques as well as the techniques that facilitate the activities of analysis, design, development and implementation of Information Systems (Misic & Graf, 2004)
Analytic ability	The ability to examine things critically, and to segregate the broad scope into its individual components (Misic & Graf, 2004)
Interpersonal Skills	Interpersonal Skills are essentially people skills that allow the analyst to interact effectively with the individuals associated in an IS project and also act as an effective mediating or negotiating agent when the situation demands it. (Lee et al., 1995)
Problem Characteristics	**Definition**
Business Complexity	The inherent nature of the business functionality to be implemented in the information system, in terms of the number of requirements, the clarity of understanding about the requirements and the structural aspect of the requirements. (Ratbe, King & Kim, 1999)
Technological Complexity	The degree of compliance of the underlying information system with the business requirements (for existing systems) in terms of the size of the proposed system, or the amount of change in the underlying information system (Roberts, Cheney, Sweeney & Hightower, 2004)
Project Environment Characteristics	**Definition**
Socio-political environment	The social and political climate of the project in terms of uncertainty and the degree of alignment of the objectives, and relationship amongst the project stakeholders

Fit and Analyst Effectiveness

In the preceding section we have elaborated on the nature and dimension of analyst capabilities, problem characteristics and project environment, which we believe are important source of contingencies related to understanding system analyst effectiveness in RE. However an important question remains with regards to nature of the contingent relationship between two or more these constructs. We feel that the answer to this question lies in a closer analysis of the analyst capabilities considered to be important (see Table 3.3 below).

Table 3.3– Taxonomy of Analyst Capabilities

<table>
<tr><th rowspan="2">Articles</th><th colspan="3">Job Related</th><th colspan="5">Individual Specific</th></tr>
<tr><th>Business knowledge</th><th colspan="2">Technical Knowledge</th><th>Analytic Ability</th><th colspan="4">Interpersonal Skills</th></tr>
<tr><td>Bassellier& Benbsasat</td><td>Business Competence</td><td colspan="2">-</td><td>-</td><td>Interpersonal Communication</td><td colspan="2">Leadership</td><td>Knowledge Networking</td></tr>
<tr><td>Bassellier, Reich and Benbasat</td><td>-</td><td>Explicit IT Knowledge</td><td>Tacit IT Knowledge</td><td>-</td><td>-</td><td colspan="2">-</td><td>-</td></tr>
<tr><td>Lee, Farwell and Trauth</td><td>Business Functional knowledge</td><td>Technical Knowledge</td><td>Knowledge of technical Management</td><td>-</td><td colspan="4">Interpersonal and Management Skills</td></tr>
<tr><td>Green</td><td></td><td colspan="2">Technical Skill</td><td>-</td><td colspan="4">Behavioral Skills</td></tr>
<tr><td>Lerouge Blanton and Cheney</td><td>Business task knowledge</td><td>Technology Skills</td><td>System Development Task skills</td><td>-</td><td colspan="2">Interpersonal Skills</td><td colspan="2">Political skills</td></tr>
<tr><td>Hunter and Beck</td><td>Business Knowledge</td><td colspan="2">Technical Knowledge</td><td>Problem Solving</td><td colspan="4">Verbal and Written Skills</td></tr>
<tr><td>Wynekoop and Walz</td><td>Functional Knowledge</td><td colspan="2">Technical Knowledge</td><td>Problem Solving</td><td colspan="2">Communication</td><td colspan="2">Leadership</td></tr>
<tr><td>Todd, McKeen and Gallupe</td><td>Business</td><td colspan="2">-</td><td>Problem Solving</td><td colspan="2">Social</td><td colspan="2">Management</td></tr>
</table>

An important category of skills considered critical is the job-related skills. These constitute of two broad categories of knowledge based skill sets – business knowledge and technological knowledge. These knowledge based skill sets specifically allow the analysts to supply the requisite skills that are demanded by the problem domain of a particular project. In addition given the diverse nature of information system implementation that are evident (ranging from enterprise wide applications like ERP and CRM applications to specialised software applications for mobile devices) it will not be wrong to presume an increased requirement for specialisation in both business (functional) and technical knowledge on the part of the systems analyst. A logical conclusion that can therefore be drawn is that the nature of the problem of a project drives the kind of knowledge based capabilities required from an analyst. In addition, the interpersonal skills that the analyst possesses, allows him/her to leverage the knowledge based skills to better understand the requirements posed by the problem domain of a particular project. Therefore we propose that *the individual would need to possess a minimum subset of capabilities required of an analyst. These capabilities possessed by the individual need to be congruent to the characteristics of the specific problem being addressed in the project.* In other words, if we conceptualise analyst capability and problem characteristics as two independent sets, the congruence or alignment would be best represented as an intersection between these sets (see Figure 3.1). This implies that analyst effectiveness would be enhanced if there were an intersection between the set of capabilities possessed by the analyst and the set of characteristics demanded by the problem (we term this as the analyst-problem fit).

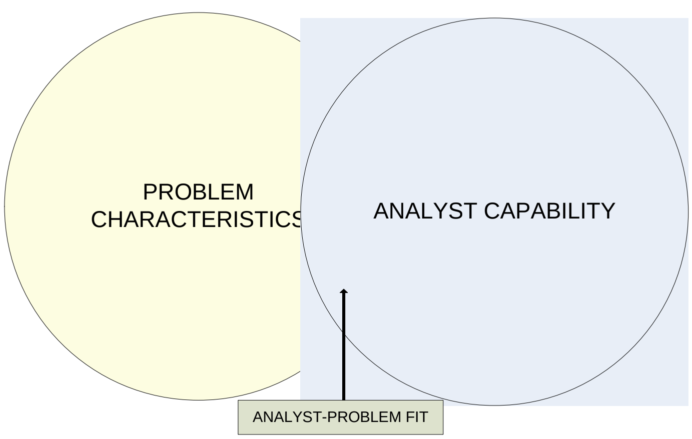

Figure 3.1-Condition for analyst effectiveness

Thus, we propose:

P1 – Achieving analyst-problem fit would leads to increased analyst effectiveness.

The environment of the project also plays an important role. The project environment represents a socio-political context within which the tasks of the ISD project are carried out. As the project team is essentially a social collective, most of the activities of the RE phase is accomplished through a series of social interactions and collaborative efforts (Akshawi & Al-Karaghouli, 2003; Urquhart, 1997). This is reiterated by (Davidson, 2002, p. 330) who argues that RE essentially unfolds through a social sense-making process, involving multiple stakeholders, and is "chaotic, nonlinear and continuous." This suggests that the social interaction/collaboration is a difficult process, and the project environment can to facilitate/impede the success of the RE. It has also been argued that the analyst's ability to succeed during RE would depend on the social, and political factors surrounding the project (Urquhart 1997). Therefore, we propose that the project environment has a moderating influence on the relationship between the analyst-problem fit and analyst effectiveness, and argue

P2: The project environment would have a moderating effect on the relationship between analyst-problem fit and analyst effectiveness.

The above propositions lay down the basis of the contingent theory for explaining analyst effectiveness (the aim of this paper). However, in order to understand fully the modalities of such a contingency it would be necessary for us to elaborate on the nature of the fit construct and propose an appropriate analytic perspective for the fit construct. In the next section we discuss in detail the various analytic approaches towards examining a fit construct prescribed in the literature and rationalize the selection of an appropriate approach

Operationalizing the nature of the Fit construct

The concept of fit has been used as an important building block for theory both within and outside the IS discipline (Venkatraman, 1989; Umanath, 2002). An important consideration when drawing on this concept to develop theory is the need for defining it in precise analytical terms (Kristoff, 1996; Venkatraman, 1989). Venkatraman (1989) identified six different perspectives of fit – fit as moderation, fit as mediation, fit as matching, fit as gestalts, fit as profile deviation, and fit as covariation. The choice of the appropriate fit perspective should depend on: a) the extent of precision with which the underlying relationship between the variables can be specified, b) whether the concept of fit is anchored to a specific criterion, and finally, c) the number of variables in the fit equation (Venkatraman, 1989; Umanath, 2002). There are three different types of fit that are anchored to a specific criterion variable. They are: moderation, mediation, and profile deviation. Of these three perspectives, the first two involve univariate variables, and the last offers a multivariate perspective.

The *moderation* perspective states that the "impact a predictor variable has on a criterion variable is dependent on the level of a third variable" (Venkatraman, 1989, p. 424). Essentially this perspective is appropriate if one can explicitly depict fit in terms of the following functional relationship: Y = f (X, Z, X.Z), where Y is the criterion variable, X is the predictor variable, Z is the contextual variable, and X.Z represent the joint effect of X, Z on Y (i.e., the fit). Fit as *mediation,* "portrays a transitive effect and is expressed by the functional form Z = f(X) and Y = f(Z) indicating the necessity for the presence of Z for transmitting the effect of X on Y" (Umanath, 2002, p. 553). The third type of fit that is anchored in a criterion variable is the *profile deviation* or the *deviation score* approach. In this approach, fit is characterized in terms of the "degree of adherence to an externally specified profile" (Venkatraman, 1989, p. 433). Venkatraman (1989) characterizes this fit as a multivariate criterion specific fit, while Umanath (2002) views it as an alternative option to characterizing a moderating fit. This perspective has been deemed to be more useful for confirmatory research due to the challenges associated with developing the ideal profile, as well as a baseline model to assess the strength of the theoretical formulation (Venkatraman, 1989).

In addition to the above-mentioned types of fit, are three types of criterion-free fit, which conceptualizes fit in terms of the association or internal consistency between the fit constructs (Umanath, 2002. They are: fit as matching, fit as covariance, and fit as gestalt. The *matching perspective of fit* is invoked in situations where the fit is a theoretically defined match between the two variables. The *covariation* perspective reflects a similar principle, but extends it to the possibility of fit between more than two variables. Further, the covariance approach conceives fit as a second-order factor that reflects the degree of co-alignment between multiple fit antecedents (Venkatraman, 1989). Finally, the *gestalt fit* perspective reflects a multivariate approach where the higher order fit is derived from lower level associations of the dimensional elements of the fit constituents. Specifically, Venkatraman (1989, p. 432) argues that a gestalt fit focuses on the "identification of gestalts, which is defined in terms of internal coherence among a set of theoretical attributes." In other words, a gestalt fit exemplifies a feasible set of consistent or equally feasible configurations (Venkatraman 1989).

In selecting an appropriate fit construct in our theoretical model, three different issues were taken into consideration: 1) certain assumptions about the two fit antecedents – analyst capability and problem characteristics, 2) the analytic perspectives that have driven our initial theoretical conceptualization of the fit construct, and 3) the extent of anchoring of our fit construct to a specific criterion. Both analyst capability and problem characteristics are inherently multivariate, and needs to be defined explicitly in terms of the varying levels of their constituent elements. Further, given that our aim is to understand the fit between analysts with varying levels of capabilities (across the different dimensions) with projects having different levels of complexity, we cannot ignore the dimensional characteristics of both these fit antecedents. That is, we are interested in the existence and effect of the different combinatorial configurations of the dimensional elements of analyst capability. Similarly, we view problem characteristics of an ISD project as a configurational combination of business complexity and technological complexity, rather than an overall complexity. The specific nature of our research focus therefore requires us to examine the fit at multiple levels, consequently leading to a multivariate conceptualization of analyst-problem fit.

Second, our theoretical approach has been to conceptualize analyst-problem fit in terms of congruence between the dimensions analyst capabilities and the project characteristics. Therefore the analytical approaches for conceptualization of fit that are arrived through “matching” are more appropriate for our problem at hand. The congruence based approach implies that we are concerned only with the constituent elements when defining our fit construct, and this definition is to a great extent independent of our criteria of interest – analyst effectiveness (although we are interested in examining the effect of this fit on analyst effectiveness, as a part of our research). In summary, our conceptualization of analyst-problem fit is intrinsically multivariate, based on an idea of congruence or “matching” and is criterion-free. Given such an assumption, and drawing upon the conceptual framework of fit proposed by Venkatraman (1989), we believe that the *gestalt* perspective of fit is the most appropriate for our context. In the next section we describe our specific gestalt conceptualization in further details.

The fit construct as a gestalt fit

The analyst-problem fit can be perceived as a fit between the demands of the problem domain of the information system being developed and the capabilities that can be supplied by the analyst (Edwards, 1991; Kristoff, 1996). As the underlying variables are multivariate, this fit occurs at multiple levels, where each dimension of the problem domain makes different demands on each of the analyst capabilities. An overall analyst-problem fit is obtained through the various contingent fits at the sub-dimensional levels.

The gestalt conceptualization of the analyst-problem fit results from a matching, or a degree of consistency among the different dimensions of *analyst capability* and *problem characteristics.* Therefore, at the highest level, there needs to be generic congruence amongst these factors that would lead to the creation of a fit (Umanath and Kim, 1992). We thus argue.

P3: Analyst's capability will require significant alignment with the problem characteristics of the particular ISD project that he/she is participating in.

The above proposition defines the analyst-problem fit at the highest level. However in the context of the essential multivariate nature of analyst capability and project characteristics of this project, this proposition is necessary but not sufficient. In essence, it is important to also understand the particular pattern in (and the degree to) which the underlying dimensions of the fit antecedents are associated with each in other. We describe the possible patterns below.

To better understand what the association at the dimensional level could be, we again referred to the resourcing literature. In the personnel psychology literature, a particular way of categorizing fit has been in terms of a ***demands-ability*** perspective (Kristoff, 1996). The demands-ability is said to occur when *an individual has the abilities required to meet the organization's demands.* We believe that analyst-problem fit (the context of our theory) can be constructed through a *demands-ability* fit between the dimensional element of analyst capability and the problem characteristics. The problem domain (represented by its business complexity and technological complexity) demands specific abilities from the analyst. When the analyst is able to provide those specific requisite skills, an *optimal fit* is obtained. As mentioned earlier, we conceptualize both the analyst capabilities and the problem characteristics as two distinct sets.

Let PC represent the set of problem characteristics and AC represent the set of analyst characteristics. Thus,

PC = {Business Complexity, Technological Complexity} and AC = {Business Knowledge, Technological Knowledge, Analytic Ability, Interpersonal Skill}

The fit that we are attempting to conceptualize is essentially a function that maps the different elements of AC to corresponding elements in PC. For example, an attempt to increase performance in an environment of high "business complexity" would require high *business knowledge,* as well as *analytic ability* (Butterfield, 1998). The inherent business complexity of a proposed information system poses a dual challenge for the analyst – the need for an adequate understanding of the underlying business processes, as well as an ability to arrive at a problem solution based on the information at hand. Further, as RE is essentially an activity that requires extensive interaction, the analyst would also need to rely heavily on his/her interpersonal skills in order to understand the complexity of the given problem and efficiently disseminate his/her interpretation to both clients and developers. Given such a situation, we argue that *business knowledge* of the analyst would allow him/her to grasp the intricacies of a complex business problem, the inherent *analytic ability* would enable him/her to formulate the solution, and interpersonal skills would enable him/her to communicate more effectively with the other stakeholders. In terms of our *gestalt analyst-problem fit*, this suggests that there needs to be an association between the business complexity (belonging to the PC set) and business knowledge, analytic ability, and interpersonal skills (belonging to the AC set). Therefore,

P4: ISD project with high values of business complexity will require analysts with high values of the business knowledge, analytic ability and interpersonal skills.

Using a similar pattern of logic, we argue that:

P5: ISD project with high values of technological complexity will require analysts with high values of the technical knowledge, analytic ability and interpersonal skills.

In Figure 3.2 below, we present our expanded theoretical model explicitly depicting analyst-problem fit as a gestalt fit

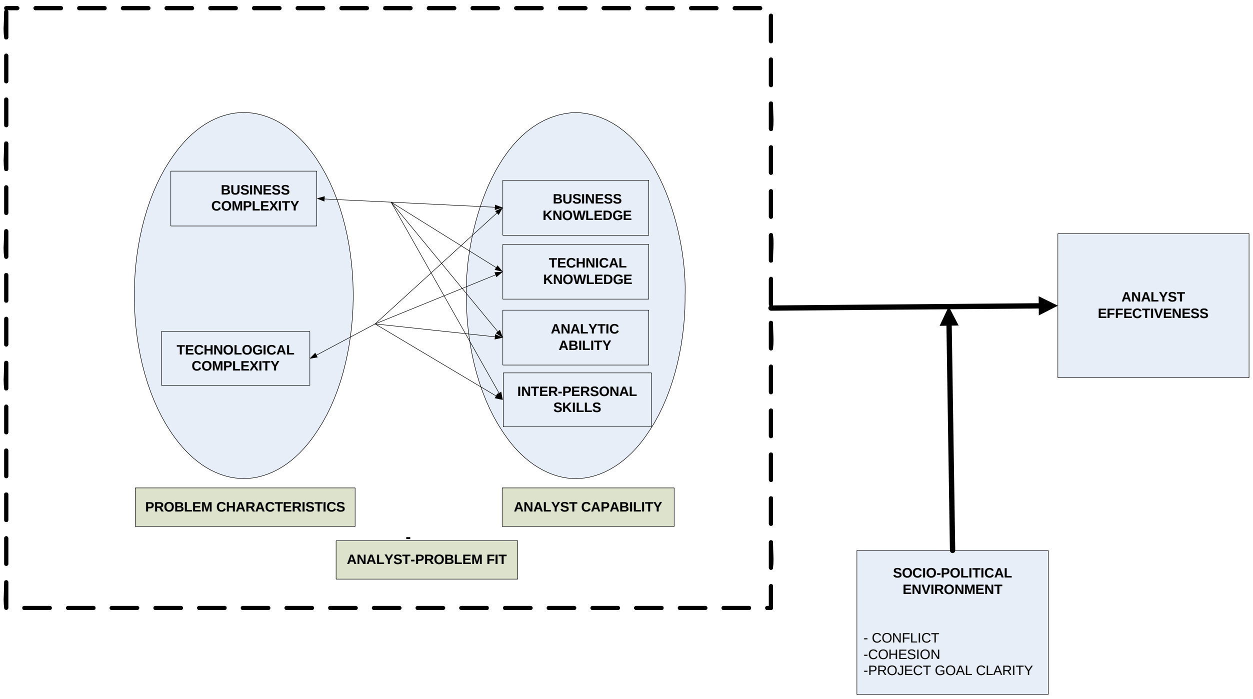

Figure 3.2: Expanded Theoretical Model

In the next section we discuss a few approaches that might be followed to empirically evaluate the contingent theory of analyst effectiveness proposed in this article

Proposed methodologies to test Gestalt Fit

Survey of Organizational IT projects

The objective of this approach is to collect data from organizational settings. The proposal is to collect data from multiple InfoTech companies involved in information system development projects. The detail about the survey in terms of its design is discussed in detail in the subsequent sections.

Survey Design

The unit of analysis for the survey would be the analysts who have performed RE activity in ISD projects within the chosen organizations. The ISD project would therefore be the contextual unit. Therefore in terms of selection of the IT organizations, an attempt needs to be made to select and gain access to IT organizations that execute a wide variety of ISD projects. This would be crucial to ensure appreciable variance in the business complexity and technological complexity of the ISD projects included within the survey. The survey design would therefore consist of the following

1. Identification of multiple ISD projects within an organization such that they span
    a. Industry segments that are serviced (e.g. Banking, Finance, Retail, Telecom etc.)
    b. Types of ISD project (e.g. package based development like SAP, CRM, application development, maintenance, support, consulting etc.)
2. Administration of the survey instrument to the system analysts and project managers of the selected ISD project

The survey instrument would be used to measure the relevant constructs. A combination of subjective and objective measures could potentially be used. Parts of the instrument would be administered to both the project managers and analysts and part of it would be administered to just the systems analysts. In Table 3.4 below we provide an initial exploration about the content of the instrument and the plan for its administration

Table 3.4- Initial instrument design and administration plan			
Construct	**Description/Source of candidate measures**	**Administration**	
		Systems Analysts	**Project managers**
Technical Knowledge	Explicit IT Knowledge and Tacit IT Knowledge (Bassellier, Benbasat and Reich 2001) Technical Knowledge (Lee, Trauth and Farwell 1995)	X	-
Business Knowledge	Business IT competence (Bassellier and Benbasat 2004)	X	-
Analytic Skills	Multi-rater instrument measuring problem solving skills (Lohman 2004)	X	X
Interpersonal Skills	Interpersonal Skills (Bassellier and Benbasat 2004; Lee, Trauth and Farwell 1995)	X	-
Socio-Political Environment	Intra group conflict (Miranda and Bostrom 1993) Perceived cohesion (Bollen and Hoyle 1990) Clarity of Project Goals (Patterson et al 2005)	X	X
Business Complexity	Function Point Analysis	-	-
Technological Complexity	Number of objects created/Line Of Code estimation	-	-
Analyst Effectiveness	Content analyst of defect analysis report for the project for defects having a source at the RE phase of the project. Creation of a new subjective measure which would measure perceives *completeness* and *accuracy* of the requirements captured for the project	X	X

Simulation study using student subjects

As an alternative approach to the survey of IT organizations described above, we propose a methodology that adopts role-play simulation using student subjects as a possible means of testing our contingent theory. Simulations and role-playing exercises “form one of the most important techniques in experiential learning” and have been used in disciplines such as Law and

Medicine as means for professional training (Vincent and Shepherd 1998). Role-playing simulations have been proposed to have considerable advantage where the objective is to gain an understanding of complex, dynamic social systems (Gredler 1992). As such, participants in ISD projects represent complex social systems, and role-playing simulations can be an effective technique to simulate them. In addition, such a study can also double up as an effective instructional technique that would expose the students to the social complexities of requirements gathering in an ISD project. We now elaborate on a possible methodological approach to deductively examine our process model.

Study Design

Each "team" of RE participants within the study would have two sets of actors:

1. 3 – 5 undergraduate/graduate MIS students taking a systems analysis course, would play the role of the *systems analysts;* and
2. 3 -5 MBA students, enrolled in a graduate-level management-oriented MIS course in the same semester would play the role of *user representatives.*
3. The role-play simulation would be centered around semester-long projects where the analysts performed requirements analysis for a proposed information system
4. The requirements for this proposed system are formulated their "user representative" counterparts.
5. The projects would require each team to participate in RE, and collaboratively generate project artifacts typically associated with this phase of ISD.

Procedure

1. The student in user representative role would imagine themselves as representatives for an organization with the need for an information system – they would be required to

prepare a business proposal based on this need prior to interaction with the analysts to ensure that the user representatives understand their requirements to some degree.

2. During the course of the semester, a series of scheduled meetings would be conducted between the RE participants (i.e. "user representatives" and the "systems analysts") during which the students would interact to understand/co-construct the requirements and prepare the formal specifications for the proposed system. Each of these meetings would be facilitated by one of the researchers and also be videotaped. No other interactions between the two sub-groups of RE participants would be allowed.
3. The analyst groups will be encouraged to produce intermediate documents, which user representatives can review and provide feedback on.
4. A final meeting would be held at the end of the term where the "systems analysts" within each team would develop a comprehensive requirements document and present it to the user representatives, who will then will sign-off on (or reject) the requirements presented.

The survey instrument described above would be administered to the student-analyst participating in this simulation study, with the following modifications

- *Business* and *Technology complexity* would be measured by independent coders through the analysis of the business proposal and the final systems design document submitted by the student-analyst team
- *Analyst Effectiveness* would be measured using the objective score obtained by dividing the grade received for the course project by the overall grade received by each student for the course.

Illustration of Resourcing Implication of the Gestalt Fit

We believe that an important implication of the gestalt fit perspective described in the previous section is its application towards resourcing ISD projects with systems analysts. In this section we provide some initial directions towards this endeavour.

The resourcing strategy is based on two important assumptions: 1) effectiveness of analysts may be enhanced through an intersection between analyst capability and problem characteristics, and 2) that these intersections may be characterised as a gestalt fit construct where the fit is obtained through an association between the constituent dimensions. The previous discussion on the gestalt nature of the fit essentially proposes that the <u>overall fit</u> is obtained by maximising the lower level fits. The lower level fit can be conceptualized as a type of covariation (i.e. high values are matched by high values, low values are matched by low values).

Given the above assumptions, the basic steps of our resourcing strategy are as follows –

1. Create a categorisation of the existing analyst pool or the Analyst Profile Matrix. This categorization would be based on the dimensions of the analyst capability – business knowledge, technological knowledge, analyst ability, and interpersonal skills, where each analyst is rated as High, Medium or Low on each dimension.[5]
2. Create the profile of the problem characteristic specific to the ISD project to be executed, based on the respective dimensions, and the categories mentioned earlier (e.g., technological complexity)
3. Identify resources for each of the low level fit associations

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[5] At this point, we would like to introduce an exception to the heuristic or rule derived from the second assumption. *We believe that analysts by definition cannot be realistically low in either analytic ability or interpersonal skill. Thus, for the purpose of the illustration here, we only categorize analysts as high or medium in these two above-mentioned dimensions.*

4. Optimally combine the low level fits to obtain the higher order fit

The objective of step 1 is to essentially create a profile of the analysts, categorising their various skills into High, Medium, and Low. The categorisation levels would have to be an organization specific decision based on the nature of their work and their resource demographics. If we consider that an organization has the following analysts {A1, A2, A3, A4, A5, A6}, then after performing step1 the organization should have the matrix provided in Table 3.5. Each cell in Table 3.5 has the following information: First, there is the name of the set of systems analysts that satisfy the analyst capability dimension, and the value corresponding to the cell. The nomenclature convention for each of these sets is as follows - for example, BKH denotes the set of analysts with high business knowledge, BKM refers to the set of analysts with medium business knowledge, and BKL the set of analysts with low business knowledge. Second, the cells also identify the actual analysts in the organization that possess that corresponding level of the capability. For example the inclusion of analysts {A1, A2, A3, A5) in the first cell implies that they possess high levels of business knowledge. The low value cells for analyst ability and interpersonal skills are left blank because of the restrictions enforced earlier.

Table 3.5 - Analyst Profile Matrix

Analyst Capabilities	**Categories**		
	High	**Medium**	**Low**
Business Knowledge (BK)	BKH = {A1, A2, A3, A5}	BKM= {A4}	BKL= {A6}
Technological Knowledge (TK)	TKH = {A2, A3, A4}	TKM ={A5, A6}	TKL = {A1}
Analytic Ability (A)	AH = {A5, A6, A2, A3}	AM = {A1, A4}	-
Interpersonal Skill (I)	IH = {A2, A3, A5}	IM = {A4, A1, A6}	-

Step 2 of our strategy involves creating a matrix for each ISD project in the organization, categorising the differing levels of problem characteristic (see Table 3.6). Such a matrix takes into consideration that projects differ in terms of their <u>complexity</u> (both business and technological) of their problem domain, and this difference would affect the analysts' ability to perform their task effectively.

Table 3.6 - Project Profile Table

Project	Problem characteristics	
	Business Complexity	**Technological Complexity**
Project 1	High	High
Project 2	Low	High
…….	……	……
Project N	High	Medium

Once the profiles for the analysts and the projects have been created, the final step involves identifying the analysts who embody the analyst-problem fit. These essentially are the analysts, the nature and level of whose capabilities put them in the intersection region of the analyst capabilities and project characteristics set. Please see Figure 3.3, where both analysts A2 and A3 (by being in the intersection regions) embody analyst-problem fit.

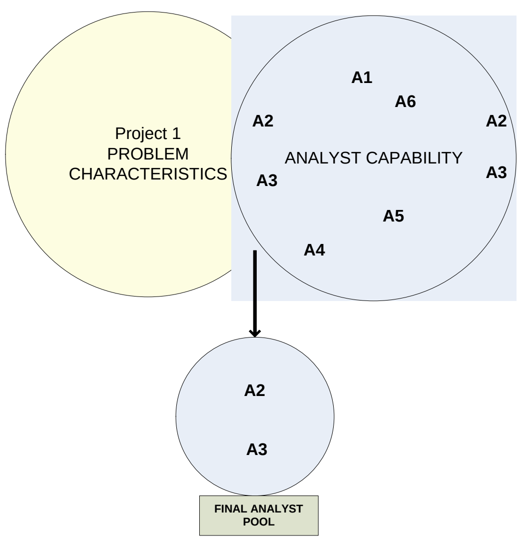

Figure 3.3: Final analyst pool

Steps 3 and 4 of our strategy involve the use of the dimension level fit heuristics (assumptions a and b above), and the dimension level association rules discussed in the previous section. This would result in the creation of one more set of matrices to identify the dimensional level fit for overall analyst-problem fit (see Table 3.7). We take Project 1 as an exemplar and show how the cells of these matrices should be populated, and would ultimately lead to the identification of analysts in the intersection regions of Figure 3.3. Project 1 scored high on each of the dimensions of project complexity (see Table 3.6). The association rule for analyst-problem fit, suggests that business complexity should be associated with business knowledge and analytic ability. Further, our assumption that high values should match high values for an optimal low-level fit requires the analysts to have high values in both business knowledge (BKH) and analytic ability (AH). So the optimal set of resources for the business complexity dimension AP1 is obtained by performing the following operation – BKH ∩ AH ∩ IH (Cell 1 Table 3.6). This operation enables us to identify the analysts who possess both high levels of business knowledge as well as analytic ability as a result of which we obtain the set AP1 = {A2, A3, A5} (from Tables 3.5 and 3.6). Similarly, Table 3.7 shows the optimal resource sets for technological complexity (AP2).

Table 3.7 Analyst Capability-Project Matrix

Project 1	
Project Characteristic	**High**
Business Complexity	AP1 =BKH ∩ AH ∩ IH={A2, A3, A5}
Technological Complexity	AP2 =TKH ∩ AH ∩ IH = {A2, A3}
-	-

Once the set of individuals have been identified, the final step of the resourcing strategy can be conducted. The analysts who would represent the optimal resource pool for the projects in terms of analyst-problem fit (say AP), would be obtained by the following logical set operation (see Table 3.7):

AP = AP1 ∩ AP2 = {A2, A3}

Drawing on our overall theoretical model (discussed earlier), we propose that the final analyst pool (AT) may be obtained as follows: AT = AP = {A2, A3} (as this set would contain analysts who embody the fit constructs). Thus, AT would represent the pool of analysts from which the analysts for the particular project should be selected. While we have used an exemplar project with only high values on all these dimensions, a similar logic could be used for projects with medium or low values on some dimensions.

The above strategy provides an illustration of how the gestalt fit perspective can be used to resource an ISD project. However, the strategy illustrated here has certain inherent limitations. One limitation is that this is primarily applicable for a single project. Its application in contexts where the IS manager is confronted with the problem of resourcing multiple projects from a finite pool of systems analysts may be challenging, especially since this strategy accomplishes resourcing using a maximisation perspective. The ideal resourcing problem needs to resolve the issue of resourcing multiple projects from a pool of resources with an objective of meeting two important constraints simultaneously

- Maximising analyst resourcing for an individual project based on the gestalt fit perspective
- Optimising allocation of resource from the available pool of analyst resources across all available ISD projects

We believe that development of such a resourcing strategy would require an extended empirical investigation that would compare the effectiveness of different combinations of teams obtained by applying the strategy mentioned above. Another way to obtain different combination of teams would be by relaxing the stringency of the rules used to obtain the lower levels of fit (assumption b). For example, one could follow a more “satisficing” approach by including the analysts who have medium levels of business knowledge, technical knowledge, and analytic ability. If one follows this approach, the rules to obtain lower level fit could be changed to (BKH U BKM) ∩

(AH U AM) ∩ (IH U IM) and (TKH U TKM) ∩ (AH U AM) ∩ (IH U IM). The analyst pool that may be obtained from such a strategy is shown in Table 3.8.

Table 3.8 – Low level fits using a relaxed rule for low level fit	
	Project 1
Project Characteristic	**High**
Business Complexity	AP1 = (BKH U BKM) ∩ (AH U AM) ∩ (IH U IM)={A1, A2, A3, A4, A5}
Technological Complexity	AP2 =(TKH U TKM) ∩ (AH U AM) ∩ (IH U IM)= {A2, A3, A4, A5, A6}

Therefore, following the modified rules, the final analyst pool for project 1 is obtained as AT = AP1 ∩ AP2 = {A2, A3, A4, A5}. One should note that this team now consists of analysts with high values in all dimensions (A2, A3), and those with medium level values in the dimensions (A4, A5). Therefore, if project 1 needs be resourced with two analysts, the organization now has an option of using any of the following combinations – {A2, A3}, {A2, A4}, {A2, A5}, (A3, A4}, {A3, A5} and {A4, A5}. It should be noted that of these combinations, the first provides an optimal fit, the last represents a sub-optimal fit, and the others are satisficing fit. The satisficing fits allow the organization to keep in reserve at least one of the high performing analysts A2, A3 for another project.

Contribution

Theoretical Contribution

The fit perspective conceptualized in this research contributes to the existing literature examining analyst effectiveness by proposing a more integrative view of this complex issue. Our theoretical model deviates from the deterministic and isolationist view adopted by prior research on examining analyst effectiveness. The fit perspective proposed in this manuscript, takes a more integrative view by conceptualising analyst effectiveness as being rooted within a contingent framework composed of different contextual factors (e.g., the specific problem characteristic of the ISD project) whose pattern and degree of association affects analysts' effectiveness. The manuscript not only provides an understanding of how the specific type of fit leads to effectiveness, but also highlights the structural nature of the fit (i.e. the gestalt fit), and provides an understanding of the specific dimensions of analysts capabilities and project characteristics, based on which, the fit is achieved. Finally, the manuscript also provides an illustration of how the theoretical perspective can be used to formulate an analyst-resourcing strategy for ISD projects.

Practical Contribution

The proposed theoretical model also makes some important practical contributions. Deployment of analysts for ISD projects is often done in an ad hoc manner, based on availability of resource. Anecdotes from both research and practice suggest that such a resourcing strategy is inefficient and ineffective. We believe that the fit perspective proposed here could be used as a means for resourcing ISD project teams. Further, the fit would also enable an organization to use it as a strategy to identify the *potential* of its pool of analysts. In other words, it could enable the organization to assess, which of the analysts have a set of capabilities that makes them suitable for specific projects. The organization may also formulate a plan for developing and training analysts who have been viewed as "weak" based on the use of the fit based metrics proposed in this manuscript.

Overall, analysts remain a key actor of every ISD project, and we hope that the model proposed here can enable organizations to hire and appoint analysts who have the highest potential to be effective.

4. Essay Three

An Empirical Investigation of Analyst Effectiveness in RE: A Gestalt Fit Perspective

Introduction

Systems Analysts are considered among the most pivotal members within an information systems development (ISD) project team, particularly because of the crucial role they play during the front end of the systems development lifecycle (Coughlan, Lycett & Macredie, 2003). They are an important conduit between the business users and the systems developers during the requirements elicitation (RE) activity, being instrumental in capturing the business requirements and translating them in terms of the technological implications. There has also been further acknowledgement that performance of the system analyst or *analyst effectiveness* is an important factor determining the effectiveness of RE during ISD (e.g. Hunter and Beck 1996). Understandably then, IS research focusing on systems analysts has been quite extensive. An important research agenda in this area has been in figuring out the factors that lead to analyst effectiveness and how it could be further enhanced. Such research has investigated important skill requirements or capabilities that are essential for an analyst to perform his/her task successfully (e.g. Pare and Jutras 2004; Taylor, McWilliam, Gresty and Moynihan 2004; Lerouge, Newton & Blanton 2005; Nord & Nord 1997; Green 1989), functional and cognitive processes used analysts (e.g. Coughlan et al., 2003; Davidson, 2002; Pitts & Browne, 2004; Urquhart, 1997; Marakas & Elam, 1998), education and training of analysts (Heiker, 1974, Jenkins, 1986), core roles and activities of systems analysts, (Miller, 1981), and evaluating analyst performance (Scharer 1982).

Notably a substantial amount of research on analyst effectiveness has focused on analyst capabilities. While such research has contributed considerably to our cumulative knowledge there do exist some important limitations. First, there is an implicit assumption that the set of analyst capabilities is a sufficient indicator of analyst effectiveness. Though this assumption is not wholly inaccurate, it ignores the effect of a number of other contextual variables such as environmental and task-related factors. The second limitation lies in the assumption that possessing certain generic capabilities would make analysts universally effective for any kind of ISD project. The existence of highly complex state of the art enterprise wide information systems (IS) that require specialized skills for its conception and design belies the appropriateness of such an assumption. We would like to argue that the nature of the ISD project drives to a large extent the set of skills required from a systems analyst. Consequently we propose that analyst effectiveness is contingent and depends on a fit a between the analyst's capabilities and the problem context of the particular ISD project. We term this as analyst-problem fit. The main aim of this article is to investigate the nature of this fit and explore its relationship with analyst effectiveness. The specific research questions that we propose to resolve are –

- *What is the nature of analyst-problem fit?*
- *How does analyst-problem fit lead to analyst effectiveness?*

The rest of this manuscript is structured as follows. In the next section we briefly review existing literature on analyst capabilities and ISD project characteristics. Then we discuss our research model based on analyst-problem fit. After that we present our methodology and report the results of our analysis. The article concludes by discussing the implications of our findings and the conclusions that can be formed from these.

Literature Review

Analyst Capabilities

The systems analyst is one of the most influential and important actors in the ISD project and especially during the RE phase (Saiedian & Dale, 2000; Graf & Misic, 1994). Consequently, there have been a considerable number of studies that have tried to understand in detail what it means to be a good analyst. This endeavor over the years has led to a variety of prescription with regards to improving an analyst's job performance such as training users as analysts (Chen 1985), developing a successful deskside manner (Maxwell, 1988) and effectively dealing with change management (Pare and Jutras 2004) among others. Chen (1985) suggested that an effective way develop a system analyst would be to train a user in the technicalities of systems analysis thereby creating specialized systems analysts with in-depth knowledge about a particular field. Maxwell (1988) proposed that successful systems analyst must develop an identifiable "deskside manner," integrating people-oriented skills, personal practices, and technical competencies.

A substantial majority of research however has attempted to explicitly identify the relevant skill sets that the analysts need to possess in order to be effective (e.g., Green 1989; Hunter & Beck, 1996; Lerouge et al. 2005). For example, Green (1989, p. 115) concluded from his empirical study that analysts should possess "behavioral skills for effective development." Lerouge et al. (2005) argue that systems analysts play a socio-technical role, and thus it is more important for them to possess interpersonal skills and system development skills, rather than just technical skills. Hunter and Beck (1996) investigating the profile of an "excellent systems analyst" concluded that he/she needs to have the right attitude, and knowledge, and be able communicate effectively. On the same lines, Misic and Graf (2004) found in a survey of critical skill perceptions among IT practitioners that aanalytical skills were considered the most important skills overall, followed by technical and communication skills. Intriguingly they also found that the least important amongst these skills were interpersonal skills.

While technical and behavioral skills have always been considered important skills for analysts, and there is a continued tradition of seek out and promote individuals with strong programming backgrounds for systems analyst positions, there are indications that that broad analytical skills may be a better predictor of success as a systems analyst (Misic 1996). In fact importance on analytical or problem solving skills have also been echoed by a number of researchers as an important skill set that an analyst requires to deal with the problem complexities of ISD projects (e.g. Hunter and Beck 1996; Wynekoop and Walz 2000; Todd, McKeen and Gallupe 1995).

The importance of the systems analyst in the front end of a ISD and his/her critical role as a conduit between the business user and systems analyst indicates a further importance of functional business knowledge as a key competence e.g. (Lerouge, Newton and Blanton, 2005; Bassellier and Benbasat, 2004; Bassellier, Benbasat and Reich 2001; Lee, Farwell and Trauth 1995; Green 1989). This is probably even more critical given the specialized domain specific functional requirements that drive modern information systems and aligns with Misic's (1996, p. 34) suggestion that "successful systems analyst of tomorrow may very well be recruited from a more traditional functional area of business rather than relying on the pool of computer programmes to fill analyst positions". Business competence focuses on the areas of knowledge that are not specifically IT-related. Bassellier and Benbasat (2004) proposed important dimensions of business competence and found that it significantly influences the intentions of IT professionals to develop partnerships with their business clients.

While the studies have put forth a number of such traits or characteristics, (and have also highlighted perceptual differences in the perception of relative importance) they are essentially similar and can be categorized in terms of expertise or knowledge of Business/functional or technological domains, inherent capability in terms of analytic or intellective ability and interpersonal skills (Nord and Nord, 1997). In the table 4.1 below we provide a taxonomy of analyst capability l using representative research in this area. We have used this taxonomy to identify the critical capability set of an analyst and have used it in the subsequent sections of this paper to develop our theoretical perspectives. In the next section we shall present a brief discussion on ISD project characteristics considered important in existing literature.

Table 4.1 – Critical Analyst Capability Set

Articles	**Job Related**			**Individual Specific**			
	Business knowledge	**Technical Knowledge**		**Analytic Ability**	**Interpersonal Skills**		
Bassellier & Benbasat (2004)	Business Competence	-		-	Interpersonal Communication	Leadership	Knowledge Networking
Bassellier, Reich and Benbasat (2001)	-	Explicit IT Knowledge	Tacit IT Knowledge	-	-	-	-
Lee, Farwell and Trauth (1995)	Business Functional knowledge	Technical Knowledge	Knowledge of technical Management	-	Interpersonal and Management Skills		
Green (1989)		Technical Skill		-	Behavioral Skills		
Lerouge Blanton and Cheney (2005)	Business task knowledge	Technology Skills	System Development Task skills	-	Interpersonal Skills	Political skills	
Hunter and Beck (1996)	Business Knowledge	Technical Knowledge		Problem Solving	Verbal and Written Skills		
Wynekoop and Walz (2000)	Functional Knowledge	Technical Knowledge		Problem Solving	Communication	Leadership	
Todd, McKeen and Gallupe (1995)	Business	-		Problem Solving	Social	Management	

ISD Project Characteristics

There are two approaches to try and understand the characteristics of an ISD project. The first is to look at it from the perspectives of important metrics identified within project management as well as IS literature. These are project risks (e.g. Schmidt, Lyytinen, Keil and Cule 2001; Ropponnen and Lyytinen), project uncertainty (e.g. Nidomolu, 1995; Turner and

Cochrane; 1993) and project complexity (e.g Xia and Lee, 2004, Williams 1999). The second aspect is try and demarcate a project in terms of the problem characteristics (functional requirements of the specific information system being developed) and the project environment (the situational context in which the stakeholders interact) of the ISD project. The problem domain for an information system includes both the business (functional) perspective, and the technological perspective (Ratbe, King & Kim, 1999). On the other hand the project environment represents the social as well as organizational aspects of an ISD project.

Software project risk has been defined as the product of uncertainty associated with project risk factors and the magnitude of potential loss due to project failure (Barki, Rivard and Talbot, 1993). Project uncertainty is a related concept that rises from absence of information (Downey & Slocum, 1975, Tushman & Nadler, 1978) about a given risk factor, which in turn leads to the inability to accurately predict the outcome of a given system (Nidumolu, 1995). Finally, Tatikonda and Rosenthal (2000, p. 78) define project complexity, "as the nature, quantity, and magnitude of organizational subtasks and subtask interactions posed by the project" and propose three project complexity characteristics – "the degree of interdependence between and among the product and process technologies to be developed; the newness of the project's objectives to the development organization; and the difficulty of the project objectives".

These characteristics are deemed to have an adverse effect on performance of projects. Software project risks such as threats to successful software operation, major sources of software rework, implementation difficulty, or delay, if ignored increase the likelihood of a project failure (Lyytinen, Mathiassen, Ropponnen 1998). Project uncertainty has also been identified as an important reason for project failure (Mazzola & McCardle, 1996), reduced project performance (Nidumolu, 1995) non-adherence of budgets, schedules, and poor system quality (Jiang et al., 2002). Xia and Lee (2004) found linkages between complexity and poor project performance in terms of a number of dimensions – delivery time, cost, functionality and user dimension. Tatikonda and Rosenthal (2000, p. 78) found similar adverse effects of complexity in the context technology based product development on achievement of ISD objectives. In addition, each of these characteristics has been found to be inherently multidimensional, spanning the problem domain as well as the environmental aspects of a project. For example, a Delphi study conducted by Schmidt et al (2001) found risk factors range from diverse topics such as – *managing user relationships and user expectations, project management methodologies and project management skills, turbulence of business environments, organizational politics and organizational culture*, *diversity and multiplicity of stakeholders and user communities, critical aspects in the management environment, evolution of the IT infrastructure.* Similarly project uncertainty can be considered multi-dimensional too, as by definition it becomes salient due to lack of information about various risk factors. ISD project complexity are acknowledged to have both technological and organizational dimensions, such projects have to deal with organizational factors beyond the control of these projects, in addition to technological issues (Xia and Lee, 2004). In addition Xia and Lee (2004) also suggest a further dimension based on structural and dynamic perspectives. The former deals with the aspect of the problem boundary of the information systems being developed and the latter from the social and environmental factors of change, uncertainty and risk.

In Table 4.2 we present a matrix of project characteristics. As is probably evident from the previous discussion, ISD project characteristics are multi-faceted and quite varied. We feel that the for the sake of analytical clarity, and to bound our research problem it would make sense to clearly identify the aspect of ISD project characteristics pertinent for this study. Our initial intention is to define analyst problem fit in terms of complexity, and that too from the perspective of the core problem domain of the particular ISD project. Therefore further discussion on project complexity in this article will refer to the concepts of structural technology and business function based complexity of an ISD project. In the next section we initiate our discussion about the nature of analyst-problem fit

Table 4.2 – Classification of ISD Project Characteristics

	Problem Characteristics		**Environmental characteristics**	
	Technological	**Business/Functional**	**Social**	**Organizational**
Complexity	*Structural Technology based Complexity* (Xia and Lee, 2004; Ratbe, King and Kim 1999)	*Structural Business Function based Complexity* (Xia and Lee, 2004; Ratbe, King and Kim 1999)	*Dynamic Social interaction based complexity* (Xia and Lee, 2004)	*Dynamic Organizational Complexity* (Xia and Lee, 2004)
Risk	*Technology risk rising from evolution of technology infrastructure* (Schmidt, Lyytinen, Keil and Cule 2001)	*Business functional risks rising from turbulence of business environment* (Schmidt, Lyytinen, Keil and Cule 2001)	*Social Interrelationship based risks (e.g. relationship management based risks)* (Schmidt, Lyytinen, Keil and Cule 2001)	*Organizational risk factors (e.g. organizational politics etc.)* (Schmidt, Lyytinen, Keil and Cule 2001)
Uncertainty	*Technological Uncertainty* (Nidumolu, 1995)	*Requirements based* (Nidumolu, 1995)	*Social risk based uncertainties* (Asllani and Ettkin 2007)	*Organizational risk based uncertainties* (Asllani and Ettkin 2007)

Fit and analyst effectiveness

As we have mentioned earlier a primary aim of this paper is to establish and empirically test a contingent theory of analyst effectiveness. It would therefore make sense before we proceed any further, to provide a formal clarification about what analyst effectiveness means in the context of this research. The task context of this research is the RE activity in an ISD project and for our purpose analyst effectiveness is directly linked with the successful performance of this activity. Therefore we define analyst effectiveness as follows –

> Analyst Effectiveness is the extent to which an analyst is able to capture accurately and completely the underlying business functionality and technological requirements of an Information System during the performance of the requirements elicitation activity.

To clearly understand what facilitates an analyst's performance during RE, two contextual factors become quite important. The first of these is of course the analysts' capability, the second is the problem context presented by the particular ISD project. We argue that the nature of relationship between these two provides the contingencies that ultimately lead to analyst effectiveness. It is of course important to understand the nature of this relationship. In order to further investigate this relationship let us turn back to the analyst capability dimensions.

The important categories of skills that have been considered critical for systems analysts are the job-related skills and individual specific skills. The former constitutes of two broad categories of knowledge based skill sets – business knowledge and technological knowledge. These knowledge based skill sets specifically allow the analysts to meet the knowledge based requirements of the problem domain of a particular project. Given the diverse nature of information system implementation in practice (ranging from enterprise wide applications like ERP and CRM applications to specialized software applications for mobile devices) there is an increased requirement for specialization in both business (functional) and technical knowledge. In other words, the problem context of a project drives the specific knowledge based capabilities required from an analyst. A logical conclusion from this is that for analyst effectiveness, there needs to be a match between the analyst's knowledge skills and knowledge domain the particular ISD project. The other aspect of the problem domain of an ISD project is the level of complexity associated with it. The complexities of the problem make it difficult for an analyst to elicit the exact nature of the requirements. Quite naturally a complicated problem domain would require a high order of analytic ability in an analyst. Further, given that most RE activity is essentially based on communication and social interactions, the analyst has to depend to a large extent on his/her interpersonal skills (to leverage the knowledge based skills) and better comprehend the requirements. Therefore we propose that *the individual would need to possess a minimum subset of capabilities required of an analyst. These capabilities possessed by the individual need to be congruent to the characteristics of the specific problem being addressed in the project.* Conceptually speaking, analyst-problem fit embodies this congruence or alignment between analyst capabilities and the problem characteristics. Now that we have developed a certain conceptual clarity about analyst-problem fit, the next step would be to gain an understanding about it analytical formulation.

An important consideration when drawing on the concept of fit to develop theory is the need for defining it in precise analytical terms (Kristoff, 1996; Venkatraman, 1989). The choice of the appropriate fit perspective should depend on: a) the extent of precision with which the underlying relationship between the variables can be specified, b) whether the concept of fit is anchored to a specific criterion, and finally, c) the number of variables in the fit equation (Venkatraman, 1989; Umanath, 2002). Venkatraman (1989) developed a taxonomy of six different perspectives of fit based on these criteria. These are fit as moderation, fit as mediation, fit as matching, fit as gestalts, fit as profile deviation, and fit as covariation. While a full discussion of each of these fit perspectives is beyond the scope of this paper, we feel that they represent a good candidate set from which to choose the appropriate analytic approach to further elaborate our conceptualization of the analyst-problem fit construct.

In selecting an appropriate fit construct in our theoretical model, three different issues were taken into consideration: 1) assumptions about the two fit antecedents – analyst capability and problem characteristics, 2) the analytic perspectives that have driven our initial theoretical conceptualization of the fit construct and 3) the extent of anchoring of our fit construct to a specific criterion. Both analyst capability and problem characteristics are inherently multivariate, and we believe that to comprehend fully the nature of analyst-problem fit we need to explicitly include this aspect in our conceptualization of fit. Second, in order to attain granularity of our comprehension of the fit between analysts having varying levels of capabilities (across the different dimensions) with projects of different levels of complexity, we cannot ignore the dimensional characteristics of both these fit antecedents. In other words that is our conceptualization of fit works at multiple levels in addition to being multivariate. Third, our theoretical approach has been to conceptualize analyst-problem fit in terms of congruence between the dimensions analyst capabilities and the project characteristics. Therefore the analytical approaches for conceptualization of fit that are arrived through "matching" are more appropriate for our problem at hand. Finally, the congruence based approach implies that we are concerned only with the constituent elements when defining our fit construct, and this definition is to a great extent independent of our criteria of interest – analyst effectiveness (although we are interested in examining the effect of this fit on analyst effectiveness, as a part of our research). In summary, our conceptualization of analyst-problem fit is intrinsically multivariate, based on an idea of congruence or "matching" and is criterion-free. Given such an assumption, and drawing upon the conceptual framework of fit proposed by Venkatraman (1989), we believe that the *gestalt* perspective of fit is the most appropriate for our context. The *gestalt fit* perspective reflects a multivariate approach where the higher order fit is derived from lower level associations of the dimensional elements of the fit constituents. Specifically, Venkatraman (1989, p. 432) argues that a gestalt fit focuses on the "identification of gestalts, which is defined in terms of internal coherence among a set of theoretical attributes." In other words, a gestalt fit exemplifies a feasible set of consistent or equally feasible configurations (Venkatraman 1989).

In this section we have elaborated on the conceptual and analytical foundations of our analyst-problem fit construct. In the next section we will elaborate on the precise analytical formulations and present our research model.

Research Model

The gestalt conceptualisation implies that analyst-problem fit is obtained through the various contingent fits at the sub-dimensional levels. Further the mechanism of such a fit is driven by a matching, or a degree of consistency among the different dimensions of *analyst capability* and *problem characteristics.* Therefore we feel that it would be appropriate to define analyst-problem fit structurally as follows

- Analyst-problem fit is achieved at the lowest level through congruence between different combinatorial subsets of the dimensions of analyst capabilities and problem characteristics of the ISD project
- The aggregation of the low level congruence described above in turn leads to the overall analyst-problem fit and conceptually indicates a congruence between analyst capability and problem characteristics
- Congruence in this context refers to an exact match between the values (or levels) of the dimensions of analyst capabilities and problem characteristics

We will base our subsequent analytical specification of analyst-problem fit on this definition. The next step in this endeavour is to specify the particular pattern in (and the degree to) which the underlying dimensions of the fit antecedents are associated with each in other. We describe the possible patterns below.

A good theoretical lens that would help us derive such a pattern of association is the ***demands-ability fit*** perspective (Kristoff, 1996). The demands-ability fit is said to occur when *an individual has the abilities required to meet an organization's demands.* We believe that analyst-problem fit can be constructed through a *demands-ability* fit between the dimensional elements of analyst capability and the problem characteristics. The problem domain (represented by its business complexity and technological complexity) demands specific abilities from the analyst. When the analyst is able to provide those specific requisite skills, a fit is achieved. To obtain clarity in our theorization let us conceptualize analyst capabilities and the problem characteristics as two distinct sets. Let PC represent the set of problem characteristics and AC represent the set of analyst characteristics. Thus,

PC = {Business Complexity, Technological Complexity} and AC = {Business Knowledge, Technological Knowledge, Analytic Ability, Interpersonal Skill}

The fit that we are attempting to conceptualize is essentially an associative function that maps the different elements of AC to corresponding elements in PC. For example, an attempt to increase performance in an environment of high "business complexity" would require high *business knowledge,* as well as *analytic ability* (Butterfield, 1998). The business complexity of a proposed information system requires the analyst to simultaneously understand the underlying business processes, as well as arrive at a problem solution based on the information at hand. Further, as RE is essentially an activity that requires extensive interaction, the analyst would also need to rely heavily on his/her interpersonal skills in order to understand the complexity of the given problem and efficiently disseminate his/her interpretation to both the client and the developer. Given such a situation, we argue that *business knowledge* of the analyst would allow him/her to grasp the intricacies of a complex business problem, the inherent *analytic ability* would enable him/her to formulate the solution, and *interpersonal skills* would enable him/her to communicate more effectively with the other stakeholders. In terms of our *gestalt analyst-problem fit*, this suggests that there needs to be an association between the business complexity (belonging to the PC set) and business knowledge, analytic ability, and interpersonal skills (belonging to the AC set). Therefore,

H1: Congruence between the level of business complexity of a project and the levels of business knowledge, analytic ability and interpersonal skills (e.g. high values matching with high values) of an analyst will lead to greater analyst effectiveness

Using a similar pattern of logic, we argue that:

H2: Congruence between the level of technological complexity of a project and the levels of technical knowledge, analytic ability and interpersonal skills (e.g. high values matching with high values) of an analyst will lead to greater analyst effectiveness

In Figure 4.1 below, we present our research model explicitly depicting analyst-problem fit as a gestalt fit

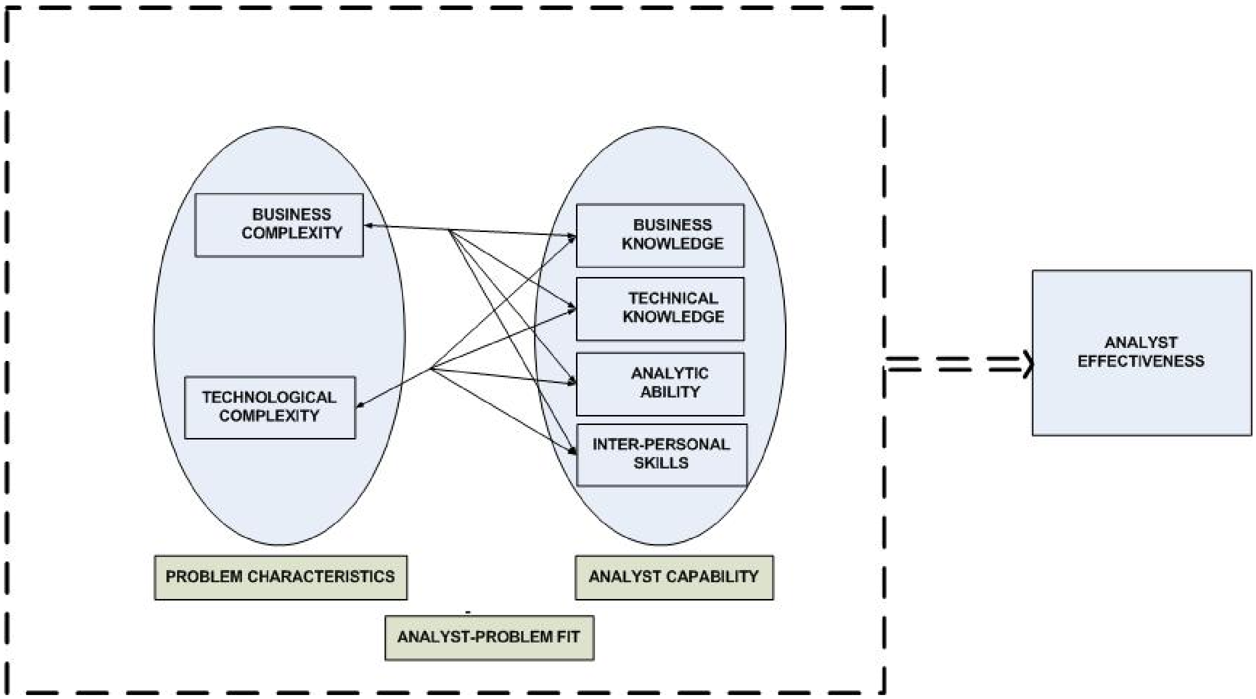

Figure 4.1 - Research Model

Methodology

Our methodology was based on a role-play simulation using student subjects. Simulations and role-playing exercises "form one of the most important techniques in experiential learning" and have been used in disciplines such as Law and Medicine as means for professional training (Vincent and Shepherd 1998). Role-playing simulations have been proposed to have considerable advantage where the objective is to gain an understanding of complex, dynamic social systems (Gredler 1992). As such, participants in ISD projects represent complex social systems, and role-playing simulations can be an effective technique to simulate them. In the next section, we discuss the design of our empirical study

Study Design

The role playing simulation of RE in an ISD project was conducted across two semesters (spring and fall 2007) and involved undergraduate and postgraduate business students of a North American public university. The two sets of student teams, from two different courses participated in the role playing simulation. The first set performed the role of analysts and the second set that of business users. Each team had 3 -5 members. The members of the student analyst teams were all taking an undergraduate IS course in systems analysis and design. The business user teams were made up of MBA students taking an IS courses during spring 2007. During the fall 2007 semester the business user team comprised of senior undergraduate students, taking the capstone project management course. The role-play simulation was based on semester-long projects in which the student-analysts performed requirements analysis for a proposed information system. The business proposal for this information system was formulated by their "business user" counterparts. The role playing simulation required each team to participate in RE, and collaboratively generate project artifacts typically associated with this phase of ISD. The role play simulation designed for this empirical study doubled up as the semester long class project for the undergraduate systems analysis and design course. The "business user" team performed their role in the simulation as a separate course assignment.

The procedure for the simulation is as follows. The student group performing the business user role prepared a business proposal based on a perceived organization need. During the course of the semester, a series of scheduled meetings were be conducted between the RE participants (i.e. "business user" and the "systems analysts") during which the students teams interacted to understand/co-construct the requirements and prepare the formal specifications for the proposed system. Each of these meetings was facilitated by one of the researchers. The analyst groups produced intermediate documents that were reviewed by the business users. A final meeting was held at the end of the term where the "systems analysts" teams developed a comprehensive requirements document. This was presented to the business users, who provided final feedback on the formal system specifications and signed off on the same. During the role simulation, data was collected from the system analysts. Across two semesters, 12 projects were included as part of the study involving 60 student analysts. In the next section we will discuss how the constructs of interest were measured.

Measurement Instrument

The Analyst capability dimensions – *business knowledge, technical knowledge, analytical skills and interpersonal skills* were measured by adapting existing psychometric instruments. *Business knowledge* was measured by adapting the instruments created by Bassellier and Benbasat (2004) to measure *business IT competence.* Technological knowledge was measures adapting instruments for measuring *explicit IT knowledge* created by Bassellier, Benbasat and Reich (2001) and *general IT knowledge* instrument created by Lee, Trauth and Farwell (1995). *Analytic ability* was measured using the instrument created by Lohman (2004). *Interpersonal skills* were measured by adapting the instruments for interpersonal and management skills created by Bassellier and Benbasat (2004) and Lee, Trauth and Farwell (1995). The entire instrument is presented in Appendix B.1. All the items were measured using a interval like scale ranging from 1 to 7.

Business Complexity and *Technological Complexity* were measured by coding the business proposal and the final specification documents for each project. These were coded by two independent coders (PhD students in department of information systems in the northwestern US public university). The dimensions, based on which these two constructs were coded, are presented in Appendix B.2

Finally, *analyst effectiveness* was measured using the grades obtained by each student analyst in the project for the systems analysis and design course. As the project grades were group grades obtained by the whole team, each grade was multiplied by the student's overall grade in the course and then converted to a 7 point scale rating.

Analysis and Result

Instrument Validation

PLS-Graph Version 3.00 (Build 1126) was used for to perform the instrument validation in this research. We chose PLS for the following reason 1) PLS does not require any assumptions of multivariate normality[6] (Bhattacharya and Premkumar 2004; Chin, Marcolin, and Newsted 2003), 2) PLS works well with small to medium sample sizes unlike other causal modelling techniques such as LISREL (Chin et al. 2003; Hulland 1999), and therefore, is appropriate in the context of the current study where we have a relatively small sample size, For validating the scales we conducted a confirmatory factor analysis.

In assessing the validity of our instruments using the PLS-approach, have followed the guidelines set down by previous researchers (e.g., Gefen and Straub 2005; Hulland 1999; Chin 1998). Such research suggests that convergent validity of items can be established by satisfying three criteria. First each item should load significantly on their respective constructs (Gefen and Straub 2005). While the norm suggested by extant research prescribes loading of 0.70 or above, a number of researchers (e.g. Hulland 1999; Gefen and Straub 2005) have acknowledged that it is common to find measurement models in an estimated item to fall below such a threshold. A slightly more relaxed recommendation suggests that items with loadings below .50 should be dropped. Second, the composite reliabilities should be greater than .70 (Hulland 1999), and third, the average variance extracted (AVE) for each construct should be greater than .50 (Bhattacharya and Premkumar 2004). In Table 4.3 we present the loading and the t statistic values of the items that passed the above three criteria. A majority of the items loaded significantly on their respective construct, and all the items (except for 5) had loadings of .70 or higher, none of the

[6] As our sample consisted of students who have not performed system analysis in real life, it is expected that the sample would be slightly skewed to lower side of the skill for most of the capabilities, especially the knowledge based skills

items loaded on their construct below the cut-off value of .50. Further, as reported in Table 4. 4 the composite reliabilities of all the constructs are over .70 and the AVEs of all the constructs are over the threshold value of .50. This established the convergent validity of our items.

Gefen and Straub (2005, p. 93) suggest that discriminant validity can be established by examining the correlation between the latent variable scores with the measurement items, and ensuring that the measurement items load higher on their "assigned factor" than on other factor (see Table 4.5). Another way to establish discriminant validity is to ensure that the AVEs of a construct exceed all squared correlations between that factor and any other construct within the study (Gefen and Straub 2005; Fornell and Larcker 1981). In Table 4. 6 we report the values of the AVEs and squared correlation for all our constructs. Evaluating our measurement items, against the validation guidelines suggested by Gefen and Straub (2005), we found a cause for concern with two of our constructs, and the rest of our measures conformed to the prescribed standards. As can be seen in Table 4.5, there were high cross loadings between the items for communication skills and interpersonal and management skills. In addition a closer inspection in Table 4.6 would show that the AVE for interpersonal and management skills, is in fact lower than its squared correlations with communication skills. Given these issues and the fact that these constructs were being used to the same overall construct – interpersonal skills, we decided to discard of them. As interpersonal and management skills is a more generic construct that communication skills, we retained this measure and discarded communication skills from our further analysis. This confirmed the relative discriminant validity of our instrument.

Finally, two of our constructs, *business complexity* and *technological* complexity were coded by two independent coders. As the coding was done using a 7 point interval like scale, the inter-rater reliability could be assessed using either Pearson's correlation or Spearman's correlation or Cronbach's alpha. We computed all three and found them to quite high. These values are presented in Table 4.7

Table 4.3 – Factor Loadings and t-values for measurement Instrument

Constructs	Sub-Constructs	Variables	Factor Loading	T-Value
Business Knowledge	**IT Business Functions**	ITBUS1	0.9420	54.7284
		ITBUS2	0.9420	54.7284
	Knowledge Network	KNOWNET1	0.7159	5.3859
		KNOWNET2	0.7977	9.8845
		KNOWNET3	0.7382	11.5129
	Business Functionality	BUSFUN1	0.8231	16.7493
		BUSFUN2	0.8833	30.5110
		BUSFUN3	0.7788	9.1893
Technical Knowledge	**Explicit IT Knowledge**	EXPIT4	0.9371	59.9601
		EXPIT5	0.8813	17.0050
		EXPIT6	0.8784	23.3435
	General IT Knowledge	GITKNO4	0.6764	7.0546
		GITKNO7	0.7351	10.6178
		GITKNO8	0.7556	11.5867
		GITKNO9	0.8758	26.6506
		GITKNO10	0.7362	11.5197
		GITKNO11	0.7573	10.1144
		GITKNO13	0.6466	5.8646
Analytic Ability	**Problem Identification**	PI2	0.7012	4.4646
		PI3	0.8300	12.2377
		PI4	0.8142	17.3751
	Goal Selection	GS1	0.7857	20.1852
		GS2	0.8410	15.3693
		GS3	0.6324	3.3035
		GS4	0.6819	6.2516
	Generation of Alternative Solutions	ALT1	0.7309	9.7964
		ALT2	0.7504	9.5345
		ALT3	0.8545	23.8987
	Consideration of consequences associated with alternative solutions	ALTCONS2	0.8261	21.1915
		ALTCONS3	0.8261	21.1915
	Approach to Decision Making	DECISH3	0.8320	18.3671
		DECISH4	0.8320	18.3671
Interpersonal Skills	**Communication Skills**	COMM1	0.8106	9.6070
		COMM2	0.8157	16.2625
		COMM3	0.8750	30.7601
		COMM4	0.8556	26.4543
		COMM5	0.7724	14.2221
		COMM6	0.7869	13.9891
		COMM8	0.8306	17.4317
	Interpersonal and Management Skills	INTER1	0.8575	21.6774
		INTER2	0.8352	20.8842
		INTER3	0.6601	7.5456
		INTER4	0.6701	7.0626
		INTER6	0.7838	14.3410

Table 4.4 – Composite Reliability and Average Variance Extracted		
Construct	**Composite Reliability**	**Average Variance Extracted (AVE)**
IT Business Functions	0.940	0.887
Knowledge Network	0.795	0.565
Business Functionality	0.868	0.688
Explicit IT Knowledge	0.896	0.553
General IT Knowledge	0.927	0.809
Problem Identification	0.826	0.615
Goal Selection	0.827	0.547
Generation of Alternative Solutions	0.823	0.609
Consideration of consequences associated with alternative solutions	0.811	0.682
Approach to Decision Making	0.818	0.692
Communication Skills	0.936	0.675
Interpersonal and Management Skills	0.875	0.586

Table 4.5 – AVE and squared correlations

	Itbus	Knownet	Busfun	Git	Expit	PI	GS	Alt	Altcons	Decish	Comm	Inter
Itbus	0.887											
Knownet	0.248	0.565										
Busfun	0.481	0.412	0.688									
Git	0.198	0.110	0.178	0.553								
Expit	0.471	0.265	0.383	0.111	0.809							
PI	0.089	0.320	0.198	0.012	0.048	0.528						
GS	0.110	0.314	0.194	0.029	0.087	0.527	0.547					
Alt	0.097	0.217	0.305	0.090	0.102	0.188	0.184	0.609				
Altcons	0.001	0.005	0.004	0.050	0.003	0.095	0.142	0.021	0.682			
Decish	0.056	0.283	0.227	0.004	0.101	0.223	0.101	0.184	0.034	0.692		
Comm	0.116	0.297	0.328	0.033	0.211	0.207	0.233	0.154	0.004	0.198	0.675	
Inter	0.060	0.238	0.203	0.010	0.143	0.348	0.303	0.232	0.005	0.270	0.549	0.54

Table 4.6 – Factor Loadings and Cross Loadings							
	ITBUS	**KNOWNET**	**BUSFUN**	**GIT**	**EXPIT**	**PI**	**GS**
ITBUS1	**.942(**)**	.491(**)	.620(**)	.351(**)	.709(**)	0.251	.330(*)
ITBUS2	**.942(**)**	.447(**)	.687(**)	.490(**)	.586(**)	.272(*)	.298(*)
KNOWNET1	.286(*)	**.716(**)**	.534(**)	.324(*)	.288(*)	.503(**)	.413(**)
KNOWNET2	.424(**)	**.798(**)**	.482(**)	0.202	.418(**)	.490(**)	.559(**)
KNOWNET3	.406(**)	**.738(**)**	.435(**)	0.230	.450(**)	0.201	.283(*)
BUSFUN1	.614(**)	.595(**)	**.823(**)**	.347(**)	.562(**)	.355(**)	.482(**)
BUSFUN2	.676(**)	.521(**)	**.883(**)**	.442(**)	.609(**)	.310(*)	.305(*)
BUSFUN3	.423(**)	.482(**)	**.779(**)**	0.250	.356(**)	.348(**)	.313(*)
EXPIT5	.623(**)	.491(**)	.557(**)	.369(**)	**.937(**)**	0.142	.290(*)
EXPIT6	.594(**)	.446(**)	.490(**)	.260(*)	**.881(**)**	0.151	.289(*)
EXPIT7	.638(**)	.451(**)	.624(**)	.269(*)	**.878(**)**	0.115	0.217
GITKNO4	.419(**)	0.233	.457(**)	**.676(**)**	.520(**)	0.076	0.123
GITKNO11	.301(*)	.278(*)	.305(*)	**.735(**)**	0.223	0.213	.375(**)
GITKNO13	.405(**)	0.149	0.240	**.756(**)**	0.107	0.001	-0.150
GITKNO14	.329(*)	0.252	.336(**)	**.876(**)**	0.236	0.102	0.087
GITKNO15	.357(**)	0.237	.281(*)	**.736(**)**	.272(*)	0.077	0.183
GITKNO16	.318(*)	.283(*)	.255(*)	**.757(**)**	0.221	0.178	0.205
GITKNO18	0.191	.312(*)	.345(**)	**.647(**)**	0.190	0.019	0.076
PI2	0.198	.465(**)	.387(**)	-0.023	0.150	**.701(**)**	.445(**)
PI3	0.051	0.249	0.134	0.067	-0.056	**.830(**)**	.617(**)
PI4	.406(**)	.551(**)	.452(**)	0.246	.271(*)	**.815(**)**	.657(**)
GS1	.467(**)	.527(**)	.558(**)	.311(*)	.512(**)	.514(**)	**.786(**)**
GS2	.377(**)	.501(**)	.367(**)	0.201	.283(*)	.597(**)	**.841(**)**
GS3	0.149	.397(**)	.287(*)	0.075	0.125	.496(**)	**.632(**)**
GSREV4	-0.071	0.209	0.053	-0.128	-0.107	.578(**)	**.682(**)**
ALT1	0.088	0.215	.282(*)	0.065	0.167	0.168	0.212
ALT2	0.229	.361(**)	.492(**)	0.229	0.173	0.242	.314(*)
ALT3	.391(**)	.496(**)	.508(**)	.387(**)	.389(**)	.330(*)	.463(**)
ALTCONSR	0.022	0.093	-0.010	-.285(*)	-0.022	0.238	.297(*)
ALTCONR2	-0.082	0.027	-0.106	-0.086	-0.080	.284(*)	.328(*)
DECISH3	0.183	.459(**)	.393(**)	-0.037	0.199	.414(**)	.328(*)
DECISH4	0.212	.427(**)	.401(**)	0.146	.332(**)	0.201	0.203
COMM1	0.249	.458(**)	.421(**)	0.080	.331(**)	.474(**)	.506(**)
COMM2	.262(*)	.391(**)	.470(**)	0.142	.424(**)	.264(*)	.266(*)
COMM3	0.252	.442(**)	.444(**)	0.016	.340(**)	.388(**)	.380(**)
COMM4	0.250	.589(**)	.558(**)	0.205	.372(**)	.329(*)	.490(**)
COMM5	0.252	.347(**)	.359(**)	0.186	.279(*)	.340(**)	.376(**)
COMM6	.389(**)	.362(**)	.565(**)	.260(*)	.518(**)	0.174	.279(*)
COMM8	.318(*)	.533(**)	.474(**)	0.179	.385(**)	.365(**)	.475(**)
INTER1	0.217	.475(**)	.407(**)	0.002	.378(**)	.362(**)	.439(**)
INTER2	0.054	.305(*)	.274(*)	-0.062	0.227	.575(**)	.536(**)
INTER3	0.215	.285(*)	.258(*)	0.205	.330(**)	0.155	.303(*)
INTER5	0.145	.344(**)	.338(**)	0.036	0.089	.504(**)	.403(**)
INTER7	0.218	.432(**)	.364(**)	0.107	.321(*)	.373(**)	.481(**)
**. Correlation is significant at the 0.01 level (2-tailed).							
*. Correlation is significant at the 0.05 level (2-tailed).							

Table 4.7 – Factor Loadings and Cross Loading (Contd.)					
	ALT	**ALTCONS**	**DECISH**	**COMM**	**INTER**
ITBUS1	0.241	-0.014	0.225	.386(**)	0.234
ITBUS2	.347(**)	-0.054	0.222	.257(*)	0.177
KNOWNET1	.423(**)	-0.011	.458(**)	.409(**)	.546(**)
KNOWNET2	.321(*)	0.152	.461(**)	.457(**)	.360(**)
KNOWNET3	.313(*)	0.014	.278(*)	.360(**)	0.191
BUSFUN1	.568(**)	-0.031	.414(**)	.506(**)	.440(**)
BUSFUN2	.413(**)	-0.050	.459(**)	.488(**)	.268(*)
BUSFUN3	.395(**)	-0.096	.308(*)	.429(**)	.370(**)
EXPIT5	.304(*)	-0.056	.272(*)	.415(**)	.326(*)
EXPIT6	.281(*)	0.039	0.248	.340(**)	.300(*)
EXPIT7	.277(*)	-0.150	.343(**)	.486(**)	.333(**)
GITKNO4	0.110	-0.175	0.061	0.222	0.050
GITKNO11	.282(*)	0.060	0.057	0.198	0.120
GITKNO13	0.164	-0.248	-0.063	0.021	-0.066
GITKNO14	.266(*)	-.284(*)	0.069	0.207	0.133
GITKNO15	0.084	-0.080	0.028	.262(*)	0.051
GITKNO16	.262(*)	-0.042	0.133	-0.042	-0.018
GITKNO18	.412(**)	-.416(**)	0.057	0.087	0.070
PI2	.469(**)	0.167	.513(**)	.412(**)	.559(**)
PI3	0.114	.355(**)	0.162	0.166	.373(**)
PI4	0.209	0.207	0.234	.400(**)	.322(*)
GS1	.473(**)	0.106	.344(**)	.600(**)	.545(**)
GS2	.340(**)	0.177	0.125	.382(**)	.397(**)
GS3	.445(**)	0.193	0.243	0.144	.437(**)
GSREV4	0.003	.696(**)	0.248	.255(*)	.310(*)
ALT1	**.731(**)**	-0.085	.378(**)	0.187	.360(**)
ALT2	**.750(**)**	-0.243	0.233	.331(**)	.419(**)
ALT3	**.855(**)**	-0.029	.391(**)	.391(**)	.367(**)
ALTCONSR	-0.019	**.826(**)**	0.242	0.083	0.097
ALTCONR2	-0.225	**.826(**)**	0.066	0.027	0.024
DECISH3	.296(*)	0.164	**.832(**)**	.483(**)	.494(**)
DECISH4	.418(**)	0.145	**.832(**)**	.258(*)	.282(*)
COMM1	0.164	0.200	.339(**)	**.811(**)**	.590(**)
COMM2	0.228	0.110	.352(**)	**.816(**)**	.537(**)
COMM3	.353(**)	0.086	.488(**)	**.875(**)**	.737(**)
COMM4	.535(**)	0.051	.496(**)	**.856(**)**	.645(**)
COMM5	.349(**)	-0.073	0.238	**.772(**)**	.575(**)
COMM6	.270(*)	-0.075	.268(*)	**.787(**)**	.440(**)
COMM8	.351(**)	0.072	.360(**)	**.831(**)**	.626(**)
INTER1	.398(**)	0.084	.558(**)	.727(**)	**.857(**)**
INTER2	.349(**)	0.204	0.246	.634(**)	**.835(**)**
INTER3	.307(*)	-0.102	0.048	.449(**)	**.660(**)**
INTER5	.395(**)	-0.070	.360(**)	.335(**)	**.661(**)**
INTER7	.421(**)	0.114	.534(**)	.580(**)	**.796(**)**
**. Correlation is significant at the 0.01 level (2-tailed).					
*. Correlation is significant at the 0.05 level (2-tailed).					

Table 4.8 – Inter rater reliability		
Inter-rater reliability coefficients	**Business Complexity**	**Technological Complexity**
Pearson's	0.875	0.97
Spearman's	0.744	1.00
Cronbach's alpha	0.934	0.99

Analysis Technique

Existing research investigating gestalt fit have recommended cluster analysis to be one of the more appropriate techniques for testing gestalts (Miller and Friesen, 1981; Venkatraman, 1986, Jain, Ramamurthy, Ryu and Yasai-Ardekani, 1998). The primary use of cluster analysis as a technique is in classifying individuals, cases, objects or entities into distinct configurations. However, it is different from other techniques such as discriminant analysis in that it adopts an inductive approach in deriving the number and characteristic of the clusters, not known *a priori* (Afifi and Clark 1990), while simultaneously distinguishing each group from other groups. Cluster analysis tries to draw out groups or clusters whose internal membership is highly coherent in terms of the attributes that are of interest. This is usually done by maximizing the *Euclidean distance* and/or the *Mahalnobis distance* between two different groups. For the context of our study, this internal membership is based on levels or values of the dimensions of analyst capabilities and project characteristics.

The analysis for our study was done in two steps. First we conducted the cluster analysis to identify the configurations/clusters of analyst capability and project characteristic dimension level. Given that our hypothesizing logically partitioned the fit aspect across the business complexity and technological complexity dimension of ISD problem characteristics, we conducted obtained two separate cluster analysis. The first one involved the variables business complexity, business knowledge, analytic ability and interpersonal skills. The second one involved technological complexity, technical knowledge, analytic ability and interpersonal skills. For ease of discussion we will refer the first as the business complexity set and the second one as the technological complexity set. Further, as our objective was to obtain a parsimonious set of clusters that could be clearly distinguished from each other, we ran a series of analysis using two, three, four and five cluster solutions. We chose the minimal cluster solution that gave us a meaningful pattern of relationship between the constructs (Jain et al, 1998). The resultant solution consisted of a four cluster solution for the business complexity set and a three cluster solution for the technology complexity set. After the cluster analysis was conducted we ran a one way ANOVA (with subsequent post hoc tests) to test for equality of means across the clusters. The final step involving the hypotheses testing was done by conducting a second one way ANOVA for our dependent variable (analyst effectiveness) across the cluster groups. We used Jain et al's (1998) article for procedural guidance. We next discuss detail the results of our analysis for the two different sets.

Results

In Table 4.8 below we report the cluster data obtained for the business complexity set. The clusters were found to be significantly differing on the means of the respective variables in most of the cases. In Table 8.9 we present a summarized form of the clusters, categorizing the mean of each cell as H (high), M (medium) and L (Low). Table 8.9 also reports the results of the one-way ANOVA run to test the differences in analyst effectiveness scores for each of the clusters. The last row of Table 8.9 shows the mean value for analyst effectiveness for each cluster. Closely inspecting the clusters, we can see that Cluster 2B represents the configuration perfectly conforms to our definition of analyst-problem fit. The other clusters represent configurations where supplied skill levels exceeding demand. The pattern of mean values across the clusters shows the trend of a positive relationship between analyst effectiveness and analyst-problem fit. To test hypothesis 1 we would need to compare the clusters that have the same level of complexity. In this case these are clusters 1B, 2B and 3B. Cluster 2B has numerically the highest mean for analyst effectiveness and this value is also significantly different from effectiveness values for both Cluster 1B and Cluster 3B. Therefore for the cluster solution for the business complexity set we find that hypothesis 1 is supported

Table 4.9 – Cluster Analyses for Business Complexity Set

Variables	**Mean (S.D.) of Cluster Groups**				**F**	**Between Group Significance**
	Cluster1 (n = 20)	**Cluster2 (n = 5)**	**Cluster3 (n = 15)**	**Cluster 4 (n = 10)**		
Business Complexity	4.40575 (0.40)	4.3350 (0.44)	4.3190 (0.36)	2.2340 (0.34)	82.53***	1-4***;1-2 NS; 1-3 NS; 2-3 NS; 2-4***; 3-4***
Business Knowledge	5.7083 (0.48)	3.6556 (0.65)	5.0360 (0.29)	5.2111 (0.65)	82.593***	1-2***; 1-3***; 1-4**; 2-3***; 2-4***; 3-4 NS
Analytic Ability	4.6833 (0.33)	3.7850 (0.53)	4.0481 (0.43)	4.2514 (0.43)	10.572***	1-2***; 1-3***; 1-4**; 2-3 NS; 2-4**; 3-4 NS
Interpersonal Skills	5.9171 (0.35)	4.2589 (0.42)	5.2903 (0.62)	5.2971 (0.74)	13.756	1-2***; 1-3***; 1-4**; 2-3 NS; 2-4**; 3-4 NS
*****p <.01 ; ** p < .05; *p<0.1**						

Table 4.10 – Business Complexity set Cluster Configurations and Analyst Effectiveness						
Variables	**Cluster1 (n = 20)**	**Cluster2 (n = 5)**	**Cluster3 (n = 15)**	**Cluster 4 (n = 10)**	**F**	**Between Group Significance**
Business Complexity	M	M	M	L	4.064**	1-2** 1-3 ^{NS} 1-4 ^{NS} 2-3*** 2-4 ^{NS} 3-4**
Business Knowledge	H	M	H	H		
Analytic Ability	M	M	M	M		
Interpersonal Skills	H	M	H	H		
Analyst Effectiveness	4.4670	5.4700	4.0247	5.0070		
***p <.01 ; ** p < .05; *p<0.1						

We report the results for the cluster solutions derived for the technological complexity set in Tables 4.10 and 4.11. In this cluster solution we do not find any configuration conforming perfectly to our definition of analyst-problem fit. Using the same heuristic as before we test hypothesis 2 by comparing clusters with the same level of technological complexity (Clusters 1T and 2T). However both of these clusters do not show any degree of fit as defined by us. Further, the one way ANOVA on analyst effectiveness scores across these three clusters was non-significant. Therefore our conclusion is that it is not possible to test this hypothesis given the data that was obtained. .

Table 4.11 – Cluster Analyses for Technological Complexity Set					
Variables	**Mean (S.D.) of Cluster Groups**			**F**	**Between Group Significance**
	Cluster1 (n = 22)	**Cluster2 (n = 7)**	**Cluster 3 (n = 21)**		
Technological Complexity	1.7091 (0.43)	1.9429 (0.49)	4.0762 (0.70)	99.722***	1-2 NS; 1-3***; 2-3 ***
Technical Knowledge	5.2251 (0.62)	4.2483 (0.99)	4.8039 (0.76)	5.022**	1-2***; 1-3 *; 2-3 *
Analytic Ability	4.4697 (0.46)	3.7948 (0.33)	4.33 (0.50)	5.489**	1-2***; 1-3 NS; 2-3 **
Interpersonal Skills	5.8377 (0.37)	4.4068 (0.36)	5.3660 (0.72)	17.984***	1-2***; 1-3 **; 2-3 **
*****p <.01 ; ** p < .05; *p<0.1**					

Table 4.12 – Cluster Configurations and Analyst Effectiveness					
Variables	**Cluster1 (n = 20)**	**Cluster2 (n = 5)**	**Cluster3 (n = 15)**	**F**	**Between Group Significance**
Technological Complexity	L	L	M	1.766 NS	1-2 NS; 1-3* ; 2-3 NS
Technical Knowledge	H	M	M		
Analytic Ability	M	M	M		
Interpersonal Skills	H	M	H		
Analyst Effectiveness	4.2441	4.7171	4.7961		
*****p <.01 ; ** p < .05; *p<0.1**					

Discussion

The discussion in the previous section indicates that we obtained mixed results in our study. While there were definite trends that indicated improvement in analyst effectiveness, on the achievement of analyst problem fit, the results were by no means overwhelming in nature. This seems to indicate the possibility of some missing elements in our theorizing. It would therefore be worthwhile to examine what this missing element is and how we may explain the entire pattern of our result within a single framework. One factor that does emerge from the re-examination of our theory is that it rests on the concept of congruence between dimensional elements of analyst capabilities and problem characteristics. We have ignored the possibility of interactions or alignment between elements within a particular construct. In other words we have implicitly assumed that analyst-problem fit does not depend on alignment between the dimensions of analyst capabilities. It may be an interesting idea therefore to incorporate the missing element within our theoretical framework and re-examine the pattern of results of this study. To do this we reformulate analyst-problem fit and propose that such a fit occurs when there is a simultaneous alignment of values within the analyst capability dimension

- A congruence between the levels of dimensional elements of analyst capabilities and problem characteristics
- An alignment between the levels of the dimensions within the analyst capability set

It must be noted that we are considering the within construct match only for analyst capability, as in the study we have logically demarcated between the business complexity set and technology complexity set. We would also want present the definition of three new metric that we believe would allow us explain the extant pattern of our result.

Congruence: Degree of match among the dimensions of different constructs (i.e. problem characteristics and analyst capability dimensions) in terms of their levels (i.e. high, medium or low)

Consistency: Degree of match among the dimensions within a particular construct (i.e. analyst capability dimensions) in terms of their levels (i.e. high, medium or low)

Degree of incongruence: The difference in levels of a dimensional element of analyst capability and of problem characteristics, when congruence is not achieved (e.g. business complexity is M, but business knowledge is L). For a given level of complexity, incongruence represented by L→M will be of a lesser degree than the incongruence represented by L→H. Also as the match or congruence is essentially driven by the problem characteristics dimension, the degree of incongruence will be termed positive when the level of the particular dimension of the problem characteristics is lower than a corresponding dimension of analyst capability and vice versa.

We now examine the clusters obtained in our study through the framework of the three metric defined above and provide a description of each on these in terms of the levels of the metric in Table 4.12. The Cluster 1B -4B belong the business complexity set and Clusters 1T – 3T. Congruency has been categorized as high when a match exists between at least two of the three elements of analyst capability and the problem characteristics dimension. Consistency has been categorized as follows – High (all three dimensions of analyst capability match), Medium (two out of three dimensions match) and Low (One or no match among the dimensions). Degree of incongruence was computed for the differences in the levels between all the elements of analyst capability set and the corresponding dimension of problem characteristic set. A difference level of L-H was computed as 2, L-M as 1 and so on

Table 4.13 – Cluster Descriptions

Business Complexity Set			
Cluster ID	**Congruency**	**Consistency**	**Degree of Incongruence**
Cluster 1B	Low	Medium	1,1,2 (Positive)
Cluster 2B	High	High	0
Cluster 3B	Low	Medium	1,1,2 (Positive)
Cluster 4B	Low	Medium	2,2,1 (Positive)
Technological Complexity Set			
Cluster ID	**Congruency**	**Consistency**	**Degree of Incongruence**
Cluster 1T	Low	Medium	2,1,2 (positive)
Cluster 2T	Low	High	1,1,1 (positive)
Cluster 3T	High	Medium	0,0,1 (positive)

Now that we have described the clusters in term of the three metric, we shall examine the analyst effectiveness levels for each cluster. The analysis is summarized in Table 4.13. Certain pattern seems to emerge in terms of the analyst effectiveness scores and the metric based cluster configurations. In the Business complexity set, the emergent pattern was as follows

- 2B with high congruence and consistence emerges as a high performing configuration with the highest analyst effectiveness score
- 2B performs significantly better than 1B and 3B, although these configurations have values of business knowledge and interpersonal ability that are higher than that required by business complexity
- 4B has a high degree of positive incongruence and demonstrates comparable effectiveness as 2B
- 4B has similar consistency but a much higher positive degree of incongruence than 1B and 3B and also demonstrates higher effectiveness value compared to both

In a similar manner we found the following patterns from the technology complexity set

- 3T with higher congruence showed higher effectiveness scores. This was significantly higher than 1T compared to which it also had a higher level of consistency
- 2T and 3T have comparable effectiveness scores, with 3T having a slight edge in terms of actual numbers. 2T has higher consistency and also higher degree of positive congruence
- 2T has higher (but not significant) effectiveness when compared to 1T. Both have low congruency, however 2T has higher consistency. On the other hand 1T has a higher degree of positive incongruence

Table 4.14 – Explanation of analyst effectiveness pattern		
Business Complexity Set		
Cluster Comparison Pair	**Analyst Effectiveness Comparison**	**Explanation**
2B ---1B, 2B----3B	Significant	High congruence and high consistency (perfect) match creates significantly higher performance in Cluster 2B
2B ---4B	Non-significant	High congruence and High consistency in 2B continues to show a higher level of analyst effectiveness score. However lower complexity and high degree of positive incongruence leads to comparable performance in 4B
1B --- 3B	Non-significant	Same configuration and therefore no statistically significant difference between the configurations
4B---3B	Significant	Same levels of consistency, but a higher positive degree of incongruence shows improved performance scores for 4B
4B---1B	Non-significant	Same levels of consistency, but a higher positive degree of incongruence shows trend for improved performance scores for 4B, although not reaching significance
Technology Complexity Set		
Cluster Comparison Pair	**Analyst Effectiveness Comparison**	**Explanation**
3T---1T	Significant	Cluster 3T has higher congruence and higher consistency. In addition slight positive incongruence nullifies the effect of high positive incongruence in 1T
3T---2T	Non-significant	Cluster 3T shows trend of higher analyst effectiveness. Cluster 2T has higher consistency, but higher congruence in Cluster 3T, drives up analyst effectiveness
2T---1T	Non-significant	Higher consistency in cluster 2T leads to higher effectiveness score, however the high positive degree of incongruence in 1T leads to elevating the effectiveness score, such that the difference is not significant

We feel that a few generic patterns emerged after applying the framework based on congruence, consistency and degree of incongruence. We list them below

- High congruence and high consistency in a configuration indicates a possibility of higher performance
- For the same complexity level, higher congruency in a configuration indicates a possibility of higher performance
- For the same complexity level , higher consistency in a configuration indicates a possibility of higher performance
- For same consistency levels, higher degree of positive incongruence in a configuration indicates a possibility of higher performance

- For same consistency levels, higher congruence in a configuration indicates a possibility of higher performance
- For same consistency and congruence levels, higher degree of positive incongruence in a configuration indicates a possibility of higher performance

Conceptually the clusters that emerged during our data analysis represent analyst profile configurations for a given level of business and technological complexity of a project. The pattern for analyst effectiveness for these different profile configurations that emerged from our analysts have some interesting implications for the analyst resourcing. The two broad implications, we feel, are with regards to a) the relationship between analyst effectiveness and the level of analyst's capabilities and b) the relationship between analyst effectiveness and all round analyst capabilities.

In terms of the capability requirements of an analyst, our data suggests that an approach based on sufficiency is quite effective. The fact that congruent profiles seem to on the whole have higher analyst effectiveness scores suggest that being able to just meet the capability requirements (across all capability dimensions) is an optimal approach. This is an interesting finding as it indicates that organizations do not need to spend effort in seeking individuals with absolute high levels capabilities, but individuals that exactly meet the capability requirements of a project. Further the effectiveness of the sufficiency approach also opens up the possibility for an organization to maximize the effectiveness of their resource allocation across multiple projects. In general organizations have relatively less number of individuals who have high values in the capability dimensions. These are mostly the senior and experienced resources. Further the numbers of the high complexity projects are also typically less than those of medium or less complexity. A resourcing strategy in which organizations allocate the bulk of their less senior resources in the medium or small complexity project based on the congruence based sufficiency approach would free up their highly capable analysts for the fewer high complexity projects.

We feel that the importance of the concept of consistency that emerged from our data has important implications about the kind of capability profiles that an organization should seek in an analyst resource. Our data suggests that profiles that show consistency in terms of levels of analyst capability dimensions would lead to higher effectiveness. An important implication of this is that all the different analyst capability dimensions are equally important. Therefore from the perspective of the organization an effective human resource development strategy would be to increase the percentage of analysts with medium to high capability levels across the analyst capability dimensions in their resource pool. There is also a related implication that for entry level recruitment the organizations should focus more on the individual specific analyst capabilities rather than the job-related capabilities (business and technical knowledge), as the latter category of capabilities can be potentially developed through in house training and experience. Therefore pursuing a strategy of recruiting individuals with high analytic abilities and interpersonal skills would give the organization a higher probability of creating analyst resource pool with capability profiles that exhibit high levels of consistency.

While our findings have interesting resourcing implications for organizations, we strongly feel (especially given the exploratory nature of our empirical study) that more research is needed along the same lines. We hope this study throws light on some interesting and hitherto unexplored aspects of analyst effectiveness that would inspire further research endeavors.

Limitations

As in most empirical studies, our study has a number of limitations that we feel we should discuss. The first of these is the use of the student subjects. While limitations concerning using student subjects are well document, it becomes particularly problematic in our context, as we have attempted to investigate a specialized and professional domain. Therefore concerns regarding the appropriateness of student proxies remain and need to be acknowledged. However, at the same time we do feel that the methodology employed by us lends validity to our results. First, we collected data from student subjects who were involved in a role play simulation of requirements elicitation. A lot of care was taken to make this simulation process as realistic as possible, therefore the students were actually immersed in an environment of "simulated reality" when responding to our instruments. Second, the students from the existing instruments were adapted so that they were contextually relevant to students and the projects they were involved in.

The sample size of this study is also a concern, especially with regards to the subject to variable ratio. However we employed PLS to conduct our instrument validation and our analysis seems to indicate acceptable levels of convergent and discriminant validity of our instrument. Second, the primary analytic techniques used by use – cluster analysis and ANOVA, are a lot more stable to small sample sizes when compared to the covariance based model testing techniques.

In conclusion we feel that while the nature of and size of our sample are sources of concern, we have managed to mitigate these to some extent by the design of our study and the analytical techniques used by use.

Conclusion

In this article we present a contingent theory of analyst effectiveness, proposing that it depends on the achievement of an analyst-problem fit. This theoretical approach, we feel addresses a limitation propagated in existing research concerning the sufficiency of analyst capabilities as construct for explaining analyst effectiveness. Our theoretical perspective proposes that analyst capabilities are necessary but not sufficient, and that analyst effectiveness depends on not only identifying capable analysts, but those with the appropriate set and level of capabilities required by the particular project. We further argue that analyst-problem fit is a multivariate fit best characterized analytically as a gestalt fit. Finally we present the results of an empirical validation of this contingent theory of analyst effectiveness. The results and the subsequent post-hoc analysis provide indication that analyst effectiveness is indeed contingent on analyst-problem fit. Further our post hoc analyst indicates that analyst-problem fit is obtained by a simultaneous achievement of match between analyst capabilities and problem characteristics as well as an internal consistency (or matching) among the analyst capability dimension levels. The patterns of relationship between analyst effectiveness and the analyst-problem fit configurations indicates the concept of fit proposed in the article may be used to drive a satisficing sufficiency-based resourcing strategy to optimize resource allocation in organizations.

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Appendix A

A.1

The Genre of GTM adopted in this study

With the maturation of the GTM landscape, important clarifications about the Strauss and Corbin's approach have also emerged with respect to two aspects of GTM relevant to our study: first, about *the logic underlying the coding procedures*; and second, about *what "grounding" means.* Initially, the term "inductive" seemed to capture the logic of coding process, with involved extrapolation from individual cases to form core categories (Bryant and Charmaz 2007); yet this resulted in the mistaken notion that researchers need to be *tabula rasa* and that the theory can be mechanically derived by conscientiously following coding procedures. Increasingly, researchers are realizing that induction may not accurately describe the logical process underlying GTM, resulting in efforts to characterize the actual logic involved in developing grounded theory. Richertz (2007, p. 225), for instance, observes that "**GT (in the variant of Strauss and Corbin)** contains an **abductive** research logic" (emphasis added, p. 225), where characterizing the research logic as "abductive" acknowledges the fact that conceptualizations do not result from a mechanical coding process but involve "an intellectual act, a mental leap" that is at the very heart of a "cognitive logic of discovery" (p. 220). A similar viewpoint is expressed by Van de Ven (2007, p. 207) when he states:

> Abduction refers to a conjecture or hypothesis that we invent… Such a conjecture or hypothesis should go beyond the information given in a specific case (Bruner 1973). Since **abduction more accurately describes the mode of reasoning entailed in grounded theorizing than induction,** I use the term abduction instead of induction. (emphasis added).

Bryant and Charmaz (2007, p. 16) also conclude that "the inductive nature of GTM is now seen as only part of the story: 'abduction' plays a key role…" and add that abductive logic "links empirical observation with imaginative interpretation, but does so by seeking theoretical accountability through returning to the empirical world" (p. 46). We believe that this description accurately captures the logic underlying our study as well. While induction played the predominant role in our open coding, the role of abduction became more evident in the axial coding and selective coding stages.

The second related clarification is with respect to "grounding" and the role of theoretical sensitivity. Glaser and Strauss' initial recommendation (1967) was to avoid preconception or forcing of existing concepts or theory, and instead let concepts emerge from the data. Indeed they ask that the researcher "ignore the literature of theory" (p. 37) and avoid commitment to "one specific preconceived theory" (p. 46). Taking a somewhat different position, Strauss and Corbin (1990) acknowledge the view that "theoretical categories, whether grounded or not, cannot start *ab avo*, but have to draw on [some] existing stocks of knowledge" (Kelle 2007, p. 197); hence the need to have "theoretical sensitivity," without which the relevance of raw data to the theoretical project may become difficult to recognize, and the researcher is likely to focus on description rather than on abstraction. Thus in our study, we do utilize theoretical sensitivity, primarily in the areas of collaboration, knowledge transfer, trust, cognitive models etc., while ensuring that pre-existing theory is not forced on the data, as this would be against the spirit of *any GTM version.* In many cases, we borrow labels/concepts from the literature and bring them to bear in the specific context of RE. As grounded theorists and prominent qualitative researchers note (e.g., Strauss and Corbin 1994; Walsham 1995; Bryant and Charmaz 2007) that such an approach ensures that the output of the study is not merely descriptive (using first order concepts) but rather is presented at a higher level of abstraction (using second order concepts)

As mentioned above, we conducted the analysis of data using the logic of three different coding procedures, referred to as open coding, axial coding and selective coding (Strauss and Corbin, 1990). *Open coding* involves "breaking down, examining, comparing, conceptualizing, and categorizing data" (Strauss and Corbin, 1990, p. 61). *Axial coding* refers to the analytic activity for "making connections between a category and its sub-categories" developed during open coding (Strauss and Corbin, 1990, p. 97), i.e., reassembling fractured data by utilizing "a coding paradigm involving conditions, context, action/interactional strategies and consequences" (p. 96). *Selective coding* involves explicating a story line by identifying a core category and linking the other categories around the core category, using the paradigm model. At the heart of the coding process is the notion of the *constant comparative analysis* (Glaser and Strauss 1967) to identify initial concepts, and to linking these evolving sets of concepts to higher level categories (Charmaz 2000). The constant comparison, in our case, involved "comparing different people (such as their views, situations, actions, accounts, and experiences),...comparing data with [emergent] category[ies], and.. comparing categories with other categories" (Charmaz 2000, p. 515). In Holton's words (2007, p. 277), "The purpose of constant comparison is to see if the data support and continue to support emerging categories. At the same time, the process builds and substantiates the emerging categories…" Next, we discuss the three coding procedures (which form the core of GTM) in further details below.

Strauss and Corbin (1990) propose a paradigm model to help researchers build their grounded theory; while the idea of having a structure or scaffolding for a theory is useful, in practice, researchers have found it "uncomfortable" to use the paradigm model rigidly (Sarker et al. 2001; Urquhart 2007; Kelle 2007), and indeed, Kelle suggests that "[f]ollowing the Straussian route by constructing one's own coding paradigm connected to the .. tradition one prefers would be one possibility to stick with grounded theory methodology without adopting the (meta)theoretical orientation of its founding parents" (p. 204). In our case, our objective was to theorize about the process involved in RE, where our definition of "process" is closely reflected in the following definition offered by Van de Ven (2007, pp. 197-199):

..[one] meaning of process is a sequence of events or activities that describe how things change over time… variables are not the centerpiece of the process models… the central focus.. is on progressions (i.e., the nature, sequence, and order).. over time.

In light of this above view of process, we model the RE process using the vehicle of *state transition diagrams* (also referred to as state charts), for which we develop the conceptual description of states, and identify enablers/inhibitors and triggers for transitions. We summarize our approach in developing our process model in Figure A1.1

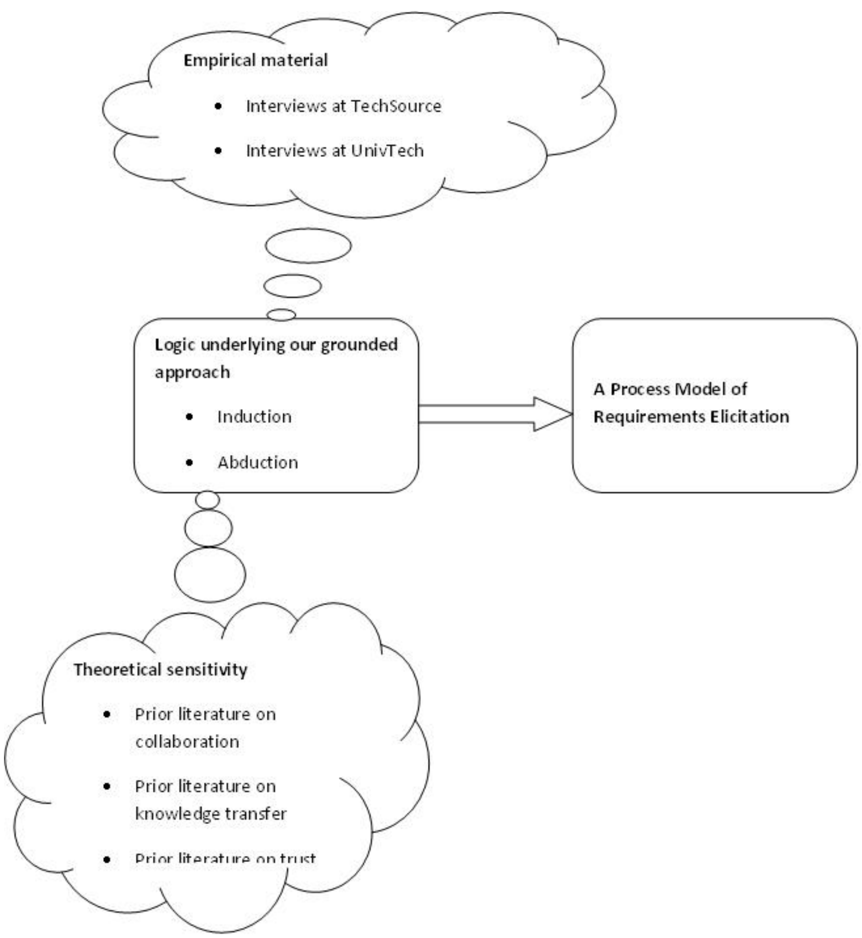

Figure A1. 1- Empirical approach adopted in this study

A.2

Data Analysis

In analyzing our data, we were primarily guided by the methodological recommendations of Strauss and Corbin (1990). In addition, we have drawn extensively on the works of Sarker et al (2001), Urquhart (2001), and of editors/contributors to the Sage Handbook of Grounded Theory (Bryant and Charmaz 2007) for practical procedural guidance on GTM.

The Open Coding Phase of this Study

This preliminary data analysis was conducted after the interview transcripts were generated. The coding was conducted in two phases. In the first phase, two of the authors individually coded a transcript and generated the open codes. In the second phase, we jointly reviewed each transcript, constantly comparing the codes generated by each other in the first phase. During this phase, common codes generated by the two researchers were combined and new, unique codes were recorded

The open coding was conducted in both the phases through a line-by-line reading of the transcripts. The coding of each new transcript was not done in isolation but through the process of constant comparison with the other transcripts, as well as that particular transcript. Prior theoretical sensitivity (e.g., that the RE phase is a collaborative and knowledge transfer process) enabled us to identify patterns from the data while coding. In Table A2.1, we provide examples of open coding, and how sections of the interview transcripts enabled the creation of open codes.

TableA2. 1 - Open Codes	
Transcripts Excerpts	**Codes Generated**
In that case, the client raise …PRAN ??? ticket or something…they also give the brief description of what they would want.. so depends actually, let us say that we got a problem statement and now if we can figure out exactly what has to be done, in that case we have fair idea, we'll build our story, we'll build our sort of design approach also…to approach to the clients…because we want to provide them maximum amount of information that we can, exchange with the clients in the first meeting itself..	**Phases in RG** – description initial phase; aim of initial meeting; **Nature/Description of problem statement -** problem domain **Approach to problem solving –** gradual building up of understanding based on available information; contingent approaches decided based on level of understanding **Information exchange –** giving and receiving information from the client; knowledge transfer?
So, during the discussion actually we exchange our thoughts, and then again I told you earlier, its iterative process actually, we get the requirements, we do the analysis and we identified more that needs to be changed, as a part of this thing, and we take it back to clients, clients see it again, if they find that okay these changes, are actually fine and actually does not break the existing system, they are fine with that, and more over cost is again one of the criteria, which is like going to decide as to how many requirements we are going to take,	**Exchange of thoughts -** Knowledge Transfer **Process of RE -** Multiple iterations through which information requirements are gathered; Analysing based on these requirements and getting feedback from clients **Cost as a bounding constraint**
We keep talking discussing but, parties don't agree, we don't think, that it can be done and, business thinks that it has to be done, or, business thinks that, it has to be done, or business thinks that, it should be done differently and we see differently, so actually might go for multiple meetings, each meetings might not have its specific minutes, just that, we try to do it as much as we can,	**Nature of Conflict -**Non convergence/Disagreement about details of requirements; Incomplete agreement on problem domain **Resolution of conflict -** Multiple iterations and meetings required for reaching an agreement
Like, clients themselves, client is not just one person, who is going to talk to me, it could be a body of people, in fact many cases, client may actually be three four dept in business. so one dept. might say that, if you do this is going to break this thing of mine, I wont let you do it, or one dept. might say that I want to do, but there are some budgetary limitations, so finance people will say that we cannot do this things, because it is going to be so costly, this year we cannot afford it, so business will again say that but we need to do and we will try, to find something that actually is going to be cost effective, or which can be done, at a lesser cost, or which, cannot be done at all, so there.. its kind of ' tug of war ' situation, also in many cases, not just plain, I give you the requirement you develop the system, and moreover requirement capturing might stop at those phases also **,** like we get some requirement and we give very high level estimate, they say we do not need to proceed any further,	**Nature of conflicts -** Functional boundary constraints; Interfunctional disagreement among business; **Cost as boundary restraint**; **Resolution of Conflict -** Continual bargaining; termination of requirements gathering if unanimous support for project not gained or due to financial constraints. **Negotiation –** means of resolving conflict

As mentioned above, the open codes were identified through an iterative process guided by the constant comparative technique. This iterative process often resulted in the merging and changing of the labels of the code categories. This coding phase ended with a set of categories and sub-categories that were generated from the open codes. Figure A2.1 provides some examples of the initial selection of open codes obtained from this process.

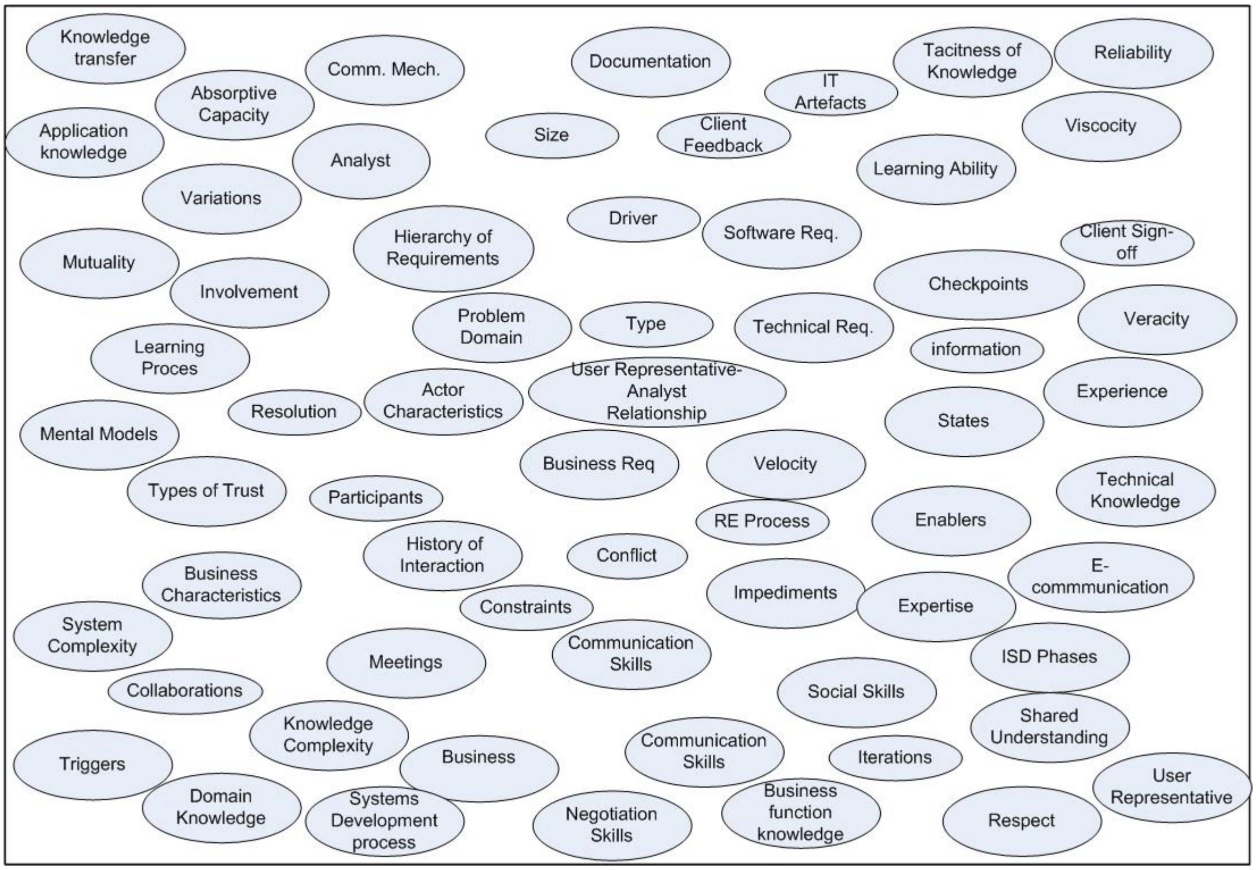

Figure A2. 1 – Open Codes

In the next phase of the data analysis, that is axial coding, the codes generated during the open coding phase were organized and hierarchically linked (Strauss and Corbin 1990). We would like to note that theoretical sampling as part of axial and selective coding "does not treat all data [or open codes] equally. [For example] within an interview, researchers may disregard some texts… use some portions of the text for verification of other interviews, use some of the text or stories.

[to] start new categories [or linkages]" (Morse 2007, p. 243). In addition, the logic of abduction guided the theorizing effort in the axial and selective coding phases, in addition to the logic of induction.

The Axial Coding Phase in this Study

In the open coding phase, we were successful in identifying a reasonably large set of open codes. The next step (which is embodied in the axial coding phase) involved the organization of these codes into meaningful conceptual clusters through the identification of logically important categories and their sub categories. While open coding and axial coding represent sequential phases in the coding activity, one needs to note that there are certain overlaps. The labels of the open codes generated during open coding have some inherent conceptual meaning that helps this process of hierarchical linking. (e.g. actor characteristic is conceptually linked to the category – actor, and can therefore be perceived as a sub category). As a result, at the end of the open coding, we were able to identify an initial set of open codes that appeared to represent concepts that were intrinsically more general or at a higher level of abstraction (i.e., a category). At the same time, each of these higher or generic categories could also be informally linked with some of the other codes. This provided us with some initial understanding of the category/sub-category relationship set.

The formal linking of the categories to the sub categories was done through an iterative and sequential process. The first step of the process was the identification of an initial approximate category/sub category relationship set through a scan of the labels of codes that were generated during open coding. This step was conducted individually and the initial set of categories identified by each of us was compared and an all-inclusive set was defined. Using this initial reference set, we (individually) made a number of passes through the interview text with a focused objective of identifying the link between a category and a candidate sub-category, and recording the text excerpt that embodied such a link. This process was continued until the initial category/sub-category relationship set was exhausted, and a majority of the open codes that were generated could be related to a particular category. Figure A2.2 provides a diagrammatic view of the linkages between one of the identified categories – actor, and its sub categories.

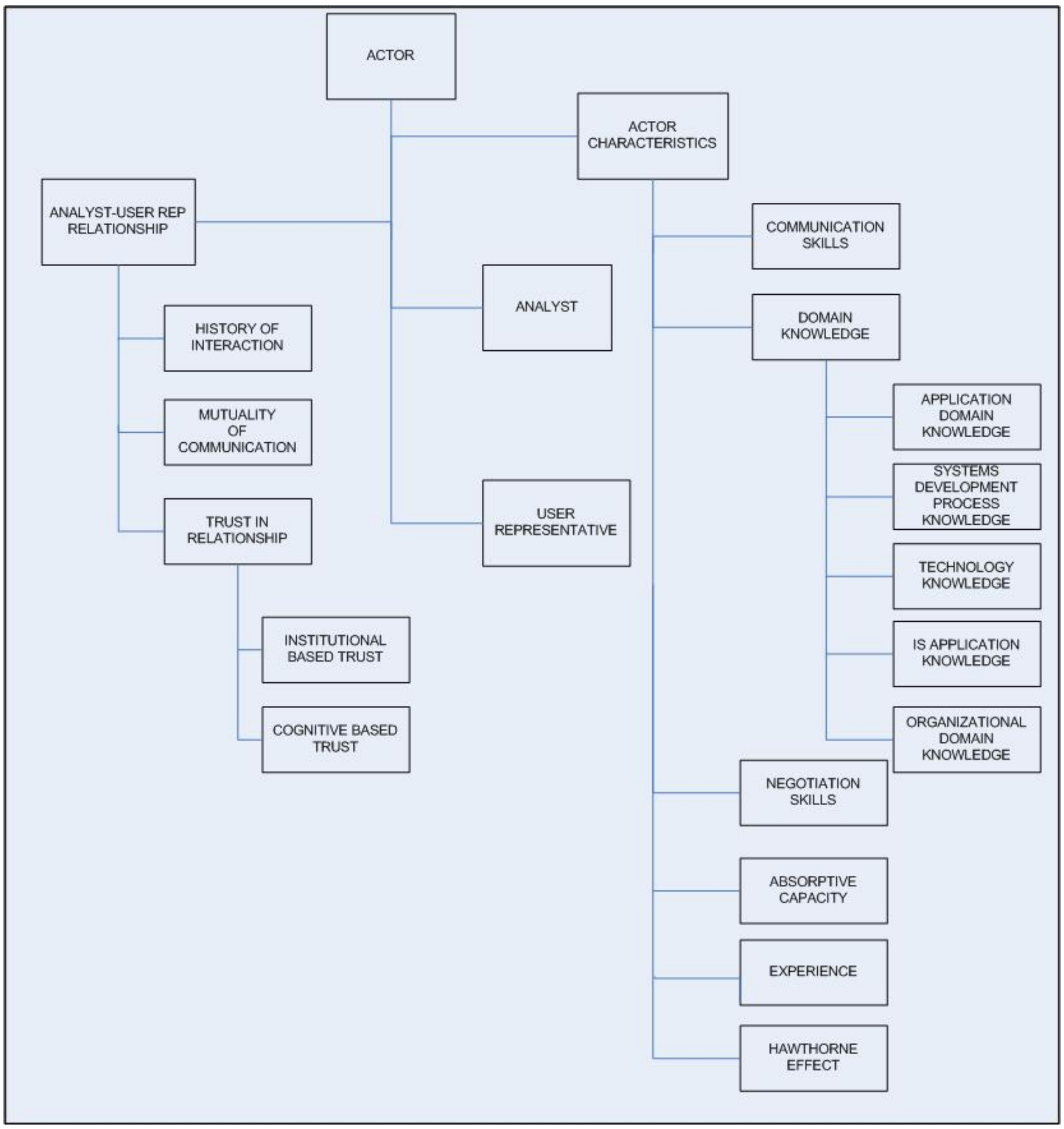

Figure A2. 2 – Sample Axial Coding

As can be seen in the Figure A2.2 at the first level actor is linked to analyst-user-rep relationship, analyst, and user-representative and actor characteristics. At the second level, user- analyst relationship is related to history of interaction, mutuality of communication and trust in relationships. The trust in relationships subcategory being further linked to –institutional based trust and cognitive based trust. Also actor characteristic is linked to communication skills, domain knowledge, negotiation skills, absorptive capacity, experience and Hawthorne effect. Finally domain knowledge is further linked to a number of subcategories that demonstrate the various kinds of domain knowledge deemed to be important – application domain knowledge, systems development process knowledge, technology knowledge, IS application knowledge and organizational domain knowledge (Iivari, Hirschheim and Klein, 2004). Similar to the above approach, links between other categories and their subcategories were also identified and recorded. At the end of the axial coding phase, we were able to identify six major categories and also explicate linkages between these categories and their sub-categories. The six categories that were identified are – actor, requirements, knowledge transfer, mental model, trust types and collaboration. This has been diagrammatically represented in Figure A3.3

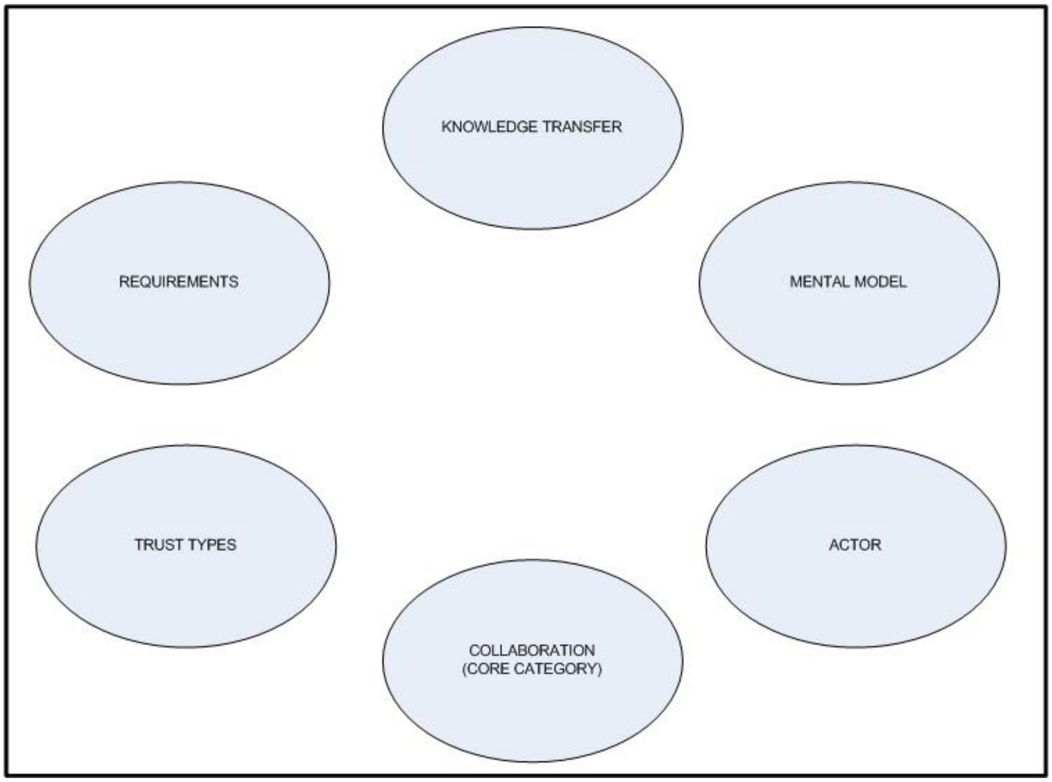

Figure A2. 3- Categories

The next step of the coding phase, that is selective coding, involved the creation of a "story line" that interweaves the linkages and relationships between each of these categories.

The Selective Coding Phase in this Study

The primary objective of the selective coding phase was to explicate the final "story line" of the theoretical narrative by identifying the core category and linking them with the other existing categories. Given our objective of understanding the dynamics of user representative - analyst collaboration during the RE phase, we selected collaboration as the core category. The objective of selective coding was then to attempt to derive an understanding of collaboration by linking it to the rest of the categories identified during open and axial coding. Scholars have suggested that this Endeavour may be well facilitated by identifying "broad theoretical frameworks (meta-theories) that the researchers identify as relevant based on their interaction with data" (Sarker et al, 2001; Bryant and Chamaz 2007; Urquhart 2001). As a result, we conducted a thorough (and more focused) review of the literature on knowledge transfer and collaboration, specifically searching for theoretical frameworks that would potentially facilitate our analysis. This focused search led us to the connectionistic epistemology of knowledge transfer, the Time, Interactions, and Performances (TIP) theory for collaborative work groups (McGrath 1991), and the literature on trust as well as mental models, along with past work on RE. As suggested by Richertz (2007), we use a different paradigm model (determined by elements of state transition diagrams) for structuring our process theory, since it closely matched our conception of how a process model describing RE should look like (Van de Ven 2007). The result of selective coding is the process model in Figure 2.2

Appendix B

B.1

Table B. 1 – Measurement Instrument		
Construct	**Variable**	**Item Description**
Business Knowledge	**ITBUS1**	Rate your ability at recognizing potential ways to exploit new business opportunities using IT?
	ITBUS2	Rate your ability at analyzing business problems in order to identify IT-based solutions
	KNOWNET1	If you have a business question or problem that you cannot solve alone, how confident are you about finding the right person to contact within your analyst team?
	KNOWNET2	If you have a business question or problem that you cannot solve alone, how confident are you about finding the right contacts outside your analyst team?
	KNOWNET3	If you have a business question or problem that you cannot solve alone, how confident are you about finding other relevant sources of business information including Internet site, magazines, trade journals, and conferences?
	BUSFUN1	Rate your Ability to learn about business functions
	BUSFUN2	Rate your Ability to interpret business problems and develop appropriate technical solutions
	BUSFUN3	Rate your Ability to understand the business environment
Technical Knowledge	**EXPIT1**	Rate your knowledge about technologies such as personal computers, client/server computing, LAN, and multimedia
	EXPIT2	Rate your knowledge about how applications such as e-mail, intranet, and groupware can be valuable to your client's organization
	EXPIT3	Rate your knowledge about different development methodologies such as the traditional system development lifecycle, end user development, and prototyping
	EXPIT 4	Rate your ability to learn new technologies
	EXPIT 5	Rate your ability to focus on new technologies as means, and not ends
	EXPIT 6	Rate your ability to understand technological trends
	Rate your skill and knowledge in the following	
	GITKNO1	Telecommunications
	GITNKO2	Networks (e.g. LAN, WAN etc.)
	GITKNO3	Operating systems
	GITKNO4	Programming Languages (e.g. Visual Basic, C#)
	GITKNO5	Web Development Technologies (e.g. HTML, ASP, XML)
	GITKNO6	Systems Development Methodologies
	GITKNO7	Systems Analysis
	GITKNO8	Relational Databases
	GITKNO9	Distributed Processing
	GITKNO10	Case Methods/ Tools
	GITKNO11	Decision Support Systems
	GITKNO12	Assembly Languages
	GITKNO13	Expert Systems/ Artificial Intelligence
Analytic Ability	**PI1**	I readily focus on important problems
	PI2	I consider relevant factors when analyzing a problem
	PI3	I have difficulty in setting priorities about which work problem I should address
	PI4	I am able to accurately describe work problems to others
	GS1	I obtain information from others to help set goals for resolving challenging

		problems
	GS2	I establish appropriate goals for resolving problems.
	GS3	I prioritize the goals that I have set for resolving problems.
	GS4	I do not consider how others will be affected if (as long as) the goals that I set are achieved.
	ALT1	I generate two or more possible solutions when dealing with a problem.
	ALT2	The possible solutions that I identify address the real causes of problems.
	ALT3	The possible solutions that I identify reflect an understanding of underlying concepts and issues related to a problem.
	ALT4	I tend to generate idealistic rather than realistic solutions to problems.
	ALTCONS1	I recognize positive consequences associated with possible solutions to problems.
	ALTOCNS2	I tend to overlook negative consequences associated with possible solutions to problems.
	ALTCONS3	I am not concerned about the short-term consequences associated with implementing possible solutions.
	ALTCONS4	I consider the long-term consequences associated with implementing possible solutions.
	DECISH1	I select a solution only after considering all possible consequences associated with possible solutions.
	DECISH2	I procrastinate when making decisions regarding the selection and implementation of solutions.
	DECISH3	I take responsibility for the decisions that I make.
	DECISH4	I consider the long-term consequences associated with implementing possible solutions
	AA1	I am generally good at providing novel solutions to problems
	AA2	I am in general good at adapting to situations of change
	AA3	In general I believe I am good at initiating change to enhance productivity
Communication Capability	**COMM1**	In general how would you rate your ability in effectively conveying verbal information?
	COMM2	In general how would you rate your ability in effectively conveying written information?
	COMM3	Rate your ability to plan and execute work in a collaborative environment.
	COMM4	In general, how effective do you think you are at communicating ideas to a group of people?
	COMM5	How effective are you at working in a team environment?
	COMM6	How well can you communicate IT-related knowledge in a non-technical language, and to non-IT specialists?
	COMM7	How would you rate your ability to listen attentively?
	COMM8	In general how you would you rate your ability to respond to other's comments effectively during communication?
Interpersonal Skills	**INTER1**	Rate your ability to work cooperatively in one-to-one and in project team environments.
	INTER2	Rate your ability to plan and execute work in a collaborative environment.
	INTER3	Rate your ability to deal with a lack of information about specific problems
	INTER4	Rate your ability to accomplish assignments.
	INTER5	Rate your ability to teach others.
	INTER6	Rate your ability to plan organize and lead projects.
	INTER7	Rate your ability to plan organize and write clear concise effective, memos, reports and documentation.
	INTER8	Rate your ability to be self directed and proactive
	INTER9	Rate your ability to be sensitive to the culture/politics within your group

Table B. 2 – Complexity Coding Dimensions	
Construct	**Dimensions**
Business Complexity	The extent of clarity of the stated business functional requirements
	Number of functional requirements
	Extent of intra-organizational interdependencies of the organizational requirement (e.g. no. of departments, no. of users)
Technology Complexity	Extent of Change conversion from a manual to an automated system if no current information system exists
	Extent of change to the current system, if there is an existing information system
	The number of functional processes in the proposed system
	Number of data stores within the system
	Number of writes/reads from datastores
	Amount of data/information exchange with external entity