Knowledge and Partnerships for Information Technology and Business People

by

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Abstract

This research describes how cross-functional competence in business and IT people provides the basis for effective partnership to develop. The specific objectives of this research are twofold. The first objective is to conceptually define and empirically measure the constructs of IT competence in business managers and of business competence in IT professionals, and test these measurements for validity and reliability. The second objective is to examine the influence of the business and IT competencies on the development and effectiveness of IT-business partnership.

We performed three empirical studies testing the validity of the instruments and assessing their contribution to partnership and performance. In the first two studies, instruments for the cross-functional competencies are developed and validated. For the IT competence instrument, results show that both IT knowledge and IT experience are instrumental in defining IT competence of business people. IT competence as a whole explains 38% of the variance in the respondents' intentions to show IT leadership, including their intentions to develop partnerships with IT professionals. For the business competence, results show that organization-specific knowledge, interpersonal and management knowledge, and knowledge of IT/business integration are all instrumental in defining business competence of IT professionals. Business competence explains 46% of the variance in the IT professionals' intentions to develop partnerships and 23% of the variance in their credibility.

The last study assesses the contribution of IT and business knowledge to the development and effectiveness of the partnerships between IT and business people. We surveyed sets of IT professionals and business clients working together on IT-related activities. A project sponsor assessed the performance of the work done by the pair. Results show that the quality of the partnerships between IT and business people, as well as the IT competence of the business client have a positive influence on the performance of their work. In addition, the own domain knowledge of the partners influences their partnerships. Lastly, IT knowledge contributes more to the explanation of partnership and performance than does business knowledge.

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1 Introduction

1.1 Research Problem

It is now widely recognized that information technology (IT) contributes to improved organizational efficiency and effectiveness, and can play a significant role in the strategic and competitive positioning of organizations (Applegate, 1999). What is less well known is how firms attain business value through IT investments and IT capabilities. One key factor that has emerged as a determinate of IT success is the development of effective partnerships. Partnerships between IT and business people are core IT capabilities (Feeny and Willcocks, 1998), and primary determinants of success in gaining business advantage through IT. Such partnerships improve the overall competence of the firm in the management of IT, enabling an organization to acquire, deploy, and leverage its IT investments successfully. They also help align a firm's IT strategies with its business strategies (Sambamurthy and Zmud, 1997).

IT research in the last decade suggests that the management of IT should be shared between IT professionals and line managers (Henderson, 1990; Rockart, 1988; Rockart, Earl, and Ross, 1996; Sambamurthy and Zmud, 1994; Silver, Markus, and Beath, 1995). It is also recognized that IT and line executives need training in both technology and business (Henderon, 1990; Keen, 1991) in order to enhance the management of IT (Silver et al., 1995). High levels of shared knowledge between IS and business executives, reflecting their ability to understand and participate in the each other's key processes, has been found to be an important enabler of the alignment of business and IT objectives (Reich and Benbasat, 2000).

In this new knowledge economy, the human capital of a firm is the firm's most important strategic asset and capability. Knowledge is a core competency for the firm (Prahalad and Hamel, 1990). But knowledge is privately held and resides in specialized form among individual organizational members. To create competitive advantage, knowledge possessed by a firm as a whole must be accessible to the right person at the right time in the right place. Hence the *common knowledge* that exists among different specialists in an organization is key to achieving better performance. In order to develop this firm-level competence, an integration of the different knowledge bases is required (Grant, 1996). While it is impossible for each individual to learn knowledge possessed by all other specialists in an organization, the integration will be facilitated when common knowledge is shared between different specialists.

Common or shared knowledge represents the overlap of the different specialists' knowledge. It refers to the commonality of vocabulary, conceptual knowledge and experiences between individual specialists (Grant, 1996). In the context of IT, shared knowledge among IT specialists and business managers represent their ability "at a deep level, to understand and be able to participate in the other's key processes and to respect each other's unique contribution and challenges" (Reich and Benbasat, 2000, p.86). Such shared knowledge between IT specialists and business managers increases the understanding of each for the domain of the other, thereby influencing communication between the parties to achieve alignment of business and IT objectives (Reich and Benbasat, 2000), and contributing to information system (IS) group performance (Nelson and Cooprider, 1996).

While the importance of shared knowledge and competence has been extensively discussed in the literature, there is little empirical work on 1) the specific types of knowledge needed for IT and business people to work together successfully, and 2) the mechanisms through which knowledge influences the partnership. Some researchers have begun investigating the issues associated with development of joint competence in IT and business (Boynton, Zmud, and Jacobs, 1994; Nelson and Cooprider, 1996; Sambamurthy and Zmud, 1997). Where empirical research exists, IT and business competencies are captured in a global way, usually in one or two items (Boynton et al., 1994; Nelson and Cooprider, 1996). In some cases, this partnership is measured in a qualitative fashion (Reich and Benbasat, 2000). The literature is generally silent on how IT and business competencies interact. It is not clear if both IT and business people need to be competent in each other's domain, or if such competence in one party only is adequate for an effective business-IT partnership. If the latter is the case, it is important to understand whether cross-functional competence is more important in the IT or business domain.

It is also important to compare the contribution of cross-functional knowledge to one's own domain knowledge. Indeed, some dimensions of partnerships, such as trust, are influenced by the domain expertise or knowledge of the person to be trusted (Mayer, Davis, and Schoorman, 1995). The business client may trust the IT professional because of her knowledge in her area of specialization: IT. Thus in addition to cross-functional knowledge, each partner's own domain knowledge is of interest in understanding the development of their partnerships.

1.2 Research Objectives

This research aims at describing how cross-functional competence in business and IT people provides the basis for effective partnership to develop. The specific objectives of this research are twofold. The first objective is to conceptually define and empirically measure the constructs of IT competence in business managers and of business competence in IT professionals, and test these measurements for validity and reliability. The second objective is to examine the influence of the business and IT competencies on the development and effectiveness of IT-business partnership. The effectiveness is reflected by the performance of the projects the partners work on together.

In developing the instruments for IT competence and business competence, our intention is to stay generic, and develop instrument not specific to any particular type of organization, business area, or level of business and IT people in the organization, in order to maximize the usability of the instruments. We performed three empirical studies testing the validity of the instruments and assessing their contribution to partnership and performance.

1.3 Overview of chapters

The remainder of this dissertation is structured as follows. Chapter 2 reports on the development of an instrument measuring the IT competence of business people, and investigate how this competence influences their IT leadership. IT competence is conceptualized as the IT-related knowledge and experience possessed by the individual whose primary area of expertise is in an area other than IT. We tested the instrument with 404 business people from two large insurance companies in British Columbia. A confirmatory factor analysis was performed using LISREL. Results show that both IT knowledge and IT experience are instrumental in defining IT competence of business people. IT competence as a whole explains 38% of the variance in the respondents' intention to show IT leadership, including their intentions to develop partnerships with IT professionals.

In the third chapter, the concept of business competence in IT people is explored. Business competence focuses on the areas of knowledge that are not specifically IT-related. It includes the organization-specific knowledge, the interpersonal and management knowledge, and the knowledge of IT/business integration possessed by the IT professionals. This chapter also explores the contribution of this competence to the development of partnerships between IT professionals and their business clients, and to their credibility in the eyes of their business clients. We tested the instrument with 109 IT professionals from two large insurance companies in British Columbia. A confirmatory factor analysis was performed using LISREL. Results show that all three areas of knowledge are instrumental in defining business competence of IT professionals. Business competence explains 46% of the variance in the IT professionals' intentions to develop partnerships and 23% of the variance in their credibility.

The fourth chapter bridges cross-functional competencies with the development and effectiveness of partnership. In this empirical study we used the instruments developed in chapters 2 and 3, and tested the contribution of these competencies to the development and effectiveness of the partnerships between the IT and business people. We tested the model with 85 sets of respondents. One set consisted of three people: an IT professional and a business person working together on IT-related activities, each reporting on their own cross-functional competence and on their partnerships, and a sponsor who can comment on the work done by the pair. The contribution of one's own domain knowledge to the partnerships was also taken into account. Results show that, overall, the model explains 61% of the variance in the partnerships and 18% of the variance in the project performance. Results indicate that the model as a whole provides a good explanation of the IT/business partnerships and of the performance of the projects.

Finally, chapter five reviews the findings, summarizes the contributions and limitations of this research, and discusses ideas for future research.

2 Measuring the IT Competence of Business Managers

2.1 Introduction

In the early days of organizational use of information technologies (IT), the main responsibility to acquire, implement, and maintain technology investments belonged to the specialists within the Information Systems (IS) department. Since the mid 1980's, as the strategic impact of IT became evident, researchers and practitioners alike have argued that the management of IT and leadership in IT must be a shared endeavour between IT professionals and line managers (Henderson, 1990; Keen, 1991; Rockart, 1988; Sambamurthy and Zmud, 1994; Smith, 1996). From this, a new role for business managers has emerged. To achieve successful IT planning and implementation, it is essential for business managers to take a leadership position in these activities. Many of these views are captured in the following quote from Rockart, Earl, and Ross (1996, p.53):

> *"The success or failure of an organization's use of IT [...] is only partially dependent on the effectiveness of the IT organization. It is even more dependent on the capability of line managers at all levels to understand the capabilities of the IT resource and to use it effectively".*

To address this new role, business managers need to include IT-related knowledge in their knowledge base. Such cross-functional knowledge in individuals enables organizations to leverage their knowledge resources. At the organizational level, knowledge is a core competency of the firm (Prahalad and Hamel, 1990), whose importance has been increasingly recognized. In the resource-based view of the firm, knowledge is commonly seen as the most strategically significant resource (Conner and Prahalad, 1996). Knowledge is also an organizational capability that is a source of sustainable competitive advantage (Kogut and Zander, 1992; Prahalad and Hamel, 1990).

But knowledge is privately held and resides in specialized form among individual organizational members. To create competitive advantage, knowledge possessed by a firm as a whole must be accessible to the right people at the right time in the right place. In order to develop this firm-level competence, an integration of the different knowledge bases is required (Grant, 1996). While it is not possible for each individual to learn knowledge possessed by all other specialists in an organization, Grant (1996) suggests that the integration will be facilitated when common knowledge is shared between different specialists. Common or shared knowledge represents the overlap of knowledge among different specialists that enables them to communicate (Demsetz, 1991).

Some studies have highlighted the importance of shared knowledge, specifically between IT professionals and their business clients, by looking at how it influences their ability to achieve alignment of business and IT objectives mainly through communication (Reich and Benbasat, 2000), as well as how it contributes to information system (IS) group performance (Nelson and Cooprider, 1996). Shared knowledge among IT specialists and business managers represent their ability "at a deep level, to understand and be able to participate in the other's key processes and to respect each other's unique contribution and challenges" (Reich and Benbasat, 2000, p.86).

This study focuses on business managers and their knowledge in the IT domain that will enable them to assume their new leadership role in regards to IT. The literature on the subject lacks an in-depth discussion of the specific competence construct and its measures that will allow researchers to empirically test statements about the new leadership role of business managers. For example, Reich and Benbasat (2000) observed that *shared knowledge* between business managers and IT professionals is an important enabler of the alignment of business and IT objectives. While IT knowledge of line managers and business knowledge of IT professionals were measured in their study, this was done in a qualitative, aggregate way in a case study setting. Reich and Benbasat have therefore suggested that further work be undertaken to measure these constructs in a more detailed way in order to fully understand its nature and the influence of their dimensions. Only with such constructs and tests will it be possible to find out what *specific types* of IT knowledge in business managers lead to IT leadership and successful IT utilization, and from this, to achieve an understanding of the kinds of knowledge that we, as IS academics, need to convey to current and future managers.

This chapter describes the development and testing of an instrument to measure the IT competence of business managers. It is the first in a series of studies; the next study will investigate business competence in IT people, and the third the influence of shared knowledge on alignment and other positive impacts of the appropriate deployment of IT resources. Section 2.2 of this chapter summarizes the literature supporting our definition of IT competence and describes how its dimensions and sub-dimensions are conceptualized. Section 2.3 discusses the criterion variable, namely IT line leadership, used to measure the nomological validity of the measures developed. Section 2.4 describes the development of measures including the validation process. Sampling design, and confirmatory analysis are described in detail. Nomological validity is also examined by measuring the relationship between IT competence and a business manager's line leadership. Section 2.5 discusses the findings, identifies the limitations, and highlights the implications of this work. It is our hope that, with refinement, this instrument will prove valuable to researchers and practitioners alike, allowing them to map the IT competence in an organization, to identify factors blocking and enabling IT competence, and to implement corrective actions.

2.2 Defining IT Competence of Business Managers

Knowledge is a key part of competence. But as competence is grounded in everyday practice (Orlikowski, 2002), knowledge on its own is not sufficient to represent competence. In that sense, competence is more than the knowledge possessed by individuals; it also encompasses the use or exploitation of such knowledge—the ability to put knowledge into practice (Brown and Duguid, 1998). It is the process of search and learning—embracing different types of knowledge and activities—that will lead to performance (Karnøe, 1995).

These two aspects of knowledge and practice are found at different levels. In their explanation of why some firms continually innovate, Cohen and Levinthal introduced the term "absorptive capacity" and suggested that it refers "not only to the acquisition or assimilation of information by an organization, but also to the organization's ability to exploit it" (Cohen and Levinthal, 1990, p.131). At the individual level, common knowledge refers to the commonality of vocabulary, conceptual knowledge, and experiences among individual specialists (Grant, 1996), focusing on the importance of both knowledge and practice. In the practitioner literature, according to Forrester Research, the new technology executive is one "who appreciates technology's capabilities and uses technology as a lever to deliver outstanding business results" (Smith, 1996, p.39). We, therefore, conceptualize competence as a duality, including the knowledge and experience of the business manager.

Other frameworks have sought to expand on the concept of knowledge either by dividing it into explicit and tacit forms, or by adding the concept of *knowing*. According to Cook and Brown (1999), knowing refers to the ability to put knowledge into practice, and knowledge is seen as something someone possesses. They refer to *knowing* as belonging to an epistemology of practice, and knowledge as being part of an epistemology of possession. Knowledge is also specialized—a usable body of facts and concepts relevant for a particular job (Boyatzis, 1982). We can further distinguish between these concepts by noting that knowledge is static and is something we *use* in action, while knowing is dynamic and is *part* of the action.

Many organizational studies use the taxonomy of knowledge that distinguishes *tacit* from *explicit* knowledge. Based on this taxonomy, explicit knowledge is knowledge that can be taught, read, and explained (Nonaka, 1994; Polanyi, 1967; Ryle, 1949). Polanyi identified that knowledge consists of more than the explicit, formal knowledge that can be clearly transmitted using systematic language. Individuals also know how to do things that they may not be able to render in an explicit fashion (Polanyi, 1967). Although most people can walk without difficulty, for example, few can explain the mechanics and techniques that make us able to walk. Therefore, tacit knowledge is gained through personal experience and is not easily transmittable (Nonaka, 1994; Polanyi, 1967; Ryle, 1949). One main challenge with this taxonomy is that while the concept of tacit knowledge is intuitively easy to understand, it is difficult to model and capture.

The relationship between these two taxonomies is complex. Despite the greater recognition of the importance of knowing as a distinct element from knowledge, how this fits with the explicit-tacit taxonomy is not clear. Some argue that tacit knowledge is distinct from knowing (Cook and Brown, 1999) while others claim that it is a form of knowing (Orlikowski, 2002, p 253). But both perspectives highlight the role of *action* in knowing.

What emerges from these studies is the importance of a multidimensional perspective of competence. Based on this, it becomes essential to look at what people *do* as well as at what they *possess* to understand competence. The nature of competence is therefore defined by the knowledge and experience of business managers. The knowledge dimension captures the specialized knowledge that is relevant to becoming competent with IT. The experience dimension captures the activities that business managers engage in to deepen their tacit knowledge and their knowing.

In this study, we are interested in investigating the capability that enables business managers to effectively apply IT in their business units. We suggest that their competence in the IT domain represents the potential that leads to an effective behavior—i.e., line IT leadership. Although it is clear that business managers need to know about IT, the essential question is *what should they know in order to be IT competent*?

Business managers who are competent in IT possess *IT knowledge* and *IT experience*, though their primary area of expertise is likely be in an area other than IT. Our intention is to develop an instrument that can identify these areas of knowledge, and that can also be generally applicable, not specific to any particular type of organization, business area, or level of business manager.

The model of IT competence that was operationalized and tested is shown in Figure 2.1, and is based on a model suggested in Bassellier, Reich, and Benbasat (2001). Each component is discussed further in the next section.

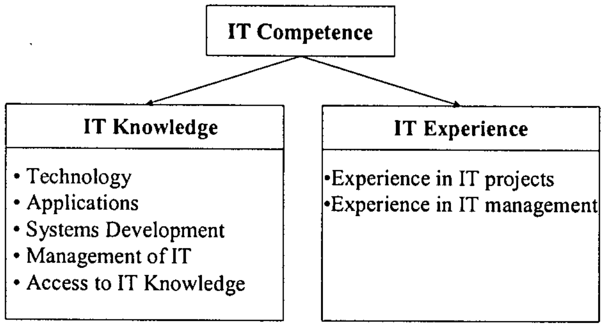

Figure 2.1 Research Model of IT Competence

2.2.1 IT Knowledge

By knowledge, we refer to specialized knowledge possessed by individuals: how well they understand fundamental IT concepts, how well informed they are about IT in their organization. IT knowledge enables business managers to communicate with IT people, and just as importantly, to understand the value of IT for their business units. As Keen (1991) noted, the main difficulty faced by managers resides not in a lack of awareness of IT or an unwillingness to participate in its management, but rather in a lack of the vocabulary and skills needed to participate in its different facets.

We evaluated the breadth and depth of the knowledge that reflect a business manager's level of IT competence. In terms of breadth, we first confirmed that our model focuses on the *IT* knowledge of business managers and excludes their business knowledge. Business managers are assumed to be familiar with their own external and internal business environment. Therefore, only those areas of knowledge within the IT domain are included in the IT competence construct. They are: (1) technology; (2) applications; (3) system development; (4) management of IT, and (5) access to IT knowledge.

These areas taken together represent the broad range of knowledge that a person can have in the IT domain. Definitions and some supporting literature are shown in Table 2.1.

Table 2.1 Linking the Areas of IT knowledge with Supporting Research

Areas of IT Knowledge	Definition	Research Support
Technology	Current and emergent technologies that are both generic to all industries and specific to the organization and its competitors.	Armstrong & Sambamurthy (1999) Keen (1991) Silver et al.(1995) Vitale et al. (1986)
Applications	Current and emerging IT application portfolio, where applications refer to the ways IT is or could be used by organizations to achieve their business goals (e.g., in order processing, decision support, or financial control).	Silver et al.(1995) Vitale et al. (1986)
System Development	Involves an understanding of both systems development methods and project management practices in order to understand the potential benefits, dangers, and limitations of IT.	Applegate et al. (1999) Keen (1991) Silver et al.(1995) Vitale et al.(1986)
Management of IT	IT management is composed of activities similar to those used in other areas—vision and goal setting, allocation of resources, and monitoring of progress.	Keen (1991) Silver et al.(1995) Sambamurthy & Zmud (1994)
Access to IT Knowledge	Knowing whom to contact to obtain more information about IT—both inside and outside of the organization—(e.g., colleagues, vendors, etc.) and secondary sources of knowledge (e.g., libraries, the Web),	Kogut & Zander (1992)

The first four components (technology, applications, system development, and management of IT) are based on the framework for IT knowledge in an MBA program (Silver et al., 1995). These components encompass the ideas suggested in the literature. For example, some studies have looked at the importance of being informed of IT assets and opportunities (Vitale, Ives, and Beath, 1986); understanding the value and potential of IT (Boynton et al., 1994); being aware of the limitations of current and future IT; knowing how the firm's competition is using IT (Armstrong and Sambamurthy, 1999); having a vision regarding how IT contributes to business value; and being aware of the integration of business strategic planning and IT strategic planning (Sambamurthy and Zmud, 1994).

The areas identified in the framework encompass the different levels at which IT is managed: 1) at the level of projects (implementing technology and applications using system development methods) and 2) at the organizational level of managing IT resources and specifying the vision for IT. This knowledge about the management of IT is needed to allow the task of managing IT to be shared by IT professionals and the rest of the firm's management.

The fifth component—access to IT knowledge, or knowing "who knows what"—is justified by the fact that people who have access to IT knowledge inside or outside the organization effectively have a higher level of IT knowledge than those who do not. Managers who know whom to contact or where to look to obtain more information about IT both inside and outside of the organization (e.g., colleagues, vendors, libraries, the web, etc.) increase their level of competence by leveraging the knowledge of others. The presence of this type of knowledge within an organization allows for the development of an effective working relationship among line managers and IT staff and can enable more effective IT leadership.

In terms of depth of IT knowledge, we assume that a business manager needs less IT knowledge than does an IT professional. As Keen suggests "the relationship between IT and business managers has to be one of mutual understanding—not of the details of each other's activities, knowledge, and skill base, but of the other's needs, constraints, and contributions to an organizational venture partnership" (Keen, 1991, p52). Therefore the knowledge in the research model focuses on the understanding of benefits of different types of IT, not on their specific features.

2.2.2 IT experience

By experience, we refer to the activities taking place in the particular organization context of the business managers' work. Experience is a *situated* action (Orlikowski, 2002). Although prescriptive advice regarding the need for experience is widespread, a careful delineation of what this should constitute has not yet been formulated. As with IT knowledge, the depth and the breadth of experience are integrated in the framework. The breadth refers to the diversity of activities in which experience occurs. Nonaka (1994) suggested that the *variety* of the experience influences its quality, which implies that managers should be involved in a diversity of activities.

Paralleling the areas of IT knowledge, experience can be gained at the level of projects and at the organizational level of managing IT. IT projects generally progress through several phases: initiation, cost-benefit analysis, development, and implementation. With respect to project experience, involvement in any of the stages of this life cycle is included as a potential source of increased competence (Vitale et al., 1986). Managers' involvement in directing the overall IT function can also augment their IT competence. All managerial activities—including vision and strategy setting, planning and budgeting, and policy setting—are needed to guide the use of IT within an organization. Definitions and some supporting literature are shown in Table 2.2.

Table 2.2 Linking the Areas of IT Experience with Supporting Research

Areas of IT experience	Definition	Research Support
Experience in IT Projects	Involvement in the life cycle of IT projects, such as initiation, cost/benefit analysis, development, and implementation.	Keen (1991) Reich and Benbasat (2000) Rockart et al. (1996) Vitale et al. (1986)
Experience in the Management of IT	Involvement in directing the overall IT function, such as vision and strategy setting, planning and budgeting, and policy setting.	Reich and Benbasat (2000) Zmud (1988)

The depth of experience can be linked to the intensity of experience. Nonaka identifies the "embodiment of knowledge through a deep personal commitment into bodily experience" (1994; p.22) as also influencing the quality of experience. The importance of intense experience is also found in the concept of absorptive capacity. According to Cohen and Levinthal (1990), intensity of effort in assimilating and using knowledge is critical in the development of effective absorptive capacity. IT experience increases business managers' understanding of IT, which in turn enables them to increase their leadership in the IT domain. The level of responsibility taken in the different activities represents the depth or intensity of the experience. Although experience does not reflect competence equally across all people, a person with more intense and more frequent experience will likely have a higher level of competence than a person with less frequent or less intense experience.

2.3 Developing the Criterion Variable: Line IT Leadership

Although the major focus of this research is to develop and measure a robust IT competence construct, it is also important to show that this construct predicts the kinds of behaviors one would expect from an IT competent business manager. Demonstrating predictive validity is one way to test for nomological validation, which examines a measure in relation to other theoretically related constructs, and predictive validity is best assessed within specific theoretical networks (Venkatraman, 1989). At the organizational level, Sambamurthy and Zmud (1994) developed a set of enterprise-wide IT management competencies. But at the individual level, no such theoretical network exists. Since this research was aimed at the individual level of analysis, it took some time to develop an appropriate criterion variable.

Based on the seminal work by Rockart (1988), we called the criterion variable "Line IT Leadership". According to Rockart et al. (1996), line managers are more likely to assume leadership in regard to IT when they have the appropriate IT education and training. Indeed, as competence enables better performance in individuals (Klemp, 1979), we expect that the IT competence of business managers will enable them to be more effective in planning and implementing IT projects, thereby improving their IT leadership. Two dimensions of the Line IT leadership construct—the extent to which the manager supports or promotes IT in their organizations, and the extent to which they strengthen relationships with IT people in their organizations—are identified (Bassellier et al., 2001). This two-dimensional view of Line IT Leadership was validated in interviews with 20 CIOs (Chan and Reich, 1999), and confirmed through informal discussions with line managers in local organizations. This view is also well supported in the IT literature.

For the first dimension, Rockart suggests that the optimum outcome of IT competence would be to have executives, who, like George David of the Otis Elevator Company, propose and implement "a major change in how the company used information systems" (1988, p.57). He argues that line managers need to take a strong role in both conception and implementation of information systems, to "actively exploit information technology resources." (1988, p.63). While the goal of senior managers identifying and steering the course of information systems is appropriate for the CEO and top management team, another path to successful implementation is a more balanced *partnership* approach (Henderson, 1990; Nelson and Cooprider, 1996). In this dimension, the desired outcome of having IT competent managers is their willingness to build a strong "relationship asset" between the IT unit and line managers (Ross et al., 1996). In this view, an IT competent business manager would seek out, and partner with, the IT department in order to maximize the value of IT within the company.

Because this study was cross sectional in design and therefore could not measure future behavior, we used self-reported intentions as a surrogate measure for Line IT Leadership. This approach is supported by the Theory of Reasoned Action (Fishbein and Ajzen, 1975), according to which *intentions* (of the managers) are the most important determinant of behavior. Items measuring these two dimensions are listed in Table 2.4.

In creating this two dimensional view of Line IT Leadership, we do not claim that these intended behaviors completely describe all the IT-related behaviors of IT-competent individuals, nor is the objective of this paper to do so. Our intent here is to provide evidence of predictive validity, and hence to show that competence influences certain important behaviors. After a thorough review of the literature and wide-ranging consultation, we feel confident that the measures used in this study capture two of the most important behaviors.

In developing this criterion variable, we did not intend to test the link between IT competence and organizational success. The literature supports the notion that partnerships between IT and line management lead to success by fostering successful project implementation (Bashein and Markus, 1997; Preiser-Houy, 1999), IT-based innovation (Boynton et al., 1994), sustainable competitive advantage (Henderson, 1990; Ross et al., 1996), and an ability to cope with business and technological changes (Feeny and Willcocks, 1998; Rockart et al., 1996).

We also know that part of the organizational resource and capability that is key to achieving better performance is the common knowledge that exists among different specialists in an organization. The contribution of common knowledge to organizational performance is accomplished by facilitating knowledge integration (Grant, 1996). Shared knowledge (between line and IT management) supports IT success (Sambamurthy and Zmud, 1994; Nelson and Cooprider, 1996). The research reported here measures one side of the shared knowledge construct, and its impact at the individual level. With a better understanding of the kinds of knowledge and experience constituting the IT competence, further investigation testing the impact at the dyad level (partnerships) and at the organizational level (IT and organizational success) will be possible.

2.4 Development of the IT Competence scale

We developed the scale used to measure IT competence by following a series of steps. First, from the literature, we developed the initial items, and then tested their measurement properties on a small scale using exploratory analysis. Finally, we conducted a full-scale test of measurement properties and of the structural model. Each of these procedures is reported below.

2.4.1 Preliminary item development

The starting point for item development was the previous empirical and theoretical literature (see Bassellier et al., 2001 for details). The model shown in Figure 1 builds on this literature. Using this model as a guide, we developed items based on previous research (see Tables 2.1 and 2.2) and supplemented this with new items that capture the different aspects of the constructs and sub-constructs that are represented in the model.

In developing the measure for IT competence our focus was in capturing managers' perceptions of their own knowledge, not an objective measure of knowledge. As it is this perception of self-efficacy that will influence the managers' behavior (Bandura, 1977), we considered it more relevant to assess this perception than to obtain an objective measure of knowledge.

Discussions held with faculty members and graduate students at our own institutions helped us to review the resulting set of items. We also obtained feedback following a presentation in an academic workshop sponsored by the Society for Information Management, where leading academics working on IT competence were in attendance. The IT competence construct was further discussed with a sample of 20 CIOs of leading firms (Chan and Reich, 1999) as part of an empirical research study investigating the ways that CIOs enhance the IT competence of their managers.

We next submitted the initial set of items to a card-sorting test (Moore and Benbasat, 1991) in which nine academics grouped the list of items into pre-defined categories. In general, the sorting resulted in a satisfactory classification of the items into the different dimensions of IT competence, as shown in Figure 2.1. It was necessary to modify some items in order to improve the clarity and comprehension of the words used and we deleted some items at this stage.

The items and scales were then subjected to two rounds of pilot testing. First, 37 students enrolled in two Executive MBA courses completed a questionnaire that included these items, and commented on its length, wording and instructions. Second, we spent approximately one hour each with four non-IT business managers who commented on the coverage of the items. Their suggestions on the clarity of the instrument resulted in formatting and wording changes.

2.4.2 Instrument pre-testing and refinement

A local insurance company agreed to help us in testing the reliability of the IT competence construct. A total of 48 questionnaires were sent to the managers in the company, from the Vice Presidents down to first level managers. In total, 42 respondents returned questionnaires, giving a response rate of 88%. The results of the reliability tests are shown in Table 2.3.

Table 2.3 Reliability Estimates for Pre-test

Dimensions	Sub-Dimensions	# items	Alpha
IT Knowledge	Knowledge of Technology	5	.86
	Knowledge of Applications	6	.86
	Knowledge of System Development	6	.94
	Knowledge of Management of IT	13	.96
	Access to IT Knowledge	3	.81
IT Experience	Experience in IT Projects	6	.93
	Experience in Management of IT	6	.90

Based on the results of this pilot test, we further modified the questionnaire. Our goal was to make the questionnaire more valid and reliable by clarifying, rephrasing, or eliminating problematic, obscure, and poorly answered items. These changes did not affect the overall structure shown in Figure 2.1. The resulting instrument contained 36 items to measure the constructs of interests shown in Figure 2.1. A 5-point Likert-type scale was used. The specific anchors used for the end of the scales are also listed in Table 2.4. Questions about demographic characteristics of the respondents and other questions related to the test of nomological validity were also included.

2.4.3 Full-scale test

We further assessed the measurement properties of the constructs in Figure 2.1 using confirmatory analysis and a larger sample. Confirmatory factor analysis allows the *a priori* specification of the relationships between the constructs and their indicators. The hypothesized relationships are then tested against the data. The model presented in Figure 2.1 suggests three levels of factors, or latent variables. The first order factors are the five dimensions of IT knowledge (knowledge of technologies, applications, system development, management of IT, and access to IT knowledge) and the two dimensions of IT experience (experience in IT projects, experience management of IT). For each of these seven factors, we developed indicators that uniquely measure that dimension of knowledge and experience. The seven factors at the first order measure two second-order factors: IT knowledge and IT experience. Lastly, a third-order factor—IT competence—is measured by the two factors at the second order factor level. We performed tests for convergent and unidimensionality validity, reliability, discriminant validity, and nomological validity. Models with higher-order factor structure are tested in the context of nomological validity. Results for test of this third-order factor model are presented and compared with other plausible models after the results for the measurement properties of the first order factor and the actual indicators. Each of these procedures is reported below. We used LISREL 8.5 (Jöreskog and Sörbom, 1996) to perform the test with maximum likelihood estimation using the covariance matrix.

2.4.4 Procedure

We empirically verified the IT competence model using the items shown in Table 2.4. The test was conducted with the cooperation of two organizations, both insurance companies in

North America. One company sells car and home insurance ($3.22 CDN billion in revenues, 5,144 employees) the other insures workers against loss of employment income ($1.6 billion CND in revenues, 2,500 employees). Target respondents were business managers at all hierarchical levels. In each company, the questionnaire was distributed to each non-IT manager in the organization. The cover letter was signed by the CIO. The respondents mailed the surveys directly back to the researchers.

2.4.5 Sample Characteristics

952 questionnaires were distributed; 467 were returned for a response rate of 49% (car and home insurance company: 346/737= 47%; workers insurance company: 121/215=56%). The 404 usable questionnaires were included in the analysis. In the final sample, 63% of the respondents were male; 68% were in the 35 to 50-age range. Average tenure in the current organization was 12 years.

Mean and standard deviations for all variables are listed in Table 2.4. Values for the experience items represent an aggregation of the two levels of responsibilities that were assessed: participation and leadership. A large proportion of the respondents answered for only one level. When both figures were provided (58%), we took the value of whichever was higher. Other aggregation schemes, such as additive or multiplicative adjustment, were not theoretically or conceptually justified. Despite this adjustment, means for the experience variables remains low, showing that the experience of our respondents in IT activities, either at the project or at the management level, is not extensive.

The data set was randomly split in two; the first half was used to test the measurement properties of the first-order factor and to refine the scales. Next, the higher-order models of IT competence and their impact on the dependent variable were tested using the second half of the data set. Both data sets exceed the recommended sample size of approximately 200 (Hair et al., 1998).

2.5 Assessment of measurement properties (first order factor model)

We first tested the fit of the *initial* 36 items specified to load on seven dimensions (see items in Table 2.4 and model in Figure 2.1). Statistics in Table 2.5 show mixed results for the fit of this initial model with the data when compared with thresholds values suggested by the literature. The χ^2 statistic, Goodness of Fit Index (GFI) and Root Mean Square Residual statistic (RMSR) are absolute indices representing the ability of the model to reproduce the actual covariance matrix. The χ^2 statistic (1236.10, p>.00) is large and significant implying that the null hypothesis of covariance matrix equality is rejected, indicating poor model fit. The overall degree of fit is not good, as reflected with a GFI of .75, below the recommended values of .90 (Gefen, Straub, and Boudreau, 2000). The standardized RMSR characterizes the residual variance of the observed variables; as high values suggest high residual variance, smaller values are better (Gefen et al., 2000).

Table 2.4 List of Items for IT Competence

Item	Dimensions/Question	Scale	Mean (std dev)
	Knowledge of Technologies		
T1	What is your general knowledge of personal computer?	a	4.223 (.85)
T2	What is your general knowledge of client-server?	a	3.163 (1.15)
T3	What is your general knowledge of LAN?	a	3.406 (1.12)
T4	What is your general knowledge of imagery technology?	a	3.025 (1.08)
T5	What is your general knowledge of multimedia?	a	3.050 (1.05)
	Knowledge of Application		
*A1**	*What is your general knowledge of e-mail?*	*a*	*4.554 (.63)*
A2	What is your general knowledge of WWW?	a	3.782 (1.08)
A3	What is your general knowledge of electronic data interchange?	a	2.584 (1.28)
A4	What is your general knowledge of E-commerce?	a	2.609 (1.27)
A5	What is your general knowledge of Groupware?	a	2.238 (1.11)
*A6**	*What is your general knowledge of Enterprise Resource Planning?*	*a*	*2.495 (1.22)*
	Knowledge of system development		
S1	What is your general knowledge of traditional system development life cycle?	a	2.094 (1.22)
S2	What is your general knowledge of end-user computing?	a	2.411 (1.26)
S3	What is your general knowledge of prototyping?	a	2.213 (1.24)
S4	What is your general knowledge of outsourcing?	a	2.450 (1.22)
*S5**	*What is your general knowledge of acquisition of software packages?*	*a*	*2.708 (1.19)*
S6	What is your general knowledge of project management practices?	a	3.084 (1.24)
	Knowledge of Management of IT		
*M1**	*Indicate your level of knowledge about the current hardware (e.g., computers, communication networks) assets of your business unit?*	*b*	*2.866 (1.13)*
M2	Indicate your level of knowledge about the current IS applications	b	2.970 (1.12)

	(including software, data) assets of *your business unit*?		
M3	How informed are you about the IT budget in *your business unit?*	b	1.921 (1.17)
M4	How informed are you about the IT strategies in *your business unit?*	b	2.421 (1.22)
M5	How informed are you about the IT policies in *your business unit?*	b	2.317 (1.14)
M6	How informed are you about the IT vision statements in *your business unit?*	b	1.896 (1.11)
*M7**	*How knowledgeable are you about your competitors' use of IT?*	*c*	*2.084 (1.10)*
	Knowledge of access to information		
N1	How knowledgeable are you about IT or business people to contact within your organization as source of information about IT?	c	3.277 (1.04)
N2	How knowledgeable are you about IT or business people to contact outside your organization as source of information about IT?	c	2.094 (1.07)
N3	How knowledgeable are you about secondary sources of knowledge as source of information about IT?	c	2.554 (1.06)
	Experience in IT projects		
P1	How often you have participated in and/or led in initiating new IS projects?	d	2.342 (1.33)
P2	How often you have participated in and/or led in identifying the cost & benefits of IS projects before they are developed; preparation of business cases?	d	1.955 (1.28)
P3	How often you have participated in and/or led in managing information systems projects?	d	2.005 (1.26)
P4	How often you have participated in and/or led in developing information systems?	d	1.733 (1.18)
*P5**	*How often you have participated in and/or led in implementing information systems projects?*	*d*	*2.089 (1.27)*
	Experience in general management of IT		
G1	How often you have participated in and/or led in creating an IT vision statement regarding how IT contributes to business value and strategy?	d	1.376 (0.89)
G2	How often you have participated in and/or led in developing IT strategy?	d	1.599 (1.10)
G3	How often you have participated in and/or led in creating IT policies?	d	1.485 (0.98)
G4	How often you have participated in and/or led in setting IT budgets?	d	1.485 (0.99)
	Line leadership		
IN1	To what extent do you intent to create or strengthen partnership/alliances with IT people within your organization?	e	3.055 (1.16)
IN2	To what extent do you intend to support/promote the use of IT in your division?	e	3.945 (1.06)

* Items dropped after testing of measurement properties

Scale:

a.	1. never heard of - 3. know about them in general - 5. understand their value to the organization
b.	1. uninformed - 5. very well informed
c.	1. not at all knowledgeable - 5. extremely knowledgeable
d.	1. never - 5. many times
e.	1. very little extent – 5. very great extent

Table 2.5 Goodness-of-Fit Indices for the IT Competence Measurement Model

	Initial Model (Model 1)	Revised Model (Model 2)	Desired levels
Total number of items	36	30	
χ^2	1236.10	686.47	smaller
df	573	384	-
χ^2/df	2.16	1.79	<3.0
GFI	.75	.81	>0.9
AGFI	.70	.78	>0.8
Standardized RMR	.063	.	<.05
RMSEA	.076	.063	.05-.08
NFI	.80	.86	>.90
CFI	.88	.92	>.90

Incremental fit measures comparing the model to the null model (single-factor model with no measurement error) and parsimonious fit measures relating the goodness-of-fit of the model to the number of estimated coefficients required to achieve the level of fit are used to complement the absolute indices (Hair et al., 1998). The Adjusted Goodness of Fit Index (AGFI) and the Normed Fit Index (NFI) are statistics between 0-1 that compare the proposed model to the null model, with a value of one indicating a perfect fit. The AGFI is the GFI adjusted by the ratio of degrees of freedom for the proposed model to the degrees of freedom for the null model. The value of .70 does not meet the recommended values of .80 (Gefen et al., 2000). The NFI gives a relative comparison of the proposed model to the null model. A value of 1.0 indicates a perfect fit, but values of .90 or greater usually indicate an acceptable level of fit (Hair et al., 1998). The observed value of .80 is below this recommended threshold.

Since it is possible to obtain a better fitting model by estimating more parameters, we use the parsimonious fit indices to evaluate the fit of the model relative to the number of estimated coefficients (or, conversely, the degrees of freedom) needed to achieve that level of fit. Among those indices are the normed χ^2 (χ^2/df), which adjusts the χ^2 by the degree of freedom, and the Root Mean Square Error of Approximation statistic (RMSEA), a measure of discrepancy per degree of freedom. Appropriate values for the normed χ^2 should exceed 1 and should be less than 2 or 3 in a conservative test, or 5 in a more liberal test (Hair et al., 1998). The initial model has an acceptable normed χ^2 of 2.16. The RMSEA value of .076 is also within the acceptable range of .05 to .08 (Hair et al., 1998).

Based on these results, with only the parsimonious fit indices suggesting an acceptable fit, we concluded that the fit of the initial first order factor model is not satisfactory. To improve the overall fit, we assessed measurement properties of each dimension and undertook modifications. As described in Sethi and King (1994), the objective of this approach is to isolate and locate the misspecifications in each dimension. Once each dimension meets the reliability and validity criteria, the revised full model can be tested again. In a complex model, this "piecewise model fitting" approach helps to identify the part of the model with a poor fit (Bollen, 1989). The measurement properties tested for each individual dimension are the unidimensionality and convergent validity, the reliability, and discriminant validity. Since higher order models are best assessed within the nomological validity context (Chin, 1998), results for the validity of the higher order models are reported together with the test of the overall model in the next section.

Unidimensionality and convergent validity ensures that all items measure a single underlying construct (Bagozzi and Fornell, 1982). For each dimension, the refinement of the scale followed an iterative procedure, where only one item was changed at every step (Jöreskog, 1993). Modifications were based on factor loadings and modification indices (values calculated for each unestimated relationship possible in a specified model) and were performed only when theoretically justified. The specific steps undertaken to refine the scales and obtain parsimonious meaningful sets of indicators are detailed in Table 2.6. Standardized factor loadings were expected to meet the minimum recommended value of .70, which indicates that the indicator reliability is over .50 (Hair et al., 1998). We modified the model until all parameters estimates and overall fit measures for each dimension were considered satisfactory. The items deleted were very similar to other items belonging to the same scale, and the shared variance was reflected by high modification indices for correlation of the error terms. We dropped a total of six items as a result of this procedure (items dropped are identified in Table 2.4).

Table 2.6 Steps for IT Competence Scale Refinement

Factor 1: Knowledge of Technologies									
Items	# items	df	χ^2	p	χ^2/df	RMSEA	GFI	AGFI	CFI
T1… T5	5	5	12.18	.00	2.44	.085	.98	.93	.94
1. Results show satisfactory fit. No modifications were performed.									

Factor 2: Knowledge of Applications									
Items	# items	df	χ^2	p	χ^2/df	RMSEA	GFI	AGFI	CFI
A1… A6	6	9	77.51	.00	8.61	.195	89	.73	.89
(A2… A6)	5	5	48.24	.00	9.65	.107	.91	.74	.92
(A2… A5)	4	2	2.56	.00	1.28	.037	.99	.97	1
1. Modification index (26.95) indicated a high error correlation between A1 & A2. A1 was dropped because of its low loading factor (.35). 2. A high error correlation was also found between A6 & A4 (MI=17.50) and A6 & A5 (MI=38.66). A6 is dropped in the interest of parsimony.									

Factor 3: Knowledge of system development									
Items	# items	df	χ^2	p	χ^2 /df	RMSEA	GFI	AGFI	CFI
S1… S6	6	9	77.78	.00	8.64	.195	.89	.73	.94
S1… S4, S6	5	5	26.29	.00	5.26	.146	.95	.85	.98
1. The initial model does not show satisfactory results. A high modification index is indicated between S5 & S6 (24,11) and S5 & S4 (18.55), reflecting strong correlation between their error terms. For parsimony, S5 was dropped. Indices then show excellent fit.									

Factor 4: Knowledge of management of IT									
Items	# items	df	χ^2	p	χ^2 /df	RMSEA	GFI	AGFI	CFI
M1…M7	7	14	84.21	.00	6.02	.158	.89	.79	.91
M2… M7	6	9	12.89	.00	1.43	.046	.98	.95	.99
M2…M6	5	5	6.98	.00	1.40	.044	.99	.96	1
1. High and unexpected error correlation between M1 & M2 (MI=63.63). M1, with the lowest factor loading (.69), is removed. 2. Although the model shows satisfactory fit, M7 is dropped because of its low factor loading (.51).									

Factor 5: Knowledge of access to information									
Items	# items	df	χ^2	p	χ^2 /df	RMSEA	GFI	AGFI	CFI
(N1… N3), (M2, M3, M4, M5, M6)	8	19	33.62	.02	1.77	.062	.96	.92	.98
With only three items, statistical fit cannot be obtained (degree of freedom being equal to 0). Therefore, these three items were added to the 5 items of factor 4 (M1, M3, M4, M5, M6), and a two-factor model was tested. 1. Results show excellent fit. No modifications were performed.									

Factor 6: Experience in IT projects									
Items	# items	df	χ^2	p	χ^2 /df	RMSEA	GFI	AGFI	CFI
P1… P5	5	5	21.66	.00	4.33	.129	.96	.88	.97
P1… P4	4	2	5.72	.057	2.86	.096	.99	.93	.99
1. P5 was dropped because of the high error correlation with P2 (MI=12.64) and no justification for it.									

Factor 7: Experience in management of IT									
Items	# items	df	χ^2	p	χ^2 /df	RMSEA	GFI	AGFI	CFI
G1… G4	4	2	5.25	.07	2.63	.090	.99	.94	.99
2. The initial model shows acceptable results, and therefore no modifications were performed.									

The internal consistency of each dimension was assessed by examining estimates of composite reliability and variance (Hair et al., 1998). Composite reliability reflects the degree to which the construct is represented by the indicators. The overall amount of variance in the indicators accounted for by the construct reflects the extent to which the indicators are truly representative of the construct. All results, as reported in Table 2.7, exceed the recommended value of .7 for composite reliability and of .5 for variance explained (Hair et al., 1998)

Table 2.7 Estimates of Composite Reliability and Variance Extracted

Dimensions	# items	Composite Reliability	Variance extracted
Knowledge of Technologies	5	.88	.60
Knowledge of Applications	4	.88	.64
Knowledge of System development	5	.94	.75
Knowledge of management of IT	5	.89	.62
Access to IT knowledge	3	.77	.53
Experience in IT projects	4	.86	.61
Experience in management of IT	4	.92	.75

Discriminant validity reflects the extent to which the measures for each dimension are distinctively different from each other. It was assessed using chi-square difference test (Venkatraman, 1989). For each pair of constructs, the fit of the previously identified model was compared with the fit of a model where the two constructs are said to be not distinct. Constraining the correlation between the pairs of constructs to be 1.0 suggests that all the items measure the same construct. A significant difference between the χ^2 measures is supportive of discriminant validity (Venkatraman, 1989). Table 2.8 reports the results of 21 pairwise tests. All chi-square differences are significant at the $p<0.01$ level, indicating strong support for discriminant validity. In addition, the estimated correlations between all pairs of constructs (Figure 2.2) are below the threshold value of .90 (Bagozzi, Yi, and Philipps, 1991) reflecting that the constructs are distinct.

Table 2.8 Assessment of Discriminant Validity

Dimensions	Constrained Model χ^2 (df)	Unconstrained model χ^2 (df)	$\Delta\chi^{2*}$
Knowledge of Technologies with			
Knowledge of Applications	193.16(27)	69.57(26)	123.59
Knowledge of System Development	407.15(35)	102.91(34)	304.24
Knowledge of Management of IT	548.13(35)	71.65(34)	476.48
Access to IT Knowledge	109.88(20)	51.44(19)	58.44
Experience in IT Projects	461.36(27)	61.19(26)	400.17
Experience in Management of IT	652.60(27)	53.65(26)	598.95
Knowledge of Applications with			
Knowledge of System Development	254.56(27)	53.04(26)	201.52
Knowledge of Management of IT	423.74(27)	47.98(26)	375.76
Access to IT Knowledge	95.55(14)	32.75(13)	62.80
Experience in IT Projects	382.35(20)	31.46(19)	350.89
Experience in Management of IT	432.41(20)	15.60(19)	416.81
Knowledge of System Development with			
Knowledge of Management of IT	553.69(35)	86.14(34)	467.55
Access to IT Knowledge	100.15(20)	42.51(19)	57.64
Experience in IT Projects	265.97(27)	68.85(26)	197.12
Experience in Management of IT	596.44(27)	54.16(26)	542.28
Knowledge of Management of IT with			
Access to IT Knowledge	96.67(20)	33.62(19)	63.05
Experience in IT Projects	448.67(27)	60.67(26)	388.00
Experience in Management of IT	684.68(27)	67.99(26)	616.69
Access to IT Knowledge with			
Experience in IT Projects	104.60(14)	14.48(13)	90.12
Experience in Management of IT	124.63(14)	17.84(13)	106.79
Experience in IT Projects with			
Experience in Management of IT	100.11(20)	35.07(19)	65.04

* *All differences are significant (for 1 degree of freedom) at 0.01 level*

Now that each dimension exhibits properties of good reliability and validity, the fit of this revised model can be assessed. The model—which now includes 30 items—is satisfactory and shows good and improved model parameters (Table 2.5). All the items, except 2, have satisfactory standardized factor loadings (Figure 2.2). One item in the "knowledge of applications" and another in the "access to IT knowledge" measures are slightly below the desired level of .7, but still in an acceptable range, i.e., above the .6 threshold suggested by Chin (1998).

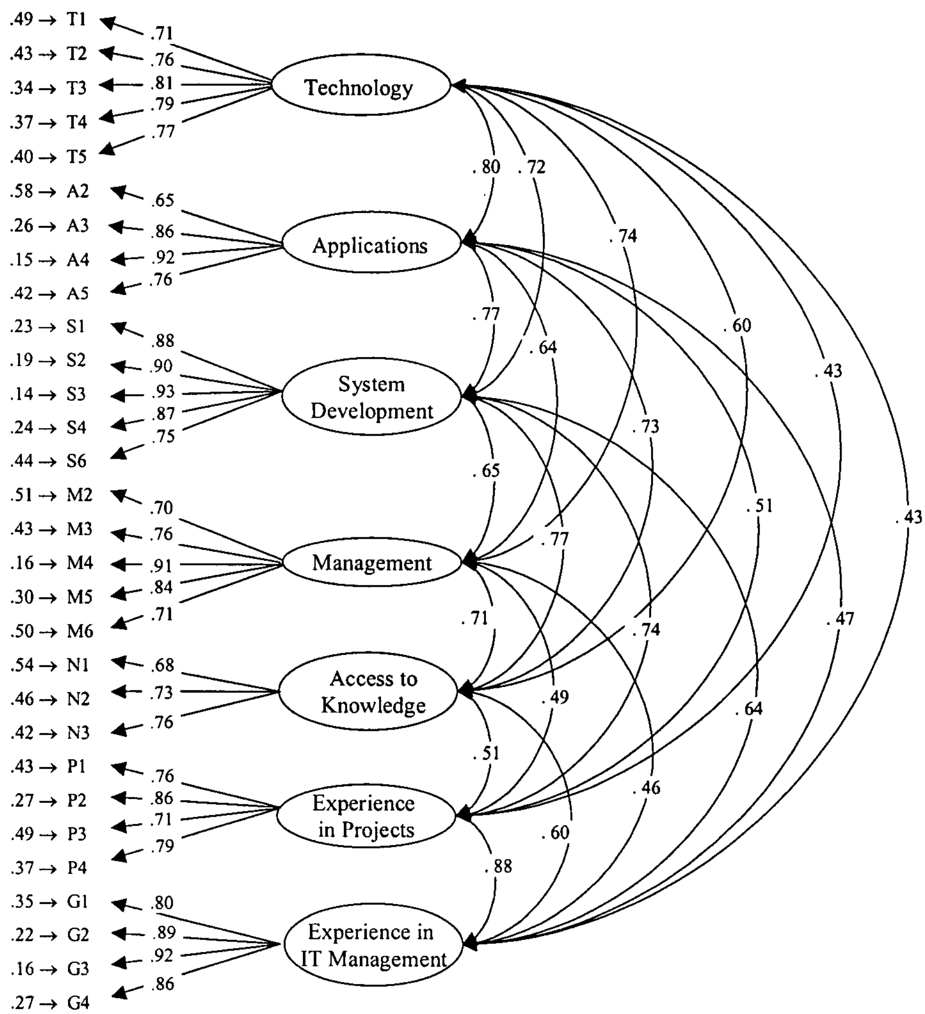

Figure 2.2 Final Measurement Model of IT Competence (first half of dataset)

With the measurement properties of the first order model tested and providing satisfactory results, higher order analysis, as suggested by the theoretical model, is investigated next, using the second half of the dataset.

2.6 Model Testing (higher order factor model)

We performed higher order factor analysis to test the IT competence model shown in Figure 2.1. Higher-order factor models have both statistical and theoretical meaning. Statistically speaking, a higher-order factor suggests that the correlations among the first order factors are governed by higher-level factors. Higher-order factors are therefore relevant when the correlation among the lower-order factors is high. Our representation of IT competence suggests that the structure of interrelationship among the seven first order factors and the two second-order factors is part of the IT competence construct. In other words, the domain of the IT competence construct is captured by the first order factors and the second order factors. This representation is supported by the pattern of intercorrelations at each level. When observing the pattern of intercorrelations between the first order latent variables representation (Table 2.9), we found high and significant correlation between the first order factors belonging to knowledge and those belonging to experience. A high, and significant, correlation (.77; p<.01) also exists between the second order factors— knowledge and experience, the two hypothesized dimensions of IT competence.

Table 2.9 Correlation Between First-order Latent Variables (second half of dataset)

	1	2	3	4	5	6
1. Knowledge of Technologies	1.00*					
2. Knowledge of Applications	.77	1.00				
3. Knowledge of System Development	.75	.78	1.00			
4. Knowledge of Management of IT	.49	.53	.59	1.00		
5. Access to IT knowledge	.70	.71	.80	.75	1.00	
6. Experience in IT projects	.47	.54	.76	.53	.70	1.00
7. Experience in Management of IT	.46	.53	.68	.52	.70	.87

*All correlations are significant at .01 level.

The meaning of higher-order factors goes beyond their ability to account for covariance. Higher order factors are modeled at a higher level of abstraction, and their justification needs to be related to factors at that same level of abstraction (Chin, 1998). The dependent variable investigated in this study is at a high level of abstraction: IT line leadership refers to broad behaviors that are better linked to an overall level of IT competence, not to specific areas of knowledge or the individual factors of IT knowledge and IT experience.

Predictive validity tests the ability of a scale to empirically confirm theory-based predictions involving the construct that the scale is intended to measure. It is one way to test for nomological validity, which examines the relationships of a measure of interest with measures of theoretically related constructs (Venkatraman, 1989). Predictive validity is best assessed within specific theoretical networks. Since there is no well-established theoretical network for IT competence in business managers, predictive validity was tested within a new framework that is theoretically defendable. IT research (described in Section 3) supports the idea that the level of IT competence in business managers will influence their leadership in regards to IT.

Competence is seen here as influencing the proactive behaviors of managers, meaning that it is the overall level of IT competence that directly impacts their intentions to behave proactively. Results in the form of standardized parameters for the third order factor model are presented in Figure 2.3.

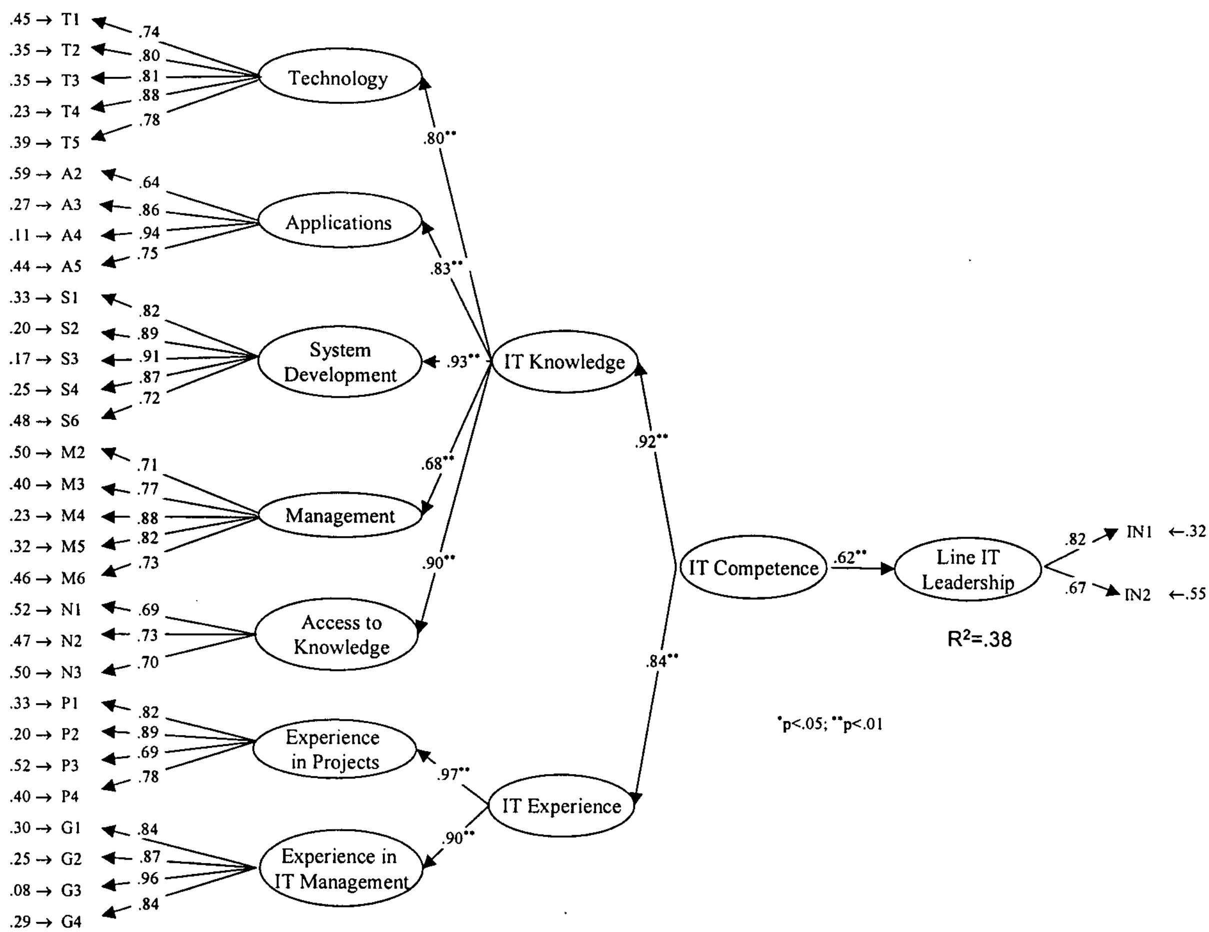

Figure 2.3 Third-order Factor Model (Model 3)

The suggested third-order factor model contains three sub-models: the first-order factor model, the second-order factor model, and the third-order factor model. The measurement properties of the first-order factor model linking the indicators and the latent variables were assessed earlier. The parameters are the same, except for the pattern of intercorrelations among the latent variables that are now replaced by the paths linking the second-order factors to the first-order factors.

The second-order factor model introduces these new regressions of the first-order factors on the second-order factors. Standardized values for these coefficients are all high, ranging from .68 to .97, and significant ($p<.01$).

The role of the IT competence as a third-order factor is to explain the covariance between the IT knowledge and IT experience. The strength of the paths linking IT competence to IT knowledge (.92; $p<.01$) and IT experience (.84; $p<.01$) are supportive of convergent validity for the third order factor model[1]. The significance and magnitude of the path linking IT competence to IT line leadership (.62; $p<.01$) attests to the nomological validity of the IT competence construct. The overall fit of Model 3 is satisfactory (Table 2.10).

Table 2.10 Goodness-of-Fit Indices for the Different Models of IT Competence

	Model 3 Third-order factor (Figure 2.3)	Model 4 First-order factor (Figure 2.4)	Model 5 Two second-order factors (Figure 2.5)	Model 6 One second-order factor (Figure 2.6)	Desired levels
χ^2	835.39	747.82	835.39	925.42	smaller
df	454	436	454	456	-
χ^2/df	1.84	1.72	1.84	2.03	<3.0
p	.00	.00	.00	.00	
Target coefficient	.90	—	.90	.81	
GFI	.79	.81	.79	.78	>0.9
AGFI	.76	.77	.76	.74	>0.8
RMSEA	.065	.060	.065	.072	.05-.08
NFI	.85	.86	.85	.83	>.90
Model AIC	983.39	931.82	983.39	1069.42	smaller
CFI	.92	.93	.92	.91	>.90

[1] For convergent validity of the third order factor to be adequately tested, at least four second-order factors are required (Marsh and Hocevar, 1985).

To confirm the appropriateness of the third-order factor model, we compare it with three different alternative models. The first model used is the baseline, first-order factor model. Model 4 is the baseline model and shows the seven first-order factors directly influencing the dependent variable (Figure 2.4). This representation suggests that the factors are independent in their influence of the line IT leadership. Results for this model are mixed. On the one side, the overall fit of the model is satisfactory, with values meeting the recommended values for most indices (Table 2.5). But on the other side, this model includes four non-significant, and two negative paths linking independent variables to the dependent variable.

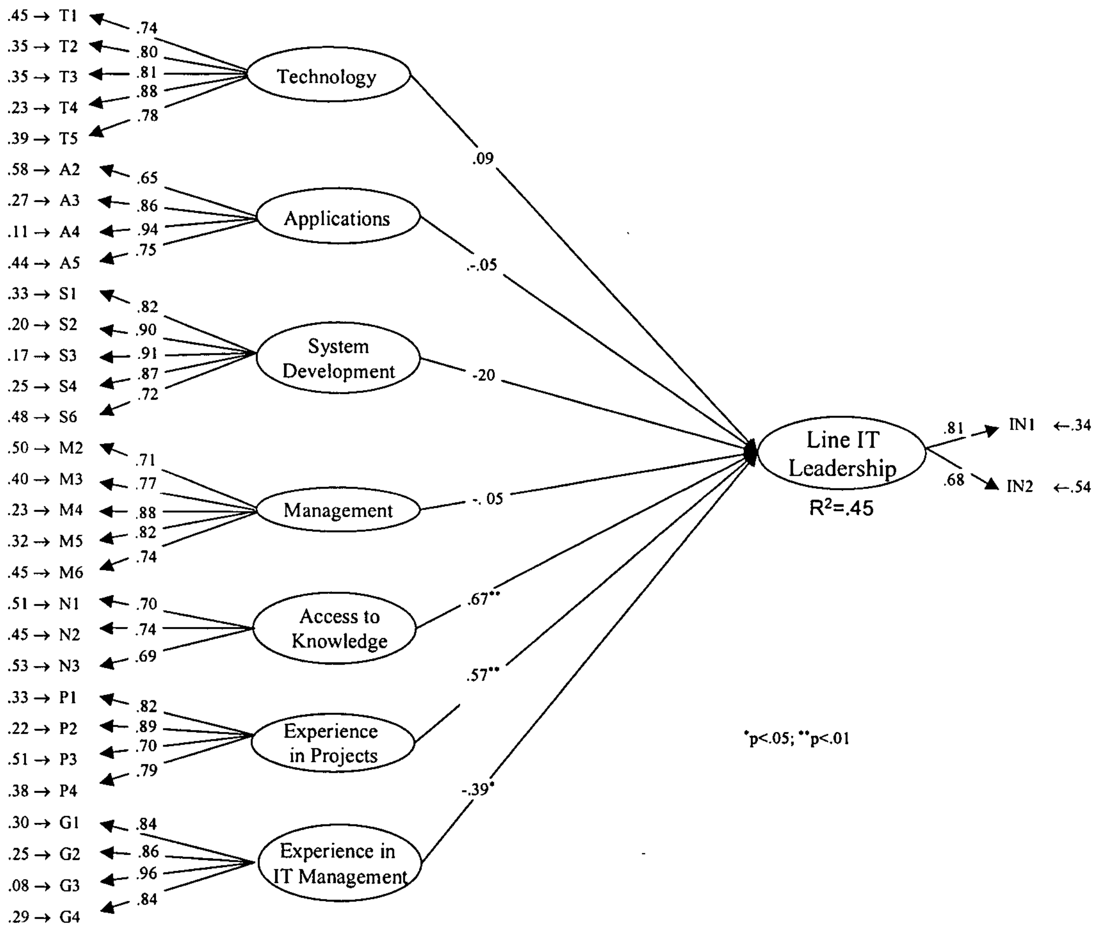

Figure 2.4 First-order Factor—Baseline Model (Model 4)

Two other models are compared to our suggested conceptualization of IT competence—one in which IT knowledge and IT experience are seen as the highest order factors (model 5) and one in which IT competence is a second-order factor reflected by the seven areas of knowledge and experience (model 6).

In model 5, IT knowledge and IT experience are hypothesized to explain the variance among the seven first-order factors. Based on the conceptualization of IT competence previously developed (Figure 2.1), five factors are dimensions of knowledge and two factors are dimensions of experience. Results in the form of standardized parameters for this two second-order factors model are presented in Figure 2.5.

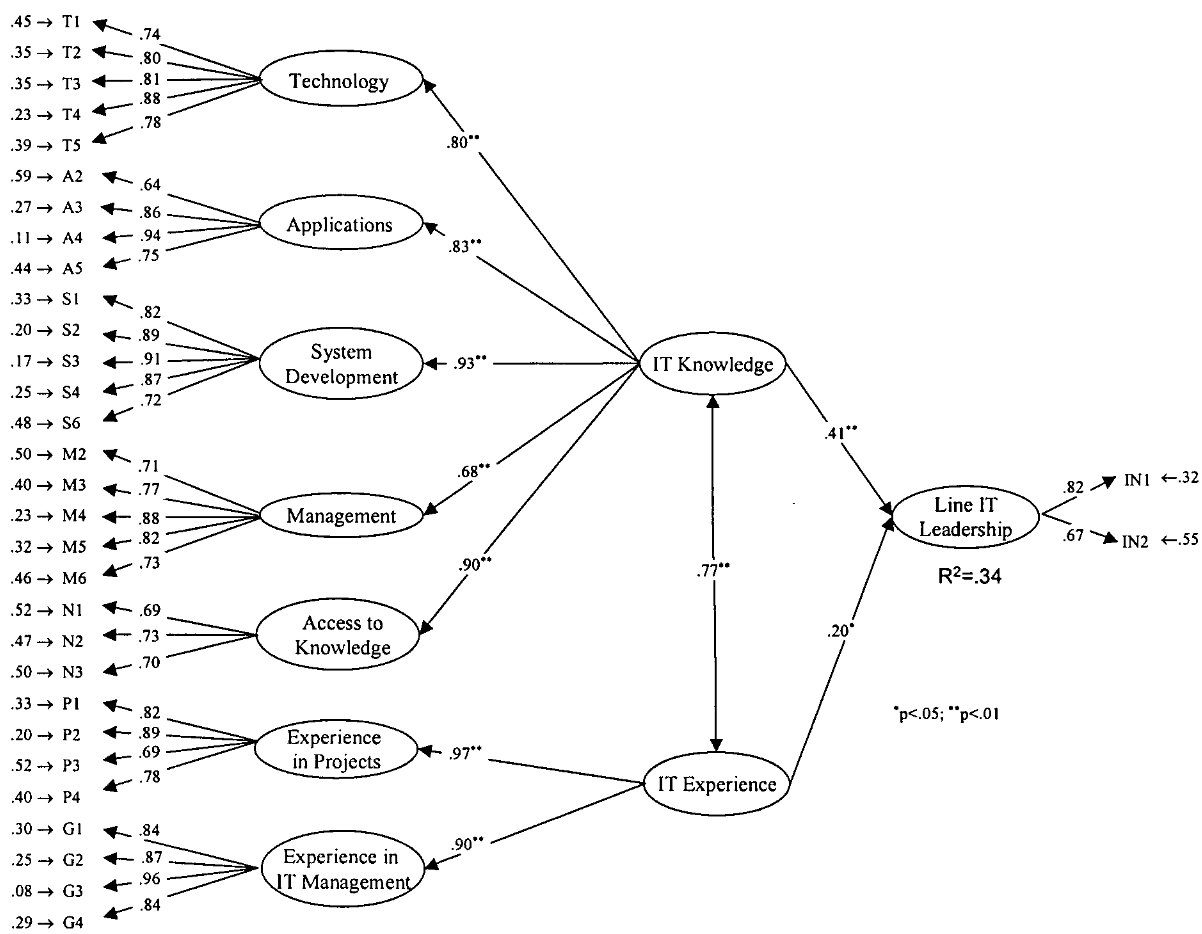

Figure 2.5 Two Second-order Factors Model (Model 5)

Convergent validity of this second-order factors model is well supported by the results. The dimension of knowledge of management has a factor loading slightly below the recommended value of .70 (Chin, 1998). All other dimensions are well above this threshold value, ranging from .80 to .97. This shows that the second-order factors are connected to the first order ones with strong paths. Looking at this model in its nomological context, the path linking IT experience to IT leadership is relatively low and not significant (.20; p>.10), while the path linking IT knowledge is more acceptable (.41; p<.01). The overall model fit is satisfactory (Table 2.10).

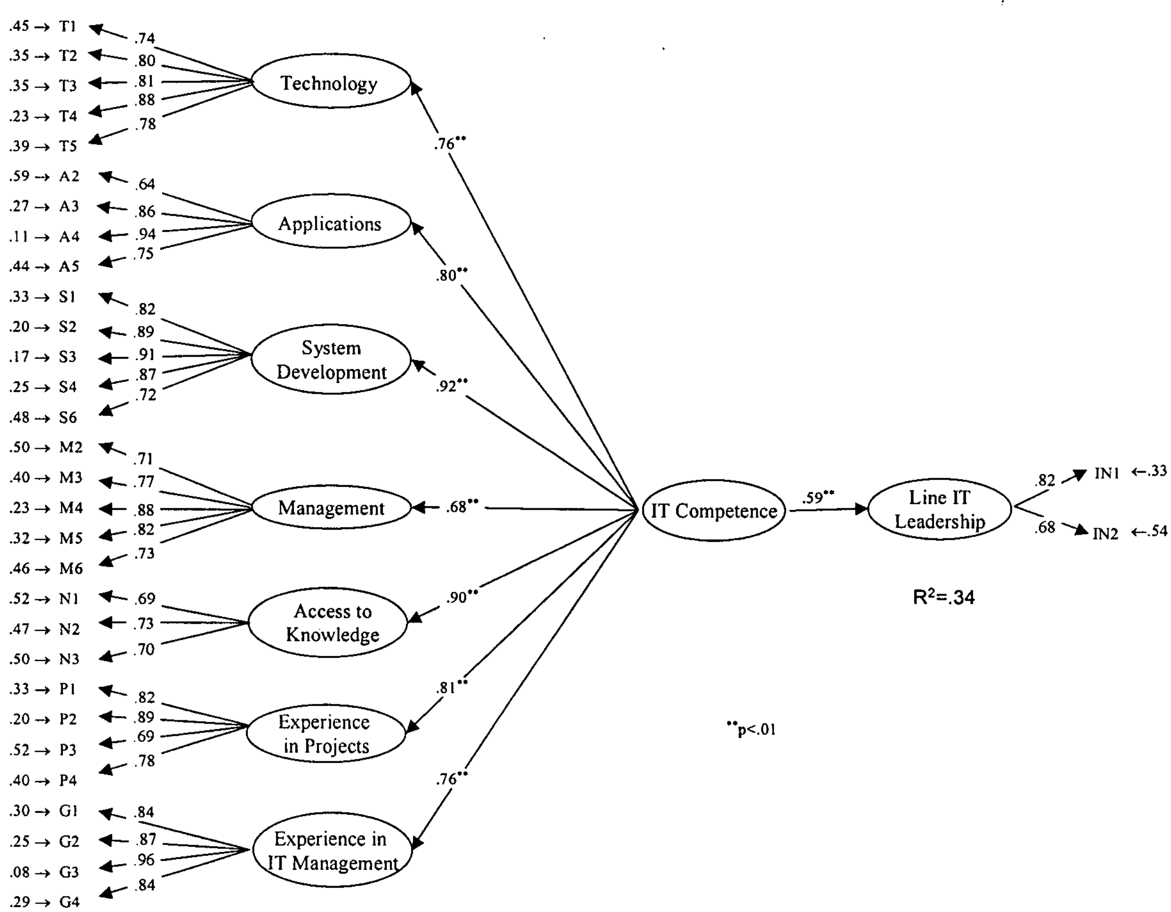

Figure 2.6 One Second-Order Factor Model (Model 6)

Model 6 suggests that IT competence in business managers is defined by the seven first-order factors and by the structure of interrelationship among those factors. Because of the strong correlations between the seven first-order factors, a model where IT competence is reflected by all seven dimensions can also be tested. In such a model, the different areas of knowledge and experience reflect the overall IT competence, without the intermediary grouping into knowledge and experience. Competence is therefore a second-order construct comprising seven dimensions. Convergent validity of this second-order factor model is, similarly to the previous model, well supported by the results. Paths linking first order factors to the second-order factor range from .68 to .90. The path linking IT competence to IT leadership is significant (.59; $p<.01$). However, the overall model fit is not as satisfactory as the other models, with all indices showing less acceptable values than any of the other model (Table 2.10).

The baseline model is useful in assessing the value of higher-order factor models. Marsh and Hocevar (1985) suggest the use of the "target coefficient" to compare higher order factor models to the baseline or first-order factor model. This index is the ratio of the χ^2 of the first-order model to the χ^2 of the higher-order model. At best, the correlations among the first-order factors are completely accounted for by the higher-order factor model. The target coefficient would then take a value of 1, its upper limit. The target coefficient is useful in comparing higher-order models to their baseline model in that it can separate the lack of fit due to the higher-order structure from the lack of fit in the definition of the first-order factors. The target coefficient, however, is also generally higher as the number of parameters estimated in the higher order model increases.

The target coefficient for the third-order factor model (Model 3) and for the two second-order factors model (Model 5) is .90, while the one for the one second-order factor model (Model 6) is a low .81 (Table 2.10).

We can assess the completeness of our constructs by examining their ability to predict the measured overall IT knowledge and IT experience. In an additional survey question, respondents were asked to assess their overall level of IT knowledge and of IT experience. The second-order factor IT Knowledge explains 71% of the variance in the overall IT knowledge. The second-order factor IT experience explains 79% of the variance in the overall IT experience. From these results, we conclude that our model of IT competence captures the dual ideas of knowledge and experience.

2.7 Selection of Final Model

When observing the results for the four models tested, the baseline model obtained the best fit. The presence of negative and low or non-significant paths in the baseline model, however, also shows the added value of the higher-order models. Among the higher-order factor models, model 6 (Figure 2.6) in which IT competence is seen as a single second-order factor provided the *least* satisfactory results, both in terms of its overall fit, as well as in comparison to the baseline model with the target coefficient.

The first alternative model, with IT knowledge and IT experience as second and higher order factors (Model 5 in Figure 2.5) shows satisfactory results. In fact, this model and the third-order factor model (Model 4) give similar results using most model selection measures. First, these two models are more parsimonious (higher degrees of freedom) thus are then said to provide a better fit to the data than the baseline model. Then statistical significance of the loadings (Figures 2.2 and 2.3) and overall fit indices (Table 2.10) give support to both models. Both models also show the same parsimony, having the same degrees of freedom. This is due to the fact that the same number of parameters is estimated in both models. Even though the third-order factor model has one additional parameter to estimate—the path between IT competence and line IT leadership—the second order model estimates the correlation between IT knowledge and IT experience, the two exogenous variables. In the third order model, there is only one exogenous variable—IT competence—and therefore no correlation to estimate. Thus, it is important to note that the models are not statistically speaking different: the number of correlations among the second-order factors is equal to the number of parameters needed to define the third-order factor. The third-order factor is therefore a just-identified model (providing the same results as the two second-order factors model). The choice of one over the other has to be based on reasons other than statistical comparison.

Support for the third-order factor model over the second-order factor model comes from two sources. First, the third-order factor model has a better ability to explain the variance in the constructs of interest: IT leadership of managers. In the second-order factor model, knowledge and experience explain a large amount of the variation in the intention towards proactive behaviours ($R^2 = .34$); with higher levels of knowledge and experience, business managers will have stronger intentions of taking initiatives in regards to IT (Figure 2.5). But when considering the third-order factor model for IT competence, the ability to explain IT leadership increases ($R^2 = .38$) suggesting that IT competence is a somewhat better mediator of the effect of the lower factors and indicators (Figure 2.3). In other words, IT competence is able to capture more variance than the correlation between knowledge and experience alone. The purpose of this study is to demonstrate the validity of the IT competence construct, and not to maximize the explanation in the variance of the dependent variable.

Second, the choice of the third order factor model is also based on a theoretical justification. As mentioned earlier, higher order factors are modeled at a higher level of abstraction, and their justification needs to be related to factors at that same level of abstraction (Chin, 1998). IT line leadership refers to broad behaviors that are better linked to an overall level of IT competence, not to specific areas of knowledge or the individual factors of IT knowledge and IT experience. The fact that IT knowledge and IT experience are strongly correlated also supports the decision to take into account their pattern of intercorrelation in addition to each individual factor in explaining their impact. The paths linking factors at second and third order are strong and significant, also supporting this third-order factor model representation.

2.8 Discussion and Concluding Comments

This research tests a model of IT competence of business managers. Significant progress has been made towards creating and validating an instrument to measure this construct. Our model states that IT competence is represented by IT knowledge and IT experience. IT knowledge concerns the areas of technologies, applications, system development, and management, as well as knowledge of where to access more IT knowledge both inside and outside their organization. IT experience is gained through working on IT projects and in the management of IT in the organization.

This research has accomplished several important goals. We have created a sound measurement instrument for IT competence that has good psychometric properties and satisfactory levels of convergent, discriminant, and nomological validity. In addition, we have identified specific areas of knowledge and experience that define IT competence in business managers[2].

Business managers' overall level of IT competence influences their intentions to show leadership towards IT. 38% of respondents' intentions towards two important IT leadership behaviours are explained in the model: creating strong relationships with IT people as well as supporting and promoting IT in their organizations.

We are confident that this instrument can be used in new survey research studies and further research will surmount some of the limitations we have identified. First, more work can be done to improve the coverage of the construct. For example, cognitive elements could be added to the knowledge and experience defining the IT competence. The prescriptive literature (Rockart et al., 1996; Sambamurthy and Zmud, 1994) strongly suggests that managers should have a "process view" of the organization and that vision to transform the organization with IT should influence leadership. Attempts should be made to measure and test the role and impact of cognitive elements. The inclusion of hands-on experience from personal use of technology by the managers can also be considered. Experimenting with and using IT can develop a familiarity with current technologies and may encourage the manager to take a more global interest in IT. Since personal use of computers increases one's experience, such use may also reflect a greater personal ability to innovate with IT. Although empirical evidence does not support the importance of managers' personal use of IT (Jarvenpaa and Ives, 1991), new studies may defined and measure the full extent and complexity of the personal use, especially as it pertains to influencing IT leadership. It may be interesting to look at how such personal use fits with the experience at the IT project and at the IT management levels.

Second, further development on the dependent (criterion) variable side is also needed. Although intentions have been shown to be good predictors of behavior, it would be interesting to understand the relationship between IT competence and actual IT leadership

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[2] As technologies are transient, the list should be updated to reflect the evolution of technologies. The objective is to create a list of items that a business manager who is well versed in IT would be familiar with.

along with IT deployment in support of organizational activities and business strategies. Further understanding of how it can be instrumental in enabling competitive positioning, be it through the appropriateness of new, IT-enabled organizational forms, or through new IT-based process structures can also be investigated in future research.

Thirdly, the model can be expanded. Commonality of vocabulary and experiences between individual specialists allows communication and integration of knowledge among members of an organization, which will in turn contribute to the creation of competitive advantage (Grant, 1996). The IT competence of business managers is one side contributing to this common knowledge among business managers and IT professionals. The other side, representing the business knowledge in IT professionals should also be investigated, as a complement to bridge the gap between these two groups. A next step can also include the identification of antecedents of IT competence. We believe factors such as background and job history (e.g., IT rotation) are promising variables to study. This research was done with data from organizations in the insurance industry. Future research should also test the applicability of the instrument to industries other than insurance and to different sizes organizations.

This research offers suggestions to executives wishing to build IT competence in the management of their organizations. Hands-on experience with IT projects and IT management are critical to building IT competence in business managers. Junior managers should be seconded to project teams and encouraged to manage the IT budget, plan, and people in their area. This should be done systematically, since a higher level of experience predicts higher IT competence. This prescriptive advice may be difficult to follow if the IT function is centralized, since having a single organizational unit responsible for IT management may not enable the sharing of the knowledge and experiences necessary for wide scale deployment and innovation with IT. Research by Chan and Reich (1999) has shown that most companies focus on narrow software-related training and do not teach more conceptual topics such as project management or IT management. Results for the current study suggests that courses in IT that instill specialized knowledge should be wide in scope, and include technology, applications, management, and systems development.

3 Measuring the Business Competence of IT Professionals

3.1 Introduction

"IT professionals must adapt to a context where collaboration is the currency of innovation and diversity its enabler" (Keen, 1999a)

An effective relationship between information technology (IT) professionals and their business clients is a primary determinant of success in gaining business advantage through IT (Keen, 1999b; Reich and Benbasat, 2000). As business innovation relies even more strongly on partnerships between IT and business people, a different perspective of how IT professionals view their organizational contributions is needed for organizations to remain competitive. IT professionals should take on roles that are more entrepreneurial in nature and focus on innovation through IT (Roepke, Agarwal, and Ferratt, 2000). Although IT specialists may be hired for their technical expertise, they will be retained only if they also exhibit the ability to develop collaborative partnerships with their business clients (Preiser-Houy, 1999). Thus, the profile of the IT professional is changing from one in which technical skills are paramount to one in which the ability to form business relationships is as important.

The relationship building ability of IT professionals has become a core capability of organizations (Feeny and Willcocks, 1998). Communication and mutual understanding between the parties are important enablers of creating effective relationships. In that sense, the business knowledge of IT professionals plays a key role in the development of relationships with business clients, by giving them the language needed to communicate with and understand their business clients, therefore enabling their participation in important organizational decision making processes (Bashein and Markus, 1997; Feeny and Willcocks, 1998; Henderson, 1990; Rockart, etal., 1996). Broader business knowledge is essential if IT people are to create linkages with other organizational units and have a wider perspective about business objectives, thus achieving fit between IT and the organizational strategies. Organizations have started responding to this challenge by demanding more business acumen in their IT staff. This is evidenced by the steady increase in recent years in the proportion of CIO hires who bring to the firm a general business background rather than solely technical training (York, 1999).

The importance of knowledge as a resource and capability for organizations has been increasingly recognized. In the resource-based view of the firm, knowledge is the most strategically significant resource (Conner and Prahalad, 1996; Quinn, 1992). Knowledge is also an organizational capability that is a source of sustainable competitive advantage (Kogut and Zander, 1992; Prahalad and Hamel, 1990). In the new knowledge economy, human capital of a firm — its workforce — represents its most important strategic asset. In particular, a firm's IT human capital constitutes a critical capability for business partnerships (Ross, et al., 1996). In order to develop such partnerships, IT professionals are required to understand and participate in their business partners' key strategic planning processes (Reich and Benbasat, 2000). The need to communicate with people from different functional areas requires IT specialists to develop some commonality of vocabulary and conceptual knowledge, and working experience with business people. This in turn requires a change in the way IT professionals are educated and trained.

This study looks at the broader expertise in IT professionals that is instrumental in the development of IT and business partnerships. It addresses two research questions: (1) What are the areas of knowledge that represent business competence of IT professionals? (2) What is the contribution of business competence in IT professionals to improving their relationships with their business clients? More specifically, this study articulates the concept of *business competence in IT professionals*, outlines its dimensions, and develops a model of the effect of business competence on partnerships with business people. It then builds and tests an instrument to measure business competence in IT professionals, and investigates the relationship between business competence and such partnerships.

Section 3.2 introduces and defines the concept of business competence in IT professionals. Section 3.3 describes the components of the IT/business partnerships that could be influenced by the business competence. Section 3.4 describes the instrument development process for business competence and reports the measurement properties of the instrument. It then tests a model that shows the relationship between business competence and IT/business partnerships. Section 3.5 discusses the results, covers the limitation of this study, and provides guidelines for future research. Section 6 offers our concluding remarks.

3.2 Business Competence in IT Professionals

3.2.1 Definition

> "*The perception exist that a successful IS professional blends technical knowledge with a sound understanding of the business while commanding effective interpersonal skills*" (Todd, McKeen, and Gallupe, 1995, p.1-2).

The importance of IT professionals possessing more than technical skills has been recognized since the early days of IS as an academic field. For instance, the ACM Curriculum Committee on "Computer Education for Management" (Ashenhurst, 1972) identified six categories of knowledge and abilities required by IS specialists to work effectively: people, organization, society, systems, computers, and models. The first three categories fall under the "generalist" profile, focusing more on the system *analysis* activity. The last three are associated with the "specialist" profile, with their skills closely related to the system *design* activity. When empirically tested, this curriculum was considered too technically focused (Henry, Dickson, and LaSalle, 1974), and the need for generalist skills was perceived as more important, regardless of the organization IT maturity levels (Benbasat, Dexter, and Mantha, 1980). An important conclusion of the studies that assessed the ACM curriculum proposal is that more emphasis should be placed on acquiring people, organizational, and society skills rather than specialist skills. It was, therefore, recommended that academic programs should combine the knowledge of IS with that of organizational behavior and development, that is concerned with the introduction of change in organizations. Lee, Trauth, and Farwell (1995) also identified that, among technical, business and behavioral skills, it is the business and behavioral that were considered the most important for the future.

Since then, several other studies have investigated the knowledge requirements of IT professionals (Table 3.1). The importance of business knowledge and behavioral knowledge, in addition to technology knowledge, emerges from these studies. However, the many studies of business knowledge for IT professionals offer a diverse set of frameworks, categories, coverage, and labeling. Thus, although the importance of a broader set knowledge in IT professionals is recognized, there is no consensus on what exactly comprises it.

The focus of this study is on the knowledge that is beyond that of the IT professional's own domain of expertise. Therefore, technical areas of knowledge, such as hardware and software, all of which are closely associated with IT skills, are not discussed in this paper. This is not to say that such knowledge is not important. Clearly technical knowledge is part of the IT professional's overall expertise, but this study is about the business competence of the IT professionals, and is therefore interested in what enables IT professionals to apply their technical knowledge in ways that are beneficial to the organization and to act cooperatively with their business partners.

In this study business competence in IT professionals is defined as the set of business and interpersonal knowledge and skills possessed by an IT professional that enables him or her to understand the business domain, speak the language of business, and interact with their business partners. This competence reflects an understanding of the business in all its dimensions; it describes the professionals' business acumen that will influence their approach in delivering IT solutions.

3.2.2 A brief note on types of knowledge and skills

As a key indicator of competence, knowledge can be explicit or tacit in nature (Polanyi, 1967). Our conceptualization of competence includes both. Explicit knowledge is the formal knowledge that can be clearly transmitted using systematic language. It is the knowledge we are aware of possessing, the "actual" or declarative knowledge (Anderson, 1983). This type of knowledge is often seen as domain-specific; it is a set of usable information organized around a specific content area (Klemp, 1979).

The literature recognizes that domain-specific knowledge is not sufficient to reflect competence (Tan and Libby, 1997). Knowledge is also developed by the understanding of how something operates, and not solely that it exists (Ryle, 1949). We learn not only through language, but also through practice and experience. When an individual modifies his actions based on the results of previous ones, he builds competence through the enrichment of tacit knowledge (Ryle, 1949). Tacit knowledge is the experience-based knowledge as well as the underlying abilities and potential that supports the acquisition and use of that knowledge (Sternberg et al., 2000). Tacit knowledge focuses on behaviors and can be linked to other concepts such as know-how and skills (Nass, 1994; Nonaka, 1994). Skill is the ability to demonstrate a set of related behaviors and processes (Klemp, 1979), and reflects information-processing abilities (Nass, 1994).

Therefore, explicit and tacit knowledge cover the range of concepts that are commonly found in studies looking at IT professionals' competencies, including knowledge, skills, and abilities (Lee et al, 1995; Sawyer, Eschenfelder, Diekema, and McClure, 1998). These three factors are intimately related in the context of competence. The Management Charter Initiative (MCI) proposed a model of competence for managers which "consists of a number of elements of competences, which are intended to reflect the skills, knowledge and abilities which experienced competent managers should possess" (Henderson, 1993, p.15). In the context of IT, Lee et al. (1995) mentioned the difficulty of distinguishing at the empirical level between different concepts such as knowledge and skills: "We found no simple way of mapping these constructs to the relationships among a list of empirically generated knowledge/skills requirements that are couched in the context of specific IS jobs or functions, i.e., many IS tasks require a combination of knowledge and skills, and the perceptual relationships among the knowledge/skill items do not correspond neatly to these theoretical constructs" (p. 321). Since knowledge is closely related to skills and abilities, in this paper we develop a framework that is inclusive of these different aspects of competence.

3.2.3 Scope of the Competence Construct

The IT literature developed different conceptualizations of competence, varying in scope from narrowly focused on current tasks requirements to broader requirements of the profession (see Schambach, 1994). Here, we develop a framework that reflects the general population of IT professionals, i.e., not tied to a particular category or organization. As IT professionals are often assigned to projects involving different functional areas of the organization, it is important to develop a broad professional competence framework, not one designed for a specific set of tasks. Competence is non-routine, and embodies the ability to cope with complex and changing environments. It is not necessarily directly linked to a specific task but relates to the ability to transfer knowledge across tasks (Brown, 1994). In addition, Roepke et al. (2000) call for a collaborative effort in general from all IT professionals, regardless of their position in the organizational hierarchy. IT professionals at all levels need to interact and work with their functional area peers in finding ways of linking business and IT objectives.

3.2.4 Developing a framework for business competence

Previous studies have investigated the need for IT professionals to develop a range of knowledge and skills beyond the technical in different contexts. For example, some investigated IT knowledge and skills needed by IT people (programmers, analysts and managers) in order to successfully perform their jobs (Lee et al., 1995; Nelson, 1991), in terms of what is demanded by the job market (Todd et al., 1995) or as specified for inclusion in an academic curriculum (Ashenhurst, 1972, Benbasat et al., 1980, Nunamaker, Walsh, Burgoon, and Glynn, 1997).

Our focus is on identifying the set of knowledge that enables IT professionals to develop better collaboration with their business partners. Feeny and Willcocks (1998) mentioned that, for organizations to effectively develop core IT capabilities such as IT/business partnerships, IT professionals must possess strong business and interpersonal knowledge and skills, in addition to their technical skills, though no empirical study has yet investigated the relationship between these areas of knowledge and the formation of successful IT/business partnerships.

Our proposed taxonomy is based on an integration of the different studies that have investigated knowledge of IT professionals and is represented on the left-end side in Table 3.1. As mentioned above, different studies have offered different frameworks, categories, coverage, and labeling as shown on the right-end side in Table 3.1. But the literature does not include any study that investigates the entire set of components of business and interpersonal knowledge as shown in Table 3.1. Thus, based on the elements of business and interpersonal knowledge and skills identified in earlier studies, we develop a more comprehensive taxonomy of business competence in IT professionals that adapts and reorganizes the different components previously identified. Our proposed taxonomy includes 7 specific areas of knowledge grouped in three broad categories: organization-specific knowledge, interpersonal and management knowledge, and knowledge of IT/business integration. The components of the taxonomy are discussed next.

Table 3.1 Proposed Taxonomy of Business Competence and Review of Studies on IT Professionals' Knowledge

Our proposed taxonomy of business competence for IT professionals		**Ashenhurst (1972) Benbasat et al. (1980)**	**Todd et al. (1995)**	**Lee et al. (1995) Sawyer et al. (1998)**	**Nelson (1991)**	**Avital and Vandenbosch (2000)**	**Joseph et al. (1996)**
Organization-specific Knowledge	*Organizational overview*	Organizations	Business	Business functional	Organizational overview	Business orientation	—
	Organizational units				Organizational unit		
	Business responsibility	—	—			Business responsibility	
Knowledge of IT/business integration	*IT/business integration*	Model	Problem solving	—	—	—	
Interpersonal and management knowledge	Interpersonal communication	People, Society	Social and Management	Interpersonal and Management	Organizational skills	—	Managing others
	Leadership skills						
	Knowledge Networking	—	—		—		Managing tasks

3.2.5 Organization-specific Knowledge

This category refers to the IT professional's understanding of the specific organizational context in which IT are deployed. This knowledge enables IT professionals to see the "big picture" of IT in their current organization, make linkages between different organizational units, and ensures focus on a larger perspective needed to benefit from the potential fit between the IT and the organizational context. It represents a holistic view of the organization and its current activities. This knowledge represents the IT professional's capability for business understanding (Feeny and Willcocks, 1998). From the previous literature, we identified three areas of knowledge that cover the business knowledge domain: organizational overview, organizational units, and organizational responsibility.

3.2.5.1 Organizational overview

In a business environment where IT is used to gain business value, IT professionals must have an understanding of what their organization is about, that is the business context in which technologies are developed, deployed, and used. At the broad overview level, knowledge of the organization implies knowing the organization's goals and objectives, its core capabilities, and its critical success factors. Knowledge about the organization also includes knowledge about its environment and the constraints imposed on it by its suppliers, buyers, the government, and competitors.

Some of the previous studies discussed the importance of an *overall knowledge of the organization* (e.g., Avital and Vandenbosch, 2000). According to Nelson (1991), organizational overview focuses on the organization at a broad level, and includes knowledge of objectives, purpose, opportunities, constraints, and internal and external functioning. Lee et al. (1995) used a single dimension to describe the knowledge of the organization that includes general business knowledge and is related to the *specific* organization where the IT professional works. An exception to the organizational specificity of business knowledge is found in Todd et al. (1995). In their investigation of the knowledge and skills required by employers (as specified in job advertisements), they identified a business knowledge category that includes functional expertise and industry expertise. This was not defined as organization-specific, explained by the fact that their categories were derived from job ads that do not usually ask for knowledge specific to an organization prior to recruiting.

3.2.5.2 Organizational units

IT professionals need to understand what the functional areas of their organization are, including their objectives and problems and the language they speak (York, 1999; Todd et al., 1995; Lee et al. 1995). This internal view of the organization is concerned with an understanding of the business processes supported by IT (Avital and Vanderbosh, 2000), as well as an understanding of the connections and interdependencies among different organizational units. Nelson (1991) referred to *organizational unit knowledge* that covers the internal unit functioning of the organization, including objectives, purpose, functions, resources, problems, and links with other internal and external units.

3.2.5.3 Organizational responsibility

Avital and Vandenbosch (2000) identified IT professionals' *business ownership* as an important component of an organization IT-driven value efforts. Business ownership includes IT professional's overall business responsibility, reflected when IT professionals feel responsible for business processes and outcomes beyond their specific responsibilities for the direct performance of IS. Business responsibility is linked to the specific organization, as it not only refers to a more active role taken by IT professionals, but also to a sense of commitment, empowerment, personal involvement, and organizational pride.

IT professionals can develop a stronger understanding of the organization by feeling responsible for organizational performance that is beyond the direct impact of their specific area of work (Avital and Vandenbosch, 2000). This means that they need to think about and understand the development of the business as a functional area member would, and participate in making functional areas successful in the same way. There is an active component associated to this responsibility that refers the IT professionals' ability to learn about their business. This active role IT professionals take in learning about their organization adds to the more static knowledge of the organization identified in other studies, and increases their general business knowledge specific to their organization (Lee et al., 1995).

3.2.6 Interpersonal and Management Knowledge

IT professionals' partnering capability is also enabled by their interpersonal and management knowledge and skills. IT professionals have to participate in social interactions and deal more with group dynamics more than ever before (Sawyer et al., 1998). They are increasingly asked to be team players and effective, jargon-free communicators (Bashein and Markus, 1997; Markus and Benjamin, 1997). Therefore, their business competence also includes their ability to interact with and manage others. Interpersonal and management knowledge includes knowledge networking, interpersonal communication, and leadership.

3.2.6.1 Knowledge Networking

An individual's competence includes knowing where knowledge resides within and outside the organization. IT professionals who develop a personal social network have a greater level of business competence than their uninformed counterparts because of their increased ability to access information and knowledge when needed (Sawyer et al., 1998). Their ability to develop such a network, or their networking skills, allows them to expand their own knowledge by leveraging others'. Joseph et al. (1996) "managing task" category includes the need for IT professionals to maintain a directory of "who knows what" (in their environment). Although knowing what others know enhances a group's overall capacity, this competence resides in individuals, not in groups (Grant, 1996; Kogut and Zander, 1992).

3.2.6.2 Interpersonal communication

In cross-functional environments, IT professionals' team orientation and their ability to develop and maintain relationship with others is crucial. IT professionals are expected to be able to put away the IT specialized vocabulary to communicate effectively with their partners (Reich and Benbasat, 2000). Joseph et al. (1996) propose a category called "managing others" that refers to strategies for interacting and working with others people in the workplace, i.e., the IT professional's interpersonal skills. Lee et al. (1995) include skills such as ability to communicate, manage projects, and work cooperatively in this category.

Nelson's (1991) category of organizational skills contains interpersonal behavior and group dynamics skills. Using the framework developed by Lee et al. (1995) to examine the current and future IT skills needs in one organization, Sawyer et al. (1998) also include in the interpersonal skills category the ability to develop a personal social network.

3.2.6.3 Leadership skills

A key element of the knowledge of IT professionals is their ability to manage projects (Nelson, 1991; Schambach, 1994; York, 1999). Project management is an umbrella term that includes direct activities such as managing the scope, time, and cost of projects, as well as general management and interpersonal activities, such as leading, communicating, negotiating, and managing risk and change (Sawyer et al., 1998). Todd et al.'s *management* category is made up of general management skills, including leadership, project management, planning, controlling, training, and organization. These skills help IT professionals serve as effective managers and enable them to interact and work with their business peers in order to find ways of combining business processes with IT. Joseph et al. (1996) focus on the non-technical skills of IT professionals, mainly managerial competencies defined as intrapersonal and interpersonal strategies for managing tasks, self, career, and others within the IS work context.

3.2.7 IT/business integration

The third component of the IT professionals' business competence refers to their ability to understand the connections between IT and business. It addresses the need for IT professionals to act as business problem solvers (Bashein and Markus, 1997) and integrate business development with IT capability. The ability of IT professionals to integrate IT in an organizational context is reflected by the IT professional's capability to visualize the ways in which IT can contribute to organizational performance, and by actively seeking for synergies between IT and business activities (Brown and Sambamurthy, 1999). It is the analytical thinking skills that enable an IT professional to understand clients' issues and needs, to see problems within a "big-picture" framework, and to conceptualize how parts and functions fit together (Sawyer et al., 1998). This understanding of the tight coupling between IT and business is implemented in the different phases of projects, from the initial analysis to the assessment of success.

This knowledge of how IT and business could be integrated is similar to the definition of "business systems thinkers" provided by Feeny and Willcocks (1998). Such individuals understand the connections and interdependencies between activities, and can communicate how existing processes work; they use that base to catalyze understanding of processes that technology can enable in the future (Feeny and Wilcock, 1998).

3.3 Influence on the Quality of IT/business Partnerships

This study aims at assessing the impact of business competence in IT professionals on the quality of their partnerships with their business clients. As a core IT capability, relationship building between IT and business groups within an organization enables the business to constructively engage in IT issues, and building relationships with another department in an organization depends on the IT professional's ability to convince the business partners that they understand their goals, concerns, language, and processes and are trying to help them achieve those goals. It is a measure of their capacity for business understanding (Feeny and Willcocks, 1998).

We focus on two dimensions of the IT/business partnerships: the IT professionals' credibility towards business clients, and the intentions of IT professionals to develop and strengthen the relationship. With these two dimensions, our focus is on the IT professionals' contribution to and perspective on their partnerships with business clients.

3.3.1 Credibility

Effective partnerships are characterized by mutual trust between the parties (Henderson, 1990). A hurdle in the development of such trust is that IT professionals often face a credibility problem when working with business clients: their lack of understanding of the business side discourage their business clients from relying on them, as they fear their needs might not be well understood. Indeed, although the role of the IT professional within organizations is changing, many business people tend to see internal IT specialists as technical experts who do not understand business and do not respond well to the clients' needs (Murray & Hardin, 1991 in Preiser-Houy, 1999, p.33). In many cases, the level of business credibility of the IT specialist is relatively low (Bashein and Markus, 1997; Markus and Benjamin, 1997).

The business credibility of IT professionals is found to be a function of their perceived expertise. Interestingly, this credibility is not clearly related to their technical competence (Bashein and Markus, 1997). People tend to trust other people that are similar to them. In that sense, IT professionals who are business-competent increase their trustworthiness by displaying their understanding of the organization to business people. Similarity is not the only way through which IT professionals increase their trustworthiness; with business competence, they also possess good interpersonal skills that facilitate their interaction with their business client. As more people recognize the new role of IT professionals and their enhanced business competence, the business credibility of IT professionals will increase.

3.3.2 Intentions to develop partnership

The contribution of the IT professionals to their partnerships with their business clients can also be examined through their intentions to engage and maintain such partnerships. IT professionals' understanding of the business will form their beliefs and increase their awareness of the importance of working towards relationship building. Although partnerships can be mandatory, with an organizational structure that support such partnerships, the actual willingness of the partners to engage in such relationships will increase its effectiveness. IT professionals' knowledge and understanding of the business may be a key determinant in the tact they will take in dealing with their business clients. This business competence provides them with the vocabulary and understanding needed to interact with business people. In that sense, the overall business competence of IT professionals is expected to influence their collaboration with business clients (Lee et al., 1995; Preiser-Houy, 1999).

Therefore, the IT professional's capacity to develop good partnerships, as reflected by their credibility and intentions to develop partnerships is likely to be influenced by their overall business competence as reflected by their knowledge of the organization, their interpersonal and management knowledge, and their knowledge of the integration between IT and the business.

3.4 Method

This study first developed the business competence construct and generated its measures (i.e., developing sub-constructs and items). Next, using the structural equation modeling method, it investigated the effect of having business competence on the IT professionals' partnership with business people. By considering the tangible expected outcomes of business competence, we assessed the nomological and predictive validities of the business competence construct (Carmines and Zeller, 1979).

The first step consisted in developing the measures that were then used in the analysis of the measurement and structural models of business competence. For both types of analyses (measurement and structural model), the proposed model is compared to reasonable alternative models, in order to show the comparative efficacy of the proposed model.

3.4.1 Item and Scale Development

The first phase of this research consisted of the development of a measuring instrument to assess the level of business competence in IT professionals. In developing this measure, the focus was to capture IT professionals' assessment of their own knowledge. We believe that this is a reasonable approach since others' assessments of one's competence is fraught with difficulties, the main among them being the difficulty of someone to figure out how much a person truly knows (more than the person can herself assess). The starting point for item development was the previous empirical and theoretical literature (summarized in Table 3.1). The taxonomy shown in Table 3.1 builds on this literature. To generate a sample of items, first as many items as possible were identified from existing scales that fit the construct definitions of the current study. Additional items were added to improve the quality of the scales. Then the instrument was submitted to a panel of IS and business managers, as well as IS academics, to obtain their views on which items are appropriate to include.

A card sorting exercise (Moore and Benbasat, 1991) was next used in the scale development process. Two rounds of this exercise were executed, with a different goal at each one. In the first round, five master and doctoral students who were unfamiliar with the study were asked to sort the items into separate categories, based on the similarities and differences among the items, and then to label the underlying constructs represented by each category. In the second round, three of the initial five students were asked to classify items in pre-determined categories. This exercise helped establishing the discriminant validity of the items. It also facilitated refinement of the wording of ambiguous items and elimination of redundant or confusing ones. This version of the business competence measure contained 25 items: 12 for the different dimensions of organization-specific knowledge, 8 for the dimensions of interpersonal and management knowledge, and 5 for the knowledge of IT/business integration. Tables 3.2, 3.3, and 3.4 contain the items grouped within the specific dimensions. A 5-point Likert-type scale was used for all the items.

Table 3.2 Items for the Organization-Specific Knowledge (items dropped are shown in italics)

Dimension	Item	Question
Organizational overview	OVR1	Rate your level of knowledge of the organization's external environment (e.g., government, competitors, suppliers, and customers)
	OVR2	Rate your level of knowledge of the goals and objectives of the organization as a whole
	OVR3	Rate your level of knowledge of the core capabilities of the organization
	OVR4	Rate your level of knowledge of the key factors that must go right for the organization to succeed
Organizational units	UNT1	Rate your level of knowledge of the main challenges that different divisions in the organization face in achieving their objectives
	UNT2	Rate your level of knowledge of the language (e.g., key concepts, jargon, etc.) of the different divisions in the organization.
	UNT3	How well do you understand the work processes of the different divisions in your organization?
	UNT4	Rate your level of knowledge of the connections and interdependencies between the various divisions in the organization
Organizational responsibility	RES1	To what extent do you take actions to stay informed about business developments not directly related to IT?
	RES2	How much do you participate in business activities that are not directly related to IT?
	RES3	To what extent are you concerned by the overall performance of your business organization?
	*RES4**	*To what extent does your work have an impact on the performance of the organization?*

* Items dropped after testing of measurement properties

Table 3.3 Items for Interpersonal and Management Knowledge

Dimension	Item	Question
Knowledge Networking	NET1	If you have a business question or problem that you cannot solve alone, how confident are you about finding the right person to contact in your organization?
	NET2	If you have a business question or problem that you cannot solve alone, how confident are you about finding the right contacts outside your organization (consultants, vendors)?
	NET3	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?
Interpersonal communication	COM1	In general, how effective do you think you are at communicating with people at different levels of the organization (e.g., with your subordinates, peers, superiors)?
	COM2	How effective are you at working in a team environment?
	COM3	How well can you communicate about IT matters in non-technical language and within a business context to non-IT specialists?
Leadership	LEA1	In general, how effective do you think you are at managing projects (planning, managing resources, evaluating, etc.)?
	LEA2	In general, how effective do you think you are at acting in a leadership role (e.g., establishing direction, directing people, motivating and inspiring, etc.)

Table 3.4 Items for Knowledge of IT/business Integration

Dimension	Item	Question
IT/business integration	ITG1	How experienced are you at recognizing potential ways to exploit new business opportunities using IT?
	ITG2	How experienced are you at analyzing business problems in order to identify IT-based solutions (understand situations, getting the "big picture", identifying underlying root problems, etc.)?
	ITG3	How experienced are you at evaluating the organizational impacts of IT solutions?
	ITG4	Rate your level of knowledge of the alignment between business goals and information systems goals in the organization as a whole
	ITG5	Rate your level of knowledge of the way IT contributes to the value of the organization

The same procedure was followed for the two partnerships dimensions scales. Because this study was cross-sectional in design and therefore could not measure future behavior at the time the study was conducted, we measured intentions for forming partnerships. This approach is supported by the Theory of Reasoned Action (Fishbein and Ajzen, 1975), according to which *intentions* (of the individual) are the most important determinant of behavior. The scale for the intentions to develop partnerships and the scale for credibility each contained three items. Tables 3.5 and 3.6 contain the items for each of these scales respectively. A 5-point Likert-type scale was used with all the items.

Table 3.5 Items for Intentions to Develop Partnership

Item	Question
INT1	To what extent are you willing to commit to the sharing of responsibilities with your business clients for the development and implementation of future projects?
INT2	How comfortable would you be to getting involved with your business clients in projects that may require more innovative technologies, with the risk it may imply?
INT3	In the future, to what extent do you intend to develop strong partnerships with business clients?

Table 3.6 Items for Credibility

Item	Question
CRE1	To what extent are your business clients willing to rely on you for important aspects of the projects your work on?
CRE2	How comfortable are your business clients with accepting your recommendations (without challenging them)?
CRE3	To what extent are your business clients willing to let you have influence over issues that are critical for the projects your work on?

3.4.2 Sample Demographics

The study was conducted with the cooperation of two organizations, both insurance companies in North America. Organization A sells car and home insurance ($3.22 CND billion in revenues, 5,144 employees) organization B insures workers against loss of employment income ($1.6 billion CND in revenues, 2,500 employees). Target respondents were IT professionals at all hierarchical levels. The questionnaires were distributed by each organization. The respondents mailed the surveys directly back to the researchers.

A total of 166 questionnaires out of the 326 distributed were returned, giving response rate of 51% (organization A: 29/46= 63%; organization B: 137/280=49%). The questionnaire consisted of two sections: the first section contained the different items assessing business competence and was followed by the items assessing their relationship with their business clients. To answer the second section, respondents were asked to refer to their business client with whom they have worked to most frequently in the past six months. 50 respondents reported not having done any work with any business clients in the last six months hence did not answer the questions in the second section. After removing these questionnaires as well as those with a high number of missing values, the final dataset used for the analysis of the business competence measurement is of 109. Although small, this sample size meets the threshold of 100 suggested for Structural Equation Modeling using LISREL (Hair et al., 1998).

In the final sample, 63% of the respondents were male; 79% were in the 35-50 group age. Average tenure in the current organization was about 9 years. Means of different variables were compared for IT professionals with and without partnerships, as well as for respondents from both organizations. No significant differences were found. Although only two organizations participated, and not wanting to downplay the effects of organizational variables, it appears that the full range of levels of competence can occur within a given organizational context. Therefore, conducting a study within one or two given contexts should still provide valuable insights about business competence and its contribution to the development of partnerships.

Measurement and structural models are tested using LISREL. In structural equation modeling, a rule of thumb is to have a minimum ratio of five respondents for each estimated parameter (Hair et al., 1998). In order to adhere to this constraint, with a total of 109 respondents, we needed to limit the number of estimated parameters. Therefore, composite scales for the 7 specific areas of knowledge are used in the analysis of the full model. The measurement properties for each of these scales were tested prior to proceeding with the *aggregation* of the scales. The procedure followed and the corresponding results for the aggregation are described in the next section.

3.4.3 Creation of Composite Scales

In order to create composites scales, the scales' reliabilities were tested. Each scale was tested separately using confirmation factor analysis in LISREL. Confirmatory factor analysis allows the *a priori* specification of the relationships between the constructs and their indicators. The hypothesized relationships are then tested against the data. We used LISREL

8.5 (Jöreskog and Sörbom, 1996) to perform the test with maximum likelihood estimation using the covariance matrix.

The constructs reliabilities were assessed using two measures: composite reliabilities measure—a measure of internal consistency comparable to coefficient alpha—and variance extracted measures—a measure of the variance captured by a construct. All scales met the threshold value of .70 for internal consistency, but three were below the recommended value of .50 for the variance extracted (Hair et al., 1998). Based on a low loading factor and high measurement error, one item of "organizational responsibility" was deleted (shown in italics in Table 3.2). The deletion of any specific item or subset of items for the other scales would not improve significantly their value of variance extracted. Therefore all their items were kept. Variance extracted for three scales are still below the standard, but only marginally.

Table 3.7 Estimates of reliability and variance extracted for the scales

Dimensions	# items	Composite reliability	Variance extracted
Organizational overview	4	.85	.59
Organizational units	4	.85	.58
Organizational responsibility	3	.73	.48
Knowledge network	3	.78	.54
Interpersonal communication	3	.70	.46
Leadership	2	.80	.67
IT/business integration	5	.80	.46

Reliabilities for the scales with the final set of items are all satisfactory, with internal consistency coefficients ranging from .70 to .85. Values for variance extracted are ranging from .46 to .67 (Table 3.7). Composite scales were created for each of the dimensions and used in further analyses as indicators of organization-specific knowledge, interpersonal and management knowledge, and knowledge of IT/business integration.

3.4.4 Measurement Properties of composite scales

The measurement properties of organization-specific knowledge, interpersonal and management knowledge, and knowledge of IT/business integration were tested through confirmatory analysis using LISREL 8.5 (Jöreskog and Sörbom, 1996) with maximum likelihood estimation using the covariance matrix. Confirmatory factor analysis allows the *a priori* specification of the relationships between the constructs and their indicators. The hypothesized relationships are then tested against the data. A plethora of indices are generated in LISREL reflecting the fact that the interpretation of the results from this type of analysis is far from straightforward. At best, we can show that a model is plausible (i.e. consistent with the data), but we can never rule out that other models can also fit the data well, since many different causation models can fit the data and produce exactly the same values for the fit indices though implying very different causation paths. For that reason, we follow the strategy of comparing the proposed model with other reasonable alternatives, in order to show the superiority of the proposed model. We next report the measurement properties of the proposed model, followed by those for two plausible competing models. A comparison of the competing model with the proposed model is also reported. Descriptive statistics and correlations for the 7 indicators used in these tested are presented in Table 3.8.

Table 3.8 Descriptive Statistics and Correlation for Composite Scales

Dimensions	Mean	Std dev	1*	2	3	4	5	6
1. Organizational overview	3.2	.80						
2. Organizational units	2.9	.87	.82					
3. Organizational responsibility	3.0	.87	.60	.68				
4. Knowledge network	3.6	.87	.45	.41	.29			
5. Interpersonal communication	4.0	.64	.48	.38	.34	.46		
6. Leadership	3.6	.83	.39	.38	.34	.49	.55	
7. IT/business integration	3.4	.76	.69	.63	.58	.41	.54	.59

* All correlations are significant at .01 level.

3.4.5 Measurement properties of proposed model

We use the theory developed in section 2.4 to guide us in the creation of our base model (Model 1). The proposed model for business competence contains 7 indicators specified to load on three factors—organization-specific knowledge, interpersonal and management knowledge, and IT/business integration. The overall fit of the proposed model (Model 1) was first tested (Figure 3.1). We report the results as well as recommended threshold values (Gefen et al., 2000; Hair et al., 1998) in Table 3.9.

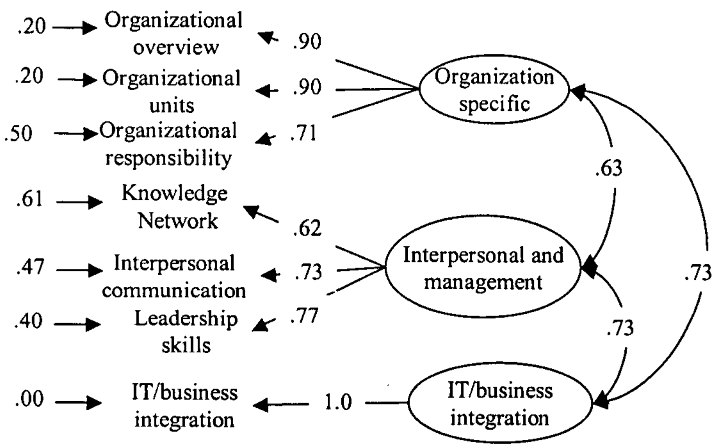

Figure 3.1 Measurement Model for Business Competence as Three-factor Model (Model 1)

Based on a number of goodness of fit measures to assess the model (Table 3.9), the overall results suggest that the model provides satisfactory fit. The χ^2 statistic, Goodness of Fit Index (GFI) and standardized Root Mean Square Residual statistic (RMSR) are **absolute** indices representing the ability of the model to reproduce the actual covariance matrix. The non-significant χ^2 obtained (χ^2=20.22; p=.06) implies that the null hypothesis of covariance matrix equality is not rejected, or in other words, that the fit between the covariance derived from the model and the one derived from the data is good. The very high GFI (.95) attests to a good overall degree of fit. The RMSR statistic characterizes the residual variance of the observed variables; as high values suggest high residual variance, smaller values, such as that obtained for the proposed model (.024), are better (Gefen et al., 2000).

Incremental fit measures—comparing the model to the null model—and **parsimonious** fit measures—relating the goodness-of-fit of the model to the number of estimated coefficients required to achieve the level of fit—are used to complement the absolute indices (Hair et al., 1998). The Adjusted Goodness of Fit Index (AGFI) and Normed Fit Index (NFI) are statistics between zero and one that compare the proposed model to the null model, with one being a perfect fit. The AGFI is the GFI adjusted by the ratio of degrees of freedom for the proposed model to the degrees of for null model. Our value of .88 represents a good fit because it exceeds the recommended level of .80. The NFI gives a relative comparison of the proposed model to the null model (single-factor model with no measurement error). The observed value of .95 exceeds the recommended .90 threshold.

Because one can always obtain a better fitting model by estimating more parameters, we use the parsimonious fit indices to evaluate the fit of the model relative to the number of estimated coefficients (or, conversely, the degrees of freedom) needed to achieve that level of fit. Among those indices is the normed chi-square ($\chi 2$ /df), which adjusts the chi-square by the degrees of freedom, and the Root Mean Square Error of Approximation (RMSEA), a measure of discrepancy per degree of freedom (Hair et al., 1998). The normed chi-square value of 1.68 is below the most conservative threshold of 2. The RMSEA value of .08 just meets the acceptability criterion of being less than .08. Both values are supportive of the good fit of the proposed model.

Table 3.9 Goodness-of-Fit Indices for the Proposed and Competing Measurement Models

Indices	Model 1 three first order factors (Figure 3.1)	Model 2 two first order factors (Figure 3.2)	Model 3 one first-order factor (Figure 3.3)	Suggested threshold values
χ^2	20.22	37.06	76.97	Smaller
p	0.06	.00	.00	
df	12	13	14	
χ^2/df	1.68	2.32	5.50	<2-3.0
GFI	.95	.91	.83	>.90
AGFI	.88	.81	.66	>.80
RMSR	.024	.035	.055	<.05
RMSEA	.08	.131	.204	.05-.08
NFI	.95	.91	.83	>.90
Model AIC	52.22	67.06	104.97	Smaller
CFI	.97	.93	.86	>.90

After finding a satisfactory overall fit for the proposed model, we proceed with the specific tests of the measurement model. First, convergent validity (unidimensionality and reliability) was evaluated separately for each construct (Gerbing and Anderson, 1988). Unidimensionality was tested by examining the estimated factor loading for each indicator and by assessing their statistical significance. All the factor loadings, except for "knowledge network" with a value of .62 (Figure 3.1), met the threshold value of .7 as recommended by Hair et al. (1998). The constructs' reliability for scales with more than one item was also assessed (Table 3.10) and the met the threshold values of .7 for internal consistency and .5 for the variance extracted (Hair et al., 1998).

Table 3.10 Assessment of Reliability for Dimensions of Business Competence

Dimensions	# items	Composite reliability	Variance extracted
Organization-specific knowledge	3	.88	.70
Interpersonal and management knowledge	3	.75	.51
Knowledge of IT/business integration	1	-	-

Discriminant validity was assessed using chi-square difference test (Venkatraman, 1989). For each pair of constructs, the fit of the model was compared with the fit of a model where the two constructs are presumed to be not distinct. Constraining the correlation between the pairs of constructs to be 1.0 suggests that all the items measure the same construct. A significant difference between the $\chi 2$ measures is supportive of discriminant validity (Venkatraman, 1989). Table 3.11 reports the results of 3 pairwise tests. All chi-square differences are significant at the p<0.01 level, indicating strong support for the presence of discriminant validity. Discriminant validity is also supported by the correlation between each pair of constructs (Figure 3.1) below the threshold value of .90 (Bagozzi and Fornell, 1982)

Table 3.11 Assessment of Discriminant Validity

Dimensions	Constrained Model χ^2 (df)	Unconstrained model χ^2 (df)	$\Delta\chi^{2*}$
Organizational-specific knowledge			
Interpersonal and management	51.72	9.88	41.84
IT/business integration	86.12	7.42	78.70
Interpersonal and management knowledge			
IT/business integration	36.19	1.25	34.94

* All differences are significant (for 1 degree of freedom) at 0.01 level

Based on the results for convergent and discriminant validity, the measurement properties of this initial model of business competence are satisfactory. A proper strategy to further test the appropriateness of the measurement model, consist of comparing the proposed model with other models that represent reasonable alternatives (Hair et al., 1998). Two models different than the initial one appear as plausible alternatives to represent business competence.

3.4.6 Measurement properties of competing models

The first alternative model (Model 2) suggests that "IT/business integration" and "organization-specific knowledge" together form a *single* factor (Figure 3.2). Hence, by putting together "IT/business integration" and "organization-specific knowledge", all items related to business knowledge are integrated, whether specific to the current organization or not. In this model, business competence is a two-factor model; the first dimension is "organizational knowledge" and includes the items from "organization-specific knowledge" and "IT/business integration", and the second dimension is the "interpersonal and management knowledge".

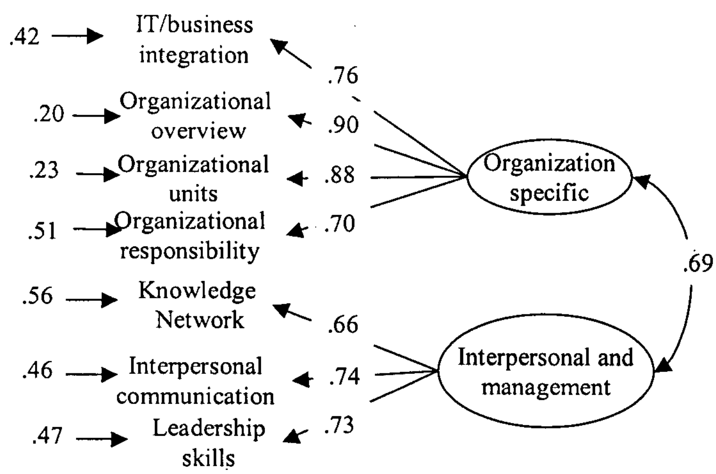

Figure 3.2 Measurement Model of Business Competence as Two-factor Model (Model 2)

The second alternative model (model 3) suggests that all the items are reflecting a single factor: business competence (Figure 3.3). Although most studies investigating business competence have identified different dimensions to the construct, the option of a unidimensional model to represent the underlying data structure can also be tested. Such a model implies that business competence accounts for all the common variance among the seven items.

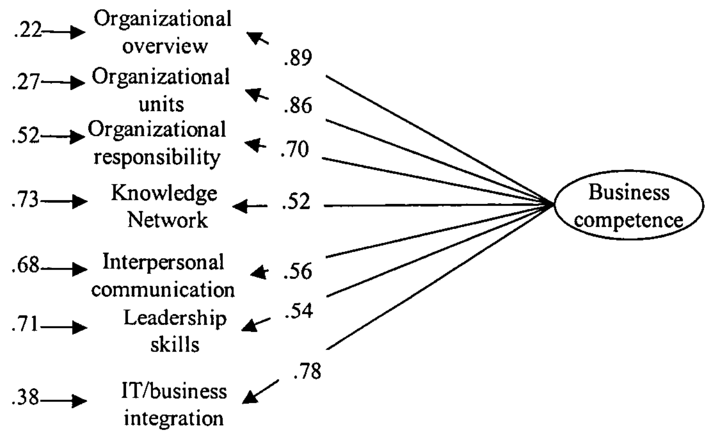

Figure 3.3 Measurement of Business Competence as One-factor Model (Model 3)

Table 3.9 compares the three models on different fit measures. Model 2 provides satisfactory results for the overall fit of the model. Other than a high and significant χ^2, all measures of fit are above the recommended values. Model 3, on the other hand, does not offer a good fit for the data; most indices are below the threshold values. Comparing our proposed model (Model 1) to the two alternative models, we find that each of the indices favors model 1. In addition to the fit measures that we have described, there are two other indices that can be used to compare models. The model Akaike Information Criterion (AIC) uses the χ^2 and the number of estimated parameters to form an assessment of the fit and parsimony of the model, and is therefore useful in comparing models with different numbers of constructs. Smaller numbers indicate a better fitting, more parsimonious model. The AIC for our proposed model is smaller than the AIC for models 2 and 3, so our proposed model is favored. Finally, a comparison of the Comparative Fit Index (CFI)—a more appropriate measure when a smaller sample size is available (Hair et al., 1998)—also supports the superiority of the proposed model, with its highest value of .97, over the alternative models.

Our overall results strongly support the appropriateness of our proposed model (Model 1) with its three distinct factors. Therefore this conceptualization of business competence will be used to test the contribution of business competence to the development of partnerships in the organization.

3.4.7 Measurement properties of Partnerships

We assessed the construct reliabilities for both dimensions of partnerships using composite reliability measures and variance extracted measures. The results are presented in Table 3.12. Our measure of "intentions to develop partnerships" has satisfactory measures of composite reliability and variance extracted. Our measure of "credibility" has a satisfactory measure of composite reliability, while its measure of variance extracted (.43) is slightly below the recommended standard of .5. Correlation between both scales is low (.31; $p<.01$). These scales are used in the analysis of the overall model.

Table 3.12 Estimates of Reliability and Variance Extracted for the Scales

Dimensions	# items	Composite reliability	Variance extracted
Intentions to develop partnerships	3	.77	.53
Credibility	3	.70	.43

3.4.8 Test of the Model

We performed higher order factor analysis to test our model of the business competence. A higher order factor model suggests that the correlations among the first order factors are governed by higher-level factors. In a nomological context, a higher order factor acts as a mediator of predictors and consequent variables, and may be a more important mediator than the lower order factors. Chin (1998) recommends testing the efficacy of higher order factor models within nomological networks.

The higher-order model developed for business competence in IT professionals (Model 4) suggests that the structure of interrelationship between the three first-order factors—"organization-specific knowledge", "interpersonal and management knowledge", and "knowledge of IT/business integration"— are part of the business competence construct. In other words, the domain of the construct is captured not only by the first order factors, but also by the second order factor—the overall business competence. High and significant correlations between the three first-order factors support (Figure 3.1) this representation.

Table 3.13 Goodness-of-Fit Indices for Initial and Competing Model of Business Competence

Indices	Model 4 second order factor (Figure 3.4)	Model 5 3 first order factors (Figure 3.5)	Suggested threshold values
χ^2	72.28	65.68	Smaller
p	0.00	0.00	
df	61	57	
χ^2/df	1.19	1.16	<2-3.0
GFI	.91	.91	>.90
AGFI	.86	.86	>.80
RMR	.045	.042	<.05
RMSEA	.041	.038	.05-.08
NFI	.89	.89	>.90
Model AIC	132.28	133.68	Smaller
CFI	.97	.98	>.90

The initial model proposed (model 4) has an overall satisfactory fit (Table 3.13). The paths linking competence to both dimensions of partnerships (Figure 3.4) represent the impact of competence on these variables and are a test for the nomological validity of the business competence construct. The estimates of .68 ($p<.01$) for the path to "intentions to develop partnerships" and of .48 ($p<.01$) for the path to "credibility" provides strong support for the impact of competence on the dependent variables. Intentions to develop partnerships (R^2 = .46) of IT professionals are strongly affected by their business competence, and their credibility (R^2 = .23) is moderately affected by that level of business competence. The overall fit measures, the multiple square correlation coefficients (R^2) of the dependent variables, and the positive and significant paths coefficients all indicate that the model fits the data well (Figure 3.4).

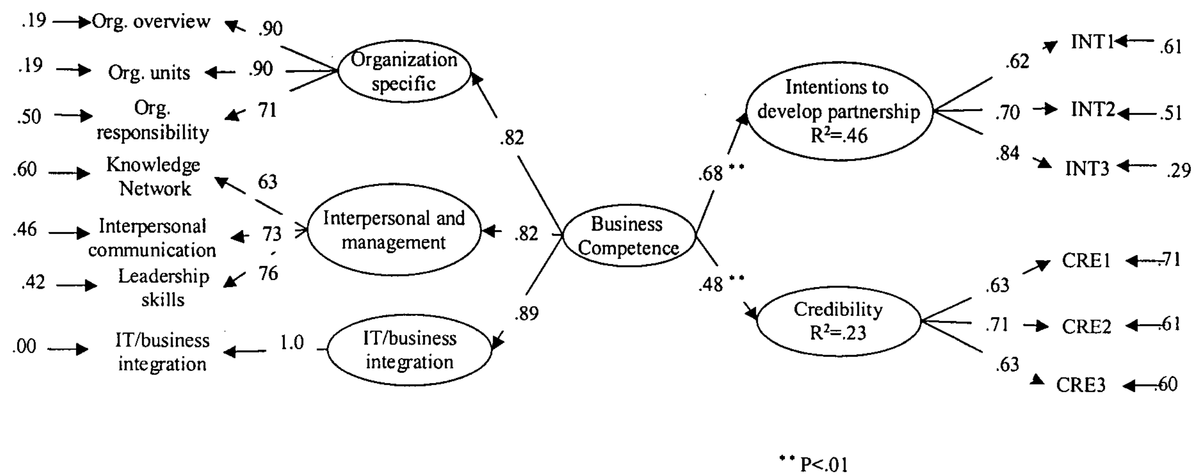

Figure 3.4 Business Competence as Second-order Factor Model (Model 4)

The strength of the paths linking competence to its dimensions—organization-specific knowledge (.82; p<.01), interpersonal and management knowledge (.82; p<.01), and knowledge of IT/business integration (.89; p<.01) —are supportive of convergent validity for the second order factor model[3], meaning that these areas of knowledge are representative of business competence.

To further confirm the appropriateness of the second-order factor model, we compared it with a competing model (Model 5) in which organization-specific knowledge, interpersonal and management knowledge, and knowledge of IT/business integration directly impact the two dimensions of partnerships of IT professionals, eliminating the second order factor (Figure 3.5).

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[3] For convergent validity of the second order factor to be adequately tested, at least four first-order factors are required (Chin, 1998).

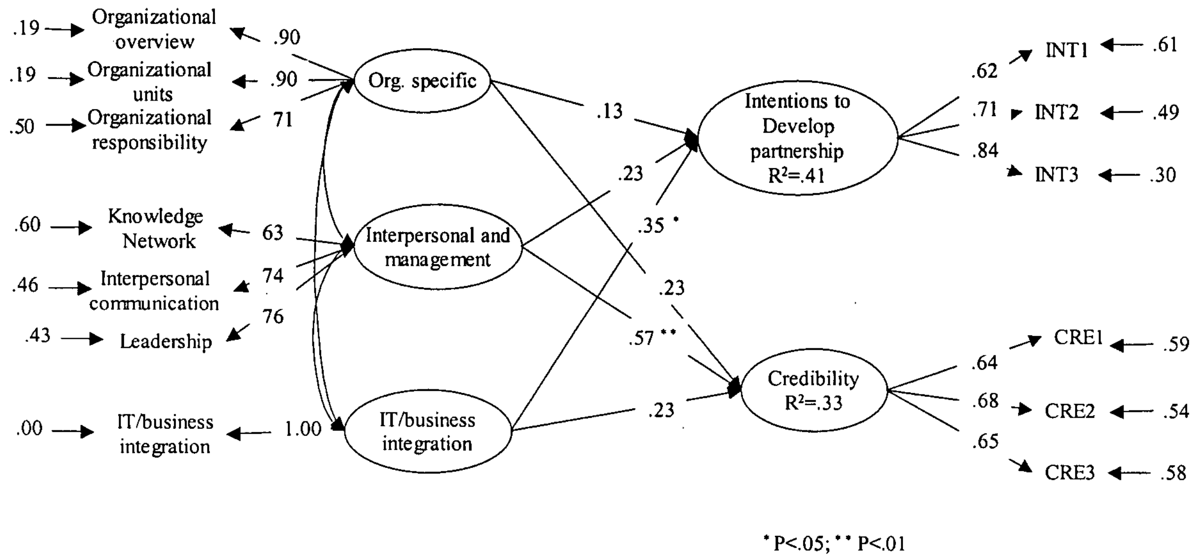

Figure 3.5 Business Competence as Three First-order Factors (Model 5)

Table 3.13 compares the two models on different fit measures. The comparison of the second order factor (Model 4) with the first order factor (Model 5) provides mixed results. Model 5 has the lowest chi-square value, but this model also has the lowest degrees of freedom, meaning less model parsimony. Models 4 and 5 have very similar results for most fit measures. The CFI, appropriate to use with smaller sample, has a difference of only .01 between both models, not meeting the minimum of .02 usually required to state that the differences are statistically significant (Bagozzi et al., 1991).

Marsh and Hocevar (1985) suggest the use of the Target coefficient (T) to compare first-order and higher-order models. This coefficient is the ratio of the χ^2 of the baseline model to the χ^2 of the higher-order model. Its upper limit is 1 and is found when the correlations among the first-order factors are completely accounted for by the second-order model. The target coefficient (65.68/72.28) in this instance is a high .91, supporting the efficacy of the higher-order model. In addition, as the second-order model is more parsimonious, it is said to provide a better fit to the data.

A main difference between the models is the presence of non-or low significant paths in the competing model (Figure 3.5). This result shows the added-value of the second-order factor hence supports our conceptualization of the second-order factor of business competence acting as a mediator between the specific areas of knowledge and the partnerships.

In summary, we hypothesized that business competence in IT professionals influences their partnerships with their business clients. Results show that business competence explains 46% of the variance in the IT professionals' intentions to develop partnerships, and 23% of the variance in the IT professionals' credibility with their business clients. We also proposed that business competence in IT professional is a second-order multidimensional latent construct reflected by the definitional properties of organization-specific knowledge, interpersonal and management knowledge, and knowledge of IT/business integration. A competing structural representation of business competence was evaluated to examine the construct's dimensionality. This alternative suggests that business competence is represented as three correlated, but distinct, first order factors. Comparing these models provides support for the second-order factor representation (Model 4). With fewer degrees of freedom than its alternative model (the first order model), second-order factor model explains the covariation of the first-order factors in a more parsimonious way.

3.5 Discussion

The academic IT literature for the last three decades has stressed the importance of IT people having business knowledge and on the potential of this knowledge for increasing the contribution of IT to organizational goals. To perform a test of this proposition, in this chapter we proposed a model of business competence in IT professionals, defined its constructs, developed measures of these constructs, tested their validity and reliability of the measures, and measured the relationship between business competence and intentions to form partnerships and IT credibility. The model of business competence proposed, including the second order construct "business competence", is well supported by the data, and all three components of business knowledge, namely organization-specific knowledge, interpersonal and management knowledge, and knowledge of IT/business integration, were found to be influential in contributing to overall business knowledge.

Organizations need to educate and train their IT professionals to be more business oriented, given that they invest substantial amounts of money in IT, and often depend on IT to gain competitive advantage, to avoid a competitive disadvantage, and for the survival of the business. This study aims at improving such education by giving managers insights into the best areas for further development of their IT professionals' competence. Identifying a generic set of knowledge that enables IT professionals to understand the business reality may provide guidance to organizations regarding training to be provided to IT people. This guidance may also be of help to educators, for the development of the academic programs addressed to IT professionals.

3.6 Limitations and Future research

The small dataset used to test the model represents an empirical limitation of this study. Even though our sample size met the threshold value of 100, a sample size of approximately 200 is most recommended (Hair et al., 1998). Although some results (e.g., variance in credibility explained) are marginal, they are acceptable for our work that remains somewhat exploratory.

Further development on the dependent variable side is needed. First, the reliability for credibility could be improved, as the current scale has a variance extracted slightly below the recommended value. For the intentions to develop partnerships, although intentions have been shown to be good predictors of behavior, it would be interesting to understand the relationship between business competence and actual partnerships with business clients along with IT deployment in support of organizational activities and business strategies. Further understanding of how it can be instrumental in enabling competitive positioning, be it through the appropriateness of new, IT-enabled organizational forms, or through new IT-based process structures can also be investigated in future research.

3.7 Conclusions

The nature of the IT professionals work is changing; interaction with people other functional areas is now part of their work. IT professionals need to apply their technical knowledge in a way that is beneficial to the organization, and act cooperatively with their business partners. To succeed in this endeavor, IT professionals need a growing range of non-IT skills. The conclusion we draw from this study stands out clearly: the knowledge that IT professionals have in the general business domain and in the interpersonal and management domain, and their ability to integrate IT with the business do matter in the development of partnerships with their business clients.

Our work adds to the body of studies on the IT professionals' knowledge and skills. We have developed a framework inclusive of the different areas of cross-functional knowledge, and represent the business competence as a higher order construct, reflected by the areas of knowledge. This study also adds to the literature on partnerships between IT and business people. The IT professionals' credibility with their business clients is influenced by their knowledge of the business, which is not their core expertise, but is the language spoken by their clients. With higher levels of business knowledge, IT professionals also have higher intentions of developing further or strengthening their partnerships with their clients.

4 Assessing the Contribution of IT and Business Knowledge to the Partnerships and Performance

4.1 Introduction

With the pervasive nature of IT in the business world and its increased importance to the overall performance of many firms (Rockart et al., 1996), a greater interdependence between IT and business people has evolved. This interdependence reflects the existence of influence or control between persons and creates the need for coordination (Thompson, 1967). In such a context, the creation of working relationships between interdependent units emerges as a coordination mechanism (Brown and Ross, 1996; Kraut, Steinfield, Plummer, Buthler, and Hoag, 1999) by providing the space for collaborative action to take place (Nonaka and Konno, 1998). Only through the development of such effective working relationships can complex systems of coordinated action be efficiently managed. By increasing the coordination between these interdependent units, partnerships between IT and business people foster successful project implementation (Bashein and Markus, 1997; Preiser-Houy, 1999), IT-based innovation (Boynton et al., 1994), sustainable competitive advantage (Henderson, 1990; Ross et al., 1996), and an ability to cope with business and technological changes (Reeny and Willcocks, 1998; Rockart et al., 1996).

Thompson (1967) suggests that interdependence is explained by the differentiation among actors caused by their distinctive responsibilities and resources. And with the increasing importance of knowledge in organizations, it is now the sharing of intellectual information that has become important and shapes the need for more coordination between actors with different set of skills and knowledge. The sharing of knowledge among different specialists facilitates the integration of the different knowledge bases in an organization, thereby developing firm-level competence that will create competitive advantage (Grant, 1996).

Common or shared knowledge represents the overlap of knowledge among different specialists that enables them to communicate (Demsetz, 1991). Shared knowledge among IT specialists and business managers represents their ability "at a deep level, to understand and be able to participate in the other's key processes and to respect each other's unique contribution and challenges" (Reich and Benbasat, 2000, p.86). Some studies have highlighted the importance of shared knowledge—specifically between IT professionals and their business clients—by looking at how it influences the ability to achieve alignment of business and IT objectives, mainly through communication (Reich and Benbasat, 2000). Others have analyzed how shared knowledge contributes to information system (IS) group performance (Nelson and Cooprider, 1996).

The goal of this study is to understand the contribution of shared knowledge between IT professionals and their business clients to the development and the effectiveness of their partnership. We use the concept of shared knowledge to refer to the cross-functional knowledge in both IT professionals and business clients. An interaction effect between these two sources of cross-functional knowledge may further contribute to shared knowledge. We measure partnership using both process and performance variables.

This chapter is organized as follows. First, we discuss the theoretical background for shared competence and partnerships, and develop the hypotheses. The presentation of the research method, construct operationalization, and results of the model testing follows. We conclude this chapter with a discussion of the contributions and limitations of this study.

4.2 *Theoretical background and research hypotheses*

4.2.1 Shared Competence

Recent evidence has only reinforced Keen's (1991, p. 121) assertion that "business cannot afford technology-illiterate managers any more than it can afford business-illiterate IT professionals". Knowledge is an organizational capability that is a source of sustainable competitive advantage (Kogut and Zander, 1992; Prahalad and Hamel, 1990) and cross-functional knowledge in particular enables organizations to leverage their knowledge resources by facilitating the integration of different sources of knowledge (Grant, 1996). Hence, to maximize the benefits of IT within a firm, it becomes imperative for the firm to employ people who share both knowledge and an understanding of each other's reality (Henderson, 1990; Ross et al., 1996).

Redundancy or an overlap of knowledge and expertise is a prerequisite for organizations to create absorptive capacity (Cohen and Levinthal, 1990) and for rapid innovation (Nonaka, 1994). In addition, pooling of IT and business people's knowledge is needed for these parties to develop mutual understanding and partnerships (Armstrong and Sambamurthy, 1999; Henderson, 1990; Nelson and Cooprider, 1996). Boynton et al. (1994) defined shared knowledge as "overlapping know-how of IT and line managers (in particular, the knowledge IT managers possess about the business and strategic issues within the firm, and the knowledge line managers possess about the potential opportunities from applying IT within their business domain)" (Boynton et al., 1994).

We define shared competence as the set of cross-functional knowledge in IT and business people. In this study, we examine the IT competence (ITC) of business people and the business competence (BC) of IT professionals. The focus of this approach is the "extra" or cross-functional knowledge possessed by business and IT people, that is, the knowledge that is above and beyond an individual's own domain and relates specifically to the knowledge domain of the other partner. It is important to note that competence in this context is dynamic, interactive, and transferable, (i.e., not linked to a specific task). The model is thus generic in nature and is not directed at a particular type of technology, position, organization, or industry.

4.2.1.1 IT Competence

Business people are increasingly asked to integrate IT into their decision-making processes and IT is taking a pervasive role in the work of business people. They are now expected to deploy IT effectively and strategically (Silver et al., 1995), to assume ownership of IT projects within their domain of business responsibility (Sambamurthy and Zmud, 1994), to develop a partnership with IT professionals (Ross et al., 1996), and to take the leadership in IT implementation (Rockart et al., 1996). IT competence is required for an organization to prepare for its future.

As seen in chapter 2, **IT competence in business people** is defined is this study as the *set of IT-related knowledge and experience that a business person possesses.* A business professional competent in IT thus possesses explicit and tacit IT knowledge, even though his or her primary area of expertise lies in a function other than IT. The areas of knowledge we identify and test are applications, technologies, system development, management of IT, as well as access to other sources of knowledge. We analyze experience at two levels: project and management. Detailed conceptualized is described in chapter 2.

4.2.1.2 Business competence

Organizations are increasingly demanding more business acumen in their IT staff. This is evidenced by the steady increase in recent years in the proportion of CIO recruits who bring to the firm a general business background rather than technical training (York, 1999). This expectation of business competence at all levels in the organization requires that IT professionals expand their domain of expertise beyond that of technology. Business knowledge is essential if IT people are to make linkages with other units, have a larger perspective, and if the firm is to benefit from the fit between IT and the organizational context (Silver et al., 1995). It is important for IT professionals to increase their business knowledge and understanding in order to improve their relationships with business managers and to be able to participate in important decision making processes with others (Bashein and Markus, 1997; Henderson, 1990; Keen, 1991; Rockart, 1988).

As seen in chapter 3, **business competence in IT professionals** is defined in this research as the *set of business and interpersonal knowledge and skills possessed by an IT professional.* The areas of knowledge we identify and test are organization-specific (organizational overview, organizational units, and business responsibility), knowledge of IT/business integration, and interpersonal and management knowledge (interpersonal communication, leadership skills, and knowledge networking). Detailed conceptualized is described in chapter 3.

4.2.2 Partnerships

Interdependence reflects the existence of influence or control between persons, organizational units or firms. With the pervasive nature of IT in the business world and its increased importance to the overall performance of many firms (Rockart et al., 1996), a greater interdependence between actors from IT and other business areas has evolved. Such interdependence creates the need for coordination and communication between the actors (Galbraith, 1977). In such a context, the creation of working relationships between interdependent units or individuals emerges as a coordination mechanism (Brown and Sambamurthy, 1996; Kraut et al., 1999) by providing the space for collaborative action to take place (Nonaka and Konno, 1998). Effective working relationships between interdependent actors are required for complex systems of coordinated action to be efficient (Fichman and Levinthal, 1991). This means that developing partnerships is one way by which individuals manage their interdependencies.

The focus of this study is on the working relationship between people from different departments but from the same organizational rank. These working relationships, in contrast to social relationships, play an important role in the achievement of effective, changed-oriented results through cooperation and collaboration (Gabarro, 1990). They provide the means for mutual adjustment and coordination, both of which are needed by individuals facing uncertainty and interdependence with people from other functional area within the organization (Thompson, 1967).

In this study we distinguish between the development of the partnerships and their effectiveness. This view is consistent with Hackman's (1987) model of team effectiveness, which suggests that group process variables determine actual team effectiveness. Effectiveness refers to the performance of the partners and will be described below. The development of the partnership refers to the variables that facilitate the coordination between the partners. The partnership process variables included in this study are the communication, trust, and collaboration between the partners. Together they contribute to a greater coordination between the parties. The literature clearly identifies the creation of partnerships as a dynamic process, built through the development of communication, trust, and collaboration (Gabarro, 1990; Gambetta, 1988; Henderson, 1990; Nelson and Cooprider, 1996; Preiser-Houy, 1999). Indeed, the development of these components creates the coordination that brings the actors into a common action, sharing goals as well as risks and responsibilities (Henderson, 1990; Ross et al., 1996). Therefore we define partnerships as the working relationships between IT and business people formed by the communication, mutual trust, and collaboration between the parties.

4.2.2.1 Communication

Communication between two interdependent individuals allows for more coordination and mutual adjustment (Thompson 1967). Communication is the means by which business and IT people share information and expertise; it is a building tool in the development of the partnership between business and IT partners. However, because of their differences in background and frames of references, effective communication between IT and business people can often be difficult to establish (Orlikowski and Gash, 1994).

In this study, communication refers to the *quality of the exchanges occurring between IT and business people.* The quality of the communication is reflected by characteristics such as the openness, the ease of information flow, and the balanced contribution of both partners. When the level of cross-functional knowledge is high for IT and business people, the communication between the parties involved is more likely to be balanced[4]. Indeed, to be effective, communication requires fluency in the language of the other person. Cross-functional competence gives IT and business people the common language needed to communicate and share information about IT in the organizational context (Cohen and Levinthal, 1990; Galbraith, 1977). In this sense, shared knowledge between IT and business people is an important factor facilitating communication between the parties (Murray, 1998;

[4] The influence can also be reverse, where communication between IT and business people will increase their cross-functional competence. This study focuses on the influence of competence on the directionality and quality of the communication.

Reich and Benbasat, 2000). The more knowledge they have in common, the more the parties will be able to exchange information and understand each other. Knowledge of each other's domain should therefore have a positive influence on the overall communication between the parties.

4.2.2.2 Trust

Trust is a key component in the development of working relationships. It may arise from situations where interdependence exists between business and IT people (Kipnis, 1996). A high-quality partnership is characterized by a high level of trust between the parties (Preiser-Houy, 1999). A lack of trust also explains an inability to develop workable partnerships between IS and line managers (Henderson, 1990). Trust within organizations is a determining factor in the development of coordination between parties (Gambetta, 1988; McAllister, 1995).

Trust is a belief that can be distinguished from the behavioral manifestation of trust (Mayer et al., 1995). As a belief, trust reflects one's expectation about someone else's behavior (Gambetta, 1988). It is the probability that the person we trust will behave in a way that is beneficial to us. Trust exists when there is a risk factor associated with interactions with the other party. This implies that for trust to exist, a vulnerability must exist (Mayer et al., 1995). Trusting someone means believing that the trusted person is capable of managing valuable resources (Kipnis, 1996). Trust is also domain-specific (Zand, 1972). Based on these elements, mutual trust in the context of this study refers to the *shared beliefs by IT and business people that the other will behave in a way that benefits their joint IT-business efforts*.

Shared competence can affect the level of trust between the parties through two mechanisms. First, an important condition of trust is the competence or expertise of the party to be trusted (Barber, 1983; Butler, 1991; Mayer et al., 1995; Mishra, 1996). Trust will increase with the competence possessed and demonstrated by the other. Second, people are more likely to trust others who are similar to themselves (Bashein and Markus, 1997; McAllister, 1995). Based on these two observations, IT and business people are likely to increase their trustworthiness by showing some similarity and by being competent in their understanding of the other's reality. In the present study, the domain in which the trustee (person to be trusted) is expected to be competent happens to be the work domain of the trustor (person who trusts). Cross-functional competence in IT and business people increase each party's similarity to the other, and thus increases trust.

4.2.2.3 Collaboration

Partnerships between IT and business people are also characterized by the collaboration that takes place between them (Henderson, 1990). In the context of this study, collaboration refers to the *degree to which responsibilities and goals are shared between IT and business people in their joint IT-business efforts*. When IT professionals and business people understand each other's reality, they are more likely to work towards common goals and be willing to share risks and responsibilities in their common activities. When collaborating, partners share the responsibility for what they collaborate on (Preiser-Houy, 1999). Therefore, collaborative action between actors is a key component of partnerships (Henderson, 1990; Preiser-Houy, 1999).

4.2.3 Influence of shared competence on partnership

A considerable hurdle in the development of partnerships between IT and business people is their "cultural gap" (Bashein and Markus, 1997; Preiser-Houy, 1999). Each functional area in an organization has its own specialized view. This leads to a well-recognized divergence between the IT group and other line or business groups in the organization regarding the role of IT within the organization. Each group has its complaints about the other group, which serve to enforce the divergence between the groups. Business people often feel that IT professionals are concerned with technical issues at the expense of business issues, that they do not understand the business reality, and that they lack communication skills. IT professionals, on the other hand, often feel that business people lack technical knowledge, have unrealistic deadlines, and do not know what they want (Preiser-Houy, 1999). IT and business people in an organization are two solitudes (Murray, 1998).They have different perceptions of the role of IT in the organization and their frames of references are often incongruent (Orlikowski and Gash, 1994). This misunderstanding of each other's frames of reference negatively affects the interactions between the parties (Athos and Gabarro, 1978).

IS and business people's respective limited skills and knowledge in the other's domain is a reason for failure that can be controlled for (Lyytinen, 1988). The challenge is for organizations to create bilateral relationships between people with different sets of skills and knowledge. An important factor in the development of working relationship is task-based competence (Gabarro, 1978). Displaying competence is a key tactic leading to high quality relationships between IT professionals and their business clients (Preiser-Houy, 1999). Interestingly, Markus and Benjamin (1996) found that the trust that business people have in their IT partners is not clearly related to their technical competence. Business people tend to trust and develop partnerships with IT professionals who have business knowledge and understanding (Markus and Benjamin, 1996). By improving their competence in the other's domain, each group can improve its understanding of the other party and can share some of the other party's reality. Seeing someone as similar to oneself makes him or her a more attractive partner in a relationship (Athos and Gabarro, 1978). Common interests and language contribute to the development of trust (Bashein and Markus, 1997) and of communication (Athos and Gabarro, 1978; Orlikowski and Gash, 1994).

H1. IT competence in business people will positively influence their partnerships with IT professionals they work with.

H2. Business competence in IT professionals will positively influence their partnerships with their business clients.

4.2.4 Influence of partnerships on Performance

By increasing the coordination between these two interdependent units, partnerships between IT and business people foster successful project implementation (Bashein and Markus, 1997;

Preiser-Houy, 1999), IT-based innovation (Boynton et al., 1994), sustainable competitive advantage (Henderson, 1990; Ross et al., 1996), and an ability to cope with business and technological changes (Feeny and Willcocks, 1998; Rockart et al., 1996).

Group process variables are identified as determinants of the effectiveness of the team (Hackman, 1987). Partnerships between IT and business people, as formed by the communication, trust, and collaboration between the parties, should result in an enhancement of IT performance in an organization. "The partnership concept rests on the notion that performance can be significantly improved through joint, mutually dependent action" (Henderson, 1990, p.8)

The team performance, or its ability to deliver a timely and high quality product, is a tangible outcome of the partnership process (Pinto, Pinto, and Prescott, 1993). As pointed out by Henderson (1990) and Rockart and Short (1989), an effective partnership between the two major actors (IS and business people) is required to get an effective delivery of information systems products and services. We thus have the following hypothesis:

H3. Partnership between IT and business people positively influences performance of the project they work on together.

4.2.5 Influence of Shared Competence on performance

The performance of the project that IT and business people work on together may also be directly influenced by the level of cross-functional knowledge in both parties. Indeed, when knowledge and understanding is shared among IT and business people or groups, a better information systems performance in organizations has been observed (Chan, Huff, Barclay, and Copeland, 1997; Nelson and Cooprider, 1996).

H4. IT competence in business people will positively influences performance of the project they work on with their IT professional partner.

H5. Business competence in IT professionals will positively influences performance of the project they work with their business clients.

4.2.6 Interaction between IT and business competence

The nature of the shared competence construct can vary with the level of interaction between the two components and by the nature of this interaction. It is therefore worth asking if there is a synergy between ITC and BC, if one competence is more important than the other is, or if both competencies are required for to maximize the effectiveness of cross-functional competencies. We hypothesis that the partnerships and performance outcomes are determined not only by each individual competence, but also by the fit between them. Different conceptualizations of fit exist, and the literature on strategic alignment has thoroughly examined this concept (see Venkatraman [1989] for a detailed taxonomy). Fit as *moderation* refers to the case where the fit between a predictor and a moderator – a third variable on which the impact of the predictor variable on the criterion variable depends – is the primary determinant of the criterion variable. The underlying conceptualization of fit is the **interaction** (Venkatraman, 1989). This conceptualization was used in previous studies investigating shared knowledge (Boynton et al., 1994; Nelson and Cooprider, 1996). Under this perspective, shared competence is a synergistic combination of business and IT competence. It implies that each source of competence interacts and leads to the existence of an explicit interaction effect. This underlying conceptualization of interaction leads to a multiplicative assessment of the two sources of competence in which each source is given equal weight. This type of assessment allows us to evaluate the level, or intensity, of shared competence. The studies just cited used very generic measures of knowledge. In the present study, we use this conceptualization to establish the level of shared competence, which in this case refers to the degree to which ITC and BC complements and augment one another in contributing to the partnership between IT and business people.

Fit as moderation suggests that ITC moderates the relationships between BC and partnerships, and that BC moderates the relationships between ITC and partnerships. It is therefore the combination of the ITC and the BC variables, as well as the synergy between the two that matters.

H6. The interaction between IT competence in business people and business competence in IT professionals will positively influences performance of the project they work together.

H7. The interaction between IT competence in business people and business competence in IT professionals will positively influences their partnerships.

4.2.7 Control variables: own domain knowledge

The quality of partnerships between individuals of different areas can also be influenced by their knowledge in their respective domain. Expertise or competence is a known antecedent to the trust between two individuals (Mayer, Davis, and Schoorman, 1995). That knowledge is also the reason why these individuals get into these partnerships in the first place.

H8. The BC's business knowledge will have a positive influence on the partnership with the IT professional.

H9. The ITP's IT knowledge will have a positive influence on the partnership with the business client.

To summarize, this study is concerned with the contribution of IT and business knowledge in members of two interdependent actors—the IT professionals and the business client—to the development of their partnerships and to the performance of their projects. Based on the fact that competence provides the means to better performance (Klemp, 1979), shared competence is seen here as an enabler of bilateral partnership between IT and business people leading to better project performance. The aspects of partnership included in this study are the communication, trust, and collaboration between IT and business people. The model is generic in nature, and is not directed at a particular type of position, organization, or industry. Figure 4.1 shows the overall model of this study. The empirical study to test this model is discussed next.

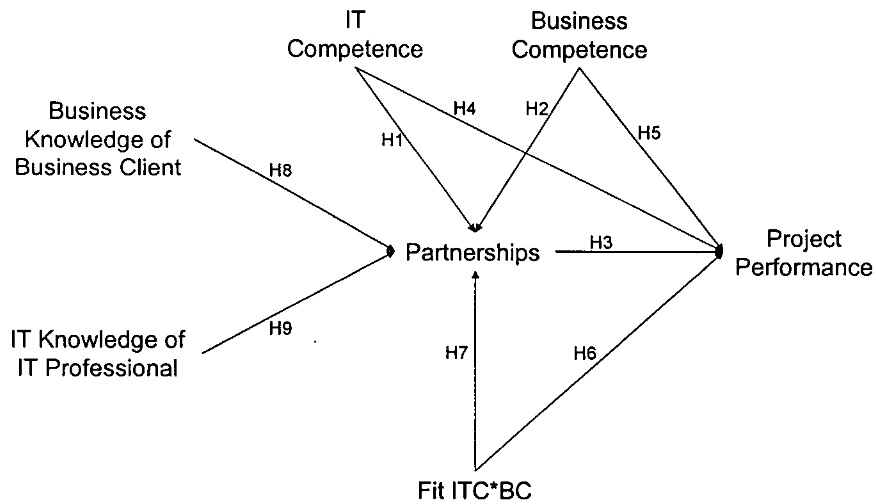

Figure 4.1 Model of the IT and Business Knowledge, Partnerships and Performance

4.3 Research Method

4.3.1 The sample

We gathered the data needed to explore the effect of shared competence on partnerships and performance through a cross-sectional survey. Respondents reported on cross-functional dyadic relationships with peers at work.

The organizations contacted to participate in this study were either members of the advisory board of the UBC Faculty of Commerce and Business Administration or personal contacts from industry. Of the 52 organizations we contacted, 18 (35%) agreed to participate. We asked our contacts in these firms to identify sets of respondents. One set consists of three people: an IT professional, a business client with whom the IT professional works on specific IT projects or for day-to-day IT operations, and a sponsor who can comment on the work done by the pair. Respondents may be at any level in the organization, and may have different status (employee, contractor, etc).

Participating organizations identified different numbers of participating sets, varying from 1 to 21, for a total of 117 sets. We sent each respondent a package containing an introductory letter signed by our contact in the organization, the survey, and a prepaid return envelope. Completed surveys were mailed directly to the researcher.

Response rates were: 93% (109/117) for IT professionals, 82% (96/117) for business clients, and 90% (105/117) for the sponsors. The final data set consists of 85 complete sets (73%) representing 17 different organizations. 18 respondents were involved in more than one set (nine sponsors were involved in two sets, and two sponsors were involved in three sets; four ITP were involved in two sets, and one was involved in four sets; two BC were involved in two sets). Respondents worked on a wide range of IT projects at various stages of completion. In some projects, members of the dyads were the sole participants in the project, while in other they were part of a large team. When they were not the only members, the respondents were the leader of their group (IT or business). Respondents' profile is described in Table 4.1. Participating organizations represented different industries, such as government, banking, oil and gas, telecommunications, publishing and media, and real estate investments. They ranged in size from around 200 to over 27,000 employees.

Table 4.1 Respondents Profiles

		IT professional	Business client	Sponsor
Gender	Male	46 (54%)	46 (54%)	67 (79%)
	Female	38 (45%)	38 (45%)	17 (20%)
Age	20-35	15 (18%)	18 (21%)	10 (12%)
	36-50	58 (68%)	50 (59%)	52 (61%)
	51-65	12 (14%)	16 (19%)	22 (26%)
Level of education	High school diploma	10 (12%)	14 (16%)	—
	College diploma	22 (26%)	14 (16%)	—
	University bachelors degree	36 (42%)	34 (40%)	—
	University masters degree	11 (13%)	15 (18%)	—
	Other	6 (7%)	8 (10%)	—
Tenure (years)	Mean (std dev)	12 (8.6)	14.8 (10.0)	12.1 (9.1)

4.3.2 Level of analysis

The unit of analysis is in this study is the pair of IT professional and business manager working together. The level of measurement is the individual member of this partnership. Individual team members (ITP and BC) responded to measures of competence and of partnership. Some data is at the individual level (e.g., competence) as self-reported by each member of the dyad, while other data is reported by both members of the dyad (e.g., communication). The sponsors assessed the measures of team performance, thereby avoiding same-source bias for links to performance. Team members and sponsors surveys were administered at the same time period. Table 4.2 shows the respondents for the different constructs.

Table 4.2 Respondents for Each Construct

Construct	Respondent: IT professional	Business client	Sponsor
IT competence of business client		X	
Business competence of IT professional	X		
ITP IT knowledge		X	
BC business knowledge	X		
Communication	X	X	
Trust	X	X	
Collaboration	X	X	
Project performance			X

4.3.3 Construct Measurement

The model is generic in nature, and is not directed at a particular type of position, organization, or industry. Instruments to measure the IT competence, business competence, partnership and performance were required for this study. For IT competence and business competence we used the instruments described in chapters 2 and 3. For some of the other variables, we adapted existing instruments to the context of this study. Other constructs in the research model do not have validated measures, but conceptual work exists that allows us to develop theory.

4.3.3.1 IT Competence and Business Competence

The scales for IT competence and business competence emerge from the work of the previous chapters. Certain differences in the measures exist because the instruments for this study were developed before the analyses on the previous ones were finalized. The differences are as follows. For the business competence instrument, two items were added to the "leadership" dimension, and three items were removed from the "IT/business integration" dimension. For IT competence, two items were removed from the dimension "knowledge of technology" (personal computer, imagery). Two items were removed from the dimension "knowledge of applications" (WWW, EDI), one was added to that scale (data warehouses and data mining), and the item about "groupware" was replaced with "group support". In the "knowledge of the management of IT" dimension, the items about "assets" was rewritten to

include both assets of hardware and software, and the item about "policies" was removed. In the "experience in IT project", the item about "identifying cost and benefits" was removed; the item about "developing IT" was replaced by "building and acquiring IT".
Except for one case, the differences are inconsequential. But for the "organizational responsibility" dimension of the IT competence, three of the four initial items were not included, leaving only one item to measure this dimension.

The initial instrument to measure business competence used in this study contained 24 items. All items, along with their means and standard deviations are listed in Table 4.3. The initial instrument to measure IT competence used in this study contained 25 items. All items, along with their mean and standard deviation are listed in Table 4.6. A 7-point Likert-type scale was used with these items.

To facilitate the analysis of the current model, we aggregated scales for IT competence and business competence. IT competence is the latent construct measured by its two dimensions of IT knowledge and IT experience, while business competence is the latent construct measured by its three dimensions of organization-specific knowledge, interpersonal and management knowledge, and knowledge of IT/business integration. Although these instruments were validated in the studies reported in chapter 2 and 3, we assessed the measurement properties to ensure that the good results found in these previous studies also apply in the context of this new study. Using PLS-Graph 3.0, we assessed factor loadings and reliabilities before proceeding with the aggregation of the scales. The item-constructs loadings were assessed with no relationships specified between the constructs. Items were all reflective, as modeled in the previous chapters. Results are in Table 4.3. Loadings below .70 indicate low reliability for the item. We deleted items with loading below .70, except for two that were only slightly below this threshold value. Three items were deleted using this criterion for the business competence scale (represented in italics in Table 4.3).

Table 4.3 Initial Set of Items for Business Competence (items dropped shown in italics)

Dimension	Question	Mean (std dev)	Loading
	Organization-specific knowledge		

Organizational overview	Rate your level of knowledge of the organization's external environment (e.g., government, competitors, suppliers, and customers)	4.54 (1.03)	.7116
	Rate your level of knowledge of the goals and objectives of the organization as a whole	5.65 (.88)	.8593
	Rate your level of knowledge of the core capabilities of the organization	5.27 (.85)	.8073
	Rate your level of knowledge of the key factors that must go right for the organization to succeed	5.05 (1.18)	.7405
Organizational units	Rate your level of knowledge of the main challenges that different divisions in the organization face in achieving their objectives	4.51 (1.15)	.8198
	Rate your level of knowledge of the language (e.g., key concepts, jargon, etc.) of the different divisions in the organization.	4.99 (1.09)	.7740
	How well do you understand the work processes of the different divisions in your organization?	4.61 (1.09)	.7472
	Rate your level of knowledge of the connections and interdependencies between the various divisions in the organization	5.08 (.97)	.7206
Organizational responsibility	How much do you participate in business activities that are <u>not</u> directly related to IT?	4.78 (1.42)	1.00
	Interpersonal and management knowledge		
Knowledge Networking	*If you have a business question or problem that you cannot solve alone, how confident are you about finding the right person to contact in your organization?*	*6.05 (.62)*	*.0702*
	If you have a business question or problem that you cannot solve alone, how confident are you about finding the right contacts outside your organization (consultants, vendors)?	4.88 (1.38)	.8662
	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?	4.98 (1.24)	.8700
Interpersonal communication	In general, how effective do you think you are at communicating with people at different levels of the organization (e.g., with your subordinates, peers, superiors)?	5.85 (.84)	.8929
	How effective are you at working in a team environment?	6.19 (.59)	.6788
	How well can you communicate about IT matters in non-technical language and within a business context to non-IT specialists?	5.84 (.74)	.8274
Leadership	In general, how effective do you think you are at managing projects (planning, managing resources, evaluating, etc.)?	5.80 (.86)	.6715
	In general, how effective do you think you are at acting in a leadership role (e.g., establishing direction, directing people, motivating and inspiring, etc.)?	5.75 (.77)	.7170
	In general, how effective are you at applying practices for the management of change in the organization?	5.12 (1.06)	.7771
	In general, how effective are you at applying risk management practices in the organization?	4.80 (1.16)	.8651
	Knowledge of IT/business integration		
IT/business integration	How experienced are you at recognizing potential ways to exploit new business opportunities using IT?	5.13 (1.18)	.8295

How experienced are you at analyzing business problems in order to identify IT-based solutions (understand situations, getting the "big picture", identifying underlying root problems, etc.)?	5.75 (.86)	.7152
How experienced are you at evaluating the organizational impacts of IT solutions?	5.25 (.91)	.8965
Rate your level of knowledge of the alignment between business goals and information systems goals in the organization as a whole	*4.98 (1.12)*	*.5782*
Rate your level of knowledge of the way IT contributes to the value of the organization	*5.89 (.82)*	*.5199*

We then used the factor loading to calculate the scales composite reliabilities, which reflect the scales' internal consistency (Hair et al., 1998). The internal consistency was calculated as follows:

Reliability = $(\Sigma\lambda)^2 / [(\Sigma\lambda)^2 + \Sigma \mathrm{Var}(\varepsilon)]$,

where λ refers to the item loadings, and var(ε) to the error variance. All scales showed acceptable reliability, with values ranging from .75 to .86 (Table 4.4), all above the recommended values of .70 (Hair et al., 1998).

Table 4.4 Composite Reliability for the Business Competence Dimensions

Dimension	#items	Composite Reliability
Organizational overview	4	.86
Organizational units	4	.85
Organizational responsibility	1	-
Knowledge network	2	.75
Interpersonal communication	3	.84
Leadership	4	.85
IT/business integration	3	.86

We then calculated an overall measure of each dimension by taking the average of the items in that dimension. Next, we assessed the item-constructs loadings of these aggregated scales using a new factor analysis conducted in PLS, with no relationships specified between the constructs. Results presented in Table 4.5 show that two of these scales did not load properly on their respective dimension, with values significantly under the threshold value of .70. We removed both "organizational responsibility" and "knowledge network".

Table 4.5 Factor Loadings for Composite Scales of Business Competence

Dimension	Composite Scales	Loadings
Organization-specific knowledge	Organizational overview	.8686
	Organizational units	.8953
	Organizational responsibility	*.5131*
Interpersonal and Management knowledge	*Knowledge network*	*.4496*
	Interpersonal communication	.8296
	leadership	.8526
Knowledge of IT/business integration	IT/business integration	1.00

We followed the same procedure for the IT competence scale. The item-constructs loadings for the initial 25 items specified to load into 7 dimensions were tested through a factor analysis in PLS, with no relationship specified between the constructs. Mean, standard deviation and loading for all items are reported in Table 4.6. We deleted one item from the "access to IT knowledge" dimension, as its loading was well under the recommended value of .70 (item shown in italics in Table 4.6).

Table 4.6 Initial Set of Items for IT Competence (item dropped are shown in italics)

Dimension	Question	Mean (std dev)	Loading
	IT Knowledge		
Technology	What is your general knowledge of client-server?	3.38 (1.48)	.8942
	What is your general knowledge of LAN?	3.38 (1.37)	.8968
	What is your general knowledge of multimedia?	3.38 (1.42)	.6803
Application	What is your general knowledge of e-commerce?	3.83 (1.61)	.8402
	What is your general knowledge of data warehouses and data mining?	3.57 (1.68)	.8219
	What is your general knowledge of Group support (e.g., intranets, Lotus Notes)?	3.40 (1.3)	.7173
System development	What is your general knowledge of traditional system development life cycle?	3.91 (1.93)	.8184
	What is your general knowledge of end-user computing?	4.11 (1.78)	.7229
	What is your general knowledge of prototyping?	3.88 (1.77)	.6830
	What is your general knowledge of outsourcing?	4.21 (1.43)	.8838
	What is your general knowledge of project management practices?	5.28 (1.37)	.8538
Management of IT	Indicate your level of knowledge about the existing and planned IT assets (hardware, software)	4.09 (1.41)	.7405
	How informed are you about the IT budget in your business unit?	3.73 (1.83	.8963
	How informed are you about the IT strategies in your business unit?	3.94 (1.70)	.9129
	How informed are you about the IT vision statements in your business unit?	3.76 (1.74)	.8938

Access to information	*How knowledgeable are you about IT or business people to contact within your organization as source of information about IT?*	*5.48 (1.20)*	*.0653*
	How knowledgeable are you about IT or business people to contact outside your organization as source of information about IT?	4.29 (1.53)	.8796
	How knowledgeable are you about secondary sources of knowledge as source of information about IT?	4.67 (1.22)	.8862
	IT Experience		
IT projects	To what extent are you experienced in initiating new information technology projects?	4.51 (1.74)	.8901
	To what extent are you experienced in building or acquiring information technology (e.g., analysis, selection, programming)?	3.87 (1.93)	.8930
	To what extent are you experienced in managing information technology projects (e.g., budgeting, scheduling, staffing)?	4.23 (1.85)	.9050
Management of IT	To what extent are you experienced in creating an information technology vision statement regarding how IT contributes to business value and strategy?	3.33 (2.05)	.8436
	To what extent are you experienced in developing information technology strategy (e.g., decide what projects to invest in, set priorities)?	4.26 (1.87)	.8896
	To what extent are you experienced in creating information technology policies (e.g., buy or build, outsource?	3.30 (1.82)	.9045
	To what extent are you experienced in setting information technology budgets?	3.32 (1.75)	.9075

All scales showed acceptable reliability, with values ranging from .84 to .97 (Table 4.7), all above the recommended values of .70 (Hair et al., 1998).

Table 4.7 Composite Reliabilities for the IT Competence Dimensions

Dimension	# items	Composite Reliability
Knowledge of Technology	3	.87
Knowledge of Applications	3	.84
Knowledge of System development methods	5	.90
Knowledge of Management of IT	4	.92
Access to knowledge	2	.88
Experience in IT projects	3	.92
Experience in IT Management	4	.97

We then calculated an overall measure of each dimension by taking the average of the items in that dimension. The item-constructs loadings of these aggregated scales were then assessed through a new factor analysis conducted in PLS, with no relationships specified between the constructs. Results presented in Table 4.8 show that all scales load properly on their respective dimension.

Table 4.8 Factor Loadings for Composite Scales of IT Competence

Dimensions	Composite Scales	Loadings
IT Knowledge	Knowledge of Technology	.8038
	Knowledge of Applications	.8392
	Knowledge of System Development Methods	.8436
	Knowledge of Management of IT	.7591
	Access to knowledge	.8016
IT Experience	Experience in IT projects	.9302
	Experience in IT Management	.9302

In addition to these detailed self-assessment measures of competence, the partners also assessed each other's own knowledge, with a four-item measure. Items, means, and standard deviation are listed in Table 4.9.

Table 4.9 Items for the Partner's Cross-functional Knowledge

Question	Assessed by	
	ITP Mean (Std Dev)	BC Mean (Std Dev)
Does your partner have experience [in IT projects and activities /with business (non IT) projects]?	4.71 (1.32)	4.72 (1.48)
Does your partner have sufficient [IT/business] knowledge to understand this project?	5.22 (1.15)	5.29 (1.31)
Does your partner understand your work environment (problems, tasks, roles, etc.)?	5.02 (1.22)	5.39 (1.27)
Is your partner knowledgeable about [general IT issues/the general organizational context of the organization]?	4.80 (1.24)	5.47 (1.17)

4.3.3.2 Partnership

Table 4.10 lists the items used to measure communication, trust, and collaboration. We developed scales for communication and collaboration for this study. The scale for trust is adapted from Jarvenpaa, Knoll, and Leidner (1998) and Mayer and Davis (1995). A 7-point Likert-type scale was used with these items.

Both partners were individually asked to assess these dyad-level variables. As the unit of analysis is the dyad, we aggregate the BC and ITP data. Prior to proceeding with the aggregation, we assessed the within-dyad agreement. It is critical to demonstrate the within-dyad agreement in order to justify using the dyad average as an indicator of a dyad-level variable. This agreement can be assessed using the InterRater Reliability (IRR). IRR is the proportion of systematic variance in a set of judgments in relation to the total variance (random measurement-error and systematic variance) in the judgments (James et al., 1984). It is equivalent to an index of interrater similarity. The IRR is calculated as:

[1- (observed variance/expected variance from random responding)].

This within-group interrater reliability is relevant for situations involving judgments of a single target by one group of judges (James et al., 1984). Values over .70 indicate a good level of agreement which justifies the aggregation of data. IRR data are reported in Table 4.10.

Table 4.10 Items for Partnership Constructs

Construct	Question	Assessed by		IRR	Average score
		ITP Mean (Std Dev)	BC Mean (Std Dev)		Mean (Std Dev)
Communication effectiveness	Do you and your partner communicate openly?	5.93 (1.14)	6.01 (.97)	.80	5.95 (.89)
	Is your communication with your partner effective?	5.76 (.98)	5.76 (1.06)	.83	5.75 (.85)
	Does your communication with your partner flow easily?	5.95 (.97)	5.90 (1.20)	.81	5.90 (.92)
	Are you and your partner contributing equally when communicating with your partner?	5.77 (.88)	5.64 (1.21)	.82	5.70 (.88)
	Do you and your partner adapt communication practices to changing circumstances?	5.51 (.91)	5.51 (1.18)	.77	5.45 (.85)
Mutual trust	Can you and your partner rely on each other?	5.88 (1.13)	6.01 (1.10)	.84	5.95 (.96)
	Are you and your partner considerate of one another's feelings?	5.94 (1.09)	6.05 (1.13)	.84	5.99 (.96)
	Do you and your partner trust each other?	6.12 (1.21)	6.05 (1.14)	.76	6.08 (.94)
	Do you and your partner have confidence in one another?	5.98 (1.06)	5.81 (1.26)	.79	5.89 (.96)
Collaboration	Do you and your partner cooperate?	6.12 (.93)	6.16 (.97)	.84	6.12 (.79)
	Do you and your partner support each other's goals?	5.85 (1.04)	5.83 (1.12)	.80	5.82 (.90)
	Are you and your partner committed to the same project goals?	6.06 (.85)	5.65 (1.31)	.77	5.86 (.89)
	Are the different responsibilities related to the project shared between you and your partner?	5.52 (1.10)	5.31 (1.31)	.70	5.42 (.93)

4.3.3.3 Performance

The project sponsor assessed the performance of the project. As sponsors, they should recognize the unique goals, orientations, and priorities of each cross-functional project. A four-item measure was used to assess the performance. The focus was on the task outcomes of the project (Pinto, Pinto, and Slevin, 1993). A 7-point Likert-type scale was used with these items. Items with their mean and standard deviation and listed in Table 4.11.

Table 4.11 Items for Project Performance

Question	Mean (Std Dev)
Are the projects on which they work on schedule?	5.15 (1.46)
Do these partners accomplish the tasks that they set out to do?	5.72 (1.06)
Do the projects come in on or near budget (+/- 10%)?	5.51 (1.39)
Are the projects' goals achieved?	5.67 (1.15)

4.3.3.4 Interaction

As the interaction is between two latent variables, we used a product indicator approach in conjunction with the PLS procedure to estimate the interaction term (Chin, Marcolin, and Newsted, 1996). In this approach, described by Chin et al. (1996), each indicator for the interaction term is modeled as being influenced not only by the underlying latent variable, but also by the error; this represents an improvement over simple regression which assumes error free measurement. We assumed all indicators were equivalent and we standardized them (mean of zero and variance of one). Then all pair-wise products indicators were created by multiplying each indicator of ITC with each indicator of BC. This resulted in 6 indicators used to reflect the fit variable.

4.3.3.5 Own domain knowledge

We also assessed both partners own domain knowledge and used it as a control variable that may also influence the partnership. Each member of the dyad assessed their partner's own domain knowledge using a four-item measure. This means that the IT professional assessed the business knowledge of the business partner, and the business partner assessed the IT knowledge of the IT professional. A 7-point Likert-type scale was used with these items. Items, means, and standard deviation are listed in Table 4.12.

Table 4.12 Items for Partner's own Domain Knowledge

Question	Assessed by	
	ITP Mean (Std Dev)	BC Mean (Std Dev)
Is your partner successful in performing his/her work?	5.94 (.88)	5.7 (1.06)
Is your partner well qualified for [business/IT] aspects of this project?	6.18 (.95)	5.68 (1.11)
Does your partner have specialized capabilities that add to the overall [business/IT] expertise for this project?	5.84 (1.03)	5.25 (1.26)
Do you feel confident about your partner's [business/IT] knowledge?	6.12 (.93)	5.68 (1.25)

4.3.4 Data Analysis

The statistical analysis technique used is Partial Least Squares (PLS), as implemented in PLS Graph 3.00. PLS is a method used for the analysis of structural equation models (SEM), and is well suited for theory development, particularly when the research goal is causal-predictive testing and explanation of variance (Chin 1998a; 1998b, Gefen et al., 2000). SEM can also be performed using covariance-based analysis, as implemented by LISREL. PLS is a component-based SEM technique. It is similar to regression, but models structural and measurement paths simultaneously. Two reasons justify the choice of PLS over LISREL for this study. First, PLS also allows for testing of formative items in addition to reflective items. Some of the constructs in the model are formative and therefore could not be adequately modeled using LISREL. The second reason is linked to the sample size. A minimum of 100-150 cases are needed for LISREL, while PLS can perform analysis with a minimum of at least 10 times the number of items in the most complex construct (Gefen et al., 2000). Given the sample size of 85, it was more appropriate to use PLS for this study.

SEM models consist of a measurement model describing the relationships between the latent variables and their indicators and a structural model describing the relationships between the latent variables.

4.3.4.1 The Measurement Model

We standardized all items used in the analysis. The analysis of the measurement model differs for the reflective and the formative constructs. On the one hand, reflective items should be unidimensional in their representation of the latent variable, and therefore correlated with each other. The assessment of reliability and discriminant validity is performed for reflective constructs. Discriminant validity is assessed by determining if the constructs share more variance with their own measures than they share with the other constructs in the model. The Average Variance Extracted (AVE) measures the percent of variance captured by a construct. To show discriminant validity, each construct square root of the AVE has to be larger than its correlation with other factors (Gefen et al., 2000). All constructs meet this requirement (Table 4.13).

The values for internal consistency are all above the suggested minimum of .70 (Hair et al., 1998). Thus, all reflective constructs display adequate consistency and discriminant validity. Loadings and t-statistics for the reflecive constructs are listed in Table 4.14.

Table 4.13 Intercorrelations among Reflective Constructs

Construct	# items	Internal consistency	1	2	3	4
1.IT competence of BC	2	.911	**.914**			
2.Business competence of ITP	3	.856	.095	**.811**		
3.Business knowledge of BC	4	.908	.007	.351	**.844**	
4.IT knowledge of ITP	4	.939	.210	.016	.234	**.891**

Diagonal elements are the square roots of average variance extracted

Table 4.14 Statistics for Reflective Items

Latent variable	Item	Loading	t-stat
ITC	ITC1	.950	11.06
	ITC2	.879	7.20
BC	BC1	.833	3.77
	BC2	.851	7.28
	BC3	.748	4.23
BC's business knowledge	BBK1	.806	13.39
	BBK2	.898	23.94
	BBK3	.768	8.68
	BBK4	.895	16.25
IT professional's IT knowledge	IIK1	.896	34.27
	IIK2	.862	19.78
	IIK3	.888	27.19
	IIK4	.915	39.70

On the other hand, formative items form or cause the latent variable and can represent different dimensions of it. The latent variable is a summative index of the items. Hence the items are not assumed to be correlated with each other (Gefen et al., 2000). With formative items, internal consistency and unidimensionality cannot be used to assess the measurement model. It is also normal for weights on formative constructs to be lower than loadings on reflective constructs. The general approach for formative indicators is compare the weights of different indicators, more than to interpret them in a factor loading sense (Sambamurthy and Chin, 1994). Weight and t-statistics for the formative constructs are listed in Table 4.15. The weights of three items for performance were very low and non significant, and will therefore be removed from the analysis.

Table 4.15 Statistics for Formative Items

Latent variable	Item	Weights	t-stat
Partnership	Communication	.500	1.23
	Trust	.439	1.37
	Collaboration	.088	0.27
Performance	On schedule	.323	0.66
	Tasks accomplished	.334	0.66
	On budget	.146	0.22
	Goals achieved	1.29	1.81

4.3.4.2 The Structural Model

The results of the PLS analysis for the model are presented in Figure 4.2. Since PLS does not generate an overall goodness of fit index, the validity is assessed by examining the R^2 values and the structural path. Since we performed the analysis using standardized constructs values, the beta values can be interpreted directly. Statistical significance was estimated with a bootstrap procedure using 200 samples.

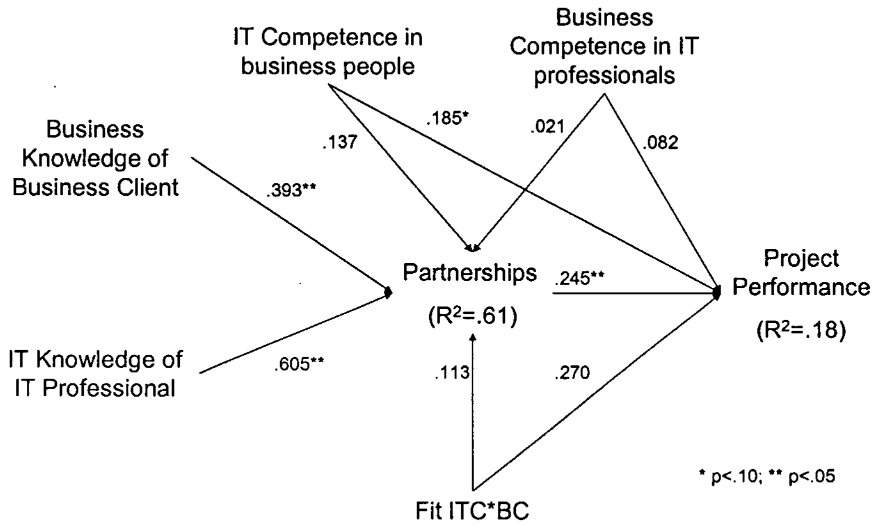

Figure 4.2 Results for the Model of IT and Business Knowledge, Partnerships, and Performance

Together, the variables in the model explain 61% of the variance in the partnerships and 18% of the variance in the project performance. Results indicate that the model as a whole provides a good explanation of the performance of the projects. The effect size of the overall model is calculated as follows:

f^2 = [R^2 (full model)] / [1 – R^2 (full model)].

The value of the effect size for the model as it explains the variance in the project performance is .222 (.182/1-.182). The value of the effect size for the model as it explains the variance in the partnerships is 1.57 (.611/1-.611).

An F test testing the significance of the effect size with the number of restrictions and n-k degrees of freedom can be obtained by multiplying f^2 by [(n-k)/j], where n is the sample size, k is the number of independent constructs, and j is the number of restrictions (number of paths to the dependent variable). Using this calculation, the effect size for the model as it explains partnership is significant (p=0.000) with an F-value of 25.12 (1.57 * [(85-5)/5]) while the effect size for the model as it explains performance is significant (p =.003) with an F-value of 4.44 (.222 * [(85-5)/4]). Therefore, overall, the model has strong explanatory power for both dependent variables.

However, not all paths are significant, indicating a lack of support for some hypotheses. The lack of significance in the paths may be explained by the small sample size. Most paths are indeed below the minimum standard of .20 to be considered meaningful (Chin, 1998). Table 4.16 summarizes the results of the empirical testing.

Table 4.16 Summary of the Results for the Hypotheses

Hypothesis	Path			Path Coefficient	t value	Support for H
H1	ITC	→	Partnership	0.137	1.332	N
H2	BC	→	Partnership	0.021	0.252	N
H3	Partnership	→	Performance	0.245**	2.802	Y
H4	ITC	→	Performance	0.185*	1.810	Y
H5	BC	→	Performance	0.082	0.687	N
H6	FIT	→	Performance	0.247	1.335	N
H7	FIT	→	Partnership	0.270	1.065	N
H8	BBK	→	Partnership	0.393**	3.479	Y
H9	IIK	→	Partnership	0.605**	7.480	Y

*p<0.10; **p<0.01

4.3.4.3 Interpretation of fit

Conceptualizing fit as moderation suggest that better partnerships and performance are achieved through the joint effect that is added to the individual impact of ITC & BC. An estimate of the effect size of the interaction is provided by the additional variance explained in the dependent variables. The effect size (f^2) is calculated as follows:

$f^2 = [R^2 \text{ (interaction model)} - R^2 \text{ (main effects)}] / [1 - R^2 \text{ (interaction model)}]$

Effect of .02, .15 and .35 have been suggested as small, moderate, and large effects respectively (Cohen, 1988). The effect size of the interaction between ITC and BC on partnership is small, with a value of .033 ([.611-.598]/[1-.611). The effect size of the interaction on project performance is small to average, with a value of .084 ([.182-.113]/[1-.182).

An approximation of a F test testing the significance of the effect size with 1 and n-k degrees of freedom can be obtained by multiplying f^2 by (n-k-1), where n is the sample size and k is the number of independent constructs (Mathieson, Peacock, and Chin, 1998). Using this calculation, the effect size of fit on partnership is non significant (p=0.11) with a pseudo F-value of 2.61 (.033 * [85-5-1]), while the effect size of fit on performance is significant (p =.012) with a pseudo F-value of 6.66 (.084 * [85-5-1]). Therefore there is a significant difference in the model with and without fit as a determinant of performance. Path linking fit to partnership is low (.113) and non significant (t=1.06), and the path from fit to performance is larger (.270) but only significant at the p=.20 level (t=1.33).

4.4 Discussion

The model performs well overall in explaining partnerships and the performance of projects. Some specific hypotheses are not supported, however, due to the lack of statistical power caused by a small sample size.

The IT professional's and business client's own domain knowledge have a significant impact on the quality of their partnerships, as formed by their communication, trust, and cooperation. Out of the cross-functional competencies, only the IT competence of the business client has a significant impact on the performance of the project. Although the interaction of IT competence with business competence adds to the explanation of the project performance, the interaction does not have a significant influence on the project performance. But its significant effect size may reveal that the business competence in IT professionals, although not contributing directly significantly to the performance, adds to the impact of IT competence.

A possible explanation for the lack of significance in the contribution of the cross-functional competencies on the partnership is that the perception of each member of the dyad of the other's competencies is what is important, rather than the self-assessment of the levels of knowledge.

Overall, the results show that the IT knowledge plays a more important role than the business knowledge in explaining partnerships and performance. Indeed, the IT knowledge of business people has a significant impact on the project performance but not the business knowledge of the IT professional, and the IT knowledge of the IT professional has a stronger influence on partnership than the business knowledge of business people.

Although the variance of the performance explained by the model is not very high, explaining 18% of the project performance indicates that knowledge and partnerships are important contributors. We can also keep in mind that the objective here was not to maximize the explanation of project performance, but to assess the contribution of cross-functional competencies and partnerships to that performance. Clearly, our results show that the quality of the partnerships is important for the performance of the projects.

4.5 Limitations

One important challenge for this study was obtaining a sample that is large enough to be able to perform the proposed statistical analysis (structural equation modeling). Although our sample size was large enough to run SEM, it may have limited our ability to obtain significant results. The fact that the sample was not randomly selected limits the external validity of this study. But since our sample represents a wide range of industries and organization size we have confidence in the applicability of the results.

Another limitation lies with the self-assessment of the competence construct. Although an individual's perception of their competence may proven useful in assessing constructs influenced by self-efficacy, it may be less useful when assessing other constructs, such as partnerships, that may be more influenced by an individual's perception of the partner's competence than of their own. Hence, a comparison of self-assessment and partner's assessment of competence could be investigated in future research in an attempt to shed light on the difference between self-assessment and externally perceived measures of competence. The method used to aggregate the data is also a limitation to this study. Indeed, the strength of the analysis could be improved by using factor scores instead of average scores for the aggregated scales. Finally, a longitudinal design would allow us to test causal relationships in the model, but would significantly increase the difficulty of an already challenging data-collection exercise.

5 Conclusions

The overall objective of this study is to identify the contribution of cross-functional knowledge of IT and business people to the development and effectiveness of their partnerships. Its premise was that commonality of vocabulary and experiences between individual specialists allows better partnerships, through mechanisms such as communication, trust and collaboration, which in turn will contribute to a better performance. To address this overall objective, we undertook three empirical studies. In the first two studies we developed and tested instruments to measure the cross-functional competence of the business and IT people. The impact of each cross-functional competence on the individual's intentions to develop partnerships was also tested. The analysis was at the individual level. In the last study, we assessed the influence of these competencies on the IT/business partnerships and on the performance the projects using the previously tested instruments. The analysis was at the dyad level, involving an IT professional and a business person working together on IT-related activities. The contribution of their own domain knowledge to the partnerships was also taken into account.

5.1 Review of the findings

5.1.1 The importance of partnerships

The importance of partnership between IT and business people has been increasingly mentioned and recognized in the literature. However, few empirical studies have linked partnerships to the performance of the work done by the partners. Our study, reported in chapter 4, provides empirical evidence for the importance of the quality of the partnership to enhance the performance of the work done by IT and business people.

5.1.2 Explaining partnerships

At the individual level, the literature mentions the importance of increasing the cross-functional knowledge in both IT and business people, stating that organizations can't afford IT-illiterate business people and business-illiterate IT professionals. Our studies reported in chapter 2 and 3 support this statement for both business and IT people. These cross-functional competencies play an important role in increasing the individuals' intentions to develop partnerships.

- We conceptualized the IT competence in business people as the IT-related knowledge and experience possessed by the individual whose primary area of expertise is in an area other than IT. Results show that both IT knowledge and IT experience are instrumental in defining IT competence of business people. IT competence as a whole explains 38% of the variance in the respondents' intention to show IT leadership, including their intentions to develop partnerships with IT professionals.

- We conceptualized the business competence in IT people as the organization-specific knowledge, the interpersonal and management knowledge, and the knowledge of IT/business integration possessed by the IT professionals. Results show that all three areas of knowledge are instrumental in defining business competence of IT professionals. Business competence explains 46% of the variance in the IT professionals' intentions to develop partnerships and 23% of the variance in their credibility in the eyes of their business clients.

We then assessed, at the dyad level, the contribution of cross-functional competencies in both IT and business people to the partnerships. We also took into account the contribution of their own domain knowledge to the partnerships. We found that what business and IT people know about their own domain (i.e., what IT people know about IT, and what business people know about business) is what influences their partnerships, not their cross-functional competence.

- Using the instruments previously developed, we tested the contribution of the cross-functional competencies to the development of the partnerships between the IT and business people. We also took into account the contribution of the partners' own domain knowledge to the partnerships. Results show that, overall, the model explains 61% of the variance in the partnerships. However only the contributions of the own domain knowledge of IT and business people were significant.

5.1.3 Explaining performance

We assessed the contribution of cross-functional competencies and partnerships to the actual performance of the work done by the IT and business in the study reported in chapter 4. Our model explains 18% of the variance in performance. Our results show that the quality of the partnerships plays a significant role in explaining the performance. The IT competence in business people was also a significant determinant of the performance, showing the importance for business people to know about IT when working on IT-related projects. Results also show that the interaction between IT competence and business competence significantly contributes to the performance, having a significant effect size (but not a significant path). This may show that although business competence in IT professional is not a significant determinant of performance, it adds to the contribution of the IT competence in business people.

5.1.4 IT and business knowledge

The model tested in chapter 4 includes two sources of IT knowledge (as the own domain knowledge of the IT professional, and as cross-functional knowledge of the business person) and two sources of business knowledge (as the own domain knowledge of business people, and as cross-functional knowledge of the IT professional). Overall, the results show that the IT knowledge plays a more important role than the business knowledge in explaining partnerships and performance. Indeed, the IT knowledge of business people has a significant impact on the project performance but not the business knowledge of the IT professional, and the IT knowledge of the IT professional has a stronger influence on partnership than the business knowledge of business people. The work that brought these pairs together was IT-related. Many, if not most, projects undertaken in organizations these days have an IT component. It is therefore very important for organizations to increase the overall IT knowledge possessed by all, in order to increase the likelihood of success.

5.2 *Contribution*

This thesis makes both theoretical and practical contributions. As firms invest substantial amounts of money in IT, and as their dependency on IT to gain competitive advantage increases, there is an obvious need to effectively manage IT. The first contribution of this research is to improve managerial practices by giving managers insights into which aspects of competence they should focus on to improve IT/business partnership. We identified a generic set of knowledge that enables business and IT people to understand each other's reality. For the business people, the set of cross-functional knowledge was found a good determinant of their intentions to develop partnerships and be more proactive in regards to IT in their organization. It was also a significant determinant of the performance of the IT-related projects they worked on. For the IT professionals, the set of cross-functional knowledge was found to be a good determinant of their credibility in the eyes of their business clients and of their partnerships. The sets of knowledge identified can provide guidance to organizations regarding training to be provided to both business and IT people. Results should encourage organizations to increase the level of cross-functional competence in their business and IT people. Knowledge in the different areas identifies can be gained through specific education and training, and through participation in cross-functional projects (mix teams), or by practices such as "seeding the line" (Reich and Kaarst-Brown, 1999). This guidance may also be helpful to academia in the development of academic programs for both business and IT students.

From a theoretical perspective, three contributions are identified. First, the study defines the concepts of business competence in IT professionals and of IT competence in business managers. Prior to this study, both terms were in frequent use, but no clear grasp of the concepts existed. Second, we now have reliable and validated measures of these concepts. Finally, the contribution of these cross-functional competencies on individual behavior, and the importance of the IT competence and of its interaction with business competence in explaining project performance were identified.

5.3 Limitations

Several differences between the first two studies and the last one may limit the findings of the last study and provide an explanation for some of the difference in the results. These differences, explained below, concern the conceptualization of partnership, the empirical representation of the cross-functional competencies, the method used to analyze the data, the size of sample, and the sample used.

In the first two studies, we defined partnership mainly as the individuals' intentions to develop partnerships, thus focusing on future behavior, and on the individual's <u>intentions</u> towards that behavior. In the last study, we tested actual realized partnership, defined as the quality of the communication, the level of trust, and the actual collaboration between the parties.

In the two instrument development studies, we represented the cross-functional competencies as higher order constructs, but in the last study we aggregated the scales. The aggregation was performed to simplify the analysis, and to allow testing for the interaction effect. We used a product indicator approach to represent the interaction, meaning that the number of indicators for this interaction term equals the product of the number of indicators of the two interacting latent variables. It is not clear how interaction between higher order latent variable can be represented. Also, the items and dimensions of both cross-functional competencies included in the last study differ from the ones in the first two studies as a result of a new scale validation.

In the first two studies we analyzed using LISREL, as the sample size permitted. In the last study, with a sample size of only 85, PLS was used. Although both methods implement structural equation modeling, they operate under different assumptions, and may lead to different results. The size of the sample in the last study may also limit the power of the statistical tests to obtain significance in the results. Lastly, the sample was also drawn from different population: The first two studies were tested in the insurance industry, while the final model was tested in a wide range of industries.

5.4 Future research

One important area of development for this study is the investigation of the specific dimensions of partnerships. Future study should look into the specific mechanisms linking knowledge to communication, trust, and collaboration, and their specific impacts on performance.

Future research could also compare self-assessment and perception of cross-functional competence. Although an individual's perception of their competence, such as IT knowledge in a business person, may prove useful in assessing constructs influenced by self-efficacy, it may be less useful when assessing other constructs, such as partnerships, that may be more influenced by an individual's perception of the partner's competence than of their own. Hence a comparison of self-assessment and partner's assessment of cross-functional competence could be investigated in future research in an attempt to shed light on the difference between self-assessment and externally perceived measures of competence.

To conclude, cross-functional competence is an important business enabler and can help in the development of strong partnerships between IT professionals and business managers and in increasing the performance of their work. Competence may not be the only way to achieve these results, but it is one that is manageable: organizations can take action to increase their employees' level of knowledge by education, training, and involvement in cross-functional projects.

References

Anderson, J.R. 1983. *The Architecture of Cognition.* Cambridge, MA: Harvard University Press.

Applegate, L.M., McFarlan, W.F., and J. McKinney. 1999. *Corporate Information Systems Management: Text and Cases*. Boston: McGraw-Hill.

Armstrong, C.P., and V. Sambamurthy. 1999. Information technology assimilation in firms: The influence of senior leadership and IT infrastructure. *Information Systems Research,* (10:4), 304-342.

Ashenhurst, R.R.1972. Curriculum Recommendations for Graduate Professional Programs in Information Systems. *Communications of the ACM,* (15:5), 363-398.

Athos, A.G., and J.J. Gabarro. 1978. *Interpersonal Behaviour: Communication and Understanding in Relationships.* Englewood Cliffs, N.J.: Prentice-Hall.

Avital, M. and B. Vandenbosch. 2000. IT-Business Ownership: The Missing Link for IT-Driven Value. *Proceedings of the 2000 Annual Conference of the Administrative Sciences Association of Canada,* 116-125.

Bagozzi, R.P. and C. Fornell. 1982. Theoretical Concepts, Measurement, and Meaning. In C. Fornell ed. *A Second Generation of Multivariate Analysis*. Vol.2. Praeger. 5-23.

Bagozzi, R.P., Yi, Y., and L.W. Phillips. 1991. Assessing Construct Validity in Organizational Research. *Administrative Science Quarterly,* (36), 421-458.

Bandura, A. 1977. Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review,* (84:2) 191-215.

Barber, B. 1983. *The logic and limits of trust.* New Brunswick, NJ: Rutgers University Press

Bashein, B.J. and M.L. Markus. 1997. A Credibility Equation for IT Specialists, *Sloan Management Review,* 35-44.

Bassellier, G., Reich, B.H. and I. Benbasat. 2001. Information Technology Competence of Business managers: A Definition and Research Model. *Journal of Management Information Systems* (17:4), 159-182.

Benbasat, I., Dexter, A.S. and R.W. Mantha. 1980. Impact of Organizational Maturity on Information Skill Needs. *MIS Quarterly,* (4:1), 21-34.

Bollen, K.A. 1989. *Structural Equations with Latent Variables*. New York, NY: Wiley.

Boyatzis, R.E. 1982. *The Competent Manager: A Model for Effective Performance*. New

York, NY: John Wiley and Sons.

Boynton, A.C., R.W. Zmud, and G.C. Jacobs. 1994. The Influence of IT Management Practice on IT Use in Large Organizations. *MIS Quarterly*, (18:3), 299-318.

Brown, C.V. and V. Sambamurthy. 1996. *Building Strategic IT-Business Relationships: A Guidebook of IT Coordination Mechanisms.* Society for Information Management (SIM International), Advanced Practices Council.

Brown, C.V. and V. Sambamurthy. *Re-Positioning the IT Organization to Facilitate Business Transformation*, Pinnaflex Press, 1999.

Brown, J.S. and P. Duguid. 1998. Organizing Knowledge. *California Management Review.* 40(3), 90-111.

Brown, R.B. 1994. Reframing the Competency Debate. *Management Learning* (25:2), 289-299.

Butler, J. 1991. Toward Understanding and Measuring Conditions of Trust: Evolution of a Condition of Trust Inventory. *Journal of Management*, (17), 643-663.

Carmines, E.G. and R.A. Zeller. 1979. *Reliability and Validity Assessment*. Beverly Hills, CA: Sage Publications.

Chan, Y.E., Huff, S.L., Barclay, D.W., and D.G. Copeland. 1997. Business Strategic Orientation, Information Systems Strategic Orientation, and Strategic Alignment. *Information Systems Research,* (8:2), 125-150.

Chan, Y. E., and B.H. Reich. 1999. Current Practices to Raise Information Technology Competence in Business Managers. Working paper. Queen's University.

Chin, W.W. 1998. Issues and Opinions on Structural Equation Modeling. *MIS Quarterly* (21:1), vii-xvi.

Chin, W. W., Marcolin, B. L., and P.R. Newsted. 1996. A Partial Least Squares Latent Variable Modeling Approach For Measuring Interaction Effects: Results From a Monte Carlo Simulation Study and Voice Mail Emotion/Adoption Study. *Proceedings of the 17th International Conference on Information Systems,* Cleveland, Ohio, December.

Cohen, J. 1988. *Statistical Power Analysis for the Behavioral Sciences* (2^{nd} Edition). Hillsdale, NJ: Erlbaum.

Cohen, W.M. and D.A. Levinthal. 1990. Absorptive Capacity: A new Perspective on Learning and Innovation. *Administrative Science Quarterly*, (35), 128-152.

Conner K.R. and C.K. Prahalad. 1996. A Resource-Based Theory of the Firm: Knowledge versus Opportunism. *Organization Science*, (7:5), 477-501.

Cook, S.D.N. and J.S. Brown. 1999. Bridging Epistemologies: The Generative Dance between Organizational Knowledge and Organizational Knowing. *Organization Science*, (10:4), 381-400.

Demsetz, H. 1991. The Theory of the Firm Revisited. In O.E. Williamson and S. Winter, eds. *The Nature of the Firm*. New York: Oxford University Press, 159-178.

Feeny, D.F. and L.P. Willcocks. 1998. Core IS Capabilities for Exploiting Information Technology. *Sloan Management Review* (39:3), 9-21.

Fichman, M. and D. Levinthal. 1991. Honeymoons and the Liability of Adolescence: A New Perspective on Duration Dependence in Social and Organizational Relationships," *Academy of Management Review*, (16:2), 442-468.

Fishbein, M. and I. Ajzen.1975. *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Addison Wesley Longman, Reading.

Fornell, C. and D.F. Larcker. 1981. Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, (18), 39–50.

Gabarro, J. J. 1978. The Development of Trust, Influence, and Expectations. In A.G. Athos, and J.J. Gabarro (Eds.), *Interpersonal Behavior: Communication and Uunderstanding in Relationships*. Englewood Cliffs, NJ: Prentice-Hall, 290-303.

Gabarro, 1990. The Development of Working Relationships. In J. Galegher, R.E. Kraut, and C. Egido (Eds), *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*. Hillsdale, NJ: Lawrence Erlbaum Associates, 79-110.

Galbraith, J.R.1977. *Organization Design*. Reading. MA: Addison-Wesley

Gambetta, D. 1988. Can we Trust? In D. Gabarro (Eds.*), Interpersonal behaviors: Communication and understanding in relationships*. Englewood Cliffs. NJ: Prentice-Hall, 290-303.

Gefen, D., Straub, D.W. and M.-C. Boudreau. 2000. Structural Equation Modeling and Regression: Guidelines for Research Practice," *Communications of the Association for Information Systems* (4:7).

Gerbing, D.W. and J.C. Anderson. 1988. An Updated Paradigm for Scale Development Incorporating Unidimensionality and its Assessment. *Journal of Marketing Research*, (25), 186-192.

Grant, R.1996. Prospering in Dynamically-competitive Environments: Organizational Capability as Knowledge Integration. *Organization Science*, (7:4), 375-387.

Hackman, R. 1987. The Design of Work Teams. In J. Lorsch (Ed.), *Handbook of Organizational Behavior*. Englewood Cliffs, N.J.: Prentice Hall.

Hair, J.F.J., Anderson, R.E., Tatham, R.L. and W.C. Black. 1998.*Multivariate Data Analysis with Readings*. Englewood Cliffs, NJ: Prentice Hall.

Henderson, I. 1993. Action Learning: A Missing Link in Management Development? *Personnel Review,* (22:6),14-24.

Henderson, J.C. 1990. Plugging into Strategic Partnerships: The Critical IS Connection. *Sloan Management Review,* (31:3), 7-18.

Henry, R.M., Dickson, G.B., and J. LaSalle. 1974. Human Resources for MIS: A Report of Research," working paper, 74-01, MIS Research Center, University of Minnesota, Minneapolis, MN.

James, L., Demaree, R., and G. Wolf. 1984. Estimating Within-group Interater Reliability with and without Response Bias. *Journal of Applied Psychology,* (78), 306-309.

Jarvenpaa, S.L., Knoll, K. and D.E. Leidner. 1998. Is Anybody Out There? Antecedents of Trust in Global Virtual Teams. *Journal of Management Information Systems*, (14:4), 29-64.

Jöreskog, K.G. and D. Sorbom, 1996. *LISREL 8 User's reference guide,* Chicago: Scientific Software Inc.

Jöreskog, K.G. 1993. Testing Structural Equation Models. In Bollen, K.A. and J.S. Long (Eds), *Testing Structural Equations Models*. Sage, Newbury Park, CA, 294-316.

Jöreskog, K.G. and D. Sorbom. 1996. *LISREL VIII User's Guide*. Scientific Software Inc. Mooresville, IN.

Joseph, D., Ang, S. and H.T. Tan. 1996. The Nature of Soft Skills of Information Systems Professionals. *Proceedings of the Americas Conference on Information Systems.*

Karnøe, P. 1995. Competence as Process and the Social Embeddeness of Competence Building. *Proceedings of the Academy of Management 1995 Annual Meeting*, Vancouver, B.C., August, 427-431.

Keen, P.G.W. 1991. *Shaping the Future: Business Design Through Information Technology.* Harvard Business School Press, Boston.

Keen, Peter G.W. 1999a. The Monsters Among Us. *Computerworld*, 41, November.

Keen, Peter G.W. 1999b .Middle-out Ideas," *Computerworld*, 56, April.

Kipnis, D. 1995. Trust and Technology. In R. M. Kramer, & T. R. Tyler (Eds.), *Trust in Organizations: Frontiers of Theory and Research*. Thousand Oaks, CA: Sage, 39-50.

Klemp, G. O. 1979. Identifying, Measuring, and Integrating Competence. In Pottinger, P. S. and J. Goldsmith (Eds). *New Directions for Experiential Learning: Defining and*

Measuring Ccompetence. San Francisco: Jossey-Bass, 41-52.

Kogut, B. and U. Zander. 1992. Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology. *Organization Science,* (3:3), 383-397.

Kraut, R. E., Steinfield, C., Plummer, A. C., Butler, B., and A. Hoag. 1999. Coordination and Virtualization through Electronic Networks: Empirical Evidence from Four Industries. *Organization Science, (10:6) 720-740.*

Lee, D., Trauth, E. and D. Farwell 1995. Critical Skills and Knowledge Requirements of IS Professionals: A Joint Academic/Industry Investigation. *MIS Quarterly,* (19:3), 313-340.

Lyytinen K. 1988. Expectation Failure Concept and Systems Analysts, View of Information System Failures: Results of an Exploratory Study. *Information and Management*, (14:1), 45-56.

Markus, M. L., and R. I. Benjamin. 1996. Change Agentry: The new IS Frontier. *MIS Quarterly,* (20:4), 385-405.

Markus, M.L. and R.I. Benjamin. 1997. IT-enabled Organizational Change: New Developments for IT Specialists. In C. Sauer, P.W. Yetton, and Associates (Eds.) *Steps to the Future: Fresh Thinking on the Management of IT-based Organizational Transformation*, San Francisco: Jossey-Bass, 115-142.

Marsh, H. and W.D. Hocevar. 1985. Application of Confirmatory Factor Analysis to the Study of Self-concept: First- and Higher order Factor Models and their Invariance Across Groups. *Psychological Bulletin,* (97:3), 562-582.

Mathieson, K., Peacock, E., & W.W. Chin. 2001. Extending the Technology Acceptance Model: The Influence of Perceived User Resources. *The Data Base for Advances in Information Systems*, (32:3), 86-112.

Mayer, R., C. and J.H. Davis, J.H. 1999. The Effect of the Performance Appraisal System on Trust in Management: A Field Quasi-Experiment. *Journal of Applied Psychology*, (84:1), 123-136.

Mayer, R. C., Davis, J. H., and F.D. Schoorman. 1995. An Integration Model of Organizational Trust. *Academy of Management Review* (20), 709-734.

McAllister. D.J. 1995. Affect and Cognition Based Trust as Foundations for Interpersonal Cooperation in Organizations. *Academy of Management Journal*m (38:1), 24-59.

Mishra, A. K. 1996. Organizational Responses to Crisis: The Centrality of Trust. In R. M. Kramer and T. R. Tyler (Eds.). *Trust in Organizations: Frontiers of Theory and Research*. Thousand Oaks, CA: Sage, 261-287.

Moore, G. C. and I. Benbasat. 1991. Development of an Instrument to Measure the Perception of Adopting an Information Technology Innovation. *Information Systems*

Research, (2:3), 192-222.

Nass, C. 1994. Knowledge of Skills: Which do Administrators Learn from Experience?" *Organization Science*, (5:1), 38-51.

Nelson, K.M. and J.G. Cooprider. 1996. The contribution of shared knowledge to IS group performance. *MIS Quarterly*, (20:4), 409-432.

Nelson, R.R. 1991. Educational Needs As Perceived by IS and End-User Personnel: A Survey of Knowledge and Skill Requirements. *MIS Quarterly* (15:4), 503-525.

Nonaka, I. 1994. A dynamic Theory of Organizational Knowledge Creation. *Organization Science,* (5:1) 14-37.

Nonaka, I. and N. Konno. 1998. The Concept of "Ba": Building a Foundation for Knowledge Creation. *Califormia Management Review,* (3:40), 40-54.

Nunamaker, J. F., Walsh, K. R., Burgoon, J., and M.S. Glynn. 1997. A Vision for a New Discipline, *Proceedings of the Thirtieth Annual Hawaii International Conference on System Sciences.*

Orlikowski, W.J. 2002. Knowing in Practice: Enacting a Collective Capability in Distributed Organizing. *Organization Science*, (13:3), 249-273.

Orlikowski, W.J. and D.C. Gash. 1994. Technological Frames: Making Sense of Information Technology in Organization. *ACM Transactions on Information Systems*, (12:2), 174-207.

Pinto, M.B., Pinto, J.K., and J.E. Prescott. 1993. Antecedents and Consequences of Project Team Cross-functional Cooperation. *Management Science*, (39), 1281-1297.

Polanyi, M. 1967. *Tacit Dimension*. London: Routledge & Kegan Paul.

Prahalad, C.K. and G. Hamel. 1990. The Core Competence of the Corporation. *Harvard Business Review*, (68:3), 79-92.

Preiser-Houy, L. *Building High-Quality Working Relationships Between Information Systems Specialists and Business Clients: The impacts of IS Role, Tactics and Institutional Context*, Ph.D. Dissertation, Claremont Graduate University, Claremont, California, 1999.

Quinn, J.B. 1992. *Intelligent Enterprise: A Knowledge and service based paradigm for Industry,* The Free Press, New York.

Reich B.H. and M.L. Kaarst-Brown. 1999. Seeding the Line: Understanding the Transition from IT to non-IT Careers, *MIS Quarterly,* (23:3), 337-364.

Reich, B.H. and I. Benbasat. 2000. Factors that Influence the Social Dimension of Alignment between Business and Information Technology Objectives. *MIS Quarterly*. (24:1), 81-111.

Rockart, J. F. 1988. The Line Takes the Leadership - IS Management in a Wired Society.

Sloan Management Review, (29:4), 57-64.

Rockart, J. F., M. J. Earl and J.W. Ross. 1996. Eight Imperatives for the New IT Organization. *Sloan Management Review.* (38:1), 43-55.

Roepke, R.P., Agarwal, R. and T.W. Ferratt. 2000. Aligning the IT Human Resource With Business Vision: The Leadership Initiative at 3M. *MIS Quarterly,* (24:2), 327-353.

Ross, J.W., Beath, C.M. and D.L. Goodhue. 1996. Develop Long-Term Competitiveness Through IT Assets. *Sloan Management Review,* (38:1), 31-42.

Ryle, G. 1949. *The Concept of Mind.* Hutchinson & Co, London.

Sambamurthy, V. and R.W. Zmud. 1994. *IT Management Competency Assessment: A Tool for Creating Business Value Through IT.* New Jersey, Financial Executives Research Foundation.

Sawyer, S., Eschenfelder, K.R., Diekema, A., and C.R. McClure. 1998. IT Skills in the Context of BigCo., *SIGCPR 98.* 9-18.

Schambach, T.P. 1994. *Maintaining Professional Competence: An Evaluation of Factors Affecting Professional Obsolescence of Information Technology Professionals*, Ph.D. Dissertation, University of South Florida.

Sethi, V. and W.R. King. 1994. Development of Measures to Assess the Extent to which an Information Technology Application Provides Competitive Advantage. *Management Science*, (40:12) 1601-1627.

Silver, M. S., M.L. Markus, and C.M. Beath. 1995. The Information Technology Interaction Model: A Foundation for the MBA Core Course. *MIS Quarterly,* (19:3), 361-390.

Smith, J. B.1996. Becoming the New Technology Executive. *CIO Canada*, 39-46.

Sternberg, R.J., Forsythe, G.B., Hedlund, J., Horvath, J.A., Wagner, R.K., Williams, W.M., Snook, S.A., and E.L. Grigorenko. 2000. *Practical Intelligence in Everyday Life.* Cambridge University Press, Cambridge.

Tan, H. and R. Libby 1997. Tacit Managerial versus Technical Knowledge as Determinants of Audit Expertise in the Field. *Journal of Accounting Research* (35:1), 97-113.

Todd, P.A., McKeen, J.D. and R.B. Gallupe. 1995. The Evolution of IS Skills: A Content Analysis of IS Job Advertisements From 1979 to 1990. *MIS Quarterly* (19:1), 1-27.

Thompson, J.D. 1967. *Organizations in action*, McGraw-Hill: New York.

Venkatraman, N. 1989. Strategic Orientation of Business Enterprises: The Construct, Dimensionality, and Measurement. *Management Science*, (35:8), 942-962.

Vitale, M. R., B. Ives, C.M. Beath. 1986. Linking Information Technology and Corporate

Strategy: An Organizational View. *Proceedings of the seventh International Conference on Information Systems*. San Diego, California. 265-276.

York, T. 1999. Shift in IT Roles Ahead," *InfoWorld* (21:3), January 18, pp. 75-76.

Zand, E. E. 1972. Trust and Managerial Problem Solving. *Administrative Science Quarterly* (17), 229-239.

Zmud, R.W. 1988. Building Relationships Throughout the Corporate entity. In J.J. Elam, M.J. Ginzberg, P.G.W. Keen, and R.W. Zmud (Eds.), *Transforming the IS Organization: The Mission, the Framework, the Transition*. Washington, DC: ICIT Press, 55-82.