THE EFFECTS OF KEY MODERATORS ON THE RELATIONSHIP BETWEEN FIRM-WIDE IT CAPABILITY AND FIRM PERFORMANCE: AN EMPIRICAL INVESTIGATION OF AN INTEGRATIVE MODEL OF IT BUSINESS VALUE

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Robert Franklin Morris, Jr.

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DISSERTATION ABSTRACT

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In the competitive and dynamic marketplace of the contemporary organization, IT has become an integral part of the organization's success or failure. The IT function has been shown to be a valuable resource in creating IT capabilities that can contribute to superior competitive performance. Yet, the topic of IT business value continues to demand the attention of researchers and practitioners as both communities recognize the potential for IT, yet still require a more thorough understanding of how IT can be effectively leveraged to enable improved competitive performance. This dissertation

explores the complex relationship between the firm's IT capability and firm performance with the goal of expanding understanding for both research and practice.

This research investigates a higher-level model that builds upon prior research to offer a more holistic representation of the firm's overall IT capability. In addition, the model integrates key external and internal influences that are posited to interact with the firm's IT capability to moderate its relationship with firm performance. The findings of this study provide initial evidence that the higher-level and integrative model may offer a more complete representation of a firm's overall IT capability and thereby reveal new insights with meaningful implications for research and practice.

The findings of this study provide empirical support for the idea that firm-wide IT capability enables improved competitive performance for the firm, suggesting that firms should actively seek to develop a firm-wide IT capability. This study also provides evidence that firms may reap favorable performance benefits from the individual sub-process groups that underlie the firm-wide IT capability construct. This finding suggests that firms may be able to gain incremental performance benefits as they work over time to create an overall, comprehensive firm-wide IT capability. Furthermore, this research suggests that the synergistic benefits of the overall firm-wide IT capability construct may outperform the benefits of each individual sub-process group alone. Finally, the IT capability construct definitions and item statements developed for this study may provide initial guidance to organizations beginning the process of understanding and developing the ten key IT capabilities identified and described in this dissertation.

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I would like to offer a very special thank you to my dissertation chair, Dr. Terry Anthony Byrd, for his encouragement, his guidance, and his abundant patience. Dr. Byrd's willingness to share his time and knowledge in numerous discussions with me was—in a word—priceless. I could not have asked for a better chairperson.

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CHAPTER I

INTRODUCTION

How information technology (IT[1]) adds value in contemporary organizations is an important question that has been vigorously and passionately investigated for more than two decades. Over this time, multiple disciplines have applied numerous approaches and a variety of theoretical paradigms in an effort to provide clarity in addressing this inquiry. Yet, a clear understanding of this seemingly straightforward question has been quite elusive. In fact, a series of mixed findings led to a general inconclusiveness that became known as the "productivity paradox" (Brynjolfsson, 1993). Thus, while some have argued that IT's value to the organization is accepted as common sense (e.g., Lu & Ramamurthy, 2004), others have argued that the value of IT is—in a sense—uncommon (e.g., Clemons & Row, 1991). Still others have gone so far as to propose that IT, in and of itself, provides little or no value to the organization (e.g., Keen, 1993; Mata, Fuerst, & Barney, 1995; T. C. Powell & Dent-Micallef, 1997) and recent publications have bluntly claimed that "IT doesn't matter" (Carr, 2003, 2005). Such heightened rhetoric has tended to raise the level of the investigation to one of controversial debate extending beyond the boundaries of MIS research. Yet, despite such provocative headlines, research progress

[1] See Appendix A for an explanation of the differences between IT (Information Technology) versus IS (Information Systems) as defined and applied within this dissertation.

has been made. The productivity paradox has received rational explication (e.g., Hitt & Brynjolfsson, 1996), and the application of a different theoretical paradigm has produced new insights that provide support for IT as a value-adding resource for the firm (e.g., Bharadwaj, 2000). Such progress has served to debunk the more dramatic detractors and reinforce the importance of IT in the modern organization (Diedrick, Gurbaxani, & Kraemer, 2003; Seely-Brown & Hagel, 2003). However, while research progress has served to reinforce IT's importance to the firm, tighter budgets for IT spending have resulted in much more rigorous justification requirements for IT investments. Interestingly, this environment of tighter IT spending justifications has served to fuel an even greater interest in understanding how IT provides payoffs to the firm. A recent survey (Luftman & McLean, 2004) found that the question of determining IT's value to the organization was ranked among the top-five concerns for IT executives, suggesting that IT apparently *does* matter, especially to the executives who are responsible for finding that value. Consequently, the topic of IT business value[2] continues to demand the attention of researchers and practitioners alike as both communities recognize IT's potential, yet still require a more thorough understanding of how IT can be effectively leveraged to improve competitive performance.

One approach that is helping to increase such understanding involves the study of an organization's IT competence or IT capability. As Bharadwaj, Sambamurthy, and Zmud (1999, p. 378) have noted, "with such increased emphasis on the strategic role of IT in contemporary organizations, it is imperative to gain a deeper understanding of the

[2] IT business value is broadly defined as the contribution of IT to firm performance (Berger, Kobielus and Sutherland 1988).

factors that govern a firm's IT capability. Yet, there exists very little understanding as to what constitutes a firm's IT capability and how it could be measured."

Recent studies exploring IT capability (e.g., Bharadwaj, 2000; Bharadwaj et al., 1999; Melville, Kraemer, & Gurbaxani, 2004; Santhanam & Hartono, 2003; Wade & Hulland, 2004) have adopted the resource-based view of the firm as the primary theoretical framework for their investigations. In the resource-based view, "firms possess bundles of costly-to-imitate resources that are regarded as the fundamental drivers of superior performance" (Bharadwaj et al., 1999, p. 378; Reed & DeFillippi, 1990). The resource-based view also provides an important distinction between resources and capabilities (Grant, 1991; Teece, Pisano, & Shuen, 1997) emphasizing that capabilities reflect the ability of firms to assemble resources in ways that enable superior competitive performance (Amit & Schoemaker, 1993). According to this distinction, the fundamental resources of a firm are more easily copied by competition; whereas the capabilities of a firm are inherently more difficult for competition to duplicate because such capabilities develop over time in ways that tightly integrate them with firm-specific characteristics such as culture, history, and experience. Thus, gaining a better understanding of the nature of IT capabilities that enable superior firm performance is a critical issue for contemporary organizations and an important goal of IT business value research.

Among those studies that have employed the resource-based view to investigate the nature of IT capabilities, most have explored only broad-classes of IT-related resources such as IT infrastructure or human IT skills (Bharadwaj et al., 1999). Only a few studies have attempted a more comprehensive characterization, and their approach made use of a proxy to represent the firm's overall or firm-wide IT capability (e.g.,

Bharadwaj, 2000; Lu & Ramamurthy, 2004; Santhanam & Hartono, 2003). While the use of a proxy provides an important first step in exploring firm-wide IT capability, there are inherent issues with the proxy approach that limit the value of the results (Santhanam & Hartono, 2003). Recognizing the issues and limitations, Santhanam and Hartono (2003, p. 161) recommended the development of improved measures of IT capability: "To continue the assessment of the impact of IT capability, it is critical to develop standardized scales to measure a firm's level of IT capability." The need for better measures of a firm's IT capability is also clearly expressed by Bharadwaj et al. (1999, p. 379): "What is missing is an integrative conceptualization of IT capability as a multidimensional construct encompassing both the technical and organizational dimensions." Within the framework of the resource-based view, such a multidimensional construct can serve as a key variable in exploring the complex role of a firm's overall IT capability within the nomological network that leads to superior organizational performance (i.e., IT business value). As previously noted, gaining a clearer understanding of the role of IT in enabling superior firm performance is a pressing issue that requires additional understanding.

Thus, a primary purpose of this study is to employ the resource-based view of the firm to develop a conceptual model of IT business value that represents the relationship between the firm's overall IT capability and the competitive performance of the firm. The model employed in this study builds upon and extends current IT business value knowledge by allowing for the empirical assessment of a new multidimensional measure of firm-wide IT capability and its relationship to the firm's competitive performance. In addition, the conceptual model in this study further extends the extant literature by

including the effects of multiple organizational and environmental influences that interact with firm-wide IT capability to potentially moderate the impact on firm performance. Such a model and analysis can contribute new knowledge and additional understanding to the IT business value research stream while providing a platform for additional study. Thus, the overarching goal of this study is to draw upon theory and build upon prior investigations in an effort to help further elucidate the nature of IT and its value in contemporary organizations.

Development of Research Questions

IT business value research has included contributions from a variety of academic disciplines including management information systems, economics, strategy, accounting, and operations research (Chan, 2000). While such diversity has enriched general knowledge within the domain, the result has been likened to, "separate research conversations" that have hampered "cross-pollination of ideas and findings" (Melville et al., 2004, p. 285). Powell and Dent-Micallef (1997, p. 375) have blatantly described the literature as, "fragmented and far-flung." This lack of integration across disciplines, related research streams, and theoretical lenses has led to ambiguity and debate over basic principles.

The variety of approaches to conceptualizing IT business value has exposed the need to move toward the, "unification of this vast and diverse body of accumulated knowledge" (Melville et al., 2004, p. 285). A common view that can successfully integrate the extant body of IT business value understanding should provide a conceptual framework that can help expedite knowledge advancement. Thus, the need to unite the accumulated IT business value knowledge leads to the first research question:

Q1: What conceptualization of IT business value will represent a move toward unifying the vast and diverse body of accumulated IT business value knowledge?

Recent thinking using the resource-based view of the firm (resource-based theory) has proposed that IT business value is more frequently the result of synergies between or among IT and other firm resources, and less frequently the result of IT investment alone. For example, Powell and Dent-Micallef (1997) found that IT alone did not produce sustainable performance advantages, but that some firms gained advantages by using IT to leverage firm-specific complementary human, business, and intangible resources. Such firm-specific combinations of IT and non-IT resources (i.e., IT capabilities) help explain why some organizations outperform others even though they are using the same IT, and why successful IT users often fail to sustain IT-based competitive advantages (Barnett, 2005). Hence, many investigators now agree that it is most often the combined effects or synergies among or between IT and non-IT variables (i.e., IT capabilities) which affect performance and competitive position (Teece, 1986; Wade & Hulland, 2004).

Better knowledge concerning the IT capabilities that lead to improved performance would be valuable information for any firm. In addition, better knowledge of how such IT capabilities may interact with key organizational influences to affect performance would also be valuable information. Thus, the desire to improve such knowledge leads directly to the second and third research questions:

Q2: What is the nature of the relationship between firm-wide IT capability and firm performance?

Q3: Will key organizational influences interact with firm-wide IT capability to moderate the relationship with firm performance?

The majority of the extant IT business value research has taken an organization-centric perspective that has focused primarily on factors internal to the organization (Bharadwaj, 2000; Lichtenberg, 1995; Mata et al., 1995). While this approach was appropriate for pre-Internet computing models, researchers have recognized that business in the network era requires an expanded conceptualization of IT business value. Such recognition should acknowledge the impact that external electronic linkages with other organizations may have on firm performance. In addition, the use of an organization-centric view has limited the exploration of key factors in the external environment that may have an impact on IT business value. Such thinking is supported by recent research which has concluded that, "although the focal firm bounds the locus of direct performance impacts, the external environment shapes them" (Melville et al., 2004, p. 311). Thus, the desire to move beyond the limitations imposed by an organization-centric perspective of IT business value motivate the fourth research question for this dissertation:

Q4: Will key environmental influences interact with firm-wide IT capability to moderate the relationship with firm performance?

Recent research has suggested that the firm's IT capabilities embody certain attributes (Wade & Hulland, 2004). This research further suggests that these attributes can be sorted into three types of processes representing different aspects of a "market oriented" or "customer centric" ability: (1) those that are externally oriented, (2) those that are internally focused, and (3) those that involve both internal and external analysis. Thus, any differences among how these three process categories impact firm performance may reveal whether or not certain of the three process categories provide more value to the firm than the others. Such knowledge represents a step towards "opening the black box" of IT business value and would be valuable information for any firm. Thus, the opportunity to explore any differences among the three process categories and their contributions to IT business value leads directly to the fifth research question:

Q5: What differences, if any, exist among the three process categories and their respective relationships to firm performance?

Potential Contributions of the Research

While the primary contribution of this research lies in the empirical assessment of IT business value, there are at least three other contributions to the literature. First, this research introduces a conceptual model adapted primarily from the Melville et al. (2004) study which developed its' concept with the expressed purpose of attempting to unite the current body of cross-discipline IT business value knowledge into a more comprehensive model. Drawing upon the resource-based view of the firm, IT business value is

represented in the adapted model as the relationship between the firm's overall IT capability and firm performance. Using a multidimensional representation of the firm's overall or firm-wide IT capability, this research builds upon Bharadwaj's (2000) initial efforts to establish the links between firm-wide IT capability and firm performance. However, while the Bharadwaj (2000) study employed a proxy to represent firm-wide IT capability, this dissertation uses a newly developed, multidimensional construct of firm-wide IT capability. By directly measuring and empirically assessing the state of development of IT capabilities within the sampled firms, this research hopes to show how firms leverage IT resources in combination with other complementary IT and/or non-IT resources to create IT capabilities that work together to form a firm-wide, dynamic IT capability that enables improved competitive performance.

Second, this research responds to the recent calls in the literature for the development of theoretically-based, multidimensional instruments to measure firm-wide IT capability (e.g., Santhanam & Hartono, 2003). While only one existing firm-wide IT capability instrument was found in the literature (i.e., Bharadwaj et al., 1999), the new instrument used in this study builds upon and extends the existing instrument. Based upon a synthesis of the extant literature, the new instrument revises and expands some areas of the existing instrument while incorporating facets of additional areas of increasing importance to IT in business (e.g., dynamic capabilities, resource reconfigurability, outsourcing, interorganizational systems, technology integration). The new instrument is then used to gather primary data for each of the independent variables in the model. This field-based study allows for the full psychometric assessment of the new instrument concerning its validity and reliability for the sample of CIOs obtained.

Thus, in keeping with the idea of a cumulative research tradition (Keen, 1980), this study takes a first step towards the validation of a new firm-wide IT capability measurement tool that can be applied in other IT business value research.

Third, this research responds to calls in the literature (e.g., Lu & Ramamurthy, 2004; Wade & Hulland, 2004) to explore the impacts of other influential variables on the relationships in the IT business value model. This study incorporates multiple, key variables from the organizational and environmental domains that interact with firm-wide IT capability to potentially moderate the relationship with firm performance. Therefore, this study provides a more comprehensive model of the relationship between firm-wide IT capability and firm performance by including organizational and environmental moderation variables at the appropriate levels of interaction in the model. As Melville et al. (2004) have suggested, such a model can serve as a move toward uniting the current body of cross-discipline IT business value knowledge.

Organization of the Dissertation

The remainder of the dissertation is structured as follows. The next chapter includes a review of the literature in IT business value research. Conceptualizations of firm-wide IT capability and IT business value are then discussed and lead to the development of the conceptual model of IT business value used in this study. Based upon the conceptual model, hypotheses are presented and a description of the methodology is provided. Next, the results are presented and assessed. Finally, the discussion, limitations, and opportunities for future research are presented and conclusions are offered.

CHAPTER II

LITERATURE REVIEW

The review of the extant literature conducted for this dissertation suggests that perhaps two broad categories of studies can serve to delineate the vast body of IT business value research to date: (1) those studies that in some form or fashion attempt to relate IT spending or investment to productivity and/or performance, and (2) those studies that in some form or fashion attempt to relate IT competence or capabilities to performance.

The second broad category can be further divided into two sub-categories of studies that investigate IT abilities which either: (1) represent a comprehensive, firm-wide combination of IT abilities (i.e., overall), or (2) represent *less than* a firm-wide combination of IT abilities (i.e., partial). Therefore, the first broad category and the two sub-categories of the second, can be used to divide the IT business value research into three distinct areas of study, as shown in Figure 1.

While there are a variety of possibilities concerning how the IT business value literature might be divided, the three categories described here are motivated by their direct application and relevance to informing this study.

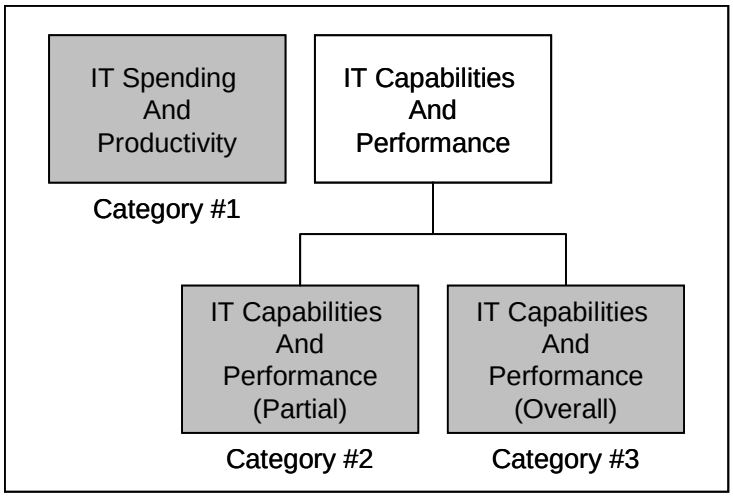

Figure 1. Three Broad Categories of IT Business Value Research

As shown in Figure 1, the first of the two broad categories includes all research that endeavors to relate IT spending (i.e., monetary IT investment) to measures of productivity, and in some studies, to performance measures also. The second broad category is split into two sub-categories representing studies that attempt to demonstrate relationships between complementary combinations of IT and non-IT factors (i.e., IT capabilities), and various measures of firm performance. The distinction between the two sub-categories (i.e., categories #2 and #3 in Figure 1) is whether or not the combinations of complementary IT and non-IT factors represent *partial* IT capabilities of the firm (i.e., less than the whole) as in category #2, or the *overall* IT capability of the firm (the whole) as in category #3. In category #3, the combinations of complementary IT and non-IT factors (i.e., IT capabilities) act as mutually interdependent parts of the whole that all work together in ways that lead to the formation of an overall, comprehensive, firm-wide IT capability. The three categories represented in Figure 1 can serve as a useful

framework for discussing the evolution of IT business value research as it applies to this dissertation.

IT Spending and Productivity (Category #1)

Rooted in econometric approaches, early studies of IT business value examined the contribution of aggregate IT spending to measures of productivity at the economy and industry levels of analysis (Thatcher & Pingry, 2004). The typical findings for these early studies indicated, at best, very little improvement in productivity, with many studies finding no improvement in productivity whatsoever. It is important to note that these results of no improvement in productivity were found in spite of massive amounts of IT spending going back as far as the early 1970s (Baily, 1986; Strassman, 1990), (see Brynjolfsson, 1994 for a review of the empirical work). These unexpected findings led to the so-called "IT productivity paradox," and sparked a search among researchers for answers to this apparent inconsistency. One explanation for the paradox gained wide support and suggested that the problem lay in the collection of data aggregated at the economy and industry levels which led to the mismeasurement of the productivity measures. As the explanation goes, this mismeasurement of inputs and outputs in the productivity measures led to the underestimation of productivity gains from IT investments (Brynjolfsson, 1993, 1994; Brynjolfsson & Hitt, 1996; Thatcher & Pingry, 2004).

As a result of such explanations for the productivity paradox, a number of subsequent studies employed disaggregated data at the firm-level, but continued to focus on measuring the contributions of IT spending in relation to firm productivity. Many of these studies found significant contributions in this relationship (Barua & Lee, 1997;

Brynjolfsson, 1993; Brynjolfsson & Hitt, 1996; Hitt & Brynjolfsson, 1996; Jorgenson & Stiroh, 1995; Lee & Barua, 1999; Lehr & Lichtenberg, 1998; Lichtenberg, 1995; Thatcher & Pingry, 2004) (see Diedrick et al., 2003 for an extensive review) for an extensive review). Still other studies, rather than continuing to use productivity as the dependent variable, focused on the relationship between IT spending and firm profitability (see Diedrick et al., 2003 for an extensive review). However, Strassmann (1997) and Brynjofsson (1996) have argued that there is *no* relationship between IT spending and measures of firm profitability.

Other measures of IT business value, such as consumer surplus (e.g., Brynjolfsson, 1996; Hitt & Brynjolfsson, 1996; Strassman, 1997), and even intermediate performance measures, such as product quality and output levels (e.g., Devaraj & Kohli, 2000; Mukhopadhyay, Rajiv, & Srinivasan, 1997; Rai, Patnayakuni, & Patnayakuni, 1996; Weill, 1990a) have also been employed in an attempt to resolve the inconclusiveness among the various research findings in these IT investment studies. However, despite these varied approaches, "the results of these studies have been mixed" (Thatcher & Pingry, 2004, p. 268).

An important insight concerning these mixed results was offered by Hitt and Brynjofsson (1996) who observed that productivity, profit, and consumer surplus are each different measures of economic performance, and that, although related, they are in fact, separate questions. Thus, it should not be surprising when different questions produce different answers, or different research results. Such insights have led to more consistent findings in more recent IT investment studies. As a result, many researchers

now agree that the original productivity paradox has been resolved, although much work remains to be done:

> The productivity paradox as originally stated by Robert Solow, which was always more of a straw man than an economic analysis, has been put to rest; [however,] evaluation of the literature indicates that the issue of returns to IT investments is far more complex than the original formulation, and hence more research is needed (Diedrick et al., 2003, p. 23).

While a number of variations on the fundamental relationship between IT investment and productivity have been examined within this category, the basic, underlying association in these studies can be represented by the simple model as shown in Figure 2.

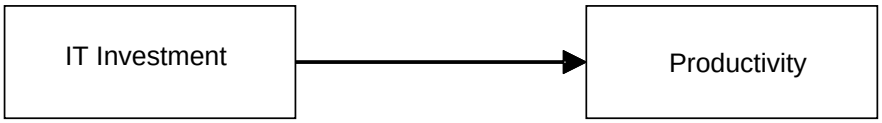

Figure 2. Basic Model Relating IT Investment to Productivity

Partial IT Capability and Performance (Category #2)

Rooted in strategic approaches, this category of IT business value studies includes research that has combined IT with other IT and/or non-IT factors (i.e., IT capabilities) to explore the relationships between these integrated factors and various measures of firm performance. These studies have generally further disaggregated IT into specific IT applications, activities, processes, and systems before combining IT with various other factors. Such studies have ranged from exploring the impact of a single IT capability on competitive advantage, to the impact of combinations of IT and non-IT capabilities on performance.

For example, Sethi and King (1994) developed measures to assess the extent to which a single IT software application provides competitive advantage. At the other end of the spectrum, Mata et al. (1995) proposed that the capability to merge IT knowledge and business knowledge through a variety of strong intraorganizational relationships was a key determinant in a firm being able to leverage business value through IT. In a more intricate example, Ross et al. (1996) found that the careful management of three key IT assets influenced the quality of three IT processes, which in turn, influenced a firm's ability to deploy IT to meet strategic objectives and produce business value.

Other studies have argued that broad classes of IT, such as the creation of a robust, enterprise-wide IT infrastructure, can distinguish a firm's ability to leverage IT for business value (Broadbent & Weill, 1997). Byrd (2001), and Byrd and Turner (2001), found a positive relationship between competitive advantage and a firm's multifaceted capability to create a flexible IT infrastructure. Neo (1988) concluded that interactions among IT and qualitative organizational variables strongly influenced IT performance; while Ginsberg and Venkatraman (1992) reported associations among IT performance and the traits of CEOs. A common theme in the majority of the studies in this second category has been the focus on combining IT with other factors to enable business value. A key observation that resulted from such studies was the proposal that IT performance most often depends, not on IT alone, but on the integration of IT with human and organizational resources (e.g., Keen, 1993; Walton, 1989).

As with the studies in the first category, a number of various models have been utilized in examining the relationship between IT-factor combinations and performance.

However, the fundamental relationships in these studies can be represented by the simple model in Figure 3.

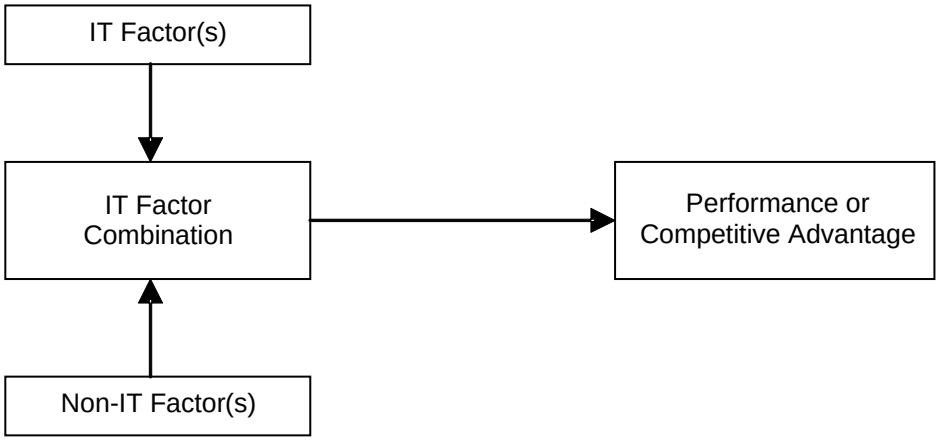

Figure 3. Basic Model Relating IT & Non-IT Combined Factors to Performance or Competitive Advantage

Overall IT Capability and Performance (Category #3)

Also rooted in strategic approaches, this third category of IT business value studies is concerned with investigating the relationships between a firm's comprehensive or overall IT capability and a variety of performance measures. A major challenge for this group of studies has been finding a way to adequately represent the organization-wide IT capability of a firm so that it could be measured and used in an empirical analysis. This third group of studies suggests that such an overall representation of a firm's IT capability should include multifaceted and complex combinations of IT and non-IT factors (i.e., IT capabilities), as previously discussed in the second category. Such a multidimensional characterization would then represent a firm-wide IT capability to leverage improved competitive performance.

In a recent study, Bharadwaj (2000) conducted one of the first empirical tests of the relationship between overall IT capability and performance. She employed a proxy representation of firm-wide IT capability by equating superior IT capability with the annual *InformationWeek* peer rankings of firms classified as IT leaders. The financial performance of these IT leader firms was then compared to similar firms that were not ranked as IT leaders. While a number of limitations exist in such an approach, the Bharadwaj (2000) analysis indicated that superior IT capability leads to superior firm performance. A follow-up study using the same proxy approach to represent a firm's overall IT capability found similar results (Santhanam & Hartono, 2003). Another follow-up study (Lu & Ramamurthy, 2004) used the same proxy approach, but included an environmental interaction term (i.e., dynamism) between the proxy for firm-wide IT capability and firm performance, while also employing a different research design and method of analysis. However, the results of the Lu and Ramamurthy (2004) study failed to confirm all of Bharadwaj's (2000) results.

Another investigation of IT business value has involved the development of a multidimensional construct to measure firm-wide IT capability (Bharadwaj et al., 1999). Such an approach avoids many of the limitations inherent in the proxy approach (Santhanam & Hartono, 2003). In the Bharadwaj et al. (1999) study, the multidimensional construct was developed and then tested psychometrically using a single sample of IT executives. While no published studies have been identified which have used the construct in evaluating the relationship between firm-wide IT capability and performance, the Bharadwaj et al. (1999) construct has been used in a working paper, which to date remains unpublished. This unpublished study reports the finding of a

positive relationship between the firm-wide IT capability construct developed by Bharadwaj et al. (1999) and two financial ratios representing firm performance (Bharadwaj, Sambamurthy, & Zmud, 2002).

This third category of studies provides a comprehensive approach to investigating IT business value, since it attempts to consider a firm's overall IT capability and not simply a partial or segmented view. The approach of blending complementary IT and non-IT abilities to develop a robust and firm-specific multidimensional construct, appears to be a promising approach to representing the very complex notion of a firm's overall IT capability (e.g., Melville et al., 2004; Santhanam & Hartono, 2003; Wade & Hulland, 2004). However, because very little empirical evidence exists, there is a need for much more additional study in this area.

The essential relationships for the studies included in this category can be represented by the simple model in Figure 4.

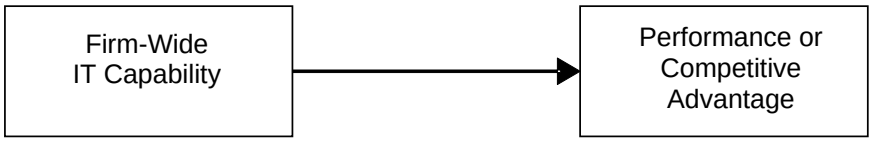

Figure 4. Basic Model Relating Firm-Wide IT Capability to Performance or Competitive Advantage

Table 1 provides a sampling of IT business value studies that have been grouped into the three broad categories of (1) IT spending and productivity, (2) partial IT capabilities and performance, or (3) firm-wide IT capabilities and performance.

Table 1.

Selected IT Business Value Research Grouped Into Three Broad Categories

IT Spending & Productivity	Partial IT Capabilities and Performance	Firm-Wide IT Capabilities and Performance
(Baily, 1986)	Neo 1988	(Bharadwaj et al., 1999)
Hackett 1990	(Walton, 1989)	(Bharadwaj, 2000)
(Strassman, 1990)	Keen 1991	(Santhanam & Hartono, 2003)
Panko 1991	(Keen, 1993)	(Lu & Ramamurthy, 2004)
Roach 1991	(Sethi & King, 1994)	
(Brynjolfsson, 1993, 1994)	Ginsberg and Venkatraman 1992	
(Brynjolfsson & Hitt, 1996)	(Mata et al., 1995)	
(Hitt & Brynjolfsson, 1996)	(Ross et al., 1996)	
(Barua & Lee, 1997)	(Rockart, Earl, & Ross, 1996)	
(Byrd & Marshall, 1997)	(T. C. Powell & Dent-Micallef, 1997)	
(Diedrick et al., 2003)	(Broadbent & Weill, 1997)	
(Thatcher & Pingry, 2004)	(Byrd, 2001)	
	(Byrd & Turner, 2001)	

Making Sense of the Research Stream

A first reaction to the previous discussions may leave the impression that the three categories of IT business value research reveal a rather chaotic stream of research. While some have shown that this is at least true to some extent (e.g., Chan, 2000), taking a broad overview of the IT business value literature reveals, not chaos per se, but rather a pattern of evolving research deftly guided by lessons learned. The next section explains one such lesson that guided this dissertation in its choice of a primary theoretical lens for investigating IT business value.

Adopting a Common Theoretical Lens. A review of the three categories previously discussed should make it clear that, in general, IT business value scholars are motivated by a desire to understand how and to what extent the application of IT within firms leads to improved organizational performance (Melville et al., 2004, p. 285). However, as the previous discussions also make clear, linking IT to organizational

performance is a complex research problem that has involved a diverse group of conceptual, theoretical, and analytic approaches while employing various empirical methodologies at multiple levels of analysis (Brynjolfsson, 1993; Brynjolfsson & Yang, 1996; Diedrick et al., 2003). Yet, this diversity has led to the separate, non-overlapping conversations mentioned earlier in this study. Thus, researchers have begun to recognize the benefits of adopting a common theoretical lens that can help unite these non-overlapping conversations and lead toward clarity and understanding in IT business value research (Chan, 2000; Melville et al., 2004).

As a means of enhancing the conceptual analysis of IT's effects on firm performance, many IT business value studies have begun to employ the resource-based view of the firm (i.e., resource-based theory) (e.g., Bharadwaj, 2000; Santhanam & Hartono, 2003). Resource-based theory offers the advantage of integrating a management perspective with an economics perspective to provide the balance required for the development of an integrative IT business value model (Melville et al., 2004; Peteraf & Barney, 2003). In addition, resource-based theory is presently the leading theoretical perspective in strategic management literature and offers a well established theoretical lens through which the link between IT and firm performance can be examined (Bharadwaj, 2000; Wade & Hulland, 2004). Therefore, this dissertation adopts resource-based theory as the primary theoretical lens for investigating IT business value. However, before discussing resource-based theory and its application within this dissertation, it is necessary to offer a few key definitions for some of resource-based theory's most commonly used terminology in an effort to promote understanding and avoid confusion.

The Need for Clarity in Terminology

An important challenge that resource-based theorists have faced is to provide clear and consistent definitions for the theory's basic vocabulary. The variety of definitions and classifications have been problematic for resource-based theory since it is often unclear what researchers mean by their key terminology (Wade & Hulland, 2004). Therefore, to help avoid such confusion in this dissertation, a synthesis of the resource-based literature was used as a foundation for developing definitions that are offered in this section for each of the key resource-based terms used in this study. However, providing definitions that apply consistently to even the most basic terminology—such as what is a *resource*—can be challenging. For example, some theorists have defined the term *resource* broadly, while others have provided much more narrow definitions. Barney (1991, p. 101) defines the *resources* of a firm broadly to include,

> "all assets, capabilities, organizational processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness." (p. 101)

On the other hand, Teece, Pisano, and Shuen (1997, p. 516) define resources more narrowly as, "firm-specific assets that are difficult if not impossible to imitate." While Teece, Pisano, and Shuen (1997, p. 516) provide no definition for the term *asset*, they go on to explain,

> "we do not like the term 'resource' and believe it is misleading. We prefer to use the term 'firm-specific asset'…to try and maintain links to the

literature on the resource-based approach which we believe is important." (p. 516)

Adding to the ambiguity concerning the definition of the term *resource*, certain studies appear to have used the term both broadly and narrowly within the same article, seeming to rely on the context of the discussion to guide the reader as to whether or not a broad or more narrow meaning is intended (e.g., T. C. Powell & Dent-Micallef, 1997). Thus, not only is it important for researchers to provide clear definitions for the resource-based terminology used in their studies, but a consistent use of the terminology as defined is also important to maintaining clarity.

In Barney's (1991, p. 101) broad definition stated previously, *resources* are defined to include capabilities. However, when distinctions are made between resources and capabilities, clear definitions become even more important. For instance, Grant (1991, pp. 118-119) states that resources are,

> "inputs into the production process—they are the basic units of analysis. The individual resources of a firm include items of capital equipment, skills of individual employees, patents, brand names, finance, and so on." (pp. 118-119)

Grant (1991, pp. 118-119) then continues by offering a specific distinction between resources and capabilities:

> "But, on their own, few resources are productive. Productive activity requires the cooperation and coordination of teams of resources. A capability is the capacity for a team of resources to perform some task or

activity. While resources are the source of a firm's capabilities, capabilities are the main source of competitive advantage." (pp. 118-119)

Amit and Schoemaker (1993, p. 35) also make a distinction between a firm's *resources* and its capabilities, defining the firm's resources,

> "as stocks of available factors that are owned or controlled by the firm...[and] converted into final products or services by using a wide range of other firm assets and bonding mechanisms such as technology, management information systems, incentive systems, trust between management and labor, and more." (p. 35)

In contrast to their definition of *resources*, Amit and Schoemaker (1993, p. 35) define capabilities as referring to,

> "a firm's capacity to deploy resources, usually in combination, using organizational processes, to effect a desired end. [Capabilities] are information-based, tangible or intangible processes that are firm-specific and are developed over time through complex interactions among the firm's resources…often by combining physical, human, and technological resources" [at the functional and/or corporate levels]. (p. 35)

As is clear from these examples, various authors have offered differing ideas concerning resources, assets, capabilities, and processes. Thus, because of the sometimes confusing variety of terms and meanings presented in the resource-based literature, the following definitions are offered to help provide clarity concerning the resource-based terminology used in this dissertation.

First, in this study, resources and assets are considered as equivalent terms, and are defined as the most basic units of analysis that serve as the building blocks of capabilities. Resources and assets are further defined in this study as anything tangible (e.g., hardware, software, network infrastructure) or intangible (e.g., software patents, strong vendor relationships) that the firm can use in its processes for creating, producing, and/or offering its products, goods, or services to a market (Wade & Hulland, 2004).

In contrast to resources and assets, capabilities are viewed in this study as enabling improved competitive performance for a firm through their "repeatable patterns of actions in the use of resources and assets to create, produce, and/or offer products, goods, or services to a market" (Wade & Hulland, 2004, p. XX). That is, as defined in this study, capabilities refer to "an organization's ability to assemble, integrate, and deploy the firm's valued resources, usually in combination," such that these bundles of resources are able to work together in ways that create competitive advantage (Bharadwaj, 2000, p. XX). Thus, as defined here, capabilities can be seen as transforming inputs into outputs of greater worth (Amit & Schoemaker, 1993; Capron & Hulland, 1999; Christensen & Overdorf, 2000; Sanchez, Heene, & Thomas, 1996; Schoemaker & Amit, 1994). Such capabilities can include skills (e.g., technical skills), abilities (e.g., managerial abilities), and/or processes (e.g., systems development).

Furthermore, following the advice of Wade and Hulland (2004, p. 109), while authors have used the terms capabilities, competencies, and core competencies with different meanings, in this study, the three terms are viewed as essentially synonymous (c.f., Teece et al., 1997; Wade & Hulland, 2004). According to Sanchez et al. (1996), the only difference between these terms lies in the fact that core competencies are

capabilities that achieve competitive advantage. Therefore, because this study discusses only capabilities that lead to improved competitive performance, the terms capabilities, competencies, and core competencies can be considered interchangeable for this dissertation.

Finally, it should be clear that the definitions that are offered in this dissertation support a view of resource-based theory that suggests a distinction between resources and capabilities (e.g., Grant, 1991; Teece et al., 1997). In summary, this view emphasizes capabilities as reflecting the ability of firms to assemble their resources in ways that enable superior competitive performance. As previously mentioned, this distinction between resources and capabilities suggests that the fundamental resources of a firm are more easily copied by competition; whereas the capabilities of a firm are inherently more difficult for competition to duplicate. This idea stems from the view that capabilities are created over time in ways that tightly integrate them with firm-specific intangibles such as history, culture, and experience. Thus, each firm should be able to create unique, firm-specific capabilities depending upon each firm's unique set of circumstances, history, and experience. These ideas are discussed in more detail in the following sections.

Resource Heterogeneity and Barriers to Imitation

The concept of each firm having its own set of firm-specific capabilities is known as resource heterogeneity and has been referred to in the literature as the fundamental point where resource-based theory begins (T. C. Powell & Dent-Micallef, 1997). The notion of resource heterogeneity argues that, "firms hold heterogeneous (i.e., diverse, varied) resource portfolios—whether by history, accident, or design—and that this resource heterogeneity is responsible for observed variability in financial returns across

firms" (T. C. Powell & Dent-Micallef, 1997, p. 377). However, while firms may hold diverse sets of resources that are used to create firm-specific capabilities, if a firm produces consistently superior returns, competitors will naturally seek to imitate, acquire, or develop substitutes that will produce similar benefits. Therefore, while capabilities are by definition intrinsically valuable (i.e., they produce fiscal value) and are also rare (i.e., they are in short supply), to provide sustainable competitive advantage capabilities must also withstand competitive attempts at imitation, acquisition, or substitution (i.e., imperfectly imitable, and with no substitutes) (Barney, 1991).

Rumelt (1984) suggests that capabilities survive attempts by competitors at imitation through protection devices referred to as imitation barriers, or isolating mechanisms. According to Powell and Dent-Micallef (1997, p. 377), such imitation barriers can include: (1) time compression diseconomies (path dependencies) - (i.e., when a capability is acquired or built-up over time through learning, experience, firm-specific knowledge, or trained proficiency in a skill); (2) historical uniqueness (first-mover advantages) - (i.e., when a capability is inherently unique or is acquired under circumstances that cannot be replicated by competitors—such as a distinctive location, reputation, or brand loyalty); (3) resource embeddedness - (i.e., when the value of a capability is dependent on a resource being linked to the presence of another complementary or cospecialized resource); and (4) causal ambiguity - (i.e., when the connection between a capability and superior firm performance is unclear or too complex for competitors to understand or manage—such as when complex cultural or social phenomena play a key role in firm success) (Barney, 1991; Dierickx & Cool, 1989; Lieberman & Montgomery, 1988).

While all of these isolating mechanisms are valid in their own right, when specifically considering IT-based advantages, the resource-based view has given more attention to sustainability protected by resource embeddedness (T. C. Powell & Dent-Micallef, 1997).

The attention given to the particular imitation barrier of resource embeddedness is due in part to the recognition by researchers that the concept of complementarity plays such an important role in IT business value research. This recognition of complementarity's importance has been greatly influenced by the perspective known as the strategic necessity hypothesis. In short, the strategic necessity hypotheses states that (a) ITs provide value to firms through creating coordination efficiencies, therefore firms that do not adopt ITs will be at a competitive disadvantage due to higher cost structures; and (b) apart from the efficiencies created, firms cannot expect ITs to produce sustainable advantages because most ITs can be readily acquired by all firms (see Clemons & Row, 1991 for discussion that underlies this concept). Powell and Dent-Micallef (1997, p. 377) explain that the strategic necessity hypothesis leaves firms with only three feasible paths to IT-based competitive advantage:

> "(1) reinvent IT advantages perpetually through continuous, leading-edge IT innovation; or (2) move first and erect unassailable first-mover advantages; or (3) embed ITs in organizations in such a way as to produce valuable, sustainable resource complementarity. [Because] the first two paths have proven precarious…the resource-based view has focused on resource complementarity [the third path] as the most feasible path to IT advantage." (p. 377)

In the next section, this discussion is continued with a focus on complementarity and its role in IT business value.

The Role of Complementarity in IT Business Value Research

As noted in the previous section, according to the resource-based view, the sustainability of IT-based competitive advantage has focused on the protection device (i.e., imitation barrier, isolating mechanism) referred to as resource embeddedness. The concept of resource embeddedness involves two related ideas: that of complementarity and cospecialization. "Complementarity represents an enhancement of resource value that arises when a resource produces greater returns in the presence of another resource than it does alone" (T. C. Powell & Dent-Micallef, 1997, p. 379). Such complementary resources are further considered to be cospecialized if one resource has little or no value without the presence of the other (Clemons & Row, 1991).

An often cited example of cospecialized complementary resources is the relationship between IT software and hardware. Because the resource of IT software enhances the value of the IT hardware resource (and vice versa), the two are considered complimentary resources. In addition, because the resource of IT software is virtually useless without IT hardware (and vice versa) the relationship between the two resources is not only considered complementary, but also cospecialized. The concepts of complementarity and cospecialization are especially indispensable in IT business value research since, "in almost all cases, IT resources act in conjunction with other firm resources to provide strategic benefits" (Wade & Hulland, 2004, p. 123). More importantly, as researchers and practitioners examine the potential value of a firm's particular resources, it is critical to understand that even a resource that might appear to

be essentially worthless when studied alone, may provide greatly enhanced value when combined with the appropriate "cospecialized" resource(s).

In light of the inconsistencies that led to the productivity paradox, the roles of complementarity and cospecialization in IT business value research have gained favor among many researchers employing resource-based theory. While the idea is not a new one, complementarity and cospecialization offer a reasonable explanation for at least some of the inconsistencies in previous findings, as well as a theoretical approach that is well-grounded in the literature. Not only do these concepts acknowledge the "commodity view" of IT expressed by some (Carr, 2003, 2005; Clemons & Row, 1991), but they also allow for the possibility of advantages arising from combining IT with other resources. Thus, complementarity and cospecialization are significant concepts within IT business value research since they imply a more complex role for IT resources by suggesting that IT resources can play an interdependent role with each other, as well as with other firm resources, to create IT capabilities (Alavi & Leidner, 2001; Henderson & Venkatraman, 1993; Wade & Hulland, 2004).

Summary: Resource-Based Theory in IT Business Value Research

Several key ideas from the previous discussions are summarized here. While specific terminologies may vary, a key assertion of the resource-based view in IT business value research is that organizations use their firm-specific abilities to assemble, combine, and integrate their resources to create organizational capabilities. These firm-specific capabilities are viewed as costly-to-copy traits of a firm which are often embedded in organizational processes and considered as fundamental drivers of performance (Conner, 1991; Rumelt, 1984; Schulze, 1992). In the same way that

organizational capabilities are created by integrating organizational resources into business processes, IT capabilities are created by integrating IT resources into business processes, often in combination with other IT and/or non-IT resources, assets, and capabilities (Bharadwaj, 2000; T. C. Powell & Dent-Micallef, 1997).

Resource-based theory in IT business value research also asserts that, because IT investments in resources such as hardware and software are easily duplicated by competitors, such IT investments by themselves would rarely provide any sustained competitive advantage for the firm. This newer IT business value paradigm reflects the proposition that most often it is not the technology alone that is likely to make the difference to contemporary firms. Rather it is the manner in which firms leverage their IT investments to create unique or hard-to-copy IT capabilities that impacts an organization's performance (Clemons & Row, 1991; Mata et al., 1995).

Such thinking has advanced business value research from the basic idea that aggregate IT spending should positively impact aggregate profitability (as in the category #1 studies previously discussed) (see Brynjolfsson, 1994 for a review of the empirical work), to the more complex and interrelated nature of IT, business, and human factors working in concert to enable impacts on performance (as in the category #2 studies previously discussed). Thus, the role of complementarity and cospecialization in creating capabilities—and more specifically, in creating IT capabilities—is fundamental to exploring IT's role in creating competitive advantage for the organization. As Barua and Mukhopadhyay (2000) have observed, it is those firms that can recognize and act on

complementarities[3] between the technology and other business resources that are likely to succeed in the new digital economy.

The Dynamic Capabilities View

Dynamic capabilities have been defined by Teece et al. (1997) as "the ability to integrate, build, and reconfigure internal and external competencies (i.e., capabilities) to address rapidly-changing environments." Eisenhardt and Martin (2000, p. 1107) have defined dynamic capabilities as "organizational and strategic routines by which firms achieve new resource configurations as market emerge, collide, split, evolve, and die." While the exact nature of dynamic capabilities is still not well understood, their visible outcome is the transformation of existing capabilities into new or revised capabilities that provide a better match to the environment (Pavlou & Sawy, 2005a).

Thus, the dynamic capabilities view provides an important extension of resource-based theory (Makadok, 2001). As Pavlou and Sawy (2005b) have explained, while resource-based theory focuses on the selection and accumulation of combinations of synergistic resources to create capabilities (capability picking), the dynamic capabilities view emphasizes reconfiguring existing resources into new or revised capabilities (capability renewal).

Wade and Hulland (2004) found evidence in previous IT business value research (e.g., Jarvenpaa & Leidner, 1998) that IT capabilities may include many of the attributes of dynamic capabilities and may thus be particularly valuable to firms operating in turbulent or rapidly changing environments. However, a more recent empirical study

[3] For the sake of brevity, from this point forward, the term 'complementarity' will be used alone with the understanding that it is intended to represent the two concepts of complementarity and cospecialization.

found evidence that even in stable or steady environments, dynamic IT capabilities can result in "more lucrative opportunities, even though seemingly-adequate competencies already exist" (Pavlou & Sawy, 2005a, pp. 30-31). The more recent findings suggest that dynamic IT capabilities can provide value to the firm regardless of the degree of environmental turbulence in which the firm operates.

Thus, resource-based theory, with its extension of the dynamic capabilities view, provides a useful theoretical platform for exploring the role of IT capabilities in IT business value research. However, resource-based theory, and to an even greater extent the dynamic capabilities view, have been used in only a limited number of IT business value studies and the majority of those analyses have been conceptual (Bharadwaj, 2000). Therefore, a need exists for conducting empirical studies that explore the role of IT capabilities in IT business value research. Such empirical studies may prove especially valuable when employing the theoretical lens of both resource-based theory and its dynamic capabilities extension. In addition, as recently called for in the literature (e.g., Lu & Ramamurthy, 2004), more comprehensive conceptualizations of the firm-wide IT capability construct are needed to further enhance such empirical studies.

The next section explains the process used to develop such a construct for this dissertation. The process is based upon a review and synthesis of the accumulated IT literature involving multiple disciplines. The result of the process is a complex, multidimensional construct reflecting a comprehensive representation of firm-wide IT capability.

Conceptualizations of IT Capability

The literature has used a number of differing approaches for classifying both organizational and IT resources. One approach has broadly classified resources as organizational, business, and technological (Walton 1989) and has argued that IT performance is dependent upon the integration of resources across these three categories to form capabilities. Using Walton's (1989) framework, Benjamin and Levinson (1993) focused on the complementary role of organizational flexibility in the successful implementation of IT. Another approach offered the broad categories of human, business, and technology resources (Keen, 1993), and identified more specific resources such as IT planning and process redesign that may interact with IT to form capabilities that produce sustainable advantages. Jarvenpaa and Leidner (1998) concluded that to deliver competitive value, IT must be deployed in ways that leverage business and human resources that are already present in the firm. Bharadwaj (2000) discussed IT capability in terms of three broad categories which include IT infrastructure, human IT resources, and IT-enabled intangibles.

In a more detailed conceptualization, Ross, Beath, and Goodhue (1996) divided the IT function into the two categories of IT assets and IT processes. The three IT assets were labeled human assets (e.g., technical skills, business understanding, problem-solving orientation), technology assets (e.g., physical IT assets, technical platforms, databases, architectures, standards) and relationship assets (e.g., partnerships with other divisions, client relationships, top management sponsorship, shared risk and responsibility).The three IT processes were identified as planning ability, cost-effective operations and support, and fast delivery. The central idea in the Ross, Beath, and

Goodhue (1996) proposal is that by working in combination, the IT assets and IT processes would contribute to business value.

Feeny & Wilcocks (1998) identified nine core IT capabilities that were organized across four related areas. The four related areas include: (1) business and IT vision (integration between IT and other parts of the firm), (2) design of IT architectures (IT development skills), (3) delivery of IT services (implementation, dealing with vendors and customers), and (4) the core set of capabilities. As shown in Figure 5, these four related areas were shown graphically as having some overlap with each other as a means of representing the potential for integration among them.

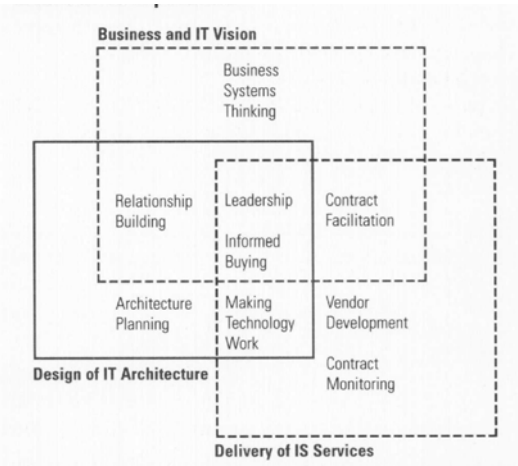

Figure 5. Feeny and Wilcocks (1998) Representation of IT Capabilities

In addition, each of the nine sets of core capabilities was ranked to indicate how much it relied on business, technical, or interpersonal skills. According to Feeny and Wilcocks (1998), the nine core IS capabilities—leadership, business systems thinking, relationship building, architecture planning, making technology work, informed buying, contract facilitation, contract monitoring, and vendor development—represent the primary core activities that need to be effectively managed for overall IT capability.

This conceptualization depicted in Figure 5, made clear the suggestion that a specific IT core capability has the potential to combine with more than one other capability, process, asset, or resource—and perhaps to do so in more than one area. This representation by Feeny and Wilcocks (1998) provides a graphic illustration of the multidimensional nature of IT capability and its complex role in the organization.

Bharadwaj et al. (1999) reported the development and subsequent validation of a multidimensional measure of IT capability with the following six dimensions: IT-business partnerships, external IT linkages, business-IT strategic thinking, IT-business process integration, IT management, and IT infrastructure. The study reported that tests of the psychometric properties for each of the six dimensions revealed all to be reliable and valid based on the study's sample of senior IT executives.

A recent study by Wade and Hulland (2004) conducted an extensive review of the extant IT capability literature and identified eight key categories of IT capabilities: manage external relationships, market responsiveness, IT-business partnerships (manage internal relationships), IT planning and change management, IT infrastructure, IT technical skills, IT development, and cost-effective IT operations. Wade and Hulland (2004) further enhanced the categorization by mapping the eight IT capability categories onto a typology proposed by Day (1994) as a useful way of thinking about the market-oriented competencies of a firm. Day (1994) argued that the market-oriented competencies held by a firm can be sorted into three types of processes—inside-out, outside-in, and spanning.

Wade and Hulland (2004, p. 111) offered the following explanations for these three types of processes: (1) *Inside-out* capabilities are deployed from inside the firm in

response to market requirements and opportunities and tend to be internally focused (e.g., technology development, cost controls). (2) *Outside-in* capabilities are externally oriented, placing an emphasis on anticipating market requirements, creating durable customer relationships, and understanding competitors (e.g., market responsiveness, managing external relationships). (3) *Spanning* capabilities, which involve both internal and external analysis, are needed to integrate the firm's inside-out and outside-in capabilities (e.g., managing IT-business partnerships, IT management and planning).

As exemplified in the various studies mentioned here, most of the more recent conceptualizations of firm-wide IT capability recognize the role of complementarity in creating capabilities that enable sustained performance advantages. Therefore, these studies represent IT capabilities as combinations of resources integrated with other IT and/or non-IT resources, assets, capabilities, and/or processes which work in combination to form an overall or firm-wide IT capability (e.g., Feeny & Wilcocks, 1998; T. C. Powell & Dent-Micallef, 1997; Ross et al., 1996; Wade & Hulland, 2004).

Three fundamental ideas become apparent in a review of these studies. First is the idea that IT alone is most often insufficient to produce sustained performance advantages for the firm. Since most IT business value researchers now agree with this first idea (e.g., Jarvenpaa & Leidner, 1998), the second and third ideas become even more important—especially within the context of resource-based theory. The second idea is the realization that, within any organization, there are at least several broad categories of resources available from which the firm can assemble IT capabilities.

Table 2 recaps the broad categories of firm resources offered by the various studies mentioned here. It is interesting to note that there are strong similarities among the general categories discussed in the studies of Table 2 suggesting a pattern among the general pools of resources available to firms for the formation of IT capabilities.

Table 2.

Comparison of General Resource Categories Identified in the Literature

Walton (1989)	Barney (1991)	Keen (1993)	Jarvenpaa & Leidner (1996)	Bharadwaj et al. (2000)
Organizational	Human capital	Human	Human	Human
Business	Organizational capital	Business	Business	Intangible
Technological	Physical capital	Technological	Technology	Technology

The third fundamental idea that became apparent in reviewing these studies builds upon and further refines the second. This third idea suggests that the non-IT resources that are available within the several broad categories of resources for a firm must be combined with IT in ways that create IT capabilities. These IT capabilities then work together to form a firm-wide IT capability that can enable improved performance advantages for the firm.

Figure 6 depicts a simple model adapted from the work of Feeny and Wilcocks (1998) that represents IT capabilities as a synthesis of the three fundamental ideas that emerged from the review of the literature. In the model shown in Figure 6, the three broad resource categories are identified as technology, human, and organizational. The organizational category is represented in the model as also including both the business and intangible labels. Double-headed arrows among the three categories depict the

essence of the third idea: that individual IT capabilities are created through the mutually interdependent integration of IT with non-IT resources.

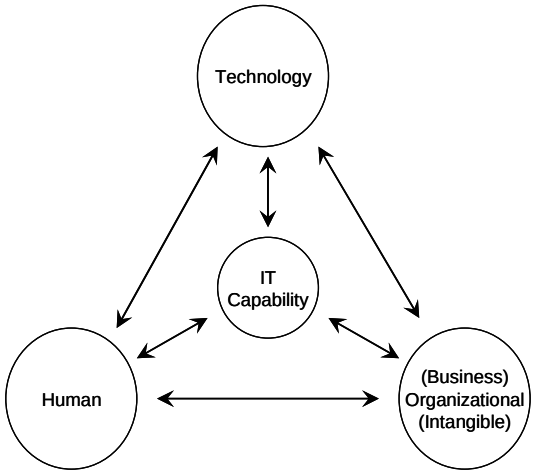

Figure 6. Resource Categories Work Together to Create IT Capability

Firm-Wide IT Capability

While the simple model in Figure 6 depicts IT capabilities at the level of a firm's general resource categories, Table 3 provides a finer level of detail by presenting individual dimensions of an overall or firm-wide IT capability as characterized by a group of predominant studies selected from the literature. In short, Table 3 presents a comparison of some of the most often cited conceptualizations of firm-wide IT capability. The studies in Table 3 are arranged from left to right in chronological order according to publication date. Analysis of such conceptualizations served to form the basis for the new firm-wide IT capability construct utilized in this study. The nine dimensions of the newly developed firm-wide IT capability construct are presented in the far right column of Table 3 and will be discussed in more detail in a later section of this study.

Table 3. Comparison of Representative Conceptualizations of IT Capability

Ross et al. 1996*	Rockart et al. 1996*	Powell & Dent-Micallef 1997*	Feeny & Wilcocks 1998*	Bharadwaj et al. 1999	Wade & Hulland 2004	Morris 2006
client relationships	manage vendor relationships	supplier relationships, supplier-driven IT	dealing with vendors and customers	external IT linkages	manage external relationships	IT external relationship management
					market responsiveness	IT alertness and market responsiveness
partnerships with other divisions, top-mngt. support	relationships with line management	open organization, consensus, CEO support, teams	relationship building, leadership	IT-business partnerships	manage internal relationships	IT-business internal relationship mngt.
	achieve two-way strategic alignment	IT-business strategy integration	business and IT vision	IT-business strategic thinking		IT-business strategic integration.
planning ability		IT planning	architecture planning		IS planning and change mngt.	IT strategic change management
problem-solving orientation	redesign and manage the federal IT org.	process redesign	business systems thinking	IT-business process integration		
physical IT assets, technical platforms	build and manage infrastructure	IT hardware, software, and linkages	implementation	IT infrastructure	IS infrastructure	IT infrastructure management
				IT management		
technical skills	re-skill the IT organization	IT training	IT development skills		IS technical skills	IT technical skills and knowledge
fast delivery	deliver and implement new systems	flexibility	delivery of IT services		IS development	IT development and acquistion
cost effective operations and support	build high performance	benchmarking	making technology work		cost effective IS operations	cost effective IT operations

** this list is adapted from the original work by placing assets, processes, resources, and/or capabilities together in a single column to allow for comparisons among lists*

As previously mentioned, all of the studies represented in Table 3 characterize each of the individual dimensions as IT resources integrated with other IT and/or organizational resources, assets, capabilities, and/or processes to create IT capabilities which represent dimensions of an overall or firm-wide IT capability. Bharadwaj (2000) defines a firm's overall IT capability as the firm's, "ability to mobilize and deploy IT-based resources in combination with other resources and capabilities." These individual IT capabilities then work together in what Ross et al. (1996, p. 34) have described as relationships that are "mutually reinforcing" and "highly interdependent." It is these complex relationships among individual IT capabilities that combine to form firm-wide IT capability.

According to resource-based theory, overall or firm-wide IT capability can be thought of as a set of firm-specific IT capabilities that in combination form an overall IT capability. Therefore, firm-wide "IT capability is not so much a specific set of sophisticated technological functionality as it is an enterprise-wide capability to leverage technology to differentiate from competition" (Bharadwaj et al., 1999, p. 383).

Performance advantages accrue to those firms that can continuously make the most of their IT functionality in combination with other firm resources. However, to achieve such advantages requires that firms have a complete understanding of the essential components of IT capability and the role they play in supporting, shaping, and enabling the business strategy. In the next section, a brief review is presented concerning several key differences that were identified among the various conceptualizations that formed the basis for the new firm-wide IT capability construct.

A New Firm-Wide IT Capability Construct

A comparison of the various conceptualizations of firm-wide IT capability provided insight into the development of the new construct as presented in the far right column of Table 3. A literature review was undertaken with the goal of synthesizing previous work to develop a comprehensive and integrative conceptualization of firm-wide IT capability. While there were a large number of studies reviewed, those compared in Table 3 represent some of the more predominant and most widely cited conceptualizations of firm-wide IT capability.

It should be noted that the Bharadwaj et al. (1999) study was the only empirical study that reported the development and subsequent validation of a multidimensional measure of firm-wide IT capability based on the study's sample of senior IT executives. However, as Lu and Ramamurthy (2004, p. 260) have stated, while "the scales developed by Bharadwaj et al. (1999) [are] a good start," there is still a "need to develop a more comprehensive measure for firm-wide IT capability." Therefore, this dissertation has included the Bharadwaj et al. (1999) research as one of the predominant studies included in Table 3, with the goal of building upon the solid foundation that has been established in that work.

As was true with the comparison of general resource categories as presented in Table 2, there are also a number of strong similarities among the sets of IT capabilities that are compared in Table 3. While these similarities among the sets of IT capability dimensions have suggested several potentially key IT capabilities, the comparison also has revealed some gaps or areas that are in need of clarification. One area that stood out as being different from the other studies was in the Bharadwaj et al. (1999) study, which

labeled one of its six firm-wide IT capability dimensions as "IT management." All of the other studies in Table 3 do not include a separate dimension for IT management, but rather appear consistent with the conclusions of Mata et al. (1995) who found that IT management plays an integral and important role across the entire spectrum of firm-wide IT capability. In a similar vein, the study by Powell and Dent-Micallef (1997, p. 395) found that IT success was "based on a fusion of people, business, and technology resources with the 'management difference' producing the critical distinctive advantage." And, according to Rockart, Earl, and Ross (1996, p. 54), "…IT management must respond to the changing business and technology environment through effective [management] efforts in each of the eight imperatives." Therefore, the new IT capability construct, as shown in the far right column of Table 3, does not include a separate dimension for IT management. Rather, IT management is incorporated as a key aspect of all nine dimensions of the new firm-wide IT capability construct.

Another key area that stood out in the comparisons of Table 3 is the dimension for the new firm-wide IT capability construct titled IT market alertness and responsiveness. This dimension was adapted primarily from the recent Wade and Hulland (2004) study and involves the ability to stay alert to the changes in the external environment and then respond to those changes by making the appropriate internal adjustments. The predominant models prior to Wade and Hulland (2004) did not include specific representations of this capability to sense and respond to market changes. Therefore, this dimension was noteworthy due to its absence in earlier models.

The desirability for including the IT market alertness and responsiveness dimension is supported by research that has recognized "the need to continually reassess

and reinterpret…[especially] within a turbulent context" (Feeny & Wilcocks, 1998, p. 11). Thus, this dimension has ties to the previously discussed concept of dynamic capabilities. However, this dimension is perhaps best identified with a specific example of a dynamic capability: the notion of resource reconfigurability, which has been defined as the ability of a firm to reconfigure its capabilities in response to a changing external environment (Pavlou & Sawy, 2005a; Rindova & Kotha, 2001). While aspects of dynamic capabilities are also represented in other dimensions of the new firm-wide IT capability construct, this dimension specifically addresses facets of resource reconfigurability as outlined by Pavlou and Sawy (2005a) (e.g., market orientation as generating, disseminating, and responding to market intelligence). Thus, the dimension of IT market alertness and responsiveness was adapted as an important factor within the new IT capability construct.

A final area that was noticeable in the comparisons of Table 3 was the disparity among the various characterizations of (a) strategic vision/strategic integration, (b) process redesign/process integration, and (c) various representations of IT planning. This disparity was resolved in the new IT capability construct by adjusting one of the existing Wade and Hulland (2004) dimensions (i.e., IT planning and change management), and by adopting the essence of a dimension that was widely used in most of the other studies (i.e., strategic vision, integration, or management). These two dimensions are labeled in the new construct as IT strategic change management and IT and business strategic integration. Eisenhardt and Martin (2000, p. 1118) concluded that in moderately dynamic markets, resource-based theory "is enhanced by blending its usual path-dependent strategic logic of leverage with a path-breaking strategic logic of change." These two

dimensions help address this blending of leverage and change in the new IT capability construct, and will be discussed in more detail in the next section.

This section has provided a brief review of the comparisons of the predominant conceptualizations of IT capability as shown in Table 3. The primary focus of this discussion has been to highlight the most notable differences among the various conceptualizations that formed the basis for the new IT capability construct. In the next section, the nine dimensions of the new firm-wide IT capability construct are each briefly discussed in an effort to provide clarity concerning the derivation of each dimension as represented in the literature and the role of each dimension within the overall, firm-wide IT capability construct.

Nine Dimensions of IT Capability

The nine dimensions of the IT capability construct have been shown to represent a synthesis of various aspects of IT capability as found in the literature (see Table 3). The combination of these nine dimensions can provide a comprehensive and "integrative conceptualization of IT capability as a multidimensional construct encompassing both the technical and organizational dimensions" (Bharadwaj et al., 1999, p. 379). These nine categories of IT capabilities include insights and features from numerous studies in the extant literature as illustrated by the various citations within the discussions for each dimension.

IT external relationship management. All of the studies in Table 3 provided some form or representation of this particular capability. In addition, the broader review of the IT literature made it clear that contemporary IT capabilities should pertain not just to technology opportunities within the firm, but to those external to the firm as well

(Bharadwaj et al., 1999). Thus, IT external relationship management was strongly supported as a vital dimension within an overall, firm-wide IT capability construct.

IT external relationship management characterizes the ability to manage interorganizational relationships between the firm and stakeholders external to the firm (i.e., customers, suppliers, partner firms) with the goal of delivering high value IT resources. This dimension includes the ability to build external relationships that can leverage the IT capabilities of the firm's partners/suppliers to the ultimate benefit of both the firm and the partner (Jarvenpaa & Leidner, 1998). Such collaborations with external customers allow for the transformation of customer-oriented IT applications and services into high-value IT resources for the firm, while also building durable customer relationships in the process (Bharadwaj, 2000; Bharadwaj et al., 1999). Similar collaborations with external suppliers can lead to the development of appropriate IT systems and infrastructure for the firm (Feeny & Wilcocks, 1998), while also encouraging longer term relationships that deliver higher value returns. IT external relationship management involves entrepreneurial IT collaborations with external partners that deliver high value IT resources among each of the participating firms. Finally, with the growth of outsourcing in contemporary firms, providing leadership for the overall outsourcing process, selecting an outsourcing strategy that meets business and IT needs, and effectively managing externally supplied services provided by outsourcing partners (Benjamin & Levinson, 1993), are vital components of this dimension. In short, "the ability to work with and manage these external relationships is an important organizational capability [that can lead] to competitive advantage and superior performance" for the firm (Wade & Hulland, 2004, p. 113).

IT market alertness and responsiveness. As previously discussed, a separate dimension for IT market alertness and responsiveness was represented in only one of the studies included in Table 3. However, due to the important role of dynamic capabilities in contemporary organizations, and more specifically, the specific aspect of sensing and responding to the marketplace as a part of resource reconfigurability, IT market alertness and responsiveness was adapted from the Wade and Hulland (2004) study and included as a vital capacity in the new firm-wide IT capability construct.

As outlined by Kohli and Jaworski (1990) and later by Day (1994), this dimension refers to the ability of the firm to combine and integrate IT with other firm resources to enhance the firm's capacity to stay alert to the market; and then respond quickly and strategically for competitive advantage. A key facet of this dimension includes combining and integrating IT with socially complex information networks to create an enhanced system that enables the firm to proactively stay alert to the market and obtain critical information ahead of competition (Zaheer & Zaheer, 1997). Additional features of this dimension include enhancing corporate analysis, communications, and development capabilities with IT systems that enable the firm to more quickly and effectively generate relevant market intelligence concerning emerging opportunities or changes in the competitive environment, disseminate such intelligence across departments (Lopes & Galletta, 1997), and then respond with speed and agility to what is learned from the firm's intelligence (Bharadwaj, 2000). Each element of this characterization describes a distinct activity having to do with collecting and acting on information about customer needs and the influence of technology, competition, and other environmental forces (Day, 1994) — all of which can directly impact the IT-business strategy. Therefore, an

important aspect of IT market alertness and responsiveness is strategic flexibility, which is the capacity for the organization to undertake strategic change when necessary (Jarvenpaa & Leidner, 1998; T. C. Powell & Dent-Micallef, 1997). This dimension also includes the ability to act quickly and provide fast delivery of IT solutions in response to changes in market conditions (Feeny & Wilcocks, 1998; Ross et al., 1996; Zaheer & Zaheer, 1997). The ability to stay alert to changes and opportunities in the marketplace and then respond quickly and strategically ahead of competition can lead to competitive advantage for the firm (Zaheer & Zaheer, 1997).

IT internal relationship management. All of the studies in Table 3 provided some representation of the IT internal relationship management capability. In addition, the broader literature review also provided considerable evidence for the importance of building internal relationships between those who provide IT support and services for the organization and those who use such support and services. Thus, IT internal relationship management was strongly supported as an essential element of an overall, firm-wide IT capability, and was therefore included as a factor in the new firm-wide IT capability construct.

This dimension represents the ability to cultivate effective internal partnerships between the IT providers and IT users in the organization with the goal of promoting positive interaction and rich dialogue among the parties to deliver high value IT resources. An important characteristic of this dimension is the ability of IT providers to understand the overall business terminology, goals, processes, and concerns to conceive of ways that technology (i.e., hardware, software, etc.) can effectively be applied to support and enhance business functions (Feeny & Wilcocks, 1998; Ross et al., 1996).

Such understanding and support of IT users by IT providers can increase respect and cooperation between them (Feeny & Wilcocks, 1998). Other facets of this dimension include the blending of business and technology expertise through the use of multi-disciplinary teams (Bharadwaj et al., 1999; Henderson, 1990), and IT users sharing IT project risk and responsibility with IT providers by sponsoring and supporting IT initiatives (Bharadwaj et al., 1999). Additional components of this dimension include the capacity for IT providers and IT users to understand the effects of IT on other functional areas (Benjamin & Levinson, 1993), as well as understanding how IT contributes to the firm's success (Feeny & Wilcocks, 1998). The building of internal relationships between IT users and IT providers can help to span the typical gaps that tend to exist between IT and functional areas and is critical for collaborative efforts such as developing innovative and strategic applications that can lead to performance advantages (Bharadwaj et al., 1999; Wade & Hulland, 2004).

IT and business strategic integration. All but two of the studies in Table 3 provided for some form of capability in IT and business strategic integration. In addition, the review of the literature provided strong evidence for the importance of aligning the IT strategy with the business strategy and developing a shared vision of IT's role in the business strategy. Thus, IT and business strategic integration was supported in the literature as an important part of an overall, firm-wide IT capability and was therefore included in the development of the new construct.

As a part of the new IT capability construct, the IT and business strategic integration dimension represents the ability to discuss, plan, and integrate a shared vision of the role of IT in the firm's business strategies and activities. A key element of this

dimension is the ability to enable the processes of integration (Benjamin & Levinson, 1993; Bharadwaj, 2000) and alignment—especially strategic alignment (Clemons & Row, 1991; T. C. Powell & Dent-Micallef, 1997)—between the IT function and the firm, recognizing that strategic alignment is a dynamic process, rather than a static process. Another important aspect of this dimension is the ability for IT and business management to clearly envision and openly discuss how IT contributes to business value within the strategy of the firm (i.e., IT-business strategic vision) (Bharadwaj et al., 1999, 2002). Other features include the ability for IT and business to regularly consult with each other on both business and IT strategic decisions, and to possess a mutual understanding of each other's responsibilities for IT (Ross et al., 1996). This dimension includes the important view that IT managers and business managers should always be included as a part of the firm's top management team, with both also involved in jointly planning the firm's strategy (Feeny & Wilcocks, 1998). The literature clearly recognizes the importance of strategic vision as a spanning capability that can allow IT to be a key driver and an integral element of the firm's value proposition (C. P. Armstrong & Sambamurthy, 1999).

IT strategic change management. All of the studies in Table 3 provided some representation of the IT strategic change management capability. However, those representations were divided between two related capabilities. Some of the studies focused more on planning abilities while others centered more on process redesign and integration. The Wade and Hulland (2004) study offered a blended representation which recognized that both areas are involved in change and growth. Thus, these capabilities were strongly supported as necessary ingredients in an overall, firm-wide IT capability

construct. Therefore, using an adaptation of the Wade and Hulland (2004) blended approach, both ideas were included in the new IT capability construct within a single dimension labeled IT strategic change management. It should be noted that this capability also plays an important role in the dynamic capability process of resource reconfigurability, which was defined earlier. Eisenhardt and Martin (2000, p. 1118) concluded that "long-term competitive advantage lies in resource configurations" and not in dynamic capabilities alone. Thus, the ability to manage the IT strategic change process—as a part of the process of reconfiguring resources to create new or revised capabilities that provide a better match to the changing environment—is an important aspect of this dimension.

Thus, the dimension of IT strategic change management represents the ability to anticipate, plan, and manage IT strategic change related to technologies, such as changes in hardware, software, and applications, to deliver high value IT resources. Key aspects of this dimension include the ability to accurately anticipate technology change by using the firm's superior market intelligence to stay alert to future technology changes (Zaheer & Zaheer, 1997), to choose platforms (including hardware, network, and software standards) that can accommodate technology change (Feeny & Wilcocks, 1998; Rai et al., 1996), and to effectively manage the resulting IT change (Bharadwaj et al., 1999; Mata et al., 1995). A vital component of this dimension is the ability to create an organizational culture that welcomes change based on new IT opportunities and experimentation with new IT advances (T. C. Powell & Dent-Micallef, 1997). Additional features of this dimension include the restructuring of business and/or IT work processes to accommodate and allow for needed changes or to take advantage of strategic

opportunities (Bharadwaj et al., 1999). Through anticipating, planning, and managing technology change, IT strategic change management also helps to span the gaps that tend to exist between the IT responsibility and the other functional areas of the firm (Wade & Hulland, 2004).

IT infrastructure management. All of the studies in Table 3 provided some form or representation of the IT infrastructure management capability. In addition, the broader literature review also provided substantial evidence for the importance of providing the physical IT assets necessary to support business functions. However, the literature also made it clear that it is much more than the just the physical IT infrastructure that contributes to a firm-wide IT capability that can enable competitive performance advantages. Thus, IT infrastructure management was included in the new IT capability construct with a focus on, not only providing the necessary physical assets, but also providing the proper management of those assets. Such IT infrastructure management allows for the flexibility and support necessary to accommodate changing IT capabilities through resource reconfigurations, and enable a performance enhancing firm-wide IT capability.

IT infrastructure management represents the ability to establish and maintain a flexible IT infrastructure that supports the current business and allows for a quick and agile modification in support of a dynamic firm strategy. Features of this dimension include the ability to effectively manage the infrastructure (Marchand, Kettinger, & Rollins, 2000; Mata et al., 1995) to ensure the security of the firm's information assets; to ensure superior storage and transmission assets, processing capacity, and response times (Lopes & Galletta, 1997); and to enable a superior overall technology asset that is both

appropriate for the business and reasonably consistent across the firm (Ross et al., 1996). Additional aspects of this dimension include the retention of in-house expertise that is able to reassess and update the IT infrastructure plan on a regular basis (Feeny & Wilcocks, 1998), and the formulation of policies that can ensure the proper integration and flexibility of IT services across the organization (Ross et al., 1996).

While some have valued the infrastructure solely in terms of its individual technological components (e.g., Carr, 2003), a growing number of researchers (e.g., Byrd, 2001; Byrd & Turner, 2001; Weill & Broadbent, 1998) now argue "that such a reductionist view of technology ignores the synergistic benefits of integrated systems" (Bharadwaj, 2000, p. 172). Integrated infrastructures take time and effort to evolve (Weill & Broadbent, 1998) and require learning through experience making the process complex and imperfectly understood (Bharadwaj, 2000). In addition, "time compression diseconomies (Dierickx & Cool, 1989) make it difficult for new comers to catch up by simply 'throwing money' and purchasing the IT systems" (Bharadwaj, 2000, p. 173) Thus, within resource-based theory, such integrated IT infrastructures are causally ambiguous (Reed & DeFillippi, 1990), and therefore capable of providing a competitive advantage for the firm (Byrd, 2001; Byrd & Turner, 2001).

IT technical skills and knowledge. All but one of the studies in Table 3 provided for some representation of a capability having to do with IT technical skills and knowledge. In addition, the literature review provided ample evidence of the importance of maintaining a work force with adequate IT technical skills and IT knowledge. Thus, the dimension of IT technical skills and knowledge was supported in the literature as a necessary capability and was therefore included in the new construct.

This dimension refers to the ability to ensure that the IT personnel hold advanced, complex, and difficult to imitate technical skills and knowledge in support of the firm's technology plan (Mata et al., 1995; Ross et al., 1996). The IT technical skills and knowledge dimension represents not only current technical knowledge, but also the ability to deploy, use, and manage that knowledge. Elements of this dimension include the ability to develop IT knowledge assets that are embedded in the expertise and experience of the employees (i.e., intellectual capital), and also embedded in the processes, policies, and networked information repositories of the firm (Bharadwaj, 2000). Other aspects of this dimension include regular training to continuously enhance IT skills and knowledge relating to current systems (Ross et al., 1996), as well as addressing the integration of legacy systems with new IT. An important precept of this capability is its focus on technical skills that are advanced, complex, and, therefore, difficult to imitate. "Although the relative mobility of IT personnel tends to be high (Mata et al., 1995), some IT skills cannot be easily transferred, such as corporate-level knowledge assets (Bharadwaj, 2000) and technology integration skills (Feeny & Wilcocks, 1998),. Thus, "[such a capability] can become a source of sustained competitive advantage" for the firm (Wade & Hulland, 2004, p. 114).

IT development and acquisition. All but one of the studies in Table 3 provided for some form of an IT development capability. In addition, the broader literature review provided evidence for the importance of possessing the ability to rapidly develop technologies that support the firm strategy. Thus, IT development and acquisition was supported in the literature as a requisite capability and was therefore included in the new construct.

The IT development and acquisition dimension represents the capacity to develop and/or acquire new technologies (e.g., hardware and software) effectively and efficiently, while staying ahead of the competition on relevant opportunities involving emerging technologies and trends (Bharadwaj, 2000; Jarvenpaa & Leidner, 1998; Lopes & Galletta, 1997). Elements of the IT development and acquisition dimension include experimenting with new technologies faster than the competition and implementing new technologies before the competition (Jarvenpaa & Leidner, 1998). This dimension also includes features associated with delivering important or strategic systems rapidly in response to business needs, employing an IT systems thinking approach this is based upon an understanding of the business activities, and abilities associated with managing a systems development life-cycle that is capable of supporting competitive advantage (Bharadwaj, 2000; Feeny & Ives, 1990; Marchand et al., 2000; Ross et al., 1996). According to Wade and Hulland (2004, p. 115), such development abilities can "lead to superior firm performance."

Cost-effective IT operations. All but one of the studies in Table 3 offered some representation of a cost-effective IT operations capability; but in several cases, the representation was not precise and only marginally associated with cost-effective IT operations per se.**.** However, the broader literature review provided strong evidence in support of the ability to provide for cost-effective IT operations as a necessary part of firm-wide IT capability. Thus, cost-effective IT operations was included as the final dimension in the new IT capability construct.

The dimension of cost-effective IT operations refers to the ability to provide an efficient and cost-effective IT operation on an on-going basis. Components of this

dimension include the ability to inform firm management concerning the total cost of IT operations (Ross et al., 1996), the ability to use IT management practices to help control IT-related project costs—i.e., "making technology work" (Feeny & Wilcocks, 1998; Marchand et al., 2000), and the ability to use evaluation and control systems to effectively monitor IT operational costs (Bharadwaj et al., 1999). Another facet of cost-effective IT operations is the ability to cross-train IT staff to allow for the cost-effective utilization of IT personnel (Feeny & Wilcocks, 1998). fundamental aspects of this dimension include the ability to successfully avoid large, persistent cost overruns and to avoid unnecessary downtime due to IT system failures (Ross et al., 1996). As Wade and Hulland (2004) point out, "firms with greater efficiency can develop a competitive advantage by using this capability to reduce costs and develop a cost leadership position in their industry" (Barney, 1991; Porter, 1985).

Mapping the New IT Capability Dimensions

Figure 7 shows how the nine dimensions of the new firm-wide IT capability construct are mapped onto the Day (1994) typology. This typology, as described earlier, provides a view of how each IT capability dimension contributes within the framework of three processes (i.e., outside-in, inside-out, and spanning.

As Day (1994, p. 41) has proposed, "when the processes underlying [a firm's] superior capabilities are well understood and effectively managed, [they can] deliver superior insights that inform and guide the direction for a firm's capabilities." The effect is to shift the span of all processes further toward the external end of the spectrum (see Figure 7) and create a firm that is more externally focused, more market driven, and more customer focused. In the modern competitive environment, most businesses would agree

that these attributes are critical tenets that are key to business success. Thus, the use of the (Day, 1994) typology can provide a useful platform for additional insight and analysis regarding the firm-wide IT capability construct.

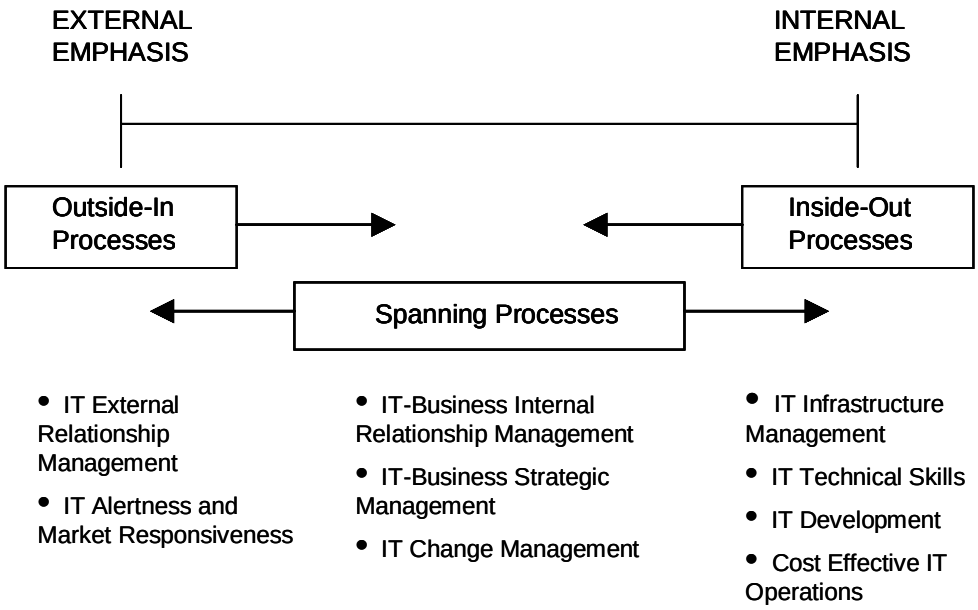

Figure 7. Mapping IT Capability to the Day (1994) Typology

Having developed a new multidimensional construct representing firm-wide IT capability, it is necessary to incorporate the construct within an appropriate nomological network representing IT business value. The next section explores several key conceptualizations of IT business value as found in a review of the literature. This exploration leads to the adoption of an appropriate conceptual model of IT business value for use in this study.

Conceptualizations of IT Business Value

As previously discussed, the lack of a theoretical framework that unifies IT business value investigations has led to, "a fractured research stream with many simultaneous, but non-overlapping conversations" (Melville et al., 2004, p. 289). This fractured research stream has been mentioned as one source of the controversy that has been referred to in the literature as the *productivity paradox* (Bakos, 1987; Brynjolfsson, 1993; Chan, 2000). As Bharadwaj (2000) points out, some researchers have attributed this inconclusiveness [i.e., the productivity paradox] to conceptual limitations and subsequently have called for better theoretical models (e.g., Beath, Goodhue, & Ross, 1994; Grabowski & Lee, 1993; Lucas, 1993; Sambamurthy & Zmud, 1994).

Specifically, these studies have recommended the use of theoretical models that promise conceptual improvements due to their capacity for mapping the overall process ranging from IT investments (or IT capability) to firm performance. An example of one such theoretical approach is the use of a process-oriented view to allow for a more complete system model (Davenport, 1993; Hammer & Champy, 1993; Melville et al., 2004). As Soh and Markus (1995, pp. 29-30) have stated, "process theories can provide powerful explanations even when causal agents cannot be demonstrated to be sufficient for the outcome to occur. In cases of outcome uncertainty, as is the case with studies of IT and business value, process theories have been shown to have distinct advantages over variance theories (Markus & Robey, 1988)."

Three Process Views of IT Business Value

In developing the conceptual model for this dissertation, three studies employing process views to represent IT business value have provided especially relevant guidance

and insight. Each of these three studies has undertaken a synthesis of the extant literature to develop a more comprehensive model intended to provide a more robust representation of IT business value. While each of the three models is different from the others, there are distinct similarities that have served to link the models with common themes.

The first of the three studies develops a process oriented conceptual model with the goal of, "moving beyond correlational evidence to explanation of the technological features, process characteristics, organizational settings, and competitive environments conducive to producing IT business value" (Mooney, Gurbaxani, & Kraemer, 1995, p. 18). A distinctive feature of this model as shown in Figure 8 is its recognition of the importance of organizational context and competitive position in studies of IT business value.

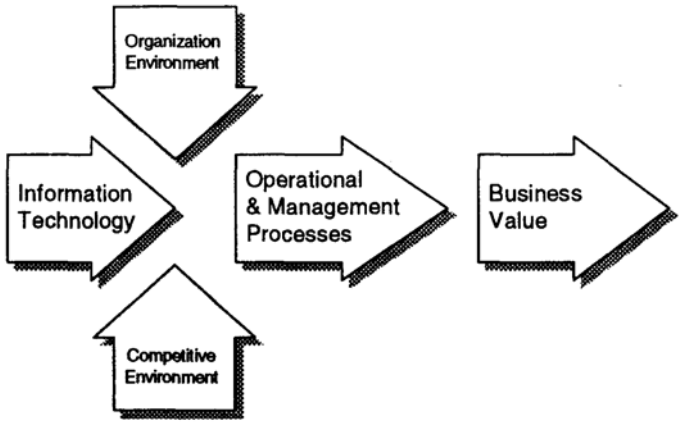

Figure 8. A Process Oriented Model of IT Business Value (Mooney et al., 1995)

Specifically, the model recognizes that the business value of IT is a, "joint technology-organization phenomenon;" and that "meaningful investigation of this phenomenon requires theoretical perspectives of both technology and organizations, and

their interactions" (Mooney et al., 1995, p. 19). The approach to studying IT business value using the Mooney et al. (1995, p. 21) model is "through a focus on the fundamental ways by which the technology can improve management and operational processes," while not losing sight of the influences from the organizational and competitive environments (see Mooney et al., 1995 for a more detailed discussion).

The second of the three models, as shown in Figure 9, develops a chain of three different process models, which when taken together are said to, "comprise and synthesize some of the major insights from prior theoretical contributions, while clarifying some of the major gaps and points of disagreement" (Soh & Markus, 1995, p. 36).

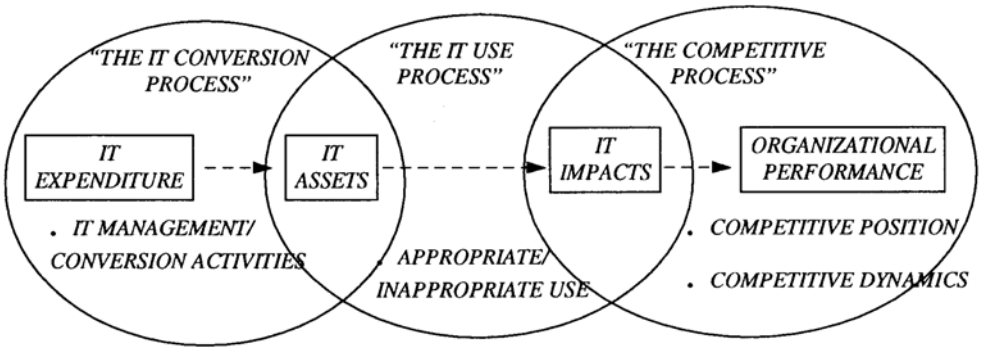

Figure 9. How IT Creates Business Value: A Process Theory (Soh and Markus, 1995)

This process model is intended to represent how, when, and why IT investment is converted to favorable organizational performance. Soh and Markus (1995) explain that their model includes…

> …necessary conditions and probabilistic processes in the following sequence: organizations spend on IT and, subject to the varying degrees of

> effectiveness during the IT management process, obtain IT assets. Quality 1T assets, if combined with the process of appropriate IT use, then yield favorable IT impacts. Favorable IT impacts, if not adversely affected during the competitive process, lead to improved organizational performance. (, p. 39)

This second process model can help in understanding why IT investment does not always lead to improved organizational performance. The model also can provide guidance in developing a framework for testing the IT conditions and processes associated with improved organizational performance (see Soh & Markus, 1995 for a more detailed discussion).

The third of the three models, as shown in Figure 10, develops an integrative representation of IT business value which. "comprises three domains: (1) the focal firm; (2) the competitive environment; and (3) the macro environment. Using the resource-based view as a primary theoretical lens, the model describes how phenomena resident within each domain shape the relationship between IT and organizational performance" (Melville et al., 2004, p. 293). This third model brings together key aspects of the first two models by recognizing that (1) IT most often impacts organizational performance through intermediate business processes; (2) other organizational resources interact with IT in the attainment of organizational performance; and (3) influences from the external environment play a role in shaping IT business value generation.

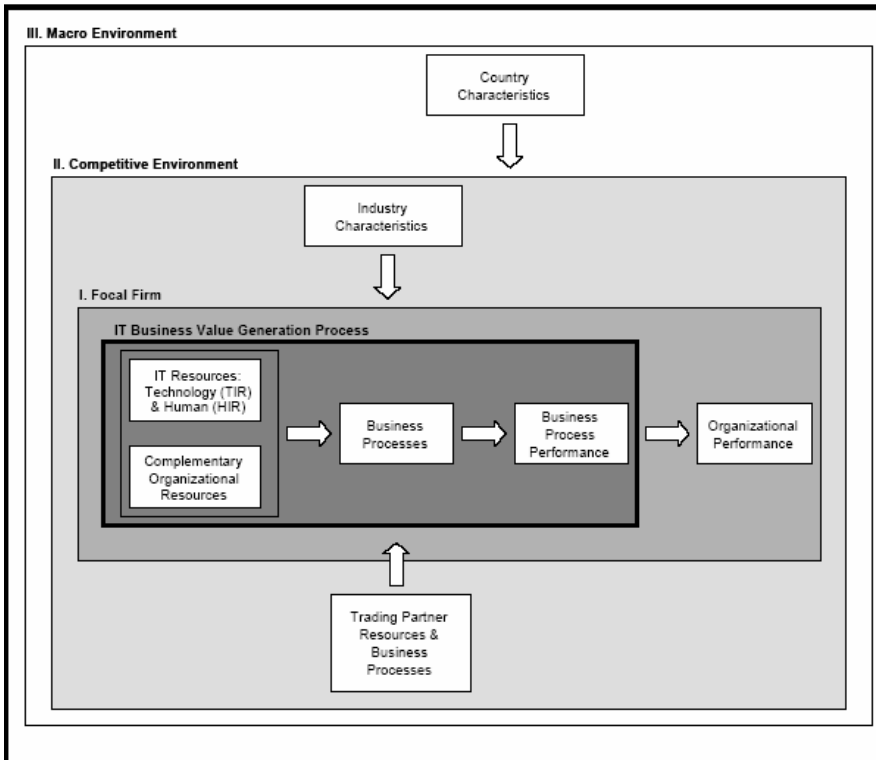

Figure 10. Integrative IT Business Value Model (Melville et al., 2004)

The conceptual model used in this dissertation is adapted from the Melville et al. (2004) model of Figure 10 (i.e., the third model). The adapted conceptual model as shown in Figure 11, reflects the use of Firm-Wide IT Capability to represent the mobilization and deployment of firm-specific IT-based resources in combination with other complementary resources, assets, and/or capabilities. Consistent with the other four models, these IT capabilities are "rooted in processes and business routines (Bharadwaj, 2000) to enable new and/or improved business process performance, as well as improved organizational performance" (Soh & Markus, 1995, p. 39). Thus, because the concept of Firm-Wide IT Capability includes the business processes, the entire box which is titled "IT Business Value Generation Process" in the Melville et al. (2004) model of Figure 10,

is replaced in the adapted conceptual model of Figure 11 as simply "Firm-Wide IT Capability."

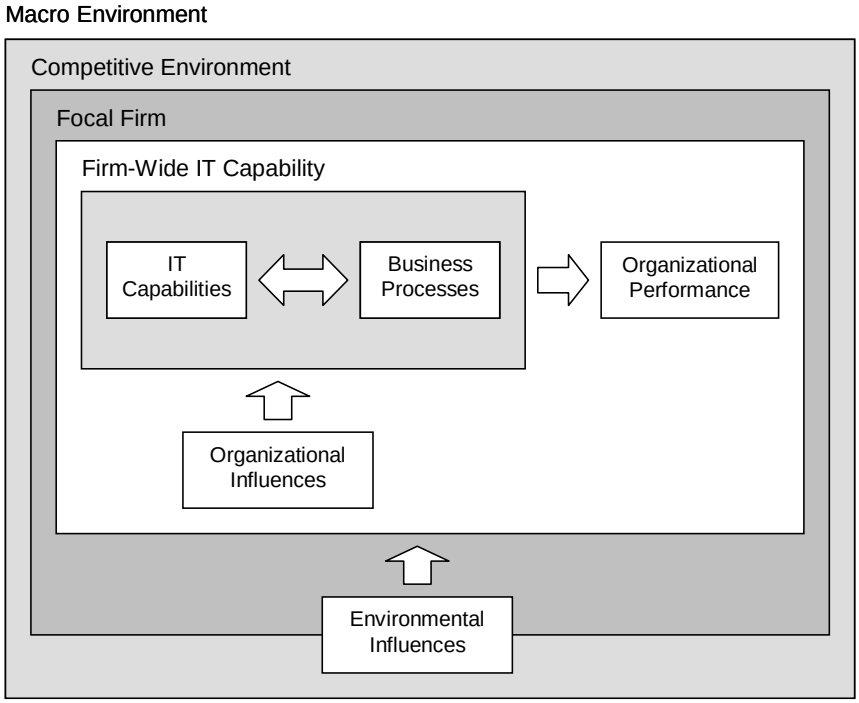

Figure 11. Integrative Conceptual Model of IT Business Value (adapted from Melville et al., 2004)

IT capabilities are subject to environmental (e.g., turbulence, munificence, complexity, country, industry) and organizational influences (e.g., structure, culture, size). Therefore, changes in these environmental and/or organizational influences can trigger the firm to use its dynamic capabilities to reassemble its resources to create revised or new configurations of capabilities that better match the external or internal environment (Eisenhardt & Martin, 2000; Pavlou & Sawy, 2005b; Teece et al., 1997).

Thus, in an effort to provide a comprehensive model that integrates elements of key IT business value models from the literature, the conceptual model in Figure 11 also incorporates influences from both the internal organizational domain (i.e., *focal firm*), as

well as the external environmental domains (i.e., *competitive environment*, *macro environment*). The final section of the conceptual model representing IT business value, depicts the relationship between the organization's overall, firm-wide IT capability and the firm's competitive performance.

This integrative conceptualization of the IT business value process as shown in Figure 11, remains consistent with Melville et al.'s (2004, p. 285) desire to move toward the "unification of this vast and diverse body of accumulated knowledge" by adopting a common view (i.e., resource-based theory with the dynamic capabilities extension) that provides for an integrative conceptual framework that can help expedite knowledge advancement in the realm of IT business value research.

Level of Analysis

As previously discussed, IT business value studies have attempted to explore the contribution that IT capabilities make to firm performance over a wide range of extremes: from the impact of a single IT application to the contribution of a firm-wide and complex IT infrastructure. Because this study involves an empirical examination of IT business value through the assessment of moderating influences on the relationship between a newly developed measure of firm-wide IT capability and the firm's competitive performance, it is appropriate that the level of analysis for this dissertation be at the firm or organizational level. In addition, while a number of studies have previously examined IT business value by employing partial or less-than-firm-wide IT capabilities, no published study was identified that has employed a multidimensional measure of firm-wide IT capability to assess IT business value. Thus, firm-level studies are needed to examine the effects of firm-wide IT capability on firm performance.

Because technology is most often implemented at the lower operational process levels within the organization, various researchers have argued that the first-order impacts of IT investment should also be measured at these lower operational levels (Barua, Kriebel, & Mukhopadhyay, 1995; Barua & Mukhopadhyay, 2000). This dissertation supports the argument that firms derive value from IT through IT's impacts on intermediate business processes, as evidenced in the discussions of the Mooney et al. (1995), Soh and Markus (1995), and Melville et al. (2004) process models. However, this study's primary focus is on assessing impacts on the firm's competitive performance that may result from the moderating effects of interactions between organizational and environmental influences with firm-wide IT capability. Therefore, because the focus of this study involves firm-wide measures of IT capability, it is appropriate that the level of analysis for this dissertation be at the firm or organizational level and not at the process level. However, such a process-level approach could represent an interesting extension of this study and provide an opportunity for future research.

Hypotheses

Having developed an integrative conceptual model of IT business value from the literature (i.e., Figure 11) and a suitable theoretical perspective for describing the relationships in the model, it is now feasible to focus on describing the hypotheses between measures of Firm-Wide IT Capability, Environmental Influences, Organizational Influences, and Organizational Performance. The resulting nine hypotheses are presented in Figure 12.

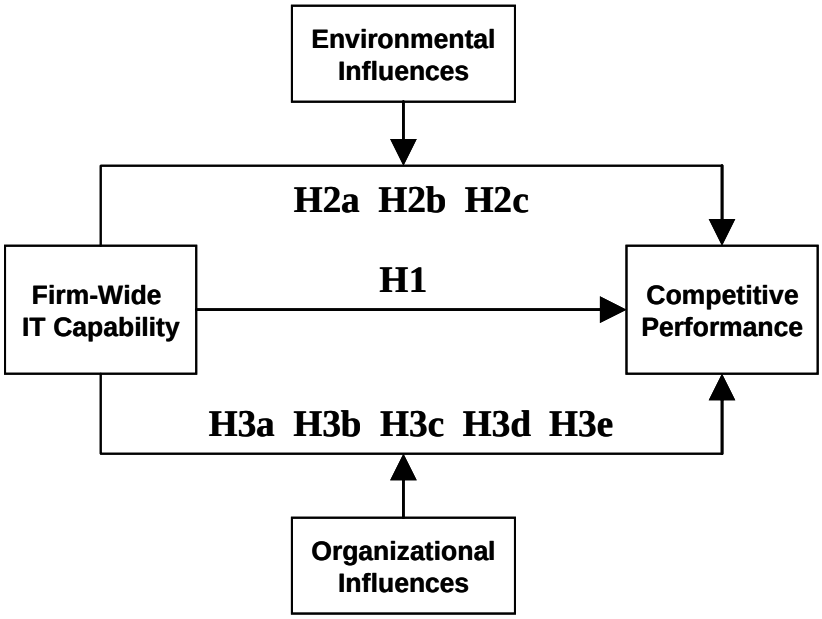

Figure 12. The Nine Research Hypotheses

Firm-Wide IT Capability and Firm Performance

As previously discussed, the concept of firm-wide IT capability represents a combination of an organization's individual, firm-specific IT capabilities. When taken as a whole, these individual IT capabilities combine to form an overall IT capability for the entire organization. Resource-based theory posits that IT capabilities are created when IT resources are integrated and combined with other IT and/or non-IT resources, assets, and capabilities, then embedded into business processes or organizational routines. In addition, resource-based theory also provides a distinction between resources and capabilities. According to this distinction, when compared to resources alone, capabilities are inherently more difficult for competition to copy or imitate and can provide the organization with improved competitive performance.

Therefore based on theory, as firms increase their level of firm-wide IT capability, it is reasonable to expect that, in general, firm performance may also increase. While very few studies have empirically assessed the relationship between firm-wide IT capability and organizational performance, the few empirical studies that have assessed the relationship found support for the view that higher levels of IT capability are related to higher levels of firm performance (e.g., Bharadwaj, 2000; Lu & Ramamurthy, 2004). Thus, based upon theory and empirical evidence, the following hypothesis is proposed:

Hypothesis 1: Firm-Wide IT Capability will demonstrate a positive relationship with firm performance.

Firm-Wide IT Capability, Moderating Influences, and Firm Performance

Just as resource-based theory recognizes the role of complementarity in explaining how one resource may influence another to affect competitive position or performance (Teece, 1986), so are certain influences recognized as having the potential to interact with the firm's IT capability to produce a moderating effect on the relationship between IT capability and firm performance. As suggested by Wade and Hulland (2004, p. 124), such moderating influences can be separated into two categories: "organizational factors (i.e., those that operate within the firm) and environmental factors (i.e., those that operate outside the firm's boundaries)."

Environmental Moderators

Key environmental moderators include the three dimensions of the environment that were determined by Dess and Beard (1984) to contribute the most to environmental uncertainty, and therefore are most likely to consistently influence firm performance: *environmental turbulence*, *munificence*, and *complexity* (Wade & Hulland, 2004).

Environmental Turbulence. In turbulent, fast changing environments, many competitive advantages achieved by a firm are short-lived due to competitive and environmental pressures which tend to quickly erode any value attributable to the firm's IT capabilities. It is in such turbulent environments that the traits of dynamic capabilities become most important by allowing firms to reassemble resources to create revised and/or new IT capabilities that provide a better match to the environment. Therefore, since IT capabilities are generally considered as dynamic capabilities (Jarvenpaa & Leidner, 1998; Wade & Hulland, 2004) and nine key IT capabilities are combined to form the new firm-wide IT capability construct used in this study, it is reasonable to expect that those firms possessing higher levels of firm-wide IT capability should also possess higher levels of firm performance in turbulent environments, when compared to firms in turbulent environments that possess lower levels of firm-wide IT capability. In addition, recent research has determined that dynamic capabilities can also provide value in relatively stable markets (cite), suggesting that those firms possessing higher levels of firm-wide IT capability should also possess higher levels of firm performance, even in non-turbulent environments, when compared to firms in non-turbulent environments possessing lower levels of firm-wide IT capability. However, because the demands on a firm operating in turbulent environments are greater than on firms operating in stable environments, it is expected that environmental turbulence will negatively moderate the relationship between firm-wide IT capability and firm performance when comparing the same firms operating in turbulent versus non-turbulent environments. Thus, the following hypothesis is proposed:

Hypothesis 2a: Environmental Turbulence will negatively moderate the relationship between Firm-Wide IT Capability and Firm Performance.

Environmental Munificence. Environmental munificence refers to the "extent to which a business environment can support sustained growth" (Dess & Beard, 1984; Wade & Hulland, 2004, p. 127). Low levels of munificence are generally associated with environments that are mature or shrinking. In such environments of low munificence, it is not unusual for stiff competition to negatively affect an organization's performance. High levels of munificence are normally associated with rapidly growing markets that are relatively forgiving, thus allowing firms to be competitive and grow despite imperfect firm strategy and lower levels of capabilities. Therefore, in low munificence environments, firms with higher levels of firm-wide IT capability are expected to be able to compete more effectively when compared to firms in the same low munificence environments that possess lower levels of IT capability. However, as with environmental turbulence, because the competitive demands on a firm operating in environments of low munificence are greater than on firms operating in environments of high munificence, it is expected that environmental munificence will negatively moderate the relationship between firm-wide IT capability and firm performance, when comparing the same firms operating in munificent versus non-munificent environments. Thus, the following hypothesis is suggested:

Hypothesis 2b: Environmental Munificence will negatively moderate the relationship between Firm-Wide IT Capability and Firm Performance.

Environmental Complexity. Environmental Complexity refers to the range and the differences (heterogeneity) that exist across an industry and/or across an organization's activities (Wade & Hulland, 2004). Environmental complexity makes it more difficult for firms to identify and understand the key drivers of performance for an industry and/or for an organization. In such circumstances, it is more difficult for competing firms to recognize the key factors underlying another firm's performance. According to resource-based theory, such ambiguity serves to prevent a firm from imitating, acquiring, or substituting the key resources and/or capabilities of its competitors. Therefore, it is reasonable to expect that the relationship between high-levels of IT capability and high-levels of performance will normally be stronger and longer lasting under conditions of high environmental complexity. However, because high environmental complexity is also associated with larger numbers of suppliers, competitors, and/or customers, higher levels of environmental complexity can create extra demands on the firms in such an environment reducing revenue and increasing expenses. Therefore, while environmental complexity can reduce resource imitation among competitors, it also serves to increase the firm's general cost of operations and/or reduce income. This leads to an expectation that firms with high levels of IT capability should possess higher levels of firm performance versus firms in the same environment that possess lower levels of IT capability. However, when taken as a whole, firms in complex environments should perform worse than firms that are not operating under conditions of environmental complexity. Thus, the following hypothesis is proposed:

Hypothesis 2c: Environmental Complexity will negatively moderate the relationship between Firm-Wide IT Capability and Firm Performance.

Organizational Moderators

Key organizational moderators have been identified in the literature as affecting or having the potential to affect the relationship between IT capabilities and firm-level competitive advantage. Such organizational factors include: top management support (e.g., C. P. Armstrong & Sambamurthy, 1999; Ross et al., 1996), organizational structure (e.g., Fielder, Grover, & Teng, 1995; Liefer, 1988; Sambamurthy & Zmud, 1999), and corporate culture--particularly as it relates to the level of innovation within a firm (e.g., Barley, 1990; Orlikowski, 1996). Firm size and industry have also been proposed in the literature as potential moderators, but will be used instead as control variables within this study.

Firm Culture. Firm culture will be investigated from the viewpoint of firms that possess an entrepreneurial culture (i.e., more dynamic with a fundamental commitment to innovation and development) versus those firms whose culture is more formal (i.e., more structured with a fundamental commitment to formal rules and policies). Since the direction of moderation is not clear, the following two hypotheses are proposed:

Hypothesis 3a: An Entrepreneurial organizational culture will moderate the relationship between Firm-Wide IT Capability and Firm Performance.

Hypothesis 3b: A Formal organizational culture will moderate the relationship between Firm-Wide IT Capability and Firm Performance.

Firm Structure. Firm structure will be examined in terms of centralized versus distributed spheres of authority. Since the direction of moderation is not clear, the following two hypotheses are proposed:

Hypothesis 3c: A Distributed organizational structure will moderate the relationship between Firm-Wide IT Capability and Firm Performance.

Hypothesis 3d: A Centralized organizational structure will moderate the relationship between Firm-Wide IT Capability and Firm Performance.

Top Management Support. Top management support or commitment to IT has been primarily related to receiving the commitment of senior management for IT programs and projects (T. C. Powell & Dent-Micallef, 1997). Top management support or commitment "has been clearly identified in the IT literature as affecting the relationship between IT [capabilities] and firm-level competitive advantage" (Wade & Hulland, 2004). The idea is simply that when the senior management team of the organization supports, guides, promotes, and is committed to the firm's IT function, the impact of IT capabilities on firm performance is perceived to be enhanced (C. P. Armstrong & Sambamurthy, 1999; Ross et al., 1996). However, the converse of this idea involves the perception that a lack of senior management commitment will result in IT capabilities having little effect on competitive performance, "even when substantial

investments are made to acquire or develop such IT capabilities" (Wade & Hulland, 2004). Thus, the following hypothesis is proposed:

Hypothesis 3e: Top Management Support will positively moderate the relationship between Firm-Wide IT Capability and Firm Performance.

Testing the Conceptual Model and Hypotheses

Having identified a conceptual model, a resource-based theory of IT business value, and a set of seven hypotheses based on the model, it is appropriate to proceed to an explanation of the methodology that will be used in performing the various elements of the study.

CHAPTER 3

METHODOLOGY

The goal of this empirical study was to assess an integrative model of IT business value by empirically examining the relationship between firm-wide IT capability and the competitive performance of the firm. This IT capability-performance relationship was tested both with and without the influence of external environmental and internal organizational moderators in the model. To accomplish this study's goal, a cross-sectional field survey involving a mix of medium-to-large publicly-held companies was employed to gather data for use with the independent variables. The subjective data was matched to objective data obtained from the Computstat database, and the objective data was used with the dependent variables in the model. Thus, primary data was used with the independent variables, while secondary data was used with the dependent variables.

Publicly-held firms were chosen as the focus of this study for at least two reasons: (a) operating data on public firms is more readily available, and (b) according to Lederer and Sethi (1988), there are fundamental differences between public and private firms. Such fundamental differences suggest that a focus on either public or private firms is necessary to avoid distorting the results. Therefore, this research focused only on firms that are publicly-held corporations. In addition, because past literature has shown that the most senior IT executive (e.g., CIO, CTO, vice president of IT, director of IT) represents

the most accurate source of information regarding IT in an organizational setting (e.g., Segars & Grover, 1998; Sethi & King, 1994), this study focused on gathering the survey data from the most senior IT executive at each of the publicly held corporations selected for the study. More details concerning the methodological procedures employed in this study will be offered in a later section of this Chapter. The following sections identify each of the variables used in the research model while offering rationale and motivation in support of the choices.

Dependent Variable: Firm Performance

Consistent with earlier research concerning IT capabilities (e.g., Bharadwaj, 2000), the dependent variable of interest in this study is the firm's competitive financial performance (i.e., the firm's financial performance relative to other firms in the same industry). Wade and Hulland (2004, p. 129) suggest three key attributes for any dependent variable used in research employing resource-based theory: (1) it should provide an assessment of performance, (2) it should incorporate a competitive assessment element, and (3) it should address the notion of performance over time. However, there is no single, well-established measure of organizational performance that is used in the IT business value research stream (Weill & Olson, 1989).

Bharadwaj (2000) and Lu and Ramamurthy (2004) both used eight financial performance measures in their proxy-based IT capabilities to firm performance studies However, not all of the measures proved to be significant. Mahmood and Mann (1993) provided evidence that composite measures of performance were generally better in IT business value studies than single measures, but their results have been regarded as difficult to understand and subject to a wide number of interpretations (McKeen & Smith,

1993). From another perspective, Weill and Olson (1989) and Weill (1990b) have argued that because different types of IT systems can have differing impacts on an organization's performance, different performance measures need to be used for each different IT system (e.g., strategic, transactional, informational). However, in practice, most systems possess elements of more that one type of IT; and, such individualized analyses would not allow for effective comparisons across studies. Perhaps a better measure for use in IT business value research is the, "good measure of performance" as identified in the broad analysis offered by McKeen and Smith (1993, p. 419).

In their work, McKeen and Smith (1993) explain that business revenue (i.e., business income), calculated by taking the total income of the company and subtracting income not generated by the business of the company (e.g., extraordinary items), is the appropriate income figure to use in the measurement of performance for the purposes of IT research. This recommendation is based on McKeen and Smith's (1993) opinion that, "business [income] reflects the volume of business where IT makes its direct impact" (p. 418). It is explained further that when business income is expressed per capita (i.e., per the number of full-time equivalent employees) this ratio reflects productivity improvements in an organization. For instance, as McKeen and Smith (1993) explain, "if (deflated) business [incomes] per capita increase over time, this must mean that employees are working more efficiently" (p. 419). It is also explained that by using the ratio of business income per capita in a model that also incorporates contextual variables (e.g., the organizational moderators of this study) and industry variables (e.g., the environmental moderators of this study), the measure of business income per capita could

facilitate even intra-organizational analysis. The following quotation from McKeen and Smith (1993) summarizes their suggestion:

> It is proposed that business [income] per capita recorded over time is a good measure of performance. Unlike other measures of organizational performance such as dividend yields per shareholder, this measure considers the specific role that IT plays and reflects the direct impact of its deployment. The advantage is that it captures both ways IT can affect performance—[income] growth and increased productivity" (p. 419).

As incorporated in the proposed 'good measure of performance' offered by McKeen and Smith (1993, p. 419) (i.e., "…recorded over time"), and as previously discussed in this dissertation, research has found that the resource-based approach to forming capabilities and embedding them in work routines requires time and is an ongoing, evolving process. Ideally then, a longitudinal analysis is preferred for discovering the relationship between IT and organizational performance. Hence, to introduce such a time element into this investigation, a period spanning three years prior to the survey was used as the time frame for all of the performance data obtained through the Compustat database and also as the basis for CIO survey responses. The details of the procedure used to incorporate such a time element into this study are explained within a later section of this chapter.

Thus, based on the guidance outlined in the previous paragraphs, this study chose to operationalize the firm performance construct (i.e., the dependent variable) using a series of eight ratio measures, with each measure taken over a three year period from the Compustat database. To provide for both single and composite measures, five of these ratios were individual ratio measures while three were composite ratio measures. Four of

the measures were income ratios and the other four were expense ratios. Both operating income (OI) and net income (NI) were expressed per capita (i.e., per number of employees, E) to create two performance variables based on the recommendations of McKeen and Smith (1993) (OI/E , NI/E). However, it should be noted that only the operating income per number of employees ratio (OI/E) represents business revenue as the total revenue of the company without the inclusion of revenue that is not generated by the business of the company (e.g., extraordinary items). Net Income (NI) represents income after all expenses and does include revenue that is not generated by the business of the company (e.g., extraordinary items). However, net income was included to provide another view and assessment of an additional, widely used income variable in the analysis. In addition to expressing operating and net income per number of employees, these two income figures were also expressed per net company sales (OI/S , NI/S) and per total assets (OI/A , NI/A). Each of these income ratio measures were also combined into two composite measures of income performance (OI/E + OI/S + OI/A , NI/E + NI/S + NI/A). The two composite measures represent two characterizations of the firm's competitive income performance formed through the combination of the three indicators for each income group (i.e., Composite Operating Income = OI/E + OI/S + OI/A, and Composite Net Income = NI/E + NI/S + NI/A).

Return on assets (ROA) measures the ratio of net income (NI) to total assets and has been described in the literature as providing an indication of the firm's effectiveness in using its resources and assets. Return on sales (ROS), also referred to as profit margin, measures the ratio of net income (NI) divided by net sales and has been described in the literature as providing an appraisal of profitability by indicating the amount of income

produced for each dollar of sales. ROS has also been used in the literature as a measure of a firm's competitive advantage (e.g., Schwager, Byrd, & Turner, 2000). Therefore, while there can be minor differences between the calculations used for ROA and the ratio of net income to assets (NI/A), both measures essentially represent a ratio of net income to assets. Likewise, ROS is essentially a representation of the ratio of net income to sales (NI/S). Therefore, since both ROA and ROS have been used in the IT business value literature, their use as aspects of the composite measure for the net income ratio is not unreasonable (NI/E + NI/S + NI/A, where NI/S ~ ROS and NI/A ~ ROA).

A similar approach was taken for the set of five expense ratio measures, except that each one of the three aspects of the composite expense measure was also used as an individual measure. The expense ratios all included the firm's operating expense (OpExp) in their numerators since the rationale for using operating expense is similar to that of operating income (i.e., it does not include expense not generated by the business of the company, such as from extraordinary items). Even though operating expense was not examined or recommended as an appropriate measure of performance in IT business value studies by the McKeen and Smith (1993) study, this ratio has been used by others (e.g., Bharadwaj, 2000) and was deemed appropriate in providing an assessment of expense performance, especially in comparison to income performance. Therefore, each of the three individual expense ratios (i.e., OpExp/E , OpExp/S , OpExp/A) along with the composite measure (i.e., OpExp/E + OpExp/S + OpExp/A) were included in the analyses of this study.

Each of the performance measures meets Wade and Hulland's (2004) first recommendation for dependent measures in resource-based theory research since all eight

measures provide an assessment of performance. The second recommendation—that the measures should possess a competitive assessment element—was achieved by standardizing each of the measures by industry SIC code to account for variance among industries. This competitive adjustment is important when assessing performance relative to that attained by other firms in different industries. However, according to the extensive review compiled by Wade and Hulland (2004), such comparative competitive adjustments are the one aspect of firm performance that has been least emphasized by researchers using resource-based theory. As Wade and Hulland (2004) have stated,

> Taken in isolation, a firm's performance, whether strong or weak, contains only limited meaning. For example, a firm may enjoy strong share growth, return on investment, and profit but actually lag [others in its industry] on those measures. Conversely, traditional performance metrics may seem disappointing until compared to an industry average that is significantly worse (p. 130).

Thus, it is important that each of the performance measures used in this study has received such a competitive adjustment because it allows for a more meaningful competitive comparison among industries. In addition, because the inclusion of such a competitive adjustment accounts for the variance among industries, it eliminates the need for an industry control variable in the model. Finally, Wade and Hulland (2004) point out that some effort must be made to track the dependent variable over time to avoid reaching invalid conclusions concerning the sustainability or durability of firm capabilities. Because the eight performance measures used in this study each represent the firm's

performance over a three year period, they all satisfy the third recommendation of making an effort to track the dependent variable over time.

Thus, eight ratios were used in this study as measures of the firm's competitive performance. However, as reasoned within the McKeen and Smith (1993) study, the operating income to number of employees ratio (OI/E) was recommended as an especially appropriate measure for IT business value studies. Therefore, when space is limited, some figures in the following chapters of this dissertation may only include results for the OI/E performance measure.

Independent Variable: Firm-Wide IT Capability

As pointed out by Lu and Ramamurthy (2004, p. 260), "The practice of using a perceptual ranking of IT leaders as a proxy may not be adequate in accurately representing the IT capability of a firm." Consequently, this study utilizes a new, multidimensional instrument to measure the overall IT capability of a firm. The process and methods used to initially develop the new instrument, as well as brief explanations for each of the nine dimensions have been previously explained in this dissertation. The process of further refining the instrument for its use in this study is explained in the following sections. Proper development of the firm-wide IT capability instrument used in this dissertation was important to the success of the study. The entire process of theoretically deriving and refining the items during the initial stages of theoretical measurement modeling is critical for proper scale development and testing (Gilbert A. Churchill, 1979; Gerbing & Anderson, 1988; Segars, 1997). Therefore, it was necessary that the pretest and pilot test be conducted appropriately to ensure proper development and refinement of the instrument.

Pretest. After the items for the instrument were generated, they were subjected to an assessment of content validity. This process involved a pretest permitting the revision or deletion of items that were deemed to be conceptually inconsistent. The pretest provided a critical means for reducing ambiguity and bias in the meaning of the measures (G. A. Churchill, 1987; Green, Tull, & Albaum, 1988). The pretest procedure was recommended by Hinkin (1998) as an advanced method for establishing content validity. The specific method employed in this study is the technique of substantive validity analysis developed by Anderson and Gerbing (1991). "The substantive validity of a measure can be defined as the extent to which that measure is judged to be reflective of, or theoretically linked to, some construct of interest" (Anderson & Gerbing, 1991, p. 732).

The substantive validity approach to pretesting was developed specifically for theory and development research in which confirmatory factor analysis and structural equation modeling would be used. In addition, the approach recommends that the respondents in the pretest should be judges who are simply familiar with the general area of study, but are not experts. Thus, Ph.D. students in the management department were chosen as appropriate candidates for the pretest. Another advantage of this pretest procedure is that it reduces the demands of the judgment task placed on the respondents (i.e., compared to other pretest approaches). Using an item-sort task, respondents were given the set of nine constructs defined in simple, one-sentence statements, and were asked to match each of the items to the one construct or concept that, in their judgment, the item best indicates. The assignment of each item, taken across pretest respondents,

constituted the data for assessments of the substantive validity of each item and helped to revise or eliminate items that did not possess adequate substantive validity.

Pilot Test. Following relatively minor revisions to the instrument resulting from the pretest, a pilot test was conducted to further assess and revise the instrument. Because of the increased difficulty and expense in obtaining CIO survey responses at the time of this study, the pilot test involved appropriate surrogates of IT senior executives. The use of appropriate surrogates for such testing is a tried and accepted practice in the literature (e.g., Anderson & Gerbing, 1991), especially when it is not desirable to use a portion of an already limited response population, such as with CIOs in this study. Thus, professional IT consultants employed by a well-known international consulting firm were asked to answer the questions in the survey. These IT consultants were instructed to respond to each question from the point of view of the senior IT executive at the one firm for whom they have consulted with the most and/or the one firm they know the most about. Thus, by adopting the point of view of the senior IT executive from the firm that the consultants knew the most about, these IT consultants completed the survey instrument and offered comments and suggestions concerning the length of the survey; the appropriateness of the factors, definitions, and items; the clarity of the wording and general ease of understanding for each of the factors, definitions, and items; and any other comments or suggestions they chose to offer for improving the instrument. The data gathered through the pilot test was very useful in providing guidance for the further refinement of the instrument. Also, the data gathered from the pilot-test was used to conduct a preliminary principle components analysis to provide additional guidance in evaluating and refining the instrument.

Personal Interviews with CIOs. In addition to the pre-test and pilot-test, personal interviews were conducted with several practicing CIOs from organizations that were selected from the sample frame. Two of the interviews were conducted in person at the offices of the CIOs, while the third was conducted via telephone. For the in-person interviews, the CIOs were shown the instrument for the first time at the meeting and reviewed it in detail before discussing each definition and question one at a time. Valuable feedback concerning appropriateness of definitions, questions, wording, and terminology was gained from each of these interviews. Each CIO was very generous with the time provided, thus allowing ample opportunity for thought and discussion.

Based on the results of the pre-test, pilot-test, and CIO interviews, the IT External Relationship Management factor was split into two constructs: IT External Relationship Management and IT Outsourcing Management. The splitting of the one construct into two along with minor refinements to some of the items resulted in a final instrument with 10 constructs and 35 items. A reduced-size copy[4] of the final instrument with its 10 construct definitions and 35 items (i.e., questions) is reproduced in Appendix G.

Moderator Variables: External and Internal

Based on guidance offered in the literature (e.g., Wade & Hulland, 2004), eight moderator variables were selected for investigation within the conceptual model of this dissertation (i.e., environmental turbulence, environmental munificence, environmental complexity, entrepreneurial culture, formal culture, centralized structure, distributed structure, and top management support). Three of the eight moderators (i.e., turbulence, munificence, complexity) represented the three dimensions of the external environment

[4] A reduced-size copy is necessary to allow the instrument to fit within the margins of this dissertation.

identified in the literature as contributing most to environmental uncertainty. Four of the eight moderators represented two pairs of extremes (i.e., converse pairs) for two key internal attributes: (a) organizational culture (i.e., entrepreneurial, formal) and (b) organizational structure (centralized, distributed). The final moderator that was chosen represented the commitment and support of the firm's top management (i.e., top management support).

The eight moderator variables were each included in the survey instrument as perceptional measures and each was measured as a single item. The approach of using single-item questions to measure each of these moderator variables was necessary to keep the length of the survey to no more than fifty total questions to fit within a two page limit. The feedback obtained from experienced researchers and from personal interviews with CIOs indicated that it was important to keep the survey under two pages so that the questionnaire would not appear to CIOs on first glance as being too time-consuming. Based upon advice received from researchers, CIO guidance during pre-survey interviews, and feedback from CIOs who were solicited for participation during the survey, CIOs over the past decade have become more and more inundated with requests to participate in questionnaire surveys. As a result, many CIOs and/or their firms, have now adopted a policy of non-participation in any survey or questionnaire. As learned through the experience of this study, many CIOs will now not even consider participation, much less read the solicitation letter or look at the survey. Most senior IT executives have their executive assistants either respond with a brief explanation of such non-participation or, more frequently, instruct these assistants to screen the mail and directly abandon such solicitations to the trash. In addition, gaining CIO participation

becomes even more problematic when involving a truly random nationwide sample offering no common threads or affiliations to help open the door and/or create a feeling of obligation, as was the case with this study. Thus, because of the inherent and growing difficulty in obtaining CIO participation in research surveys, it is important to take steps to avoid a negative first impression of the survey instrument due to appearance, length, or other such characteristics which could result in a significantly lower response-rate from CIOs. Thus, great care was taken to design the survey instrument so that it appeared orderly, straightforward, and within the advised limits for number of pages and questions.

Control Variables: Firm Size, Industry, and Country

Three control variables were considered as potentially appropriate for this study. One consideration was a control for the macro environment (i.e., country) as the outer-most level in the comprehensive conceptual model of Figure 11. Because this study chose to limit the sample frame to corporations registered and based in the United States, the sample itself provided the control for the macro environment. Another consideration was the need to control for variations due to differences among the industries represented in the sample. However, instead of using an industry control variable, this study adopted an approach that related each firm to the standard for all of the firms within the same industry as determined by the 2-digit Standard Industrial Classification (SIC) codes. This approach created a dataset that reflected the relative performance of each firm as compared to the other firms within the same industry SIC code. Thus, there was no need for a separate industry control variable. The third consideration was a control for any variations due to organizational size. The need to control for organization size can stem from a number of areas of potential variation, such as the idea that smaller firms are more

flexible than larger firms. Or, that larger firms are more capable of developing the more sophisticated IT capabilities that are represented in this study. Thus, because the sample frame for this research included a relatively broad range of firm sizes, the decision was made to include a variable in this study to control for the size of the organization.

Procedure

A first step in the methodological procedure of this dissertation focused on defining the sample frame and how it might be established. One aspect of defining the sample frame concerned the range of organization sizes that should be included. As previously mentioned, larger firms are generally more able to provide the IT systems, hardware, and personnel combinations that comprise the measures forming the firm-wide IT capability construct used in this study. Thus, when considering the generalizability of the results of this dissertation, it makes sense to center the study around larger firms which are more likely to possess the resources necessary to form a firm-wide IT capability, and as a result, are also more likely to benefit from the findings of this study. In addition, data in private databases is generally more readily available for larger firms than for smaller firms. Therefore, this study targeted medium-to-large firms that were represented in the Compustat database.

The most current Standard & Poor's Compustat database (i.e., the first quarter of 2006) was chosen as the source of the companies that would comprise the sample frame of this study. Selecting the companies from the Compustat database was done as the first step in the process in an effort to help minimize the drastic reduction in sample size experienced in some prior studies. This reduction in sample size can begin when the sample frame of companies is established outside of Compustat, and then later it is found

that many of the companies in the sample are not available in Compustat. Thus, a drastic reduction in sample size can occur when many companies must be dropped from the analysis because they are not represented in the Compustat database. To avoid any such reduction in sample size, and because a small sample size was already probable due to the difficulties inherent in obtaining survey responses from CIOs, this study chose to use Compustat as the source of the corporations in the sample frame.

Criteria for Selection of Sample Frame. Because all organizations within the Compustat database are publicly owned corporations, the criteria of only including publicly owned corporations in the sample frame of this study was accomplished by default. Next, using Standard & Poor's Research Insight interface, all of the companies represented in Compustat were screened for the following criteria: (1) companies that are registered as U.S. corporations; (2) corporations that listed the United States as their primary physical location; (3) corporations with net sales greater than or equal to 500 million U.S. dollars (i.e., one-half billion) and also less than or equal to 10 billion U.S. dollars (i.e., 0.5B <= Net Sales <= 10B). Then, using the described screening process, a total of 1655 corporations were identified in the Compustat database as meeting the established criteria for selection. Thus, the initial sample frame for this dissertation included 1655 corporations.

Identifying Senior IT Executives. Investigations into the techniques used in survey research have determined that certain methods seem to make a difference in obtaining higher response levels from businesses (e.g., Dillman, 2000). Thus, recognizing the inherent difficulties in obtaining responses from CIOs, this study followed the general methods and suggestions as outlined by Dillman (2000) for obtaining better response

rates when soliciting survey responses from businesses. One such suggestion was to identify the most appropriate respondent for a business survey and address the letter to that individual by name. To accomplish this task, it was necessary to discover the names and mailing addresses for each of the most senior IT executives currently employed with each of the firms in the sample frame selected from the Compustat database.

To identify the name of the most senior IT executive and the appropriate mailing address for each of the firms in the sample frame, this study used the most current directory of *Top Computer Executives* compiled by Applied Computer Research. A special thank-you is extended to Alan Howard who was very helpful and generous in providing a United States version of the ACR database of *Top Computer Executives* at a price that was affordable, even for a graduate student doing dissertation work. The list of *Top Computer Executives* was provided in electronic form and was trimmed-down to include only the top computer executive(s) for each company in the database. Even so, the file included a voluminous total of 23,621 entries. It should be noted that email addresses were not included in this information because the cost of including email addresses was very high and well beyond the budget constraints of this dissertation. In addition, even at the high cost, email addresses were not available for the entire set of 23,621 entries. Furthermore, the CIOs that were interviewed stated emphatically that they absolutely never responded to email requests for survey participation, with the rare exception being the request made by a good friend or by an organization strongly supported by the CIO . Since neither of these exceptions to email requests were present in this study and because of the high cost required, email addresses were not obtained.

The next task was to match the sample frame of companies selected from the Compustat database with the companies in the ACR database. This would allow for the personalization of each mailing by using the actual name of the current senior IT executive with the mailing address and cover letter for each firm. However, the task of matching the firms in the two databases turned out to be much more difficult than it first appeared.

There were a number of differences between the Compustat and ACR databases concerning a variety of details such as variations in how company names, addresses, and even telephone numbers were listed. In addition, it was discovered that there were no unique identifiers that were common to both databases. Therefore, the process of matching the companies in the Compustat database with those in the ACR database required much work and the manual confirmation of every apparent match. Company web sites, general web searches, and even some phone calls to the firms in question were periodically used to confirm or supplement information or questions raised within this matching process. As might be expected, when considering the 23,621 entries in the ACR database and the 1655 corporations in the Compustat database, the use of manual processes required much time and patience. Since the matching process was extended over a number of weeks, ACR offered an update including any changes that had occurred in the database of *Top Computer Executives* since the original ACR file was provided. While the ACR database is constantly in a state of being updated, because the IT business-world is quite dynamic with changes in personnel occurring quite frequently, and because it takes ACR some period of time to cycle through the update process for all of the companies included in the database, it is inevitable that some of the data would not

be accurate. Therefore, the update provided by ACR helped to ensure that the mailing data used in this study included the most current information ACR possessed for the names of the senior IT executives and their current mailing addresses.

At the conclusion of the process of matching the companies in the two databases, 1303 of the original 1655 corporations had confirmed matches and were retained in the sample frame for this study. The survey packets and the various mailings that were sent out to the CIOs that were randomly selected from the sample frame are described in the next section.

Survey Preparation and Mailings. Following guidelines offered by Dillman (2000), it was important that the survey packets mailed to the CIOs included a one-page cover letter that was personalized by using the name of the CIO, was carefully worded, respectful, and thanked the CIO in advance for their participation. Other such survey recommendations included the use of a questionnaire designed to be respondent-friendly, the inclusion of self-addressed and pre-stamped return envelopes, alternative methods of responding to the survey (e.g., this study provided both a paper questionnaire and a computer-based web questionnaire), and the possible use of a carefully considered incentive that would be appropriate for CIOs.

As to incentives, it was made clear during the previously described CIO interviews that the most effective incentive for a senior IT executive would be an executive summary of the results of the investigation. The CIOs that were interviewed agreed that a key to CIO participation was not the incentive, but rather whether or not the CIO had an interest in the topic of the study. As explained by the interviewed CIOs, if the cover letter and survey actually make it past the screenings performed by the CIO's

executive assistant, and if the CIO actually takes the time to read the cover letter and look at the questionnaire, and if the CIO is actually interested in the subject of the study, then the CIO may be interested in seeing the results. Thus, in the opinion of the CIOs interviewed, the best hope and the strongest motivation for CIO participation depends upon the CIO having an interest in the topic being studied. Consequently, the best incentive would be to offer an executive summary of the study's results. Thus, based on the feedback from the interviewed CIOs, this study offered as an incentive for the CIO's participation, an executive summary of the results of this study personalized to the specific industry of the CIO's firm. In the final sample of respondents, 66.7% or two-thirds of the CIOs who responded also requested a personalized copy of the executive summary of the results for this study.

Prior to mailing the surveys, a web-based version of the questionnaire was also established on a server within the Auburn College of Business. The cover letters and questionnaire instructions offered the CIOs the option of responding to the survey by using either the paper-based questionnaire along with the provided pre-addressed, pre-paid return envelope, or the web-based questionnaire. The web address for the online questionnaire was provided in all mailings and in the instructions provided on the front of the paper questionnaire. A six-digit unique identifier was assigned to each of the firms randomly selected to receive the survey mailings. The purpose of this unique identifier was two-fold: (1) the unique identifier was included on each paper survey so that objective performance data from the Compustat database could be matched to each firm returning a questionnaire; (2) the unique identifier also served as the unique log-in for each firm if a CIO chose to use the web-based option for participating in the survey. A

record of these online log-ins was attached to the appropriate web-based questionnaire and recorded in the database that stored all of the online responses. Therefore, again, the unique identifier allowed for identification of the firm associated with each web-based response and also allowed for matching the respondent firm with its associated performance data in Compustat. A cross-check was performed to ensure that no CIO had responded using both the paper-based and web-based options; however, none of the CIOs used more than one of the response options.

Following guidelines offered in the Dillman (2000) method, four mailings were planned in advance. Two of the mailings included cover letters and paper questionnaires, while the final two mailings were follow-up postcards. However, all four mailings included the web address for the online questionnaire. The mailings occurred over a ten-week period with the first mailing near the middle of May 2006. The second set of letters and paper questionnaires was mailed in mid-June 2006 approximately five weeks after the first mailing. The third mailing occurred only one week after the second mailing and involved a reminder post-card, which also included the web address for the web-based questionnaire. After approximately four more weeks, the fourth and final mailing was sent to the CIOs. The post card used for the final mailing served as a reminder to the CIOs and provided the Web address for the online questionnaire. Copies of the cover letters used in the first two mailings and the post cards used in the third and fourth mailings are included in Appendix F of this dissertation.

Data Analysis

The methodology concerning the data analyses used in this study began with the appropriate procedures for data preparation and screening. The data was organized into

an electronic format that allowed for the initial screening of the data set through examination of basic descriptive statistics (e.g., means, standard deviations, maximum and minimum ranges), frequency distributions, and values of indexes of univariate skew and kurtosis which address issues of missing observations, outliers, and normality. Such simple checks allowed for the identification of any values that appeared to be out of range or improperly coded. Such screening also included checks to determine if any missing data was due to a data entry error, or due to an omission by the respondent. Inspection of bivariate correlations and scatterplots helped identify other data characteristics such as the degree of multicollinearity and linearity in their relations to one another. The use of Mahalanobis' distance to check for outliers, and squared multiple correlations to spot multicollinearity are some of the more sophisticated multivariate indexes that were employed to identify any data-related problems. If problems were detected, proper steps were taken to prepare the data for analysis.

Non-response bias was investigated using the analysis of variance (ANVOA) and t-test techniques to compare the industry distribution of the returned surveys to the population industry distribution using a combination of measures. Response bias was investigated by comparing the set of surveys returned early with the set of surveys returned later. Bias concerning the method of response (i.e., paper-based versus Web-based response) was similarly investigated. The statistical power was evaluated to determine if the sample size was adequate to produce the generally accepted minimum desired level of power of 0.80 (Cohen, 1988).

Since exploratory factor analysis (EFA) using a Principle Components Analysis (PCA) was already performed during the pilot test, confirmatory factor analysis (CFA)

using partial least squares was used to analyze a measurement model of the ten dimensions of the firm-wide IT capability construct. The confirmatory factor analysis was employed to check the validity (convergent and discriminant) and reliability (Cronbach alphas and composite) of the measurement model. Dimensionality among the ten factors was tested using AMOS 5.0.1 (Arbuckle, 2003). Any appropriate revisions to the model were made as indicated by the analyses.

Due to several considerations associated with this study, it was determined that using partial least squares (PLS) instead of AMOS for the analysis of the structural model was advantageous. In this study, the advantages of PLS are that it can handle smaller sample sizes and does not make any underlying assumptions about the distribution of the data, whereas with AMOS, non-normality can introduce problems into the data analysis. Since the survey data used in this study utilizes five-point Likert scales and such scales are prone to non-normal distributions, the use of PLS avoided any concerns related to non-normal data. Also, PLS allows for the use of true moderation variables modeled as interaction terms (Chin, Marcolin, & Newsted, 2003b), while structural equation modeling (e.g., AMOS) employing maximum likelihood estimation cannot model interaction terms. Thus, to be consistent in the analysis of the structural model, and considering that a primary focus of this study is the evaluation of moderating variables from the external and internal environments, it seemed reasonable to choose PLS for the analysis of the structural model and its hypothesized relationships.

Another methodology decision related to the various analyses described in this section is the question of modeling the firm-wide IT capability construct as either a reflective or a formative construct. This decision and the rationale leading to the decision

are discussed in the next chapter of this dissertation (i.e., Chapter IV – Results). In addition, along with the presentation of the results of the study, Chapter IV also includes more information regarding each of the data analysis issues and/or decisions discussed in this section.

CHAPTER IV

RESULTS

This chapter presents the results of the empirical analysis utilizing the field-test data to analyze the hypothesized relationships as represented in the research model of Figure 12. These analyses and their results are presented within five main sections: (1) the results of the screening of the collected field-test data; (2) the results of the analysis of the measurement model representing a firm's overall or firm-wide IT capability; (3) the results of the analysis of the full structural model including all ten of the dimensions representing firm-wide IT capability and its relationship with the firm's competitive performance (without moderators); (4) the results of the analysis of the full structural model while including each of the eight moderator variables (i.e., eight separate models); and (5) the results of the analysis of each of the three partial, or sub-models, representing the three process groups of the Day (1994) typology (i.e., outside-in, spanning, inside-out). Each of these three sub-models is analyzed both with and without each of the eight moderator variables (i.e., nine models for each of the three sub-model groups).

Data Preparation, Sample Demographics, and Non-Response Bias

Of the letters and cards mailed out to the set of randomly selected CIOs, some were returned as undeliverable due to circumstances such as bad addresses and expired forwarding addresses. After accounting for such returned and undeliverable mail, 811

surveys were effectively mailed out. A total of 102 combined responses were received via both regular mail and Web-based replies. The effective response rate was 12.58 percent, which is acceptable for current survey research involving senior IT executives.

The 102 responses collected during the field-test phase of this study were screened for missing data, outliers, departures from normality, and other appropriate checks for problems or anomalies within the data. The results of this screening revealed no major problems with the data, thus allowing for 102 usable responses. As desired, the set of respondents represented the most senior information technology executives within the firms represented. A breakdown of the various titles and other basic demographics of the respondents is presented in Table 4.

Table 4

Summary of Respondent Demographics

Titles of Respondents	%	Management Level	%
Chief Information Officer (CIO)	37.3%	Senior Executive	64.7%
Senior Vice President and CIO	24.5%	Upper Management	33.4%
Vice President and CIO	28.4%	Middle Management	0.0%
VP, Director, or Manager	9.8%	Corporate, International	1.9%
Years With Organization	**%**	**Years Doing Current Job**	**%**
1 to 5 years	38.2%	1 to 5 years	38.2%
6 to 10 years	24.5%	6 to 10 years	31.4%
11 to 15 years	13.7%	11 to 15 years	19.6%
> 15 years	23.6%	> 15 years	10.8%
Gender	**%**	**Gender**	**%**
Male	92.2%	Female	7.80%

A representative cross-section of the industries, firm sizes, and other salient characteristics within the target population was achieved in the sample. A summary of industry representation is presented in Table 5.

Table 5

Summary of Respondents by Industry

Industry	%
Banking	3.9%
Financial Services	7.8%
Insurance	6.9%
Manufacturing	28.4%
Retail	14.7%
Transportation	8.8%
Energy and Utilities	12.8%
Food Processing and Services	9.8%
Other	6.9%
Total	100.0%

To assess non-response bias, respondent and non-respondent firms were compared on a variety of data gathered from the Compustat database (e.g., sales, operating income, net income, number of employees). Analysis of variance techniques and t-tests were both employed for testing these comparisons. No significant differences were found relative to any of these key comparisons suggesting that non-response bias was not a factor in the sample. In addition, by considering the last group of respondents as similar to non-respondents, a comparison of the first and last quartile of respondents provided an additional test of response bias within the sample (J. Armstrong & Overton, 1977; Rai, Patnayakuni, & Seth, 2006). Using this approach, the first and last 25 percent of respondents were compared on key study variables (e.g., organization size, number of employees, sales, net income). Again, the tests did not indicate that response bias was an

issue in the sample. Similar comparisons were made among those participants who responded online using the web-based survey versus those who responded by regular mail using the paper-based survey. The results of these comparisons indicated that the two groups were statistically similar on all key demographic and study variables. Thus, non-response bias, response bias, and the method of response were not found to provide any statistically significant bias within the sample.

Measurement Model Analysis

As previously discussed, the results of the pre-test, pilot-test, and interviews with CIOs resulted in a final survey instrument totaling 35 items (i.e., questions). These 35 questions were allocated among 10 separate factors. As previously explained, a tenth factor was added based on the results of the pre-test and pilot-test which indicated that the External IT Relationship Management factor should be split into two separate factors (i.e., External IT Relationship Management and IT Outsourcing Management). The interviews with CIOs also confirmed that this split was appropriate. Thus, the 35 items were hypothesized to reflect 10 separate latent constructs. All of the 10 latent constructs were modeled as reflective constructs with each possessing a specific subset of items as indicators (i.e., from among the 35 total items). The 10 first-order latent constructs were hypothesized as acting together to form a second-order construct that provides a more holistic representation of an organization's overall, or firm-wide IT capability. This second-order construct was modeled as a formative latent construct consisting of its 10 sub-constructs as indicators. Furthermore, based upon the Day (1994) typology, an organization's overall, or firm-wide IT capability can be thought of in terms of three sub-models. These three sub-models were created by dividing the firm-wide IT capability

construct into three separate second-order latent factors (i.e., outside-in, spanning, inside-out), with each also modeled as a formative latent construct, and each consisting of its subset of the 10 sub-constructs as indicators. Table 6 summarizes the association of each latent construct with its sub-constructs as well as the number of indicators associated with each sub-construct.

Table 6

Measurement of Constructs

Latent Construct	Type	Sub-Construct	Type	Number of Items
Outside-In IT Capability	Formative	IT External Relationship Management	Reflective	3
		IT Outsourcing Management	Reflective	3
		IT Market Alertness and Responsiveness	Reflective	4
Spanning IT Capability	Formative	IT Internal Relationship Management	Reflective	3
		IT and Business Strategic Integration	Reflective	4
		IT Strategic Change Management	Reflective	3
Inside-Out IT Capability	Formative	IT Infrastructure Management	Reflective	3
		IT Technical Skills and Knowledge	Reflective	4
		IT Development and Acquisition	Reflective	4
		Cost Effective IT Operations	Reflective	4
Firm-Wide IT Capability	Formative	Includes all 10of the sub-constructs above	Reflective	35

The decision to model these latent constructs as reflective or formative was based upon guidelines recommended in the literature (e.g., Jarvis, Mackenzie, & Podsakoff, 2003), and summarized by Rai et al. (2006) in the following quotation:

> …the decision to model a construct as formative or reflective should be based on four major criteria: (1) direction of causality from construct to indicators, (2) interchangeability of indicators, (3) covariation among indicators, and (4) nomological net of construct indicators. Constructs should be modeled as formative if the following decision rules hold: the direction of causality is from indicators to constructs, the indicators need not be interchangeable, covariation among indicators is not necessary, and the nomological net of indicators can differ. They should be modeled as reflective if the opposite conditions apply. (pp. 233-234)

For the 10 first-order factors, these decision rules suggest that the items for the 10 constructs should be modeled as reflective. These decision rules also suggest that the 4 second-order constructs should be modeled as formative.

Assessment of Factorial Validity. As explained by Gefen and Straub (2005) in their tutorial and guide to factorial validity using PLS-Graph:

> In first generation regression models, factorial validity was most frequently assessed with an Exploratory Factor Analysis (EFA). [The objective of the EFA] is to establish that (1) the measurement items converge into the appropriate number of theoretical factors, that (2) each item loads with a high coefficient on only one factor, and that (3) this one factor is the same factor for all the measurement items that supposedly relate to the same latent construct. (p. 92)

However, the explanation of the objective of the EFA offered by Gefen and Straub (2005) leaves open the question of what qualifies as a high coefficient for an item

loading. Hair et al. (1998) offer as a rule of thumb that a measurement item loads highly if its loading is above 0.60 and does not load highly if the coefficient is below 0.40. Thus, in an exploratory situation such as with this study, items with loadings below 0.60 and above 0.40 may be retained, especially if the items are needed due to content validity considerations. Likewise, all items with cross-loadings below 0.50 are generally retained in the model (Ravichandran & Lertwongsatien, 2005).

The most common EFA procedure for assessing the characteristics of a measurement instrument in information systems studies is through a Principal Components Analysis (PCA) (Gefen & Straub, 2005). Therefore, a principal components analysis of the 10-factor measurement model as shown in Appendix B was conducted in SPSS 13.0 for Windows using the field-test data that was collected via the survey. The PCA analysis confirmed that the 35 items did align well with their appropriate theoretical factors in this 10-factor model per the three objectives for EFA as outlined by Gefen and Straub (2005).

The results of this PCA analysis are presented in Appendix C. Only four of the 35 items have loadings below 0.60, yet each of these loadings is above 0.40 (i.e., Q3_04, Q9_03, Q9_04, Q10_04). And, while none of the items have cross-loadings above the 0.50 guideline, two of the items have cross-loadings above 0.40 (i.e., Q9_03, Q10_04). While none of these items are outside the guidelines discussed previously, some do fall below the higher recommended loading levels and were therefore examined more closely. In the end, it was decided that all of the 35 items should be retained in the model, primarily due to content validity considerations. In short, according to the guidelines offered by Hair et al. (1998), there were no truly problematic items or cross-loads

identified in the analysis. Thus, the PCA provides evidence of unidimensionality[5] for each of the 10 factors and their related items.

While an EFA/PCA enables specifying the expected number of factors based upon theory, an EFA/PCA is still considered an exploratory analysis. In contrast, a confirmatory factor analysis (CFA) involves specifying explicitly in the model the pattern of loadings of the measurement items on the latent constructs. PLS performs a CFA to explore two facets of factorial validity: convergent and discriminant validity. As Gefen and Straub (2005) explain, "Convergent validity [in PLS] is shown when each of the measurement items loads with a significant t-value on its latent construct. Typically, the p-value of this t-value should be significant at least at the 0.05 alpha protection level" (p. 93). On the other hand, discriminant validity, as another facet of factorial validity, is demonstrated in PLS by two occurrences: (1) when the correlation of the latent constructs with the measurement items shows an appropriate pattern of loadings in which the measurement items load highly on their theoretically assigned factor and not highly on other factors, and (2) when the square root of each Average Variance Extracted (AVE) for each latent construct is larger than any correlation among any pair of latent constructs (Chin, 1998). As a rule of thumb, it has been suggested that each AVE should also be larger than 0.50 (Fornell & Larcker, 1981).

Thus, one approach to assess convergent and discriminant validity in the 10-factor, 35-item measurement model was to use PLS to factor analyze items grouped under the second-order constructs.(i.e., firm-wide IT capability, outside-in capabilities,

[5] Unidimensionality refers to the property of a scale that is evidenced by each of its measurement items relating better to that scale than to any other scales in the comparison

spanning capabilities, inside-out capabilities) (e.g., Rai et al., 2006). As summarized in Appendix D, the expected factor structure was obtained for each of the four cases of second-order constructs.

In addition to the other tests, the item-total correlations for the 10 latent constructs were also examined. The results of the analysis of item-total correlations are presented in Appendix E. The results of the correlation pattern for the analysis shown in Appendix E indicate that an item posited to reflect a particular construct has a stronger correlation with that particular construct than with any of the other constructs. This result provides further evidence of discriminant and convergent validity in the measurement model.

As another test of discriminant validity, an AVE analysis was conducted to determine if the variance shared by a construct with its indicators is greater than the variance shared with other constructs in the model. Table 7 presents the results of the AVE analysis. The results of the AVE analysis as shown in Table 7 further support discriminant validity within the measurement model based upon the criteria that a construct is considered to be distinct from the other constructs in the model if the square root of the AVE for that construct is greater than the construct's correlations with the other latent constructs in the model.

As a final test of unidimensionality in the 10-factor, 35-item measurement model, Amos Graphics 5.0.1 was used to test for dimensionality among the 10 factors. This approach involves using a chi-square difference test to evaluate two nested models within Amos. The procedure involves the comparison of an unconstrained model that estimates (or "frees") the correlation between a pair of constructs and a constrained model which fixes the value of the construct correlation to unity. A significant chi-square difference

Table 7

Assessment of Discriminant Validity

Constructs	Mean (SD)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
External IT Relationship Management (Q1)	3.248 (.804)	.89									
IT Outsourcing Management (Q2)	3.173 (.890)	.32**	.91								
IT Market Alertness and Responsiveness (Q3)	3.172 (.758)	.48**	.23*	.83							
Internal IT Relationship Management Q4)	3.853 (.759)	.45**	.20*	.36**	.90						
IT-Business Strategic Integration (Q5)	3.380 (.849)	.36**	.31**	.51**	.49**	.87					
IT Strategic Change Management (Q6)	3.582 (.616)	.41**	.22*	.65**	.50**	.60**	.83				
IT Infrastructure Management (Q7)	3.729 (.790)	.30**	.11	.55**	.41**	.35**	.47**	.88			
IT Skills and Knowledge (Q8)	3.505 (.670)	.26**	.04	.53**	.38**	.32**	.54**	.52**	.85		
IT Development and Acquisition (Q9)	3.351 (.753)	.43**	.27**	.58**	.56**	.59**	.59**	.51**	.47**	.83	
Cost Effective IT Operations (Q10)	4.145 (.742)	.11	.01	.17*	.25**	.22**	.32**	.40**	.31**	.35**	.85

NOTE: The shaded diagonal values are the square root of the average variance extracted for each construct.

NOTE: A construct is considered to be distinct from other constructs if the square root of the average variance extracted for it is greater than its correlations with other latent constructs (Rai et al. 2006, Barclay et al. 1005).

** Correlation is significant at the 0.01 level 1-tailed.
* Correlation is significant at the 0.05 level 1-tailed.

suggests that the unconstrained model is a better fit for the data. Such a result supports the existence of discriminant validity among the factors (Anderson, 1987; Bagozzi & Phillips, 1982; Gerbing & Anderson, 1988; Segars & Grover, 1998). The results of the nested model comparisons for the 10-factor, 35-item measurement model found that the

chi-square difference test was significant (p = .000, alpha = .05). This result implies that all 10 factors are needed in the model and that each factor is indeed different from the others. The result provides further evidence of discriminant validity among the factors.

Assessment of Internal Consistency. To further investigate the pattern of association among the 10 factors and 35 items of the measurement model, the internal consistency of the first-order factors of the measurement model was assessed using Cronbach's Alpha (Cronbach, 1951) and Fornell and Larcker's (1981) measure of composite reliability. Internal consistency refers to the degree of consistency between multiple measurements of a variable, while reliability is an assessment of this internal consistency (Hair et al., 1998). Since unidimensionality is an assumption underlying the calculation of reliability, it is appropriate that evidence of unidimensionality of the latent constructs was established prior to assessing reliability. The results of calculations for measures of Cronbach's Alpha and Composite Reliability are included in Appendix D. Based on guidelines offered by Nunnally (1978), a reliability score of 0.70 or above is an acceptable value for internal consistency for exploratory research. Thus, all of the constructs of the measurement model exhibit acceptable levels of reliability, with most possessing scores well above the minimum recommended value of 0.70. Considering the overall results of these tests for factorial validity and reliability, the collective evidence suggests that the 10 latent constructs of the measurement model all possess good measurement properties.

Other Data Analysis Considerations. PLS Graph was not only used to assess the measurement properties of the 10 constructs, but PLS was also selected for the analyses of the various structural models included in this study. PLS Graph was selected as the

primary tool for the data analysis for several reasons. The PLS analytical approach doesn't require the more stringent adherence to distributional assumptions that are required by the analytical approaches of many popular analytical packages, such as LISREL or AMOS (Joreskog & Wold, 1982; Rai et al., 2006). Also, as Rai et al. (2006, p. 233) have noted, "the ability of PLS to model formative as well as reflective constructs makes it suitable for our purposes." In addition, PLS is an appropriate choice due to the sample size of this study and the desire to test interaction terms in the model.

The PLS product-indicator approach for assessing interaction effects has been demonstrated to perform better than single-item and even summated regression approaches (Chin et al., 2003b). The PLS product-indicator approach involves the addition of latent interaction variables in the model that are created by multiplying each of the indicators from the predictor variable with each of the indicators from the moderator variable. The effect of this cross-product approach is to essentially double the number of indicators already in the model. In addition, the desire for second-order factors in the structural models of this study also doubles the number of indicators because creating second-order factors in PLS requires assigning all of the indicators for each sub-factor to the higher-order factor. Thus, considering the size of the field-study sample (i.e., 102 responses), the full structural model, and the significant increase in the number of indicators required for both the PLS product-indicator approach and the PLS second-order construct method, the question that arises is whether or not there will be sufficient statistical power to adequately conduct the analyses of this study.

While ensuring sufficient statistical power is an important concern, the study by Chin et al. (2003b) offers guidelines for assessing whether or not a combination of certain

study characteristics will be sufficient to accurately detect and measure interaction effects. Research by Chin et al. (2003b) has demonstrated that the PLS approach is able to detect interaction effects with sample sizes that are half the size of the sample used in this study. More importantly, other factors such as the number of indicators, effect size, indicator loadings, and reliability were found to have an equal or even larger role in detection and accurate estimation of interaction effects when using the PLS product-indicator approach. Chin et al. (2003b) report that, "the results of significance levels for sample size and number of indicators suggest that appropriate detection of interaction terms requires sample sizes of 100-150 and 4 or more indicators for each predictor and moderator constructs" (p. 203).

Because the moderator variables used in this analysis were measured with single-item indicators to reduce the total size of the questionnaire for the CIOs, the resulting constructs for each of the moderators will also have a single indicator. Since the moderator variables in this study have less than 4 or more indicators, it is important to note that the number of indicators for the predictor variables are generally much higher than the minimum recommended by Chin et al. (2003b). Thus, in this study when employing the PLS product-indicator approach to detect interaction effects, the total combination of cross-product indicators represented in the interaction variable (i.e., product indicators reflecting the latent interaction variables are created by multiplying the indicators from the predictor and the moderator variables) will always be equal to the number of indicators in the predictor variable because the moderator variables will always be limited to only one indicator per moderator (e.g., 1 * X = X). In general, the number of indicators in the interaction terms of this study will be greater than the ideal

combination as recommended (e.g., the full model has 35 indicators, while the 3 sub-models have 10-15 indicators each). In addition, it is also important to note that the Chin et al. (2003b) explanation makes clear that a sample size of 100-150 with 4 or more indicators was found to represent, "ideal threshold combinations" (p. 203) when considering only two characteristics of the PLS analysis (i.e., sample size and number of indicators). Chin et al. (2003b) also emphasize that other factors (e.g., effect size, loadings, reliability) were found to make an important difference and should also be considered in the total mix of characteristics for an analysis.

Since these other factors also play an important role in the overall interaction detection equation, it should be noted that the interaction effect sizes for the analyses of this study average between small and medium (i.e., per Cohen (1988) small = 0.02, medium = 0.15, large = 0.30), while the average loadings of the indicators and the average reliabilities of the constructs are considerably higher than those used in the Monte-Carlo simulation of the Chin et al. (2003b) study. Thus, as explained by Chin et al. (2003a) in the ISR online supplement to their article, higher reliabilities (i.e., higher than those used in the Monte-Carlo simulation) are a very important consideration when assessing the ability of the PLS product-indicator approach to detect interaction effects:

> It is possible that, with more reliable measures (true loadings of 0.80 or higher), the need for 6 to 8 indicators per construct, as well as the sample size, may be relaxed. Thus, it is important to reiterate that whereas sample size increases the power to detect an effect, the key issue for consistent estimation of the true "population" effect is in obtaining reliable estimates of the underlying construct. This can be accomplished by either increasing

> the number of indicators at a given level of reliability or by increasing the reliability of the indicators at a given number of indicators (e.g., two indicators with 0.80 loading yields equivalent construct reliability to 8 indicators at 0.50 loadings). Or, in other words, a couple of good quality measures are as good as many less reliable measures. (p. 10)

Thus, with a sample size of 102, and with the number of interaction term indicators greater than the ideal threshold level, and with an average effect size in the small to medium range, coupled with the fact that the average item loadings and average construct reliabilities are significantly higher than in the Chin et al. (2003b) study, it can be concluded that the PLS product-indicator approach is appropriate for this study and should be able to detect significant and reasonably accurate interaction effects, if indeed such interactions exist. Consequently, PLS Graph was not only used to assess the measurement properties of the 10 constructs, but PLS Graph was also employed for the structural analyses of the various models, including the use of the PLS product-indicator approach to test for interaction effects.

The Creation of Linear Composite Score.. Because of the importance of maintaining adequate statistical power for the interaction analyses of this study, linear composites were subsequently created from the items used to measure each of the 10 first-order factors (i.e., the 10 sub-constructs). These linear composites were used as formative indicators for the second-order latent constructs specified in the structural models. According to Hair et al. (1998), multivariate totals or means and/or factor scores can be used to compute linear composite scores. Multivariate totals or averages, also known as summated scales, are based on the summated total or average of a construct's

items and offers the advantage of being replicable across samples (as opposed to factor scores, which are not replicable across studies). This approach is recommended by Hair et al (1998) for new measures that have been demonstrated to be valid and reliable, especially when generalizability or transferability is desired. Using linear composites based upon internally consistent scales offers the benefit of representing the multiple aspects of a concept in a more parsimonious measure (Little, Cunningham, Shahar, & Widaman, 2002). Thus, since the scales in this study were found to be both valid and reliable, the use of linear composite scores (i.e., summated scales) did not change the pattern of relationships obtained through the various analyses conducted as a part of this investigation (see Rai et al., 2006 for a similar application and approach).

Further, because it was determined that the second-order constructs should be appropriately modeled as formative indicators, the ability to create meaningful composite scores becomes important in employing the PLS product-indicator approach as previously described. This fact is important because the use of formative indicators for the second-order constructs requires an alternative application of the PLS product-indicator approach as recommended by Chin et al. (2003a) in the ISR online supplement to their journal article. The alternative approach described in these supplemental materials involves using the formative indicators to create composite scores for the predictor and moderator variables. Then, the single composite scores are used to create a single interaction term using the same method of cross-multiplication of the indicator scores for both the predictor and moderator variables.

Since the moderators of this study are already single-item constructs, composite scores are only needed for each of the four second-order constructs. While this

recommended alternative procedure for formative measures was followed to ensure that each interaction term was tapping into only a single underlying interaction effect, it should be noted that tests of the second-order factors with more than the recommended single composite scores (e.g., full model with 10 formative indicators), and even tests of the second-order factors modeled with reflective indicators did not, in general, change the direction (i.e., positive or negative) of the relationships in the models.

PLS Sample Size Estimation. A PLS rule-of-thumb for the minimum desired sample size has been offered as ten times the larger of either (a) the latent variable with the highest number of formative indicators; or (b) the dependent variable with the highest number of paths coming form independent latent variables (Chin & Newsted, 1999). For this study, the larger of the two options was (a) the latent variable with the highest number of formative indicators, which was the Firm-Wide IT Capability construct including a total of ten formative indicators. Therefore, according to the PLS rule-of-thumb, the minimum desired sample size would be ten times the ten formative indicators which equals one-hundred (10 * 10 = 100). The actual sample size in this study is 102, which meets and slightly exceeds the estimated minimum desired sample size for PLS.

Power Estimation. As previously mentioned, the interaction effect sizes for the analyses conducted in this study generally range between small and medium (i.e., 0.02 to 0.15). For a medium effect size of 0.15 and a level of significance of 0.05, a sample size of 100 cases represents a strong power level of approximately 0.97 (Cohen, 1988). Furthermore, for the same effect size and level of significance, only 53 cases are required for a minimum desirable power level of 0.80, as recommended by Cohen (1988). Even when considering a small to medium effect size averaging 0.08 and a 0.05 level of

significance, this study's sample size of 102 remains adequate to provide a power level of at least 0.80 (Cohen, 1988). Thus, power was not an issue in evaluating interaction effects and the other relationships within this dissertation.

Structural Model Analysis (Full Model Without Moderation)

The initial analysis of the full structural model did not include any of the eight moderators. Rather, this initial analysis established an analytic foundation for a base-line relationship between an organization's overall or firm-wide IT capability and the organization's competitive performance when moderators are not included in the model.

As shown in Figure 13, firm-wide IT capability is represented in the model as a second-order construct with the 10 sub-constructs of the measurement model serving as formative indicators for the second-order construct.

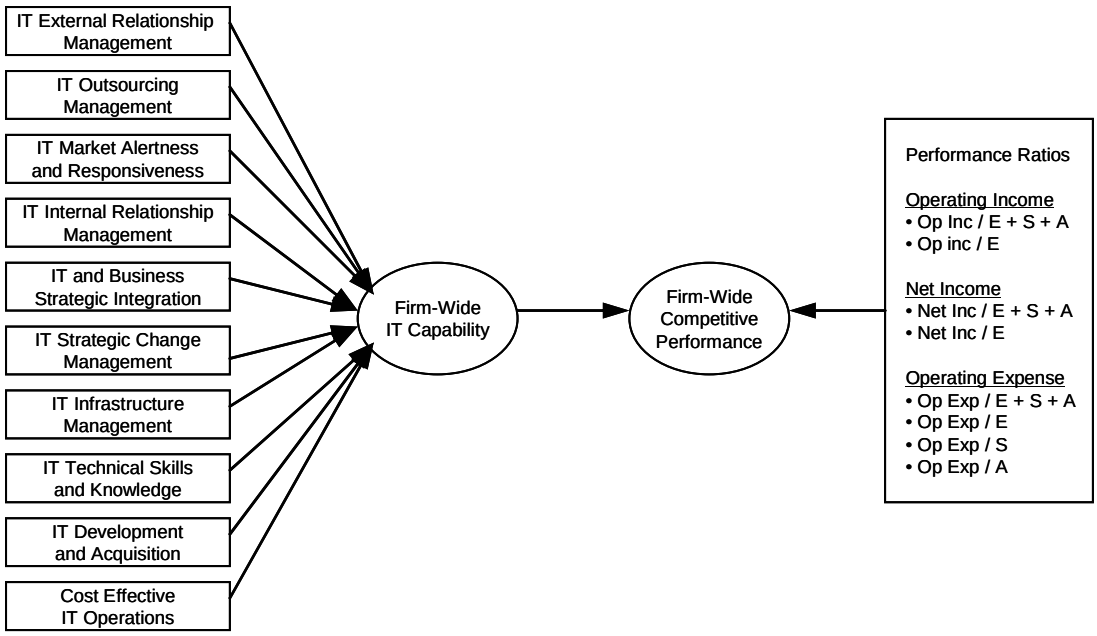

Figure 13. Full Research Model - Without Moderation

Since no moderators were included in the full structural model of Figure 13, it was not necessary to use the alternative PLS approach for these analyses. The alternative method is only necessary when using the PLS product-indicator approach for detecting interaction effects with formative measures.

Also as shown in Figure 13, various aspects of the firm's competitive performance are represented by a series of performance variables and combinations of variables as described in Chapter III of this dissertation. A separate analysis was conducted for each of the performance variables. The results of these analyses are reported in Table 8. The results reported in Table 8 include (1) the structural path loading between the second-order construct of firm-wide IT capability and the construct representing the firm's competitive performance, (2) the path's corresponding t-value with a notation of the associated level of significance, and (3) the R-square value for the competitive performance construct. Because the PLS method does not provide significance tests as a part of the general estimation procedure, the PLS bootstrapping technique was used to assess significance as denoted by t-values in the PLS output. This approach is consistent with recommendations and use in previous studies published in information systems journals (e.g., Compeau & Higgins, 1995; Rai et al., 2006; Ravichandran & Rai, 2000).

As shown in Table 8, the results of the full model analyses with no moderators indicated that firm-wide IT capability demonstrates a positive relationship with the firm's competitive income performance. Thus, as a firm's overall IT capability increases, the firm's competitive income performance also increases. This result was found for each of the income ratio variables, with each of the paths also found to be significant. The

analyses for the expense ratio variables indicated that firm-wide IT capability demonstrates a negative relationship with the firm's competitive expense performance. Thus, as a firm's overall IT capability increases, the firm's competitive expense performance decreases. These results for the full structural model with no moderation provide strong support for Hypothesis 1.

Table 8

Results of Full Model Analysis (With and Without Moderators)

		Performance Variables (Income and Expense Ratios)							
		Income Ratios				Expense Ratios			
		Op Income		Net Income		Operating Expense			
Moderator	Description	OI / E + OI / S + OI / A +	OI / E	NI / E + NI / S + NI / A +	NI / E	EXP/ E + EXP/ S + EXP/ A +	EXP/ E	EXP/ S	EXP/ A
		1	2	3	4	5	6	7	8
NO Moderation	Path	0.544**	0.540***	0.551*	0.542***	-0.383*	-0.348***	-0.349***	-0.322***
	R-Square	29.5%	29.1%	30.4%	29.4%	14.7%	14.8%	12.2%	10.4%
Turbulence	Interaction	-0.279***	-0.127*	-0.300***	-0.150**	0.239**	0.237**	0.178**	0.183**
	R-Square	7.6%	4.8%	9.5%	6.2%	10.2%	7.9%	8.1%	7.0%
	Effect Size	0.000	0.016	0.026	0.023	0.052	0.055	0.033	0.033
Munificence	Interaction	-0.221**	-0.234***	-0.221**	-0.239***	-0.047	-0.02	-0.025	-0.071
	R-Square	15.7%	13.8%	19.6%	16.3%	4.9%	2.3%	4.5%	4.0%
	Effect Size	0.037	0.059	0.049	0.063	0.002	0.001	0.001	0.005
Complexity	Interaction	-0.242**	-0.184*	-0.320***	-0.248***	0.390**	0.358***	0.351**	0.250**
	R-Square	10.7%	9.1%	14.0%	11.5%	24.2%	21.7%	18.5%	9.6%
	Effect Size	0.034	0.034	0.064	0.063	0.161	0.136	0.126	0.063
Entrepreneurial	Interaction	-0.237***	-0.191**	-0.222**	-0.191**	0.180	0.193*	0.149**	0.079
	R-Square	12.9%	12.2%	10.2%	10.3%	10.2%	9.4%	7.3%	5.7%
	Effect Size	0.048	0.038	0.032	0.039	0.031	0.039	0.023	0.006
Formal	Interaction	0.192*	0.170*	0.135	0.122	0.192	-0.078	0.148	0.093
	R-Square	8.9%	8.7%	6.9%	7.1%	7.6%	2.4%	6.3%	3.8%
	Effect Size	0.034	0.030	0.014	0.015	0.035	0.006	0.022	0.009
Centralized	Interaction	0.106	0.084	0.114	0.108*	-0.090	0.012	-0.032	-0.078
	R-Square	11.6%	5.6%	11.4%	7.7%	13.2%	4.9%	4.2%	7.0%
	Effect Size	0.012	0.006	0.013	0.013	0.009	0.000	0.001	0.006
Distributed	Interaction	-0.049	-0.091	-0.088	-0.116	0.121	0.030	0.131	0.043
	R-Square	2.6%	4.7%	4.4%	5.3%	5.5%	2.0%	5.6%	5.1%
	Effect Size	0.133	0.008	0.003	0.014	0.012	0.001	0.017	0.002
Top Management Support	Interaction	0.048	0.085	-0.010	0.061	0.246*	0.148	0.250*	0.192*
	R-Square	12.4%	5.1%	9.1%	7.3%	12.8%	6.8%	12.5%	8.3%
	Effect Size	0.003	0.007	0.001	0.004	0.061	0.022	0.064	0.038

*** Interaction is significant at the 0.01 level (1-tailed)
** Interaction is significant at the 0.05 level (1-tailed)
* Interaction is significant at the 0.10 level (1-tailed)

Structural Model Analysis (Full Model with Moderation)

This analysis of the full structural model included an individual assessment for each of the eight moderators with each of the competitive performance variables. These analyses did require the alternative PLS approach where each of the predictor, moderator, and interaction constructs possesses a single composite indicator. The basic relationships for the PLS alternative approach in the full structural model with moderation is shown in the simplified characterization of Figure 14.

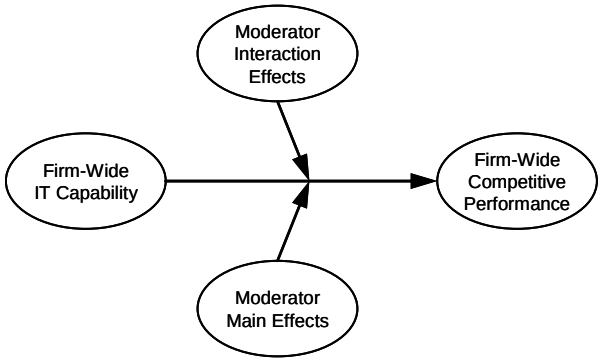

Figure 14. Full Research Model – With Moderation

The separate analyses were conducted with each of the moderators and each of the performance variables to assess any interaction effects that each of the eight moderators may have upon the relationship between an organization's firm-wide IT capability and each of the organization's eight competitive performance variables included in the analysis. The results of these eight-by-eight series of analyses are also reported in Table 8 along with the results of the analysis with no moderators. This combined presentation allows for a direct comparison of the various tests for the full structural model with no moderation versus tests of the model with moderation. It should

be noted that, as recommended by Chin et al. (2003b), the effect sizes are also reported in Table 8 for each of the analyses involving moderators .

Results for the Three Environmental Moderators. The results of the analyses of the full model with the three environmental moderators of turbulence, munificence, and complexity revealed that each demonstrated negative and significant interactions with the relationship between firm-wide IT capability and the firm's competitive income performance. Since a favorable impact on income variables should suggest an increase in income (i.e., a positive relationship), these results indicates a non-favorable interaction impact on performance (i.e., a decrease in income). The relative size of these negative interactions compared among the three environmental moderators was generally larger for the complexity moderator, somewhat smaller for the turbulence moderator, and most often the smallest for the munificence moderator.

The results for the three environmental moderators also revealed that two of the three, turbulence and complexity, demonstrated positive and significant interactions with the relationship between firm-wide IT capability and the firm's competitive expense performance. Since a favorable impact on expense variables should suggest a reduction of expenses (i.e., a negative interaction), the positive interactions in the relationship with the expense variables indicate a non-favorable impact on performance (i.e., an increase in expenses). The impact of the munificence moderator on expense performance was not significant; however, the direction of the interaction was negative, suggesting a decrease in expenses). The relative size of the interactions with the expense performance variables was largest for complexity and smallest for turbulence. While none of the munificence expense interactions were significant, the relative size of the munificence expense

interactions were all very small when compared to complexity and turbulence. In general, these full model results for the three environmental moderators demonstrate support for each of Hypotheses 2a, 2b and 2c.

Results for the Two Organizational Cultural Moderators. As shown in Table 8, the entrepreneurial moderator in the full structural model demonstrated negative interactions with the income variables and positive interactions with the expense variables. Thus, the entrepreneurial interaction suggests unfavorable impacts on performance by indicating a decrease in income and an increase in expense. The formal moderator performed in an opposite direction to the entrepreneurial moderator by demonstrating positive interactions with the income variables and negative interactions with the expense variables. These results for the formal moderator suggest favorable impacts on performance by indicating an increase in income and a decrease in expense. However, while the directions of the formal interactions with the expense variables were indeed negative, none of the interactions were significant. In total, these results provide general support for Hypothesis 3a and 3b.

Results for the Two Organizational Structure Moderators. The distributed organizational structure moderator demonstrated negative interactions with the income variables and positive interactions with the expense variables. However, none of these interactions were found to be significant. The centralized organizational structure moderator demonstrated positive interactions with all of the income variables, but only one of these interactions was significant (i.e., the positive interaction with the net income variable). This result suggest a favorable impact on performance by indicating an increase in net income. The centralized moderator demonstrated mostly negative

interactions with the expense variables, which would suggest favorable impacts on performance. But, none of the centralized moderator expense interactions were found to be significant. In total, these results provide general support for Hypotheses 3c and 3d.

Results for the Top Management Support Moderator. As expected, the top management support moderator demonstrated positive interactions with each of the income variables suggesting a favorable impact on income performance. However, none of the interactions with the income variables were significant. The top management support moderator also demonstrated positive interactions with each of the expense variables suggesting a non-favorable impact on expense performance (i.e., an increase in expense). All but one of the positive interactions with the expense variables were found to be significant.

These results indicate at least partial support for Hypothesis 3e, because it was expected *a priori* that the top management support moderator would demonstrate a negative relationship with the firm's competitive expense variables to suggest a favorable impact on expense (i.e., a decrease in expense). Possible rationale for this positive interaction with expense is discussed in the final section of this dissertation.

Thus, for the full structural model with moderators included, the overall results of the multiple analyses provide general support for each of the hypotheses as proposed. The results for each of the hypotheses are summarized in Table 9.

Table 9

Summary of Results for the Hypotheses

	Hypotheses	Results
H1	Firm-Wide IT Capability will demonstrate a positive relationship with Firm Performance.	Supported
H2a	Environmental Turbulence will negatively moderate the relationship between Firm-Wide IT Capability and Firm Performance.	Supported
H2b	Environmental Munificence will negatively moderate the relationship between Firm-Wide IT Capability and Firm Performance.	Supported
H2c	Environmental Complexity will negatively moderate the relationship between Firm-Wide IT Capability and Firm Performance.	Supported
H3a	An Entrepreneurial Organizational Culture will moderate the relationship between Firm-Wide IT Capability and Firm Performance.	Supported
H3b	A Formal Organizational Culture will moderate the relationship between Firm-Wide IT Capability and Firm Performance.	Supported
H3c	A Centralized Organizational Structure will moderate the relationship between Firm-Wide IT Capability and Firm Performance.	Partially Supported
H3d	A Distributed Organizational Structure will moderate the relationship between Firm-Wide IT Capability and Firm Performance.	Not Supported
H3e	Top Management Support will positively moderate the relationship between Firm-Wide IT Capability and Firm Performance.	Partially Supported

Structural Model Analysis (Three Sub-Models With and Without Moderation)

As with the full structural model, the analysis of each of the three sub-models was conducted both with and without the moderators. Because each of the three sub-models includes an analysis for each of the eight moderators, plus an analysis without any moderators, the sub-model analyses included a total of 27 separate evaluations (i.e., 9 * 3 = 27) conducted for each of the eight firm performance variables (27 * 8 = 216). The three research sub-models used for these analyses are shown in Figure 15.

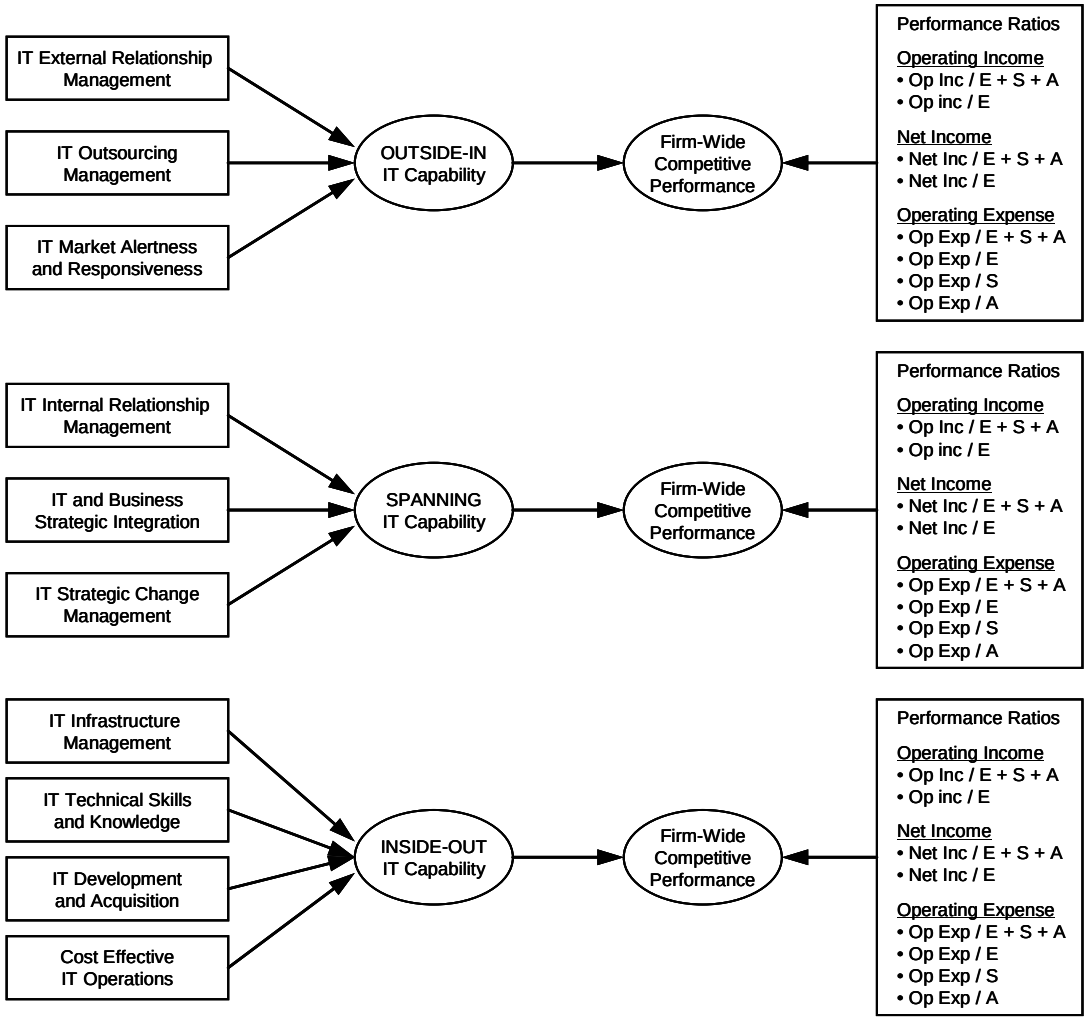

Figure 15. Three Research Sub-Models (Outside-In, Spanning, Inside-Out)

Because of the large amount of information involved with these 216 analyses, only the direction and significance of the interactions are presented in Table 10. Such a presentation allows for a simpler comparison among the results for the three sub-models.

Table 10

Results of the Analyses of the Three Sub-Models (With and Without Moderators)

		Performance Variables (Income and Expense Ratios)							
		Income Ratios				Expense Ratios			
		Op Income		Net Income		Operating Expense			
Sub-Model Moderators	Description of Data	OI / E + OI / S + OI / A +	OI / E	NI / E + NI / S + NI / A +	NI / E	EXP/ E + EXP/ S + EXP/ A +	EXP/ E	EXP/ S	EXP/ A
OUTSIDE-IN		1	2	3	4	5	6	7	8
NO Moderation	Path	0.328***	0.202***	0.357***	0.262***	-0.237	-0.211*	-0.159*	-0.144
	R-Square	10.7%	4.1%	12.8%	6.9%	5.6%	4.5%	2.5%	10.4%
Turbulence	Interaction	NEG	NEG	NEG	NEG	POS	POS **	POS	POS
Munificence	Interaction	NEG **	NEG **	NEG	NEG **	NEG	NEG	NEG	NEG
Complexity	Interaction	NEG **	NEG	NEG *	NEG *	POS *	POS *	POS	POS
Entrepreneurial	Interaction	NEG *	NEG *	NEG	NEG *	POS **	POS **	POS	POS
Formal	Interaction	POS *	POS *	POS	POS	POS	NEG	POS	POS *
Centralized	Interaction	POS *	POS	POS **	POS **	NEG	POS	NEG	NEG
Distributed	Interaction	NEG *	NEG	NEG	NEG	POS	POS	POS	POS
Top Mgt Support	Interaction	POS	POS	NEG	POS	POS **	POS **	POS *	POS *
SPANNING		1	2	3	4	5	6	7	8
NO Moderation	Path	0.435**	0.431***	0.437***	0.437***	-0.242	-0.117	-0.137*	-0.139*
	R-Square	18.9%	18.6%	19.1%	19.1%	5.9%	1.4%	1.9%	1.9%
Turbulence	Interaction	NEG **	NEG	NEG **	NEG	POS *	POS **	POS **	POS **
Munificence	Interaction	NEG	NEG *	NEG	NEG *	NEG	NEG	NEG	NEG
Complexity	Interaction	NEG ***	NEG *	NEG **	NEG *	POS *	POS	POS *	POS **
Entrepreneurial	Interaction	NEG **	NEG *	NEG **	NEG	POS	POS	POS	POS *
Formal	Interaction	POS	POS	POS *	POS	POS	POS	POS	POS
Centralized	Interaction	POS	POS	POS	POS	NEG	NEG	NEG	NEG
Distributed	Interaction	POS	POS	POS	NEG	POS	POS	POS	POS
Top Mgt Support	Interaction	POS	POS	NEG	POS	NEG	NEG	NEG	POS
INSIDE-OUT		1	2	3	4	5	6	7	8
NO Moderation	Path	0.393**	0.386***	0.457***	0.380***	-0.299*	-0.245**	-0.283***	-0.267***
	R-Square	15.5%	14.9%	20.9%	14.5%	8.9%	6.0%	8.0%	7.1%
Turbulence	Interaction	NEG ***	NEG *	NEG ***	NEG **	POS **	POS **	POS **	POS **
Munificence	Interaction	NEG *	NEG **	NEG **	NEG **	NEG	POS	NEG	NEG
Complexity	Interaction	NEG *	NEG	NEG ***	NEG ***	POS ***	POS ***	POS **	POS **
Entrepreneurial	Interaction	NEG ***	NEG **	NEG **	NEG **	POS	POS	POS	POS
Formal	Interaction	POS *	POS **	POS	POS	POS	NEG	POS	POS
Centralized	Interaction	POS	POS	POS	POS	NEG	POS	NEG	NEG
Distributed	Interaction	POS	NEG	NEG	NEG	POS	NEG	POS	POS
Top Mgt Support	Interaction	POS	POS *	NEG	POS	POS *	POS *	POS *	POS *

Note: For the interaction → performance variable relationships, NEG = a negative relationship and POS = a positive relationship

*** Path or Interaction is significant at the 0.01 level (1-tailed)
** Path or Interaction is significant at the 0.05 level (1-tailed)
* Path or Interaction is significant at the 0.10 level (1-tailed)

Results for the Three Sub-Models with No Moderators. The results of the analyses of the sub-models with no moderation revealed that each of the three sub-models (Outside-In IT capability, Spanning IT capability, and Inside-Out IT capability) demonstrated positive relationships with the firm's competitive income performance variables. These positive relationships indicate favorable impacts on income (i.e., an increase in income). As for the expense variables, all three of the sub-models also demonstrated negative relationships with competitive expense performance. Negative relationships with expense variables indicate favorable impacts on expense (i.e., a decrease in expense). All of the relationships were significant, with the exception of two operating expense variables in the Spanning analysis and one operating expense variable in the Outside-In analysis.

Sub-Model Results for the Three Environmental Moderators. The results of the analyses of the sub-models with each of the three environmental moderators of turbulence, munificence, and complexity revealed similarities and differences. All three of the sub-models demonstrated negative interactions for all three environmental variables for all of the income performance variables. These negative interactions with income variables indicate non-favorable impacts on income performance (i.e., a decrease in income). As to the expense variables, the results for the three sub-models were consistent, but there were differences among the three environmental variables as to the direction of the relationships with the expense performance variables. All three of the sub-models demonstrated positive interactions with turbulence and complexity for all of the expense variables. Positive interactions with expense variables indicate non-favorable impacts on expense performance (i.e., an increase in expense). The munificence

moderator demonstrated negative interactions in all three models for the expense variables. Negative interactions with expense variables indicates favorable impacts on expense performance (i.e., a decrease in expense). However, while the directions of the munificence interactions in each of the three sub-models were all negative, none of the munificence interactions were significant. Possible implications of this finding are discussed in the final chapter of this dissertation.

Sub-Model Results for the Two Organizational Cultural Moderators. The organizational culture entrepreneurial moderator demonstrated negative interactions with income variables and positive interactions with expense variables for all three sub-models. The direction of these entrepreneurial interactions indicates non-favorable impacts on both the income and expense variables. Not all of the entrepreneurial interactions were significant with every variable in all three sub-models. However, only the Inside-Out sub-model demonstrated no significance for any of its entrepreneurial interactions with expense variables.

The organizational culture formal moderator demonstrated positive interactions with income variables and mostly positive interactions with expense variables for all three sub-models. The positive interactions for the formal moderator with the income variables indicates favorable impacts on income performance (i.e., an increase in income), while the mostly positive interactions with expense variables indicates non-favorable impacts on expense performance (i.e., an increase in expense). However, among all three sub-models, only one of the formal interactions with expense variables in was found to be significant. This one significant expense interaction was found only in the Outside-In sub-model.

Sub-Model Results for the Two Organizational Structure Moderators. The distributed organizational structure moderator demonstrated mostly negative interactions with the income variables and mostly positive interactions with the expense variables. However, among the three sub-models, only the Outside-In sub-model had one significant distributed interaction with an income variable; while none of the distributed interactions with expense variables were found to be significant.

The centralized organizational structure moderator demonstrated positive interactions with all of the income variables, but it was only in the Outside-In sub-model that three interactions with income variables were found to be significant. This result of a positive interaction with income variables suggests a favorable impact on performance by indicating an increase in income. The centralized moderator demonstrated mostly negative interactions with the expense variables, which would suggest favorable impacts on performance. But, among all three sub-models, none of the centralized moderator expense interactions were found to be significant.

Sub-Model Results for the Top Management Support Moderator. As expected, the top management support moderator demonstrated positive interactions with most of the income variables suggesting a favorable impact on income performance. However, among all three of the sub-models, just one of the interactions with income variables was significant, and this was within the Inside-Out sub-model. The top management support moderator also demonstrated positive and significant interactions with each of the expense variables in the Outside-In and Inside-Out sub-models. These positive top management support interactions for all the expense variables in both the Outside-In and Inside-Out sub-models suggest a non-favorable impact on expense performance (i.e., an

increase in expense). It is interesting to note, that not one of the top management support interactions with income or expense variables in the Spanning sub-model was found to be significant. Possible explanations for these finding are discussed in the final chapter of this dissertation.

Summary of the Empirical Results

In total, the empirical results of the various analyses presented in this chapter provide general support for the hypotheses concerning the full structural model and the impact of eight key moderators as summarized in Table 9. The results of the measurement model analysis indicate initial assessments of validity and reliability for a new instrument designed to measure 10 key constructs that are posited to form a theoretically supported representation of an organization's firm-wide IT capability. The results of the full model analysis with no moderation provide strong empirical evidence for the notion of a positive relationship between an organization's overall, or firm-wide IT capabilities and the competitive performance of the firm. While confirmation of this relationship has seen mixed results in the literature, the results of this higher-level, more holistic characterization of a firm's overall IT capability strongly support the argument for a positive relationship with firm performance. The results of the full model with each of the eight moderators provide support for the idea that key environmental and organizational influences can and do interact with a firm's IT capabilities to impact a firm's competitive performance. In addition, the analysis involving the three sub-models provides another view of how a firm's IT capabilities work together as subgroup processes (e.g., outside-in, spanning, inside-out) to provide differing impacts on firm performance. Finally, these results and analyses confirm the challenges involved with

testing for interaction effects through the use of software-based methods that go beyond basic regression—especially when the analyses involve formative, second-order constructs. However, even with the challenges inherent in such methods, the ability to analyze complex models with more accurate and reliable results provides new levels of evaluation previously unavailable in more conventional approaches.

Having presented the results of this study, the next chapter discusses these results, considers implications of these findings for both research and practice, and offers the dissertation's final observations and conclusions.

CHAPTER V

DISCUSSION

The overarching goal proposed for this study was to draw upon theory and build upon prior investigations in an effort to help further clarify understanding concerning the nature of IT and its value in contemporary organizations. To achieve the overarching goal, this study employed the resource-based view of the firm to develop a conceptual model of IT business value representing the relationship between the firm's overall IT capability and the competitive performance of the firm. The model employed in this study builds upon and extends current IT business value knowledge by allowing for the empirical assessment of a new, multidimensional measure of firm-wide IT capability and its relationship to the firm's competitive performance. In addition, the conceptual model in this study further extends the extant literature by including the effects of multiple organizational and environmental influences that interact with firm-wide IT capability to potentially moderate the impact on firm performance. The model and the results of the analysis provide new knowledge and additional understanding to the IT business value research stream while also providing a platform for future research. This chapter discusses the findings of this study and considers the implications for both research and practice. The latter sections of this chapter consider the limitations of the current work,

the opportunities for future research, and the conclusions that can be drawn from this dissertation.

Higher-Level Representations of IT Capability

The 10 factors of the measurement model tested in this study were identified in the literature as 10 key IT capabilities for an organization. Per Grant's (1996) theoretical notion of higher order capabilities, these 10 factors were hypothesized as higher-level representations of a firm's key IT capabilities that are created through the complex and dynamic deployment of IT resources in combination with other complementary technical, human, and organizational resources, assets, and/or capabilities. When taken together, these 10 key IT capabilities were posited to form a more holistic, theory-based representation of a firm's overall or firm-wide IT capability. As discussed in Chapter 2 of this dissertation, the approach of blending complementary IT and non-IT abilities to develop a robust and firm-specific multidimensional construct was deemed to be a promising approach to representing the very complex notion of a firm's overall IT capability (e.g., Melville et al., 2004; Santhanam & Hartono, 2003; Wade & Hulland, 2004). Within the context of this study, the motivation behind such a theory-based construct was to provide the opportunity to more accurately test the complex relationship between a more complete characterization of a firm's combined IT capabilities and key measures of a firm's competitive performance.

Thus, an important underlying component of this study's modeling approach was the use of such higher-level representations for each of the first-order IT capability constructs. The term higher-level as used in the context of this study simply refers to the more comprehensive nature of the first-order constructs. That is, the first-order constructs

were designed to represent a notion of IT capabilities as multifaceted and complex combinations of IT and non-IT factors that when taken together would form a theory-based representation of a firm's overall IT capability.

The use of a higher-level construct and the assessment of IT business value at the firm-wide level represents somewhat of a return to the approach of many of the early investigations of IT business value, but without the focus on IT investment alone and without the use of aggregated data. Because of the mixed results obtained in these early IT business value studies, there were eventual calls in the literature for the creation and evaluation of lower-level, process-based studies (e.g., Barua & Mukhopadhyay, 2000). These process-based studies were advocated as necessary to open the "black box" of IT business value by exploring the lower-level, more fundamental components and relationships. These lower-level studies are indeed well justified and have added vital information concerning the individual mechanisms that help to create IT business value. However, this dissertation has taken the position that IT business value research has now progressed to a point that can benefit from taking a step back from the finer-grained focus to reassess IT business value at the firm-wide level. The idea is that lower-level studies have provided sufficient knowledge so that it is now possible to use what we have learned to empirically re-explore the higher-level view. Especially since the higher-level view is what we were interested in exploring in the first place.

The return to a higher-level of assessment can be thought of as the next logical step in following the progressive nature of research that builds upon prior knowledge to reveal new knowledge in a continuing evolution of knowledge and discovery. Using the three categories of IT business value research previously discussed in this dissertation,

Figure 16 provides a graphical representation of how this evolutionary research process might be applied to IT business value research.

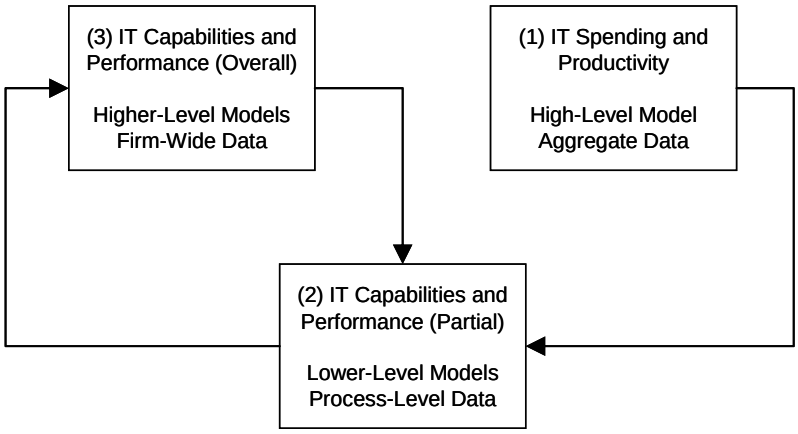

Figure 16. Continuing Evolution of IT Business Value Research

A concern in taking this next step in the exploration of IT business value is the challenge of adequately modeling the necessary complexity involved with the higher-level constructs. While resource-based theory has been instrumental in providing the theoretical framework for this process, it is interesting that insight into this problem can also be found within investigations that are exploring the inner workings of the human brain and how the brain might be modeled. This insight stems from the somewhat counterintuitive idea that the design of a brain region (higher-level) is simpler than the design of a neuron (lower-level). This straightforward but somewhat radical idea is explained in more detail by Kurzweil (2005):

> Models often get simpler at a higher-level, not more complex. Consider an analogy with a computer. We do need to understand the detailed physics of semiconductors to model a transistor, and the equations underlying a single real transistor are complex. However, a digital circuit that multiplies

> two numbers, although involving hundreds of transistors, can be modeled far more simply with only a few formulas. An entire computer with billions of transistors can be modeled through its instruction set and register description, which can be described on a handful of written pages of text and mathematical transformations. (p. 153)

Thus, the central theme in this not-so-obvious idea is that while we must carefully consider the complexities of any phenomena at a lower-level before we can advance to the next higher-level, once we understand enough and do advance, much of the underlying complexity can be simplified in the higher-level representation.

Such is the case with the 10 first-order constructs that form the firm-wide IT capability construct of this study's model. While the dynamic deployment of IT resources in combination with other complementary technical, human, and organizational resources, assets, and/or capabilities is indeed complex, it was possible to represent such complexity at the next higher-level in a relatively simplified manner through an understanding of the primary components of each lower-level construct. This was the fundamental approach that led to the development of the firm-wide IT capability construct that served as the foundation of this dissertation's models and investigations. In addition, it is this higher-level representation of firm-wide IT capability that is at the heart of addressing the first research question of this dissertation:

> Q1: What conceptualization of IT business value will represent a move toward unifying the vast and diverse body of accumulated IT business value knowledge?

Based upon the results of this dissertation, the model as shown in Figure 11 of this study—which (1) is adapted from the Melville et al. (2004, p. 285) model, (2) is based upon resource-base theory with the dynamic capabilities extension, and (3) includes at its heart the firm-wide IT capability construct—is proposed to offer a common framework that is built upon the accumulated IT business value knowledge. As Melville et al. (2004) have suggested, such a model provides an integrative conceptual framework that can help expedite knowledge advancement in the realm of IT business value research. Thus, in response to the first research question of this dissertation, the adapted model of Figure 11 is proposed as a conceptualization of IT business value that can represent a move toward unifying the vast and diverse body of IT business value studies.

The Relationship of IT With Firm Performance

The integrative conceptual model of Figure 11 also played an essential role in helping to answer the second research question of this dissertation:

Q2: What is the nature of the relationship between firm-wide IT capability and firm performance?

One of the problems of past IT business value studies has been the inconsistent nature of the results. Some studies found positive relationships with performance and some did not. The use of the newly developed, higher-level, firm-wide IT capability construct was planned to provide a firm-level view that was not limited to only the contribution of a single software application (e.g., Sethi & King, 1994) or even the much broader, but still partial contribution of a firm's enterprise-wide IT infrastructure (e.g., Broadbent & Weill, 1997). This study's approach was to utilize an integrative model incorporating the firm's overall IT capability as a combination of 10 IT capabilities,

including IT infrastructure, IT development, IT skills, and seven other key IT capabilities as identified in the literature, to test a more realistic, comprehensive representation of a firm's overall IT capabilities and the relationship with the firm's performance. The motivation behind this approach is the idea that such a comprehensive model should provide a better portrayal of the complex interrelationships among the various IT capabilities within an organization and therefore provide a truer representation of the overall relationship with firm performance.

In spite of the mixed results of past studies, it was hypothesized that this study's firm-wide IT capability construct would demonstrate a favorable relationship with the various measures of firm performance. And, the results of the tests did in fact demonstrate a strong and favorable relationship with all measures of firm performance. This finding is significant for several reasons. First, it confirms what has been assumed to be true by many IT business value researchers and practicing IT managers: that a firm's overall IT capability favorably impacts the firm's performance. However, because of a lack of evidence due to inconsistent results, the issue of whether or not IT enables improved competitive performance has more or less been left open to debate. As a result, IT has more recently been relegated to the level of a commodity offering absolutely no potential for competitive advantage (e.g., Carr, 2003, 2005). Thus, the strong and favorable relationships between IT capability and firm performance as confirmed in this study suggest that a firm's overall set of IT capabilities can and do work together to enable improved competitive performance for the firm.

The fact that this study tests a full range of 10 IT capabilities in combination rather than a single, isolated, individual, process-level capability is especially noteworthy

because it suggests that the overall result of the firm's combined set of IT capabilities—with some capabilities potentially working in opposition to others—still produces an overall, net impact on firm performance that is strong and favorable. That is, as the firm's overall, or firm-wide IT capability level increases, the firm's overall competitive performance also increases.

To summarize, the confirmation of a favorable relationship between firm-wide IT capability and firm performance is a significant finding that helps reestablish the importance of utilizing IT to form key IT capabilities within the firm. This finding can help to reinstate eroded credibility within an organization concerning the impact of IT on competitive performance. Indeed, this finding underlines the importance of IT as an essential element in forming critical IT capabilities that can enhance strategic value and lead to improved competitive performance for the firm.

The Impact of Environmental and Organizational Moderators

The third and fourth research questions in this dissertation dealt with whether or not certain organizational and environmental influences would interact with firm-wide IT capability to moderate the relationship with firm performance.

Q3: Will key *organizational* influences interact with firm-wide IT capability to moderate the relationship with firm performance?

Q4: Will key *environmental* influences interact with firm-wide IT capability to moderate the relationship with firm performance?

The findings of this study indicated that certain moderators did indeed interact with firm-wide IT capability to influence firm performance. The impacts of these findings are discussed in the following sections.

The Environmental Moderators. The three environmental moderators used in this study (i.e., turbulence, munificence, complexity) each reflect the uncertainty in an organization's external operating environment. As concluded by Dess and Beard (1984), these three dimensions of an organization's external environment contribute most to environmental uncertainty and are therefore most likely to influence firm performance over time (Wade & Hulland, 2004). The findings of this study indicated that all three of these influences tended to reduce income, but only turbulence and complexity were found to also increase expense. Thus, for firms operating in turbulent markets, which are characterized by fast-changing, unstable conditions in which change is difficult to anticipate, it is not unreasonable to expect that such conditions could produce a negative influence on performance. Likewise, firms operating in complex markets, which are characterized by a large number of suppliers, competitors, and customers, can also be expected to see such complex conditions produce a negative influence on firm performance. However, for firms that are operating in highly munificent environments, which are characterized as markets that are growing rapidly and able to support sustained growth, it may seem somewhat counterintuitive that the results of this study show a decrease in income.

This finding may be evidence of the fact that while rapidly growing markets may offer great opportunities for sales growth, such rapid growth can also place additional pressures on income. For example, to acquire and accommodate new business, firms are often required to increase inventory levels, expand facilities, add more personnel, and increase other firm resources as necessary. Such expansion generally increases expenses and requires additional capital. Additional capital can be acquired from sources such as

loans or selling additional stock. But, the needed capital may also come directly from operating income. All of these sources for obtaining additional capital could also lead to a reduction of the firm's income, which is consistent with the findings of this study. In addition, firms may purposely lower their sales margins to increase their competitiveness to attract more business. Such a move, while potentially increasing sales, could also result in lower income.

While there are rational explanations for the question of why there may be an income decrease in munificent environments, the findings for a munificent interaction with expense also raise a question. Since rapid growth generally produces an increase in expense, how can we reconcile the results of this study that suggest a decrease in expense for firms in munificent markets? The expense results for the munificence moderator do not seem to fit expectations. Two observations are offered here as possible explanations for this seemingly unexpected result.

First, while the direction for the munificence interactions with the expense variables were all negative, suggesting a decrease in expense, none of these relationships were found to be significant. Thus, the direction of the results could be considered as having no statistical relevance and could simply be ignored. Second, a plausible explanation for the negative impact on expenses can be found in the fact that, in general, while firms that are experiencing rapid growth can be expected to see an increase in expense, it can be argued that the increase in expense is often more than offset by the increase in sales, and/or by an increase in operating income. When sales increase, even though expense dollars may also increase, the overall percentage of the expense-to-sales ratio can, and often does, decrease. This occurs because the increase in expense necessary

to accommodate the rapid growth is often only an incremental increase when compared to the rapid growth in sales. Thus, in a munificent environment, as a firm experiences rapid growth, the increase in the firm's sales should, in general, more than offset the relative growth in expense. This line of reasoning provides support for the finding in this study of a decrease in expense for firms operating in munificent environments.

The Organizational Moderators. Of the five organizational moderators in this study, four can be separated into one of two groups: moderators representing the two, converse dimensions of organizational structure and moderators representing the two, converse dimensions of organizational culture. The fifth moderator represents top management support and is discussed separately in the next section. The two moderators representing the relative extremes of an organization's general governance structure are the dimensions referred to as centralized and distributed. The two moderators representing divergent views of an organization's general culture are the dimensions termed entrepreneurial and formal.

Because organizations with an entrepreneurial culture are characterized as very dynamic places with a fundamental commitment to innovation and development, it may seem somewhat surprising that the entrepreneurial moderator suggested a decrease for its interaction with income performance and an increase for expense performance. On the other hand, organizations with a formal culture are characterized as very structured places with a fundamental commitment to formal rules and policies. Thus, it was also somewhat surprising to find that the interaction of the formal moderator with firm-wide IT capability demonstrated an increase for income performance, just the opposite of the entrepreneurial interaction. As to the formal moderator's interaction with expense, the

result was positive suggesting an increase in expense, which was exactly the same as the entrepreneurial result.

While the results for the organizational moderators may appear somewhat surprising upon initial examination, a bit of reflection reveals that the results are in fact quite reasonable. For instance, the fact that the entrepreneurial interaction suggested a decrease for income and an increase for expense seems reasonable if you consider what makes a firm's culture entrepreneurial. Entrepreneurial firms are very dynamic places with a fundamental commitment to innovation and development. This description suggests that entrepreneurial firms are always changing, always trying new approaches, always developing new systems. Such firms are comfortable with trying new ideas because the culture encourages and rewards such actions. In an entrepreneurial organization, it is commonplace for new ideas, new approaches, and new development to occur. It is also commonplace for some of these new ideas, approaches, and developments to fail. In fact, one of the distinguishing characteristics of entrepreneurial cultures is the recognition that, in such circumstances, failure will occur; yet this type of failure is openly accepted as OK. This idea follows the reasoning of the old maxim, "nothing ventured, nothing gained." Thus, after some reflection concerning the nature of entrepreneurial firms, it is not unreasonable to accept the notion that the interaction effect of an entrepreneurial culture may impart a negative influence on performance.

In a similar fashion, it is necessary to give some thought as to why a formal organizational culture might interact with firm-wide IT capability to convey an increase of income performance. Formal cultures are described as structured places with a fundamental commitment to formal rules and policies. Therefore, when we consider the

interaction of such a culture with a firm-wide IT capability that is by its very nature, dynamic, this interaction may transfer upon the formal firm some of the inherently dynamic aspects of firm-wide IT capability. These dynamic characteristics are built into every one of the 10 factors that form the firm-wide IT capability construct. For example, the IT market alertness and responsiveness dimension is supported by research that has recognized "the need to continually reassess and reinterpret…[especially] within a turbulent context" (Feeny & Wilcocks, 1998, p. 11). Also, the IT strategic change management construct plays an important role in the dynamic capability process of resource reconfigurability. And, as Eisenhardt and Martin (2000, p. 1118) concluded, "long-term competitive advantage lies in resource configurations" and not in dynamic capabilities alone. Therefore, the result of a formal culture interacting with firm-wide IT capability to produce a positive influence on income can at least partially be explained through the natural infusion of dynamic capabilities throughout the formal firm. The effect of such dynamic characteristics can be expected to also create some increase in expense, as was the case with the entrepreneurial firms. However, since none of the formal culture interactions with the expense variables were significant, these interactions could be ignored due to statistical irrelevance. Thus, the performance impacts of this study which result from the interaction of a formal culture with firm-wide IT capability do have a reasonable and justifiable explanation.

The findings for the centralized and distributed interactions are very similar to those for the formal and entrepreneurial interactions. That is, the centralized interactions suggested increases for income, as with the formal interaction, and decreases for expense. However, none of the centralized interactions with expense were significant. The

direction of the distributed interactions suggested decreases for income and increases for expense, as with the entrepreneurial interactions; but none of the distributed interactions were significant for either income or expense. Therefore, even though there were differences in significance, the explanations offered for the entrepreneurial and formal interactions could be extended to the distributed and centralized firms.

Centralized firms are described as giving corporate-level managers authority over all spheres of activity, while distributed firms are described as giving this authority to the divisional and line-managers. Thus, the top-down arrangement of the centralized structure shares many of the same characteristics as the formal culture. Likewise, the approach of a distributed structure suggests similarities with an entrepreneurial culture. This may explain why the interaction effects are so similar between each pair of moderators. In addition, Grant (1996) proposes the idea that, "the primary role of the firm, and the essence of organizational capability, is the integration of knowledge" (p. 375). Furthermore, such knowledge integration is explained as the basis for competitive advantage, especially under dynamic and hypercompetitive market conditions.

A part of this knowledge-based theory of organizational capability is the idea that, "organizational culture may be regarded as a form of common knowledge, one of the functions of which is to facilitate knowledge integration within the company" (Grant, 1996, p. 380). Also, the theory proposes that organizational structures should be designed with the view of organizing activities to reduce the amount of communication needed to achieve knowledge integration. Interestingly, bureaucracy is offered as a structure which (under certain conditions) is able to maximize the efficiency of knowledge integration within an organization through its characteristic of directing activities from a central

point. Thus, Grant's (1996) knowledge-based theory of organizational capability provides additional support for the unexpected positive relationships found in the interactions of the formal and centralized moderators.

The Top Management Support Moderator. As expected, the top management support moderator provided a positive and significant impact on income performance, but only when the organizational size control variable[6] was included in the model. However, in the same model (which included the organizational size control variable), the top management support interaction with expense performance was not significant. On the other hand, when the organizational size control variable was not included in the model, opposite results were obtained. That is, the top management support interaction demonstrated a significant increase in expense, while the income interaction was not significant. It is interesting to note that the inclusion of the control variable for organizational size did not have a similar effect on any of the other models. In fact, the inclusion of the organizational size control variable did not substantially change any of the other findings, except for the top management support moderator.

However, in the case of the top management support interaction, the findings indicate that when the size of the organization is controlled for in the model (i.e., when organization size is included as a separate factor in the analysis), top management support demonstrates an increase in income. This is the expected relationship which supports a

[6] Because the organizational-size control variable did not materially change any of the findings when it was included in the models, all of the results reported and discussed in this dissertation are for models that did not include the organizational-size control variable (with the one exception being the top-management-support interaction). This approach allowed for simpler models and a more parsimonious presentation.

large number of studies in the literature that have found top management support to demonstrate a positive relationship with a wide range of dependent variables, including firm performance (e.g., Jasperson et al., 2002; Sharma & Yetton, 2003). However, in the model that did not control for firm size, the finding that top management support suggests an increase in expense is contrary to the expected result. A possible rationale for this finding of increased expense is the suggestion that for firms of certain sizes, the support of the organization's top management essentially frees these firms to innovate, experiment, or try new approaches to developing, changing, and reworking their IT capabilities. This innovative freedom, which is encouraged and supported by top management, has been credited as a necessity for firms to survive and even thrive in the rapidly changing and dynamic markets that make up much of the modern competitive landscape (Wade & Hulland, 2004). Thus, it is certainly reasonable to expect an increase in expenses in those firms that are regularly restructuring their IT capabilities. However, additional research is needed to further explore the connection to firm size.

The Three Sub-Models

The fifth and final research question in this dissertation dealt with what sorts of differences might exist between each of the three process groups and their relationships with firm performance.

Q5: What differences, if any, exist among the three process categories and their respective relationships to firm performance?

The three sub-models of this analysis represent an alternative approach to thinking about IT capabilities in terms of three types of processes as suggested by Day (1994): (1) Inside-Out processes, which include capabilities that tend to be internally

focused and are deployed from inside the firm in response to market requirements and opportunities; (2) Outside-In processes, which consist of capabilities that are externally oriented, placing an emphasis on anticipating market requirements, creating durable customer relationships, and understanding competitors; and (3) Spanning processes, which are composed of capabilities that involve both internal and external analysis, and are needed to integrate the firm's inside-out and outside-in capabilities (Wade & Hulland, 2004, p. 111).

The findings of this study suggest that these three process groups, without moderators[7], all demonstrate an increase for income and a decrease for expense. This result indicates that each of the three process groups individually contributes to improved competitive performance for the firm. This evidence of performance contributions from each individual process group (i.e., without the other groups in the model) suggests that firms may reap benefits from developing the IT capabilities of a single process group, even when the IT capabilities of the other two process groups are absent or at least not fully developed.

In addition, an examination of the relative size of the path estimates for each of the three groups suggests that the individual contributions are greatest for the spanning process group, somewhat smaller for the inside-out group, and smaller yet for the outside-in group. However, again, while there were some differences in the relative size

[7] The results for each of the three sub-model groups (with moderators included) paralleled the results of the full model (with moderators included). Therefore, additional discussion of the results for each of these sub-models with moderators would simply duplicate the previous full-model discussion. Consequently, no additional discussion is offered here for the three sub-models with moderators.

of the path estimates among the three groups, it should be stressed that each of the three process groups demonstrated strong, positive relationships with income performance and strong negative relationships with expense performance. Thus, all three process groups demonstrated strong and very favorable overall impacts on firm performance with each group indicating sizeable increases for income and sizeable decreases for expense, which is a very desirable combination for any business.

It is also interesting to note that the path estimates for the full, firm-wide IT capability model (i.e., the combination of all three sub-models) demonstrated larger path estimates than any of the three individual process groups. This observation is significant in its suggestion that the sum of the whole is greater than its parts. In other words, the impact of the three process groups working together in the overall representation of firm-wide IT capability demonstrated a stronger favorable relationship with performance than any of the three process groups individually. This result suggests evidence of the positive effects of synergy within the firm-wide IT capability construct.

As Bharadwaj (2000) has explained, "Synergy refers to the sharing of resources and capabilities across organizational divisions. Beyond operational efficiencies, knowledge and information sharing across functional units enables firms to be more flexible and to respond faster to market needs" (p. 176). The 10 IT capabilities that form the firm-wide IT capability construct in this study, reflect the use of information technologies in ways that are designed to create organizational synergies that can enable the delivery of needed resources by breaking down the physical, spatial, and temporal barriers that limit communication (Bharadwaj, 2000; Brown & Duguid, 1998). Thus, the evidence suggests that while performance benefits are available for even the individual

contributions from each of the three process groups, the greatest benefits are realized when the three groups work together to stimulate the synergistic payoffs available through the combined and reinforcing effects of the complete firm-wide IT capability construct.

Implications for Research and Practice

The findings of this study suggest implications for all organizations, but especially for organizations that bear similarities to the firms of this study. However, it should be noted that the findings of this study as reported in this dissertation should be considered as preliminary evidence only. Before definitive guidelines for practice could be offered, additional research designed to both refine the measures and further test the models with other data would be required. Even so, this dissertation offers the following implications for practice.

This study's suggestion that firms can see positive impacts on firm performance from the development of IT capabilities within even a single process group (e.g., outside-in, spanning, inside-out) is a key implication for practice. This finding suggests that firm-wide IT capability is not necessarily an all-or-nothing proposition for organizations, but that organizations can reap benefits even as the firm's overall IT capability is still being developed. This can be an important finding for organizations because research has shown that IT capabilities are built-up over time through the development, evaluation, and refinement of routines within the IT areas and throughout the organization. A substantial amount of learning and embedding of knowledge in organizational processes must occur as the routines are developed (Grant, 1996; W. W. Powell, 1998). For example, it takes an average of four to six years to develop mature system delivery

processes when organizations systematically implement software process improvement models such as the capability maturity model (CMM)" (Ravichandran & Lertwongsatien, 2005, p. 257). Likewise, building complex IT capabilities such as IT flexible infrastructure management, IT technical skills and knowledge, and effective IT external and internal relationship management also take time to develop. Therefore, the suggestion that firms can see positive impacts on firm performance from the development of IT capabilities within even a single process group should not be interpreted as a quick and simple solution, but rather such development should be seen as simply a beneficial milestone in the journey to a complete and even more beneficial firm-wide IT capability. In consideration of this point, practitioners should also note that the findings of this study suggest that the combined synergies resulting from the complete set of all three process groups working together (i.e., the 10 IT capabilities of the firm-wide IT capability construct) produced the largest and most favorable relationships with firm performance. Therefore, while performance gains can result from any of the individual process groups, organizations appear to reap the greatest benefits from the overall synergistic combinations of IT capabilities as represented within the firm-wide notion of IT capability presented in this study.

Another significant implication for practitioners (and for researchers as well) is the strong support this study found for the idea that, contrary to some opinions in the literature (Carr, 2003, 2005), IT does in fact matter. The empirical evidence in this study suggests that firm-wide IT capability can and does provide strategic value for the firm through strong IT capabilities which enable organizations to effectively leverage IT in pursuit of the firm's strategic goals. However, some senior executives tend to view IT as

a commodity and frequently target the firm's IT areas and services for cost cutting. The findings of this study suggest that such a cost-centered approach to IT would be ill-advised and counterproductive to achieving the strategic goals of the organization. Thus, a critical responsibility of IT management is to proactively engage and inform the firm's senior management as to the value of IT in achieving the firm's strategic initiatives. Such action is vital to gaining the necessary support and funding to regularly assess, improve, and restructure the firm's IT capabilities in alignment and integration with the firm's strategic thrust.

The findings of this study also indicate the value of IT capabilities for firms operating within any of the three dimensions of the competitive environment (i.e., turbulence, munificence, complexity) which were included as a part of the analyses. Previous research determined that these environmental factors contribute most to environmental uncertainty and therefore consistently influence firm performance over time. Practitioners should take note that while each of these three environmental influences did decrease the relationship and impact of firm-wide IT capability on firm performance, the net result of the interactions on firm performance were, in general, still favorable. Thus, these results suggest that firms who develop and maintain strong firm-wide IT capabilities can expect to perform better within these three uncertainty environments versus those firms in the same environments who fail to develop such IT capabilities. In the often dynamic and hypercompetitive markets of the modern competitive landscape, finding competitive support and strategic value in the firm's strong set of IT capabilities could potentially make the difference between the firm's eventual success or failure (Grant, 1996).

This study also suggests that firms with formal organizational cultures and firms with centralized organizational structures may benefit more from developing a strong firm-wide IT capability versus firms with entrepreneurial cultures or distributed structures. While the rationale behind these findings has been discussed previously in this dissertation, the implications for formal and centralized firms are clear. Future research that is focused on exploring this interesting finding may provide further insight providing meaningful implications for both practice and research.

In a similar vein, this study confirmed the benefits and positive implications of having the support of the firm's top management. A rather ancillary implication for practice is that IT management must take action to garner such support if it does not already exist. In fact, because the support of the firm's senior management is implicitly required for the development of a superior firm-wide IT capability, practitioners (and researchers) should take note that such support is not only demonstrated through an ongoing interaction with firm-wide IT capability (as demonstrated within this dissertation), but that top management support is also most certainly an essential antecedent to the development of strong IT capabilities throughout the organization. Thus, an important implication for practice is that IT management must gain the support of the firm's top management team before any consequential development of IT capabilities can be achieved within the firm; and further, due to the dynamic restructuring that is inherent in maintaining a superior firm-wide IT capability (e.g., Eisenhardt & Martin, 2000), IT management must continue to sustain top management support as IT capabilities are continually improved and evolved in support of changing competitive market conditions and changing strategic objectives.

In addition to the implications for practice, the findings of this study offer additional insights and contributions for research within the broad span of the IT business value literature. This research introduced a conceptual model adapted primarily from the Melville et al. (2004) study. The expressed purpose of the Melville et al. (2004) model was to unite the current body of cross-discipline IT business value knowledge into a more comprehensive model. Thus, the adapted model of this dissertation also offers an attempt at uniting the diverse IT business value knowledge into a comprehensive representation of IT business value. The model can be used as a platform for additional IT business value studies.

This research responded to the calls in the literature to develop theoretically-based, multidimensional instruments to measure firm-wide IT capability (e.g., Santhanam & Hartono, 2003). Using a multidimensional representation of the firm's overall or firm-wide IT capability, this research builds upon Bharadwaj's (2000) initial efforts to establish the links between firm-wide IT capability and firm performance. However, while the Bharadwaj (2000) study employed a proxy to represent firm-wide IT capability, this dissertation uses a newly developed, multidimensional construct of firm-wide IT capability. While only one existing firm-wide IT capability instrument was found in the literature (i.e., Bharadwaj et al., 1999), the new instrument used in this study builds upon and extends the one existing instrument. Based upon a synthesis of the extant literature, the new instrument revised and expanded some areas of the existing instrument while incorporating facets of additional areas of increasing importance to IT in business. The newly developed instrument was used to gather primary data for each of the independent variables in the model. This field-based study allowed for the full psychometric

assessment of the new instrument concerning its validity and reliability for the sample of CIOs obtained. Thus, in keeping with the idea of a cumulative research tradition (Keen, 1980), this study has taken a first step towards the validation of a new firm-wide IT capability measurement tool that can be applied in other IT business value research.

Another insight for research that is gained from this study is the empirical findings concerning the relationship between firm-wide IT capability and firm performance. Drawing upon the resource-based view of the firm, IT business value is represented in the adapted model as the relationship between the firm's overall IT capability and the firm's competitive performance. By directly measuring and empirically assessing the state of development of IT capabilities within the sampled firms, this research empirically demonstrated that firms leverage IT resources in combination with other complementary IT and/or non-IT resources to create complex, higher-level IT capabilities that work together to form a firm-wide IT capability. The empirical findings also add to the body of research knowledge by finding a favorable relationship with firm performance. Therefore, this study provides support for the idea that firm-wide IT capability can enable improved competitive performance for the firm. No published study was found that empirically tested the relationship between firm-wide IT capability and firm performance.

This study provides additional insight for research through its response to calls in the literature (e.g., Lu & Ramamurthy, 2004; Wade & Hulland, 2004) to explore the impacts of other influential variables on the relationships in the IT business value model. By incorporating key influences from the organizational and environmental domains as moderators in the model, this study examined the interactions of each of these variables

with firm-wide IT capability and found that these moderators do have an impact on firm performance. Therefore, this study offers an assessment of a more comprehensive model of the relationship between firm-wide IT capability and firm performance by including moderators from both the external competitive environment and the internal organizational environment.

Research Limitations

Consistent with all studies that labor to develop and assess IT-based metrics and models, this research has endeavored to bring a theoretical and operational perspective to a rather complex concept. Undertakings such as this are ambitious in nature and therefore contain some inherent limitations. A potential limitation of the present study is the range of indicators used to reflect each of the first-order constructs underlying the concept of firm-wide IT capability. In general, this study does not maintain that every aspect of these rather complex phenomena have been captured in the measurement scales for these constructs. Given the constraints of survey length, it is possible that all items from a construct's domain were not sampled. Yet, to its credit, the research design of this study incorporated multiple rounds of theory building through literature review, expert opinion, pre-testing, and pilot-testing. In addition, a rigorous methodological approach to theory testing has been applied and appears to confirm the adequacy of the measures. However, multiple studies have concluded that no psychometric technique can adequately address the ultimate breadth or completeness of a measure (e.g., Segars & Grover, 1998). Thus, it is certainly possible that other dimensions of firm-wide IT capability exist but are not included within the current conceptualization and models.

Another potential limitation is the use of a single key informant for the collection of data involving each of the independent variables in this study. The data collected represents the views of senior IT executives who are most likely to be informed about the firm-wide IT activities that make up each of the 10 IT capability constructs. Hence, their views are likely to be valid representations of the IT activities and related initiatives in their organizations. While the key informant method is typical of IT research, it is by no means an ideal approach. Methods involving multiple informants and structured approaches for triangulation are perhaps better methods for ensuring the most accurate data. However, it should be noted that such multi-informant methods can potentially limit the number of issues that can be addressed and may also limit the number of useable responses that can be collected (Segars & Grover, 1998). In addition, any biases associated with self-reporting are restricted in this study due to the use of objective data from the Compustat database that was used with all of the performance variables (i.e., the performance variables served as the dependent variables in this study). Therefore, since our data about IT capabilities were gathered through a survey of senior IT executive perceptions, an objective measure of firm performance eliminates potential concerns about methods bias and provides the foundation for a robust and conservative test of the link between IT capabilities and firm performance (Bharadwaj et al., 2002).

The research model was tested using cross-sectional data from the senior IT executives survey. However, in an attempt to avoid data that represents a single moment in time, the survey asked the senior executives to answer each of the questions with the following perspective in mind, "Relative to the other firms in your industry over the past three years, how well does your firm perform in…" This statement was then followed by

a specific aspect of one of the 10 IT capabilities as shown in the copy of the survey included in Appendix G. In addition, the objective performance data obtained from Compustat was averaged for the three years prior to conducting the survey. Thus, the subjective independent variables and the objective dependent variables were designed to represent a three-year period rather than a single snapshot in time. While this approach does not represent a true longitudinal methodology, it does offer some offset to a research design that only assesses one point in time.

Another potential limitation involves the choice of the PLS product-indicator approach as the methodological tool and procedure for the analysis of the interaction effects in the study. Yet, it should be noted that the PLS product-indicator approach was the only choice that allowed for the testing of interactions within the framework of the structural model, while also allowing for the use of reflective and formative indicators in the model. In addition, any potential limitation in this choice of method only stems from the decision to model the firm-wide IT capability construct with formative indicators. It was this decision and the recommendation of Chin et al. (2003a) that motivated the use of the alternative method for employing the PLS product-indicator approach for testing interaction effects. Furthermore, any potential limitation in this method results only from the fact that the required alternative approach *may* have lowered the ability of PLS to detect an interaction effect (i.e., significance) and to accurately estimate it (Chin et al., 2003b), although there is no evidence of this having occurred. Thus, this issue is discussed here as only a potential limitation because there is no way to be sure that the use of the PLS alternative procedure had any impact on the results of the interaction tests. Therefore, this issue is offered simply as a cautionary explanation.

Future Research

Through the adoption of a longitudinal focus, future research should benefit from follow-up studies that reassess the firm-wide IT capability of the sample firms after several years have elapsed. Such studies could compare the changes in the IT capabilities of the firms between the current and future times and draw conclusions concerning any differences. Such longitudinal studies may help reveal essential information concerning why some firms are better than others at developing superior IT capabilities. A longitudinal focus may also help explain how some IT capabilities evolve over time and under varying environmental conditions. How organizations successfully adapt IT capabilities to changes in the competitive environment is a challenging area of study that rests at the heart of the dynamic capability and resource reconfiguration discussion. Lessons learned about these critical processes would be valuable knowledge for both research and practice.

Another opportunity for future research involves an alternative approach for testing the effects of the moderators used in this study. This procedure would involve splitting the sample into separate groups of firms representing strong and weak extremes for each of the moderator characteristics. For example, the sample could be separated into one group of firms that operate in very turbulent environments versus those firms that operate in very non-turbulent environments. PLS could then be used with the full model and each of the three sub-models to separately test the IT capability relationships with firm performance for both groups of extremes (e.g.., high turbulence versus low turbulence). Such future research would offer another view of the relationships explored in this study and offer a separate evaluation. The results of both studies could be

compared to provide some corroboration of the PLS alternative approach for testing interactions in constructs with formative indicators. While the approach of subdividing the sample into smaller groups would further decrease the sample sizes used in the analysis, because there would be no need to model or test interactions, PLS should be more than adequate to produce dependable results even with the smaller sample sizes (Chin & Newsted, 1999).

A potential avenue of future research could include a replication of this study across a broader sampling frame to also include a selected sample of international firms. The findings of such a study would provide additional validity for the findings of this dissertation and provide additional empirical support for theoretical studies of this subject matter. While this study included a variety of income and expense variables to represent various aspects of firm performance, future studies may find it desirable to include additional objective measures of firm performance to represent an even broader representation of the firm's competitive performance. As a part of such inquiry into additional performance variables, an interesting research question to address would be, "which performance variables provide the best measures of firm performance when the intent is to test the relationship to IT capability?" The pursuit of performance variables that provide a more realistic overall representation of IT performance would be a worthwhile investigation with benefits for both research and practice. In addition, future research may benefit through the use of a methodology that employs multiple respondents within each organization. Such an approach could provide for a triangulation of responses to assess the accuracy of the subjective data and increase confidence in the results.

Conclusion

This study investigated the relationship between a new, multidimensional measure of firm-wide IT capability and objective measures of an organization's competitive performance. No other study was identified in the literature that has empirically tested the relationship between a multidimensional measure of firm-wide IT capability and firm performance. Therefore, this research adds a new empirical assessment of IT business value through the use of a new representation of firm-wide IT capability and in so doing extends the IT business value research stream.

The development of the new instrument provided a response to calls in the literature to develop new theoretically-based, multidimensional instruments to measure firm-wide IT capability (e.g., Santhanam & Hartono, 2003). A new theoretical model that was also developed as a part of this study provided a more comprehensive platform for testing the relationship between firm-wide IT capability and firm performance. By also including moderators from the internal and external environments, this research responded to calls in the literature (e.g., Lu & Ramamurthy, 2004; Wade & Hulland, 2004) to explore the impacts of other influential variables on the relationships in the IT business value model.

The newly developed instrument was used to measure the state of development of IT capabilities within the sampled firms, and this data was used to empirically test the relationships within the new conceptual model. The findings of this research demonstrated that firms leverage IT resources in combination with other complementary IT and/or non-IT resources to create complex, higher-level IT capabilities that work together to form an overall firm-wide IT capability. This concept of an overall or firm-

wide IT capability empirically demonstrated a strong and favorable relationship with the firm's competitive performance. Because the results of past studies have been mixed, this study's finding provides strong evidence for a favorable relationship between IT capability and firm performance and extends the IT business value knowledge base. The fact that this study used a higher-level, more comprehensive, firm-wide representation of IT capability may suggest that the IT-firm performance relationship is more completely evaluated from an overall, organization-wide perspective.

Based upon this sample, the findings of this study provide empirical evidence in support of the idea that firm-wide IT capability enables improved competitive performance for the firm. This is a significant finding for research and practice and suggests that firms should actively work to develop a firm-wide IT capability. While the literature has shown that the formation of IT capabilities takes time, this study suggested that firms may reap positive performance benefits from each of the individual sub-process groups that underlie the firm-wide IT capability construct. This finding suggests that firms may be able to gain incremental performance benefits as they work over time to create an overall, comprehensive firm-wide IT capability. In addition, this research found evidence that the combined benefits of the overall firm-wide IT capability construct may outperform the benefits of any of the individual sub-process groups alone. Thus, this research suggests that firms may reap the greatest benefit through forming a fully developed firm-wide IT capability. Information that can be used by organizations as a starting point for beginning the process of developing the key set of 10 IT capabilities as described in this dissertation can be found within each of the IT capability construct definitions and the respective indicator statements.

In keeping with the idea of a cumulative research tradition (Keen, 1980), it is hoped that this dissertation—with its presentation of a new measurement instrument, its development of a comprehensive theoretical model, and its results from the empirical analysis—will provide a useful foundation for future empirical studies to employ resource-based theory as a lens to examine the more comprehensive conceptualization of IT business value through the relationships between firm-wide IT capability, internal and external influences, and the competitive performance of the firm.

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APPENDICES

APPENDIX A

THE DIFFERENCE BETWEEN IT AND IS

AS DEFINED AND USED WITHIN THIS DISSERTATION

The Definitions for IT and IS as Adopted for Use Within This Dissertation

While the definitions for Information Technology (IT) and Information Systems (IS) can and do vary somewhat among researchers, this dissertation adopts the definitions for IT and IS as defined in a number of popular textbooks. The textbooks referred to here were written by respected authors who have numerous peer-reviewed publications in top Management Information Systems (MIS) journals. The specific definitions offered here are taken from the 2005 textbook written by Turban, Rainer, and Potter (Turban, Rainer, & Potter, 2005).

IT (Information Technology)

In its broadest sense, information technology (IT) is defined as, "an organization's collection of information resources, their users, and the management that oversees them. That is, information technology includes the IT infrastructure and all other information systems in the organization" (p. 36)

(i.e., As defined here, the term IT represents the broadest, all-inclusive, overarching term encompassing the hardware, software, databases, networks, procedures, people, and management in an organization – see definitions for IT infrastructure and IS that follow).

Note: *IT infrastructure* is defined as, "The physical facilities, IT components, IT services, and IT management that support an entire organization." (p. 36)

"Typically, the term information technology (IT) is used interchangeably with information system (IS)." (p. 36)

IS (Information System)

"An information system (IS) [is a process that] collects, processes, stores, analyses, and disseminates information for a specific purpose. An information system is not necessarily computerized, although most of them are." (p. 36)

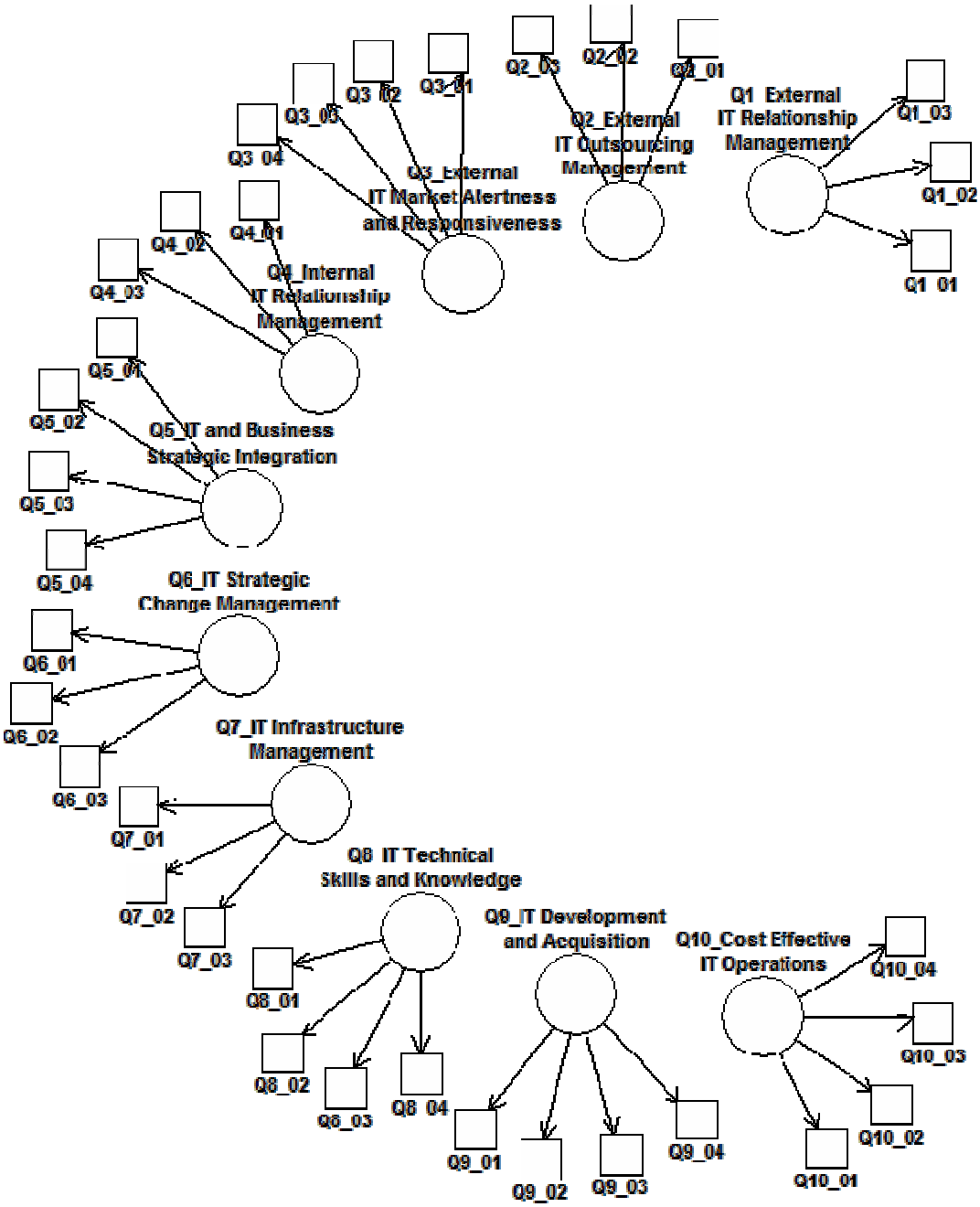
"A computer-based information system (CBIS) is an information system that uses computer technology to perform some or all of its intended tasks. (Note that the term information system is typically used synonymously with the term computer-based information system). Such a system can include as little as a personal computer and software. Or, it may include several thousand computers of various sizes with hundreds of printers, plotters, and other devices, as well as databases and communication networks (wireline and wireless). In most cases an information system also includes people." (pp. 36-37)

"The basic components of an IS include: hardware, software, database, network, procedures, and people. Not every system includes all these components" (p. 37)

APPENDIX B

10-FACTOR, 35-ITEM MEASUREMENT MODEL IN PLS

Measurement Model in PLS
(10 First Order Reflective Constructs with 35 Total Items)



APPENDIX C

RESULTS OF THE PRINCIPAL COMPONENTS ANALYSIS (PCA)

Results of the Principal Components Analysis

Factors→ Items	1	2	3	4	5	6	7	8	9	10
Q5_03	.854	.107	.009	.123	.054	.090	.052	.162	.131	.161
Q5_02	.817	.045	-.011	.185	.300	.006	.114	.058	.130	.147
Q5_01	.718	.048	.007	.209	.249	.219	.107	.049	.144	.088
Q5_04	.692	.103	.156	.093	.111	.171	.095	.020	.288	.293
Q8_01	.055	.879	.078	.091	.171	.004	.023	.059	.081	.164
Q8_02	.049	.786	-.027	.026	.077	-.084	.078	.203	.167	.216
Q8_03	.112	.752	.143	.253	.025	.001	.159	.200	.122	.102
Q8_04	.126	.670	.231	.294	.154	.030	-.008	.187	.034	.037
Q10_03	.000	.104	.918	.050	.124	-.057	.001	.047	.043	.086
Q10_02	.047	.029	.902	.063	.119	.060	.028	.221	.111	.060
Q10_01	.009	.093	.869	-.021	.047	-.072	-.022	.094	.169	.044
Q10_04	.468	.292	.537	-.075	-.199	.048	.161	.186	-.107	.008
Q3_02	.168	.066	-.020	.727	.014	-.002	.225	.232	.186	.357
Q3_03	.260	.251	.099	.695	.070	.190	.233	.257	.046	-.042
Q3_01	.040	.251	-.104	.647	-.066	.034	.132	.145	.210	.395
Q3_04	.333	.330	.086	.597	.231	.063	.173	.113	.013	.073
Q4_02	.236	.121	.081	.147	.799	.168	.187	.125	.071	.018
Q4_03	.175	.214	.015	-.022	.789	.004	.202	.154	.238	.110
Q4_01	.153	.092	.189	.023	.775	.013	.171	.117	.195	.240
Q2_01	.097	-.011	-.155	.032	-.033	.895	.102	-.084	.107	.040
Q2_02	.097	-.057	.072	-.026	.077	.885	.150	.151	-.049	.132
Q2_03	.145	.029	.024	.161	.118	.866	.113	.003	.155	-.015
Q1_02	.111	.119	.100	.159	.207	.133	.839	.006	.043	.022
Q1_03	.103	.017	-.065	.213	.169	.097	.821	.055	.142	.072
Q1_01	.099	.082	.016	.080	.113	.179	.810	.172	.128	.216
Q7_02	-.007	.192	.171	.186	.131	-.025	.036	.808	.149	.119
Q7_03	.183	.172	.150	.116	.117	.011	.199	.773	.118	.073
Q7_01	.158	.294	.191	.268	.157	.109	.007	.717	.053	.102
Q9_01	.188	.145	.130	.178	.327	.098	.191	.154	.748	-.095
Q9_02	.293	.190	.167	.023	.299	.131	.154	.087	.733	.081
Q9_04	.243	.126	.272	.234	.041	.138	.082	.189	.563	.398
Q9_03	.223	.194	.054	.378	.057	.051	.109	.209	.479	.423
Q6_03	.290	.301	.143	.173	.161	.113	.078	.026	-.038	.622
Q6_01	.304	.252	.002	.131	.148	.057	.252	.161	.056	.613
Q6_02	.232	.175	.260	.374	.268	.061	.082	.148	.154	.572

SPSS 13.0 for Windows
Extraction Method: Principal Component Analysis with Varimax Rotation, Kaiser Normalization.

Note:
Items Q3_4, Q9_3, Q9_4, and Q10_4 had loadings below 0.60, but above 0.40. Also, items Q9_3 and Q10_4 had cross-loadings above 0.40, but below 0.50. All items were retained per guidelines for exploratory analysis as outlined by Hair (1998) and Ravichandran & Lertwongsatien (2005), and due to content validity considerations for the factors involved (e.g., Rai et al., 2006).

APPENDIX D

SUMMARY ANALYSIS OF THE MEASUREMENT MODEL: FACTOR STRUCTURE, CRONBACH'S ALPHA RELIABILITY, COMPOSITE RELIABILITY, AND AVERAGE VARIANCE EXTRACTED

Items Per 2nd Order Construct	Factor Structure and Loadings*		
OUTSIDE-IN 2ND Order Construct	IT External Relationship Management (Q1)	IT Outsourcing Management (Q2)	IT Market Alertness and Responsiveness (Q3)
Q1_01	0.8950		
Q1_02	0.8980		
Q1_03	0.8884		
Q2_01		0.9122	
Q2_02		0.9082	
Q2_03		0.9069	
Q3_01			0.8163
Q3_02			0.8808
Q3_03			0.8314
Q3_04			0.7819
Average Variance Extracted	79.9%	82.6%	68.6%
Cronbach's Alpha	87.2%	89.5%	84.6%
Composite Reliability	92.3%	93.5%	89.7%
SPANNING 2ND Order Construct	IT Internal Relationship Management (Q4)	IT and Business Strategic Integration (Q5)	IT Strategic Change Management (Q6)
Q4_01	0.8933		
Q4_02	0.8867		
Q4_03	0.9139		
Q5_01		0.9001	
Q5_02		0.8258	
Q5_03		0.8502	
Q5_04		0.9185	
Q6_01			0.8073
Q6_02			0.8610
Q6_03			0.8294
Average Variance Extracted	80.6%	76.5%	69.4%
Cronbach's Alpha	88.0%	89.7%	77.9%
Composite Reliability	92.6%	92.8%	87.2%

Items Per 2nd Order Construct	Factor Structure and Loadings*			
OUTSIDE-IN 2ND Order Construct	IT Infrastructure Management (Q7)	IT Technical Skills and Knowledge (Q8)	IT Development and Acquisition (Q9)	Cost Effective IT Operations (Q10)
Q7_01	0.8906			
Q7_02	0.8691			
Q7_03	0.8717			
Q8_01		0.8933		
Q8_02		0.8373		
Q8_03		0.8660		
Q8_04		0.8077		
Q9_01			0.8262	
Q9_02			0.8780	
Q9_03			0.8330	
Q9_04			0.7919	
Q10_01				0.8905
Q10_02				0.9379
Q10_03				0.9230
Q10_04				0.6429
Average Variance Extracted	76.9%	72.5%	69.4%	73.4%
Cronbach's Alpha	87.2%	89.5%	84.6%	73.4%
Composite Reliability	90.9%	91.3%	90.0%	91.6%
FIRM-WIDE IT CAPABILITY 2ND Order Construct	The Firm-Wide IT Capability 2nd Order Construct is Formed by all 10 of the 1st Order Constructs			

* Note: All of the 35 item loadings for all 10 constructs were significant at $p < .001$

APPENDIX E

RESULTS OF THE ITEM-TOTAL CORRELATIONS ANALYSIS

(CORRELATIONS OF ITEMS TO CONSTRUCTS)

Correlations of Items to Constructs

Items	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Q1_01	.894**	.320**	.428**	.397**	.330**	.435**	.333**	.261**	.423**	.126
Q1_02	.907**	.283**	.417**	.424**	.315**	.331**	.239**	.263**	.355**	.168*
Q1_03	.879**	.259**	.443**	.394**	.310**	.346**	.241**	.182*	.381**	.029
Q2_01	.247**	.911**	.148	.081	.244**	.113	-.029	-.017	.183*	-.126
Q2_02	.316**	.909**	.174*	.206*	.278**	.227*	.184*	.032	.196*	.098
Q2_03	.315**	.908**	.297**	.260**	.329**	.247**	.147	.094	.354**	.071
Q3_01	.312**	.149	.805**	.191*	.315**	.550**	.382**	.450**	.453**	.059
Q3_02	.435**	.145	.874**	.275**	.447**	.568**	.468**	.373**	.532**	.115
Q3_03	.438**	.280**	.834**	.316**	.442**	.489**	.519**	.454**	.479**	.219*
Q3_04	.396**	.177*	.798**	.418**	.503**	.544**	.439**	.505**	.489**	.211*
Q4_01	.396**	.140	.303**	.891**	.441**	.464**	.368**	.335**	.525**	.295**
Q4_02	.418**	.266**	.371**	.891**	.451**	.459**	.364**	.308**	.461**	.196*
Q4_03	.408**	.132	.309**	.911**	.424**	.436**	.378**	.381**	.518**	.170*
Q5_01	.345**	.358**	.449**	.455**	.848**	.456**	.281**	.257**	.491**	.165*
Q5_02	.335**	.191*	.459**	.513**	.914**	.522**	.293**	.278**	.500**	.170*
Q5_03	.252**	.247**	.465**	.347**	.903**	.503**	.335**	.298**	.490**	.207*
Q5_04	.320**	.298**	.439**	.403**	.829**	.605**	.293**	.303**	.597**	.289**
Q6_01	.405**	.187*	.512**	.407**	.507**	.806**	.379**	.445**	.477**	.181*
Q6_02	.346**	.173*	.621**	.487**	.519**	.864**	.469**	.465**	.592**	.373**
Q6_03	.285**	.179*	.486**	.362**	.462**	.828**	.326**	.440**	.433**	.254**
Q7_01	.239**	.158	.547**	.380**	.362**	.457**	.877**	.524**	.461**	.374**
Q7_02	.216*	.036	.443**	.333**	.220*	.369**	.874**	.451**	.432**	.344**
Q7_03	.336**	.106	.459**	.372**	.332**	.421**	.880**	.411**	.455**	.341**
Q8_01	.189*	.030	.411**	.364**	.237**	.476**	.375**	.890**	.380**	.254**
Q8_02	.215*	-.023	.409**	.302**	.246**	.414**	.432**	.831**	.384**	.179*
Q8_03	.300**	.066	.544**	.294**	.310**	.503**	.492**	.863**	.446**	.313**
Q8_04	.203*	.061	.468**	.329**	.312**	.446**	.480**	.820**	.405**	.350**
Q9_01	.395**	.221*	.423**	.560**	.450**	.350**	.410**	.350**	.807**	.263**
Q9_02	.367**	.252**	.372**	.562**	.519**	.456**	.370**	.367**	.871**	.307**
Q9_03	.356**	.187*	.628**	.373**	.494**	.595**	.466**	.456**	.822**	.216*
Q9_04	.319**	.244**	.526**	.373**	.507**	.586**	.460**	.393**	.825**	.391**
Q10_01	.048	-.062	.086	.177*	.124	.218*	.309**	.246**	.289**	.877**
Q10_02	.132	.082	.189*	.282**	.195*	.308**	.428**	.250**	.363**	.923**
Q10_03	.071	-.047	.126	.252**	.117	.263**	.286**	.271**	.283**	.908**
Q10_04	.173*	.085	.226*	.125	.369**	.323**	.341**	.333**	.246**	.693**

** Correlation is significant at the 0.01 level 1-tailed.
* Correlation is significant at the 0.05 level 1-tailed.

APPENDIX F

REDUCED-SIZE COPIES OF THE LETTERS AND CARDS

COMPRISING THE FOUR MAILINGS OVER

MAY 12TH THROUGH JULY 26TH 2006

First Mailing: Reduced-Size Copy of Letter Used in the Survey
(Mailed on May 12, 2006)

Auburn University

Department of Management
Management Information Systems
415 West Magnolia, Suite 401

Telephone: (334) 8444071
Lowder Business Building
Auburn, Alabama 36849

Mr. Bruce McIntosh
Director, Information Technology
Graco, Inc
PO Box 1441
Minneapolis, MN 55440-1441

Dear Mr. McIntosh,

I am writing to ask for your help in a study investigating how information technology (IT) can be leveraged to enable improved competitive performance in modern businesses. This research is approved by Auburn University and is the basis for my Ph.D. dissertation in Management Information Systems. The goal of this study is to gain a better understanding of the relationship between a firm's IT abilities and improved competitive performance for the firm. Your assistance in this research is critical in helping me to receive enough data to complete my dissertation work and satisfy the requirements for the MIS Ph.D. degree at Auburn University.

You are receiving this request because you were identified as a senior IT manager for your company. Because I know you are busy, I have designed this survey to take no more than 10 minutes of your time. There are only 35 key questions about your firm's IT abilities, and a few other questions regarding your industry and organization. Your responses will mostly involve using a quick and simple 1 to 5 scale to offer your opinion of your firm's IT abilities relative to the other firms in your industry. You may also choose your preference of two available response methods: (1) an online survey, or (2) the enclosed paper survey. Instructions for using either of the two response methods are included on the front cover of the enclosed 2-page survey.

Because your participation is essential to my research, I would like to offer you a free executive summary of the results of this research—as a way of saying 'Thank You' for your response. Your summary will include both the aggregates for all participating companies *in your specific industry*, and the total group aggregates for all participating companies *in all industries* represented. To request your customized executive summary (in electronic form), simply list your preferred email address in the area indicated on your completed survey.

Please be assured that no personal information of any kind will be included in the dataset for this research. Further, any release of the results of this study will only be in aggregate form; so there will be no way that any company or associated individual could be directly or indirectly identified from the results. Of course, your participation is voluntary. However, if you decide you cannot give the 10 minutes needed to complete the questionnaire, please ask another appropriate IT manager in your firm to respond to the survey on your behalf.

If you have any questions about this research, I have included my contact information below and will be happy to speak with you. Finally, please accept in advance my most sincere appreciation for your giving a few minutes of your time to support this practical, yet significant study that examines how IT provides value in the modern business. And, thank you for your help with this crucial part of my Ph.D. dissertation research.

Sincerely,

If you PREFER to complete an ONLINE VERSION of the SURVEY, please use the Web LINK and LOGIN information as shown below:

R. Franklin Morris, Jr. (Frank)
Doctoral Candidate, MIS
Auburn University
Email: morrij3@auburn.edu
Mobile: 334-123-4567

http://business.auburn.edu/surveyBuilder/surveys/IT_value.cfm

Login User ID: Leave the User ID field **Blank**
Login Password: **R70418**

Second Mailing: Reduced-Size Copy of Letter Used in the Survey
(Mailed June 15, 2006 - 5 weeks after 1st mailing))

Auburn University

Department of Management
Management Information Systems
415 West Magnolia, Suite 401

Telephone: (334) 844-4071
Lowder Business Building
Auburn, Alabama 36849

Mr. Michael Dolan
VP, Chief Information Officer
CarMax
4900 Cox Rd
Glen Allen, VA 23060

Dear Mr. Dolan,

About three weeks ago I sent a questionnaire to you that asked for your help in a study investigating how information technology (IT) can be leveraged to enable improved competitive performance in modern businesses. However, at the time of this mailing, I still had not received a response from you. If you have responded since I mailed this follow-up letter, thank you very much for your help! If you have not yet returned your completed survey, please do so within the next two weeks.

The comments from IT executives who have already responded indicate that this is an important topic that can provide real benefits to businesses. Some have described specific strengths and challenges within their particular organizations and industries. Most agree that the results of this study are going to be very useful and have requested a **free copy of the customized executive summary** that I described in the previous mailing.

I am writing to you again because of the importance of your response in helping to obtain accurate results. In addition, **your response is critical in helping me** receive enough data to complete my dissertation work and satisfy the requirements for the MIS Ph.D. degree at Auburn University. Therefore I am asking you, please… **…if you decide that you cannot give the 10 minutes needed to complete the questionnaire, please help me by asking another appropriate IT manager in your firm to respond to the survey in your place.**

As a reminder of the procedures, **this survey is designed to take no more than 10 minutes of your time**. There are only 35 key questions about your firm's IT abilities, and a few other questions regarding your industry and organization. Most responses involve using a quick and simple 1 to 5 scale to offer your opinion of your firm's IT abilities relative to the other firms in your industry. **You may also choose your preference of two available response methods: (1) an online survey, or (2) the enclosed paper survey.** Instructions for using either of the two response methods are included on the front cover of the enclosed questionnaire.

Please be assured that no personal information of any kind will be included in the dataset for this research. Any release of the results of this study will only be in aggregate form so that no company or associated individual could be directly or indirectly identified from the results. If you have questions about this research, my contact information is listed below. Finally, please accept in advance my sincere appreciation for your giving a few minutes of your time to support this practical study that examines how IT provides value in the modern business. And, **thank you for your help with this crucial part of my Ph.D. dissertation research.**

Sincerely,

If you PREFER to complete an ONLINE VERSION of the SURVEY, please use the Web LINK and LOGIN information as shown below:

R. Franklin Morris, Jr. (Frank)
Doctoral Candidate, MIS
Auburn University
Email: morrij3@auburn.edu
Mobile: 334-123-4567

http://business.auburn.edu/surveyBuilder/surveys/IT_value.cfm

Login User ID: Leave the User ID field **Blank**
Login Password: **A70177**

P.S. If you have received this request in error or if the person identified in this letter is no longer associated with your firm, please help me by directing this letter (with the enclosed questionnaire and return envelope) to the appropriate senior IT manager in your organization. Thank you!

Third Mailing: Reduced-Size Copy of Post Card Used in the Survey
(Mailed 1 week after 2nd mailing – June 22, 2006)

June 23, 2006

Last week a 2nd questionnaire seeking your opinions about how IT provides value in the modern business was mailed to you. Your company was selected for this research because of its unique contribution to the total sample of companies. Since the sample is small, your response is critical to the success of this study. Your response is also critical to my personal success because it is needed to complete my Ph.D. dissertation work.

If you have already completed and returned the questionnaire, please accept my sincere thank you! If not, please do so today. Because your company's participation is so crucial, if you are not able to give 10 minutes to complete the questionnaire, **please help me by having another IT manager in your firm respond to the survey in your place**.

You may respond: (1) on paper [use one of the surveys that I mailed to you], or (2) online [type the following web address in your browser, then enter the 6-digit password shown on the label below]: **http://business.auburn.edu/surveyBuilder/surveys/IT_value.cfm**

As a 'Thank You' for your reply, I offer you a free executive summary of the results of this research customized for your industry. Please request your free copy with your response.

R. Franklin Morris, Jr. (Frank)
MIS Doctoral Candidate, Auburn University
morrij3@auburn.edu 334-123-4567

A70001

Fourth Mailing: Reduced-Size Copy of Post Card Used in the Survey
(Mailed 4 weeks after 3rd mailing – July 26, 2006)

July 27, 2006 *"PLEASE…PLEASE…PLEASE"* → *3 "pleas" from me to you…*

This is my 4th request for your opinions about the value of IT in the modern business. Your response is **crucial** in helping me to complete my PhD dissertation and graduate.

If you have already returned your completed questionnaire, please accept my sincere *thank you*! **If not,** (1) **PLEASE do so today**. You may respond: (a) on paper [using one of the questionnaires that I mailed to you], *or* (b) online [by typing the following web address in your browser, then entering the 6-digit password shown on the label below]:

http://business.auburn.edu/surveyBuilder/surveys/IT_value.cfm

Because a reply is critical, if you cannot give 10 minutes to complete the questionnaire, (2) **PLEASE have one of your IT managers respond to the survey in your place**.

→ → **Or, if you prefer NOT TO PARTICIPATE at all**, it is **equally critical** that you (3) **PLEASE send me an EMAIL** at **morrij3@auburn.edu** **and tell me to "remove you from the sample"** (this will **stop future mailings *to you*** and save me time *and* money).

To **'Thank You'** for completing the questionnaire, I offer you a ***free*** executive summary of the results of this research--*customized* for *your* specific industry! *Thanks for your help!*

R. F. Morris, Jr. (Frank) 334-123-4567
MIS Doctoral Candidate, Auburn University

A70001

APPENDIX G

MEASUREMENT INSTRUMENT USED IN THE SURVEY

Reduced Size Copy of Survey Measurement Instrument
(Page 1 of 2)

→ → → → → **BEGIN ON THIS PAGE** ← ← ← ← ←

For each of the items below, circle the number (1 to 5) that best answers the following question: ***Relative to* the other firms in your industry over the past three years, how well does your firm perform in…**	**Inferior To Most**		**Same As Most**		**Superior To Most**
IT external relationship management – *The following 3 questions concern the firm's ability to manage interorganizational relationships with external stakeholders (e.g. customers, suppliers, partners) to deliver high-value IT capabilities.*					
1 working with external stakeholders to leverage shared IT resources to create high-value IT capabilities?	1	2	3	4	5
2 working with external stakeholders to encourage high-value IT entrepreneurial collaborations?	1	2	3	4	5
3 working with external stakeholders to generate high-value IT solutions among the firms?	1	2	3	4	5
IT external sourcing management – *The following 3 questions concern the firm's ability to manage interorganizational relationships with external sourcing providers to deliver high-value IT capabilities.*					
4 analyzing the IT outsourcing market to find those services that deliver high-value IT capabilities?	1	2	3	4	5
5 selecting an IT outsourcing strategy that delivers the high-value IT capabilities needed by the firm?	1	2	3	4	5
6 leading the entire IT outsourcing process to ensure delivery of high-value IT capabilities?	1	2	3	4	5
IT market alertness and responsiveness – *The following 4 questions concern the firm's ability to combine and integrate IT with other resources to enhance firm capacity to stay alert to the market, and to respond quickly and strategically for competitive advantage.*					
7 constantly gathering external information for strategic responses ahead of competition…by combining and integrating IT with other resources to enhance systems for proactively staying alert to the market?	1	2	3	4	5
8 quickly interpreting market information for strategic responses ahead of competition…by combining and integrating IT with other resources to enhance systems for competitive analysis?	1	2	3	4	5
9 quickly deciding among strategic alternatives for market responses…by combining and integrating IT with other resources to enhance systems for decision support?	1	2	3	4	5
10 delivering fast solutions for strategic responses ahead of competition…by combining and integrating IT with other resources to enhance systems for rapid development and implementation?	1	2	3	4	5
IT internal relationship management – *The following 3 questions concern the firm's ability to cultivate internal relationships between IT providers and IT users to promote rich dialogue and positive interaction to deliver high-value IT capabilities.*					
11 building respect between IT providers and IT users?	1	2	3	4	5
12 building internal partnerships (shared project responsibility) between IT providers and IT users?	1	2	3	4	5
13 building internal working relationships between the IT providers and IT users?	1	2	3	4	5
IT and business strategic integration – *The following 4 questions concern the firm's ability to discuss, plan, and integrate a shared vision of the role of IT in the firm's business strategies and activities (i.e. aligning IT and business) to deliver high-value IT capabilities.*					
14 management from IT and business….integrating IT and business strategy to attain strategic alignment?	1	2	3	4	5
15 management from IT and business…creating a shared vision of the role of IT in the business strategy?	1	2	3	4	5
16 management from IT and business…jointly planning how IT will enable the business strategy?	1	2	3	4	5
17 management from IT and business…conferring with each other before making strategic decisions?	1	2	3	4	5
IT strategic change management – *The following 3 questions concern the firm's ability to anticipate, plan, and manage strategic IT change related to technology (hardware, software, applications) to deliver high-value IT capabilities.*					
18 accurately anticipating IT strategic change that is relevant to the firm?	1	2	3	4	5
19 making sure that the firm's IT plan will deliver high-value IT strategic change?	1	2	3	4	5
20 informing management about viable IT options before an IT strategic change decision is made?	1	2	3	4	5
IT infrastructure management – *The following 3 questions concern the firm's ability to provide an IT infrastructure that seamlessly supports current business needs, yet is flexible enough to allow for quick and agile modification in support of the firm's IT plan.*					
21 providing an IT infrastructure that is responsive to current business needs?	1	2	3	4	5
22 providing a flexible IT infrastructure that allows for quick modification in support of the IT plan?	1	2	3	4	5
23 providing an IT infrastructure that allows for the seamless integration of IT services across the firm?	1	2	3	4	5

→ → → → → → → **PLEASE CONTINUE TO THE NEXT PAGE TO COMPLETE THE SURVEY** → → → → → → →

Reduced Size Copy of Survey Measurement Instrument
(Page 2 of 2)

For each of the items below, circle the number (1 to 5) that best answers the following question: ***Relative to* the other firms in your industry over the past three years, how well does your firm perform in…**	Inferior To Most		Same As Most		Superior To Most
IT technical skills and knowledge – *The following 4 questions concern the firm's ability to make sure that IT personnel hold advanced, complex, and difficult to imitate technical skills and knowledge in support of the firm's IT plan.*					
24 making sure that IT personnel hold the IT technical skills/knowledge needed to support the IT plan?	1	2	3	4	5
25 making sure that IT personnel hold the IT technical skills/knowledge needed to support current systems?	1	2	3	4	5
26 making sure that IT personnel hold the IT technical skills/knowledge needed to support the complexities of technology integration?	1	2	3	4	5
27 making sure that IT personnel hold the IT technical skills/knowledge needed to support the integration (and/or transformation) of the firm's legacy systems with new IT?	1	2	3	4	5
IT development and acquisition – *The following 4 questions concern the firm's ability to develop and/or acquire IT (e.g. hardware and software technologies) in an efficient/effective manner while staying ahead of competition on new or emerging technologies and trends.*					
28 utilizing IT development and acquisition systems that deliver efficient/effective results?	1	2	3	4	5
29 utilizing IT development and acquisition systems that allow for rapid development and acquisition?	1	2	3	4	5
30 delivering opportunities for competitive advantage (e.g. first-mover advantages) by exploring relevant emerging technologies and trends prior to the competition?	1	2	3	4	5
31 developing and acquiring technologies that efficiently/effectively support the firm's IT plan?	1	2	3	4	5
cost effective IT operations – *The following 4 questions concern the firm's ability to provide efficient and cost-effective IT operations on an ongoing basis, which contribute to a positive impact on performance.*					
32 controlling IT-related costs to allow for cost-effective IT operations?	1	2	3	4	5
33 avoiding large cost overruns in IT operations?	1	2	3	4	5
34 avoiding persistent cost overruns in IT operations?	1	2	3	4	5
35 keeping management informed about the on-going total cost of IT operations?	1	2	3	4	5

For each of the nine (9) questions below, circle the number (1 to 5) that best answers each question	Strongly Disagree		Neutral		Strongly Agree
The industry environment for your firm is fast-changing, unstable, and difficult to anticipate	1	2	3	4	5
The industry environment for your firm is growing rapidly and is able to support sustained market growth.	1	2	3	4	5
The industry environment for your firm includes a large number of suppliers, competitors, and customers.	1	2	3	4	5
Your firm is a very dynamic and entrepreneurial place with a fundamental commitment to innovation and development.	1	2	3	4	5
Your firm is a very formal and structured place with a fundamental commitment to formal rules and policies.	1	2	3	4	5
In your firm, corporate-level managers have authority over all spheres of activity.	1	2	3	4	5
In your firm, divisional and line-managers have authority over all spheres of activity.	1	2	3	4	5
In your firm, top management is highly active, vocal, and visible in its commitment to supporting, sponsoring, promoting, and championing the role of IT as a key component in the firm's success.	1	2	3	4	5
Your firm's general overall performance (e.g. financial and otherwise) over the past three years was superior to most of the other firms in your industry.	1	2	3	4	5

**** Gender***: ____ Female ____ Male **** Your job title***: _____

**** Your job level***: ____ Senior Executive ____ Upper Management ____ Middle Management Other: _____

**** Your years with this organization?*** _____ years **** Your years of experience in your current job?*** _____ years

→ → **PLEASE NOTE**: To request your copy of the executive summary of the results of this study, please provide a valid email address:

Send my copy to this email address: _____

This concludes the survey. Thank you for your important contribution to this research project.

→ **Please RETURN this SURVEY in the STAMPED, SELF-ADDRESSED ENVELOPE that is provided** ←