

NORTHCENTRAL UNIVERSITY

**ASSESSING THE RELATIONSHIPS AMONG INFORMATION  
TECHNOLOGY FLEXIBILITY, STRATEGIC ALIGNMENT, AND  
INFORMATION TECHNOLOGY EFFECTIVENESS**

A dissertation submitted to  
the graduate faculty of the Department of Business & Technology Management  
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

by

**LAWRENCE R. NESS**

Prescott, Arizona  
May 2005

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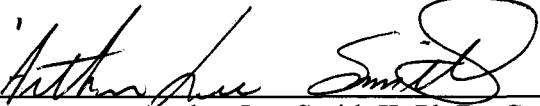
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**DOCTOR OF PHILOSOPHY**

  
Amiram Neiman, Ph.D., Committee Chair

  
Robert E. Hausmann, Ph.D., Committee Member

  
Arthur Lee Smith II, Ph.D., Committee Member

  
Al Endres, Ph.D., Committee Member

May 2005

## Abstract

Increased competitive pressures upon businesses are continuing to escalate, generating the need for greater firm-level efficiency and productivity. Breakthroughs in technology-based services and solutions are driving frequent, rapid, and unplanned changes in business strategies along with the resultant demand upon information technology for supporting services and solutions required to achieve sustained competitive advantage. The degree to which information technology (IT) can effectively and efficiently deliver these services and solutions is known as IT effectiveness.

Strategic alignment has traditionally been viewed as the means to achieve greater IT delivery capabilities, but recent research and trends seem to indicate a growing awareness as to the need for IT flexibility as a means of achieving IT effectiveness. However, there has been a lack of empirical evidence as to the relationships between IT flexibility, IT effectiveness, and/or strategic alignment to validate their relationships and to analyze which, if any, factor has a higher correlation with IT effectiveness. This study, therefore, focuses on the strength of these three relationships and to assess the evidence for the assertion that IT flexibility has a greater influence on IT effectiveness than does strategic alignment.

The results of this research provide empirical evidence supporting the research hypotheses that a positive relationship exists among these three areas. Additionally, the data confirmed that IT flexibility does have a stronger relationship with IT effectiveness than does strategic alignment. In fact, the inclusion of strategic alignment does not improve the prediction power of the construct model, in that IT flexibility carries the weight of explanatory effect of ITE within the construct model.



## Acknowledgements

This dissertation research would not have been possible without the help, patience, and support of many. First, I would like to thank God for His strength, guidance, and for leading me into this life-changing endeavor and towards paths yet unknown. I especially want to thank Carol, my wife of over 25 years, for her strong support and comfort through all the long days and nights and seemingly endless research.

Finally, I offer my sincere gratitude to my mentor, Dr. Haussmann, and to the other dissertation committee members, Dr. Endres, Dr. Neiman, and Dr. Smith, for their guidance, expert advice, and timely feedback. I would also like to thank the department chair, Dr. Harman, for challenging me and for ensuring that the highest academic and research standards were adhered to.

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## Chapter 1: Introduction

### *Statement of Problem*

Businesses are coming under increased pressure as a result of global competition (Watson, Kelly, Galliers, & Brancheau, 1997), increased complexity and economic uncertainty (Kanungo, Duda, & Srinivas, 1999), and a more dynamic and changing marketplace environment (Brown, 2004). These types of turbulent and dynamic market environments are characterized by the absence of any structure resulting in unpredictable patterns of change within the marketplace as well as for the enabling technologies (Knoll & Jarvenpaa, 1994; Scott, 1992). Martin (2002), states that the events of 9/11 and subsequent causal global economic downturn have forced businesses to pursue financial stability and competitive advantage through cost reductions and operational efficiencies. Gates (1999) offers additional insight that these types of operational improvement are often enabled through automation. As a result, information technology (IT) has taken a prominent role within business as a means to achieve not only operational efficiencies, but increased firm productivity and sustained competitive advantage in the face of dynamic change and uncertainty (Fiegenbaum, Sudarshan, & Thomas, 1990). IT executives, therefore, must seek ways to improve delivery capabilities without sacrificing speed, quality, or cost, while simultaneously achieving improved efficiency (e.g., cost reductions) and effectiveness (time-to-market) objectives.

Efficiency is viewed as a way to control cost and to constrain environmental change through the pursuit of narrowly defined range of business activities (Miller & Friesen, 1984). Effectiveness implies the ability of a supporting organization, such as IT, to be responsive in meeting the business' demands (Bartlett & Ghoshal, 1988). The

simultaneous achievement of efficiency and effectiveness becomes a strategic orientation for business, and a primary focus of IT as an enabler of sustained competitive advantage for the business (Ives, Jarvenpaa, & Mason, 1993).

In response to these objectives, strategic planning or strategic alignment has been traditionally viewed as an essential function of business (Austin, Trimm, & Sobczak, 1995), and as a necessary aspect of enabling sustained competitive advantage through coordinated planning between the business and IT (Kearns & Lederer, 2001). This is true to a large extent as strategic alignment continues to be one of the biggest concerns of management (Mayor, 1998; Henderson & Venkatraman, 1991). Studies have shown that strategic alignment is inadequate because the business climate is in a state of dynamic change and innovation (Knoll & Jarvenpaa, 1994). Nevertheless, it has been shown that strategic alignment is very temporal in nature (Broadbent & Weill, 1993), and that it falters over time (Hirscheim & Sabherwal, 2001).

Conversely, studies have shown that the role of IT has become more prevalent as a business partner (Henderson & Venkatraman, 1993) as well as an enabler of business performance and sustained competitive advantage (Labovitz & Rosansky, 1997). To the extent that business relies upon strategic alignment as a means of planning and delivering IT value towards sustained competitive advantage, then as studies indicate (above), the role of IT will be ineffective, and it will actually result in negative value to the business (Walton, 1992).

### *Definition of Terms*

To address these questions, this research will focus on the following three constructs: IT flexibility, IT effectiveness, and strategic alignment. A brief overview follows for each.

*IT flexibility.* Tallon and Kraemer (2003c) and Byrd and Turner (2000) have both defined flexibility as the extent to which management can leverage procedures and processes to control the environment in which they operate. Further, the authors propose that the construct IT infrastructure flexibility (considered by this author as being analogous to that of IT flexibility) is defined as the rapid deployment of technology components as enabled through a firm's existing technical and people base, known as IT infrastructure.

*IT effectiveness.* Differences of opinion exist as to the best definition, dimensions, and measures to use for IT effectiveness (Seddon, Staples, Patnayakuni, & Bowtell, 1999). To ensure overall continuity and to maintain a high degree of construct validity and reliability, this study will incorporate the definition used by Tallon, Kraemer, and Gurbaxani (1999) suggesting that IT effectiveness is defined by how well IT delivers products and services based on the needs, or requirements, of the business. This definition moves beyond IT's theoretical *ability* to deploy new products and services (i.e., IT flexibility), and assesses *actual* performance.

*Strategic alignment.* Slightly modifying the operational definition given by David (2003) to reflect the relationship between the business and IT, strategic alignment can be defined as the art and science of formulating, integrating, and implementing decisions between the business and IT, which enables an organization to achieve its objectives.



According to Feeny and Willcocks (1998), the function of architecture planning is analogous to that of strategic alignment in that a technical blueprint is created enabling IT to effectively respond to the needs of business, both current and future. In addition, the authors suggest that policies should be formulated to ensure that IT flexibility is integrated as an essential part of the alignment between business and IT.

Pierce (2002) suggested that alignment pertained to long-term planning as a strategic process rather than short-term planning as a tactical operational method. Chan, Huff, Barclay, and Copeland (1997) used the terms IT strategic alignment and strategic alignment interchangeably throughout their study suggesting that strategic alignment is measured as the difference between the business unit and IT's strategic orientation. In their study, the authors suggested, and empirical evidence supported, the hypothesis that (IT) strategic alignment was directly related to IT effectiveness.

In a series of studies conducted by Luftman, Lewis, and Oldbach (1993), Luftman and Brier (1999), and Luftman (2003), strategic alignment is viewed as the application of IT according to business strategies, goals, and needs defined. Henderson and Venkatraman (1993) defined strategic alignment as the relationship between two factors, strategic fit and functional integration, and they provided substantial construct factors and definition for each. In conjunction with the thought that alignment was a function of delivery, not planning, Tallon and Kraemer (2003a), defined strategic alignment as the degree to which IT supports the critical functions underlying the business strategy.

Reich and Benbasat (2000) viewed alignment as the degree to which business and IT strategies agree. Similarly, Tan (1999) provided an operational definition for strategic

alignment across the social and intellectual dimensions as being the shared understanding that business and IT have regarding their plans and objectives.

### *Brief Review of Related Literature*

The majority of academic literature focused on the relationships among four or five primary constructs, which included strategic alignment, IT value, and corporate performance (Pierce, 2002; Luftman & Brier, 1999; Venkatraman & Henderson, 1998; Feeny & Willcocks, 1998; and Chan et al., 1997). A segment of research has more recently begun to recognize flexibility as a significant factor and contributor towards the realization of these constructs within the current economic and dynamic business climate (Tallon & Kraemer, 2003a, 2003b, 2003c; Duncan, 1995; Sanchez, 1997; Nemetz & Fry, 1988; and Hatch & Zweig, 2001).

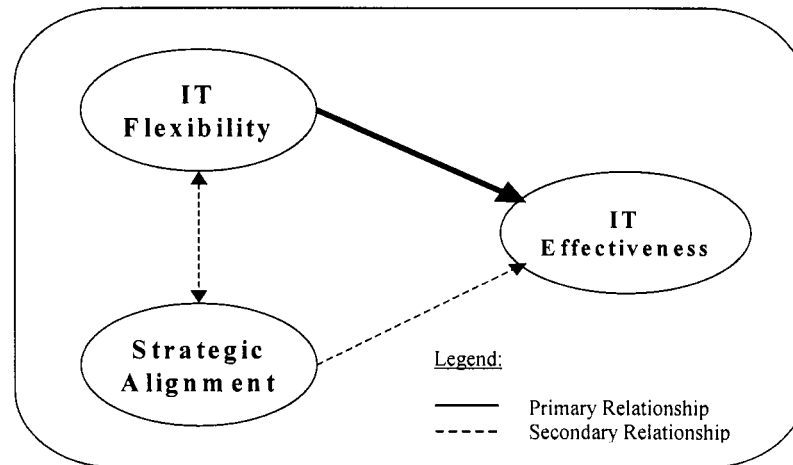
IT flexibility was recognized as a primary contributor to IT effectiveness as a means for corporations to compete in a marketplace of increasing demand and cost pressures (Cooper & Quinn, 1993), which is also known as corporate performance (Porter & Millar, 1985). Chakravarthy (1986), Cool and Schendel (1987), Ginsberg (1984), and Dess and Davis (1984) referred to IT flexibility as a foundation factor, in that IT solutions and business enablers were built upon a flexible infrastructure and without which sustained profitability and competitive advantage could not easily be achieved. Furthermore, the results of prior research pertained to the value and need for strategic alignment as a means of achieving IT effectiveness remained valid. The observations made appeared to suggest that IT flexibility offered a better means of achieving IT effectiveness as well as strategic alignment. One author commented during an informal discussion that achieving true IT “elasticity”, such as flexibility, was the way to achieve

strategic alignment between IT and the business, and not vice versa (Dortch, personal communication, July 7, 2003). Therefore, traditional methods for alignment, as well as the means for achieving IT effectiveness needed to be revisited.

### *Highlights of Methodology*

This research was designed to study the degree to which IT flexibility positively correlates with IT effectiveness as measured by IT's ability to deliver solutions to the business based on changing and increasing levels of demand. Secondly, research assessed the linkage(s) between another key variable known as strategic alignment with both IT flexibility and IT effectiveness. The correlation(s) among these relationships were determined through questionnaires designed to answer the questions: 1) What are the correlations among IT flexibility, IT effectiveness, and strategic alignment, and 2) is the correlation between IT flexibility and IT effectiveness stronger than that between strategic alignment and IT effectiveness?

Figure 1 depicts both IT flexibility and strategic alignment as inputs to IT effectiveness, with strategic alignment viewed as having a symbiotic relationship with IT flexibility towards increased levels of IT effectiveness (thus the two-way arrow). The primary interest of current research was to assess the relationship between IT flexibility and IT effectiveness as a measure of firm success and sustained competitive advantage (Vitale, 1986; DeSantos & Pfeffer, 1991). Secondary to this, yet necessary for hypotheses confirmation, was strategic alignment's influence upon IT effectiveness, as well as its interaction with IT flexibility. The secondary objective provided a measure of comparison between the relative influence of IT flexibility versus that of strategic alignment upon IT effectiveness.



*Figure 1. Conceptual model*

### *Summary of Hypotheses*

As part of current research, the hypothesis was constructed that Information Technology Flexibility (ITF), IT Effectiveness (ITE), and Strategic Alignment (SA) were all positively correlated. The results of research were intended to validate this hypothesis, while supporting the assertion that ITF has a stronger correlation to ITE towards IT's ability to meet changing and often unknown business demands. In addition, this research was intended to show that SA plays an important, but a lesser role than does ITF, in achieving business expectations such as increased profitability and sustained competitive advantage.

### *Limitations of the Study*

The primary limitations of this study were in the inclusion of only large for-profit IT organizations (greater than 80 IT staff members), and the lack of focus on IT value as a result of asserted increased IT effectiveness. Since smaller firms (not a Fortune 1000 or Forbes 500 firm) and IT organizations (less than 80 IT staff) were not surveyed, the relationships among each of the factors were not assessed within the small business

and/or not-for-profit environments. Also, because of limited instrumentation available, research on IT effectiveness was confined to perceptual values of IT service and solutions rather than a more exhaustive study of how effectively IT could better meet business demand as a measure of IT flexibility and/or strategic alignment.

### *Research Expectations*

In response to the above issues faced by business, the relationship among IT flexibility, strategic alignment, and IT effectiveness were assessed with regard to the use of information technology as an enabler of sustained competitive advantage. As noted above, this topic is current with today's business climate where economic pressures, innovation, and competition create an ever-increasing demand for rapid and often unplanned changes to operations based on internal and external factors as well as for the associated products and services to be offered. Tom Peters (1988) anticipated and illustrated this concept in his book *Thriving on Chaos*, by suggesting that change has overtaken and has in essence become the environment in which businesses must operate and compete.

It is reasonable that businesses should expect their investments in technology to result in increased productivity and performance (Sichel & Oliner, 2000), value and profitability (Mason, 2004), and competitive advantage (Clemons, 1991); however studies have found that this is not always the case (Ives, Jarvenpaa, & Mason, 1993). IT departments must become flexible for IT to truly become an enabler of sustained competitive advantage through the simultaneous achievement of efficiency and effectiveness (Allen & Boynton, 1991). Flexibility becomes the primary means by which

IT achieves improved delivery capabilities, which deals with changing business demand and uncertainty (Nemetz & Fry, 1988).

Prior research appears to focus primarily on strategic alignment, rather than IT flexibility, as the key to IT effectiveness, value, and business performance (Luftman, 2003; Burns & Szeto, 2000). Without disregarding the validity of the findings produced through prior research, this study posited that IT flexibility is a better indicator of improved IT effectiveness and produces closer strategic alignment by creating better equilibrium between business demand and IT supply. This perspective is supported by recent research (Tallon & Kraemer, 2003a; Hatch & Zweig, 2001), and is leveraged herein to provide substantial construct validity and reliability.

The importance of this research lies in establishing the potential value of IT flexibility as it relates to the business's ability to compete through IT effectiveness. This challenges the traditional view of strategic alignment as the primary method for achieving business value and IT effectiveness. The research primarily focused on the relationship between the two variables of IT flexibility and IT effectiveness, but it included an assessment of strategic alignment's association with both IT flexibility and effectiveness.

The intent of this research was to contribute to the body of knowledge that could be applied by researchers, businesses, and IT organizations alike to achieve optimal results through flexibility. These findings may be leveraged towards further research targeted at building a theoretical model for IT flexibility assessment such that strategic alignment and IT effectiveness could be optimally achieved. In addition, a possibility for future research is to evaluate the impact of IT delivery methodologies upon IT flexibility, with the assumption being that an effective systems development life cycle (SDLC)

capability, should provide value (e.g., IT effectiveness), regardless of the degree of IT flexibility. This is similar to Luftman's (2003) study, but the focus would be on IT effectiveness rather than strategic alignment as the benefactor of improved delivery capability.

## Chapter 2: Review of Literature

### *Introduction*

The literature supports the general hypothesis that IT flexibility, IT effectiveness, and strategic alignment are positively correlated. The literature also supports the assertion that IT flexibility has a stronger positive correlation with IT effectiveness than strategic alignment and is therefore a better measure of sustained competitive advantage for the business. This chapter concentrates on three areas that are relevant to this study: (1) IT flexibility, (2) IT effectiveness, and (3) strategic alignment.

The section on IT flexibility focuses on recent trends within the industry, which includes terminology and technology. The general value of IT flexibility is reviewed in the literature, and more specifically its relationship towards increased business value. The relationship between IT flexibility with both IT effectiveness and strategic alignment is explored, along with a review of literature discussing the major dimensions of IT flexibility: connectivity, compatibility, and modularity. The section on IT effectiveness covers the various perspectives of IT effectiveness within literature, theoretical models, and measures used to explain and quantify IT effectiveness, and how IT effectiveness is viewed within literature in terms of its relationship with both IT flexibility and strategic alignment. The strategic alignment section covers the historical perspective and importance of strategic alignment to the business and IT, the effective use of available resources, and the implications of having or not having strategic alignment within the organization. The final section reviews the relationship with IT flexibility and IT effectiveness from a strategic alignment perspective, and it discusses the published models, constructs, and measures for assessing strategic alignment.



### *IT Flexibility*

*IT flexibility terminology.* Many terms have been used within the industry and research to describe various aspects of IT flexibility. Terms used within the industry include IT Elasticity (Dortch, 2003), On-Demand (E-Sourcing, 2002), Utility-based Computing (Wladawsky-Berger, 2002), Virtual IT (Venkatraman & Henderson, 1998), Agile IT (Morris & McManus, 2002), IT Transformation (Transformed, 2002), Real-time Enterprise (Flint, 2003a, 2003b), and Organic IT (Gillett, Rutstein, Schreck, Buss, & Liddell, 2002). These are similar in meaning to IT flexibility, but vary in terms of their focus regarding the breadth of IT processes, strategies, methods, and/or tools to achieve true IT flexibility (Robust Processes, 2004). In the same way, a term commonly used in literature is that of IT infrastructure flexibility. While within the industry the term *infrastructure* commonly refers to the networking and platform components of the technical architecture, its meaning has been more broadly applied within research to denote the rapid deployment of technology through a firm's existing technology- and personnel-based resources (Byrd & Turner, 2000; Tallon & Kraemer, 2003c). Therefore, IT flexibility will be considered as being congruent with that of infrastructure flexibility as a basis for comparing and contrasting research findings as well as for providing construct validity and reliability.

*IT flexibility components.* In broader terms, the scope and purpose of IT architecture, as both a function and as a deliverable, provides the context for the components required for true IT flexibility. IT architecture is defined in literature as being the means by which strategy, IT implementation, and IT asset deployment are managed, by depicting how IT assets are constructed and arranged to support business

processes (Spewak & Hill, 1992). IT architecture is an essential part of the IT strategic planning process (Gartner, 1996), which provides linkage to strategic alignment through the alignment of business requirements with IT capabilities. The components of an IT architecture cover the spectrum of IT functions, resources, and technologies, which includes organization, security, applications, data, infrastructure services (network utility applications), infrastructure platform (computing hardware and devices), and network (voice and data communications equipment and circuits) (Federal Reserve Board of Governors, 1999). Supporting this view, Luftman, Lewis, and Oldback (1993), suggest that IT flexibility consists of equipment, software, and services. Pierce (2002) defines these components as hardware, operating systems (OS), database management systems (DBMS), and telecom hardware and software. Mason (2004) describes ITF as progressing beyond mere integration to IT optimization through enterprise application integration (EAI), business process modeling (BPM), and business intelligence (BI). Other references suggest that the entire spectrum of IT should be considered to provide flexibility, which includes infrastructure, applications development, business continuity, and information security (Robust Processes, 2004), as well as integration (Ives, Jarvenpaa, & Mason, 1993) of applications and data.

Kay (2004) observed that a Service Oriented Architecture (SOA) enabled solutions to be flexible by being responsive, dynamic, and allowing near real time processing through the use of standards and components-based applications. Varon (2004) provided a case study in the use of SOA by Allstate insurance company as a means to introduce new products quickly and efficiently to meet competitive business pressures. Using a web-service oriented SOA, Allstate was able to treat all data and

applications as components that could be integrated as needed. Caldwell (2004) observed the emergence of a recent trend towards IT as a provider of utility-like services for the remote delivery of standardized IT services or business processes. This offers a path for continuous optimization in cost efficiency and effectiveness of the IT infrastructure while increasing flexibility to the business through increased innovation. Caldwell viewed IT utility services as a key enabler of strategic alignment as well as IT effectiveness.

Levinson (2004) provided a thorough review of agile programming methods as a means of achieving IT flexibility. Examples of agile programming methods included extreme programming that is characterized by continuous testing of small coding improvement and rapid application development that is contingent upon the reuse of software components. In addition, Levinson suggested that joint application development and iterative development were examples of agile programming. Joint application development involves the end user in design and development, while iterative development allows for change to be made constantly throughout the development process. Iterative and Joint development achieved greater agility and fostered closer alignment by regularly producing new releases of software in close collaboration with business users.

IT staffing resources are a major factor towards enabling IT flexibility through their expertise (Feeny & Ives, 1990). Mahoney & Pandian (1992) observed that firms need to reevaluate staffing needs in response to changing business demands. Young, Karamouzis, Marriott, Iyengar, & Terdiman (2004) found that firms using outsourcing as a strategy for staffing were able to gain efficiencies, flexibility, and focus. Outsourcing offers many options including enhanced speed/timeliness, quality, flexibility, and access

to skills. Offshore outsourcing will allow firms to migrate from simply cost cutting to flexible staffing – further supporting the concept of flexibility as a means of enabling simultaneous efficiency and effectiveness (Nadler & Tushman, 1980) towards sustained competitive advantage (Vitale, 1986).

The literature offered many examples of how these components benefit business through flexibility, providing increased value through a more effective and efficient IT delivery capability. IT capabilities and flexibility account for over 50% of the value businesses receive from their IT investments, which indicates that IT flexibility plays a significant role in the IT value proposition (Brynjolfsson & Hitt, 1995). Similarly, having unified data architectures have been shown to improve ROI by 50% (Mirchandani & Berg, 1998). Kanungo, Duda, and Srinivas (1999) asserted that systems integration along with information retrieval (data), as components of IT flexibility, have provided the greatest influence on IT effectiveness.

*Does IT [flexibility] matter?* In the book, *Does IT Matter?* (Carr, 2004), the author suggested that while IT may supplement a company's strategy, it in itself does not provide a competitive advantage because of technology standardization and availability. If any advantage is gained, it is in the use of technology, but not in the technology itself. In addition, Carr claimed that in order to gain strategic advantage, IT should become more than a commodity, but a differentiator. This view is not entirely without merit in environments where legacy and embedded systems possess few flexibility features (previously described) and have stifled innovation, growth, and competitive advantage by automating the status quo (Ives, Jarvenpaa, & Mason, 1993). Allen and Boynton (1991) provided evidence supporting this view by stating that the legacy systems do not bend,

change, or adapt, therefore, they lack flexibility. Under these circumstances, failure for IT to be flexible resulted in a loss of efficiency, market share, and/or dissatisfied customers (Jarvenpaa & Ives, 1993).

As stated earlier, flexibility is an essential element of today's dynamic and changing global business landscape and increased competition. This is especially true in an age where the Internet enables increased information flow (Hamilton, 1986), and is distributed anywhere, at anytime, to anyone, and in any form (Knoll & Jarvenpaa, 1994), which results in increased competition (Porter & Millar, 1985). Caldwell (2004) found a significant benefit resulting from flexibility that included cost-reduction (efficiency), and alignment between IT and the business. Jarvenpaa and Ives (1993) found that IT flexibility offers optimal levels of effectiveness and alignment in environments having high levels of complexity and change. In contrast, Willcocks (1992) noted that when IT is not flexible, the negative effects of change renders IT as a marginal utility, or even worse, counter-productive to the business objectives.

Flexibility essentially determines the ability of IT to rapidly respond to the business in a rapid and cost-effective manner in situations where business requirements change often and without warning (Duncan, 1995; Gupta & Goyal, 1989). Goldman, Nagel, and Preiss (1995) suggested that agility, which is another form of IT flexibility, was required to operate profitably in an environment of continual change, unpredictability, and changing opportunities. Christiansen (1997) summarizes this perspective by asserting that disruptive technologies, such as the Internet, require that businesses continually innovate and do not become too rigid in their processes. Banker and Kaufmann (1988) are clear in their assertion that many companies can get a jump on

the competition; however without IT flexibility, they would not be able to maintain their advantage. Feeny (1988) extends this thought by suggesting that technology should be avoided if it cannot be defended against the competition. In addition, Parsons (1983) showed that IT has the ability to lower costs, create product differentiation, increase customer-switching costs, combat competitors, and raise market entry barriers. In these situations, IT successfully changed market structures, competition, and strategies.

Finally, several authors viewed IT flexibility as the basis for producing beneficial results to the business (Brynjolfsson & Hitt, 1996; Goldman, Nagel, & Preiss, 1995). These benefits included the ability to rapidly change the organization to be more innovative and adaptive towards a variety of situations within a dynamic environment (Milliman, Von Glinov, & Nathan, 1991). In particular, IT flexibility was viewed as an essential enabler of IT effectiveness, strategic alignment, and ultimately a sustained competitive advantage.

*IT flexibility offers increased business value.* Henderson and Venkatraman (1993) demonstrated how IT flexibility is a major contributor to faster turn-a-round, higher quality, and low inflation of businesses today. The auto industry provided a good example of this when faced with foreign competition. The auto industry used technology and process improvements to cut the time in half from design and production, therefore, reducing error rates by 72 percent. Similarly, a key IT firm, Compaq, used real-time systems to allow it to react to unplanned changes in demand (Gates, 1999).

Levinson (2004) provided several good case studies where IT flexibility added business value. Blue Cross & Blue Shield (BCBS) showed how IT flexibility provided increase value because their IT organization was unable to complete projects, and then

had a lack of organization and direction, which resulted in the overlapping of functions to solve the same problems. Through outsourcing, governance, architectural planning, project management, business case development, and requirements management, IT became more nimble, responsive, and valuable to the business. In addition, Golden Gate University (GGU) illustrated how IT flexibility was used to change from a mixture of unstable and unintegrated legacy systems and platforms that had no real architecture, to become more productive through the use of open system architectures. As a result IT delivers projects seven to 10 times faster, and it allows the business to better achieve defined goals.

The literature is not unified on this point, in that not all authors agree that IT flexibility provided increased value to the organization. The basic premise deals with a reasonable expectation for the business to believe that their investment in IT should have a solid return on investment (ROI) (Bharadwaj, Varadarajan, & Fahy, 1993), and measurable increases to the bottom line (Clemons, 1986; Weill & Broadbent, 1993). Stressman (1990) concluded that there was no correlation between IT spending and profit measures. Similarly, Loveman (1994) found that there was no significant contribution to output as a result of IT expenditures. Roach (1987) asserted that increased levels of IT spending do not lead to increased firm productivity, which maybe referred to as the IT productivity paradox. Schiesser (2002) provided additional perspective suggesting that when technical automation was applied to poorly designed and non-standardized processes, then harm could result. When applied to the correct processes, IT automation can streamline processes, reduce cycle times, increase efficiency, minimize errors, and improve service levels. Others dispelled the assertion that IT does not provide firm value

through the concept of the “lagging effect”, or the period of time between when the IT investment is made and when measurable benefits are incurred (Brynjolfsson, 1993; Lucas, 1999). In addition, Holstein (1996) and Lieberman (1987) found that the lagging effect was especially prevalent in the areas of infrastructure, application, and transformation investments. Therefore, it appears that IT does add value to the business by adding increased investment value and delivery capabilities.

*IT flexibility and IT effectiveness.* Caldwell (2004) stated that IT flexibility increased the firm’s speed of technology adoption, which is another way to say that IT delivered more technology-based products and services to the business, and maybe referred to as IT effectiveness. Kanungo, Duda, and Srinivas (1999) noted that two components of IT flexibility, systems integration and information retrieval, have the largest influence on IT effectiveness. On the other hand, a firm’s limited use of IT flexibility decreased IT effectiveness and firm performance. Middleton (2000) found that the use of prescriptive software development methodologies such as Formal (Andrews & Ince, 1991); Spiral (Boehm, Penedo, Stuckle, Williams, & Pyster, 1984); and Incremental (Gilb, 1988), actually prevented a firm from coping with uncertainty. DeMarco and Lister (1987) expanded upon this by stating that limits on IT flexibility reduced, rather than increased IT and firm-level productivity.

Kanungo, Duda, and Srinivas (1999) applied a method for developing IT effectiveness frameworks called the Interpretive Structural Modeling (ISM) technique. The ISM was used to assess the causal relationships between IT effectiveness factors, with higher stages of development (according to the framework) resulting in increased levels of IT effectiveness. According to their research, significant levels of IT



effectiveness were only visible after a business reached Stage 5 of the ISM.

Organizations achieving Stage 5 or greater were possessed a stable IS organization, the necessary IT infrastructure, and an established IT management operation already in place. These firms were able to enhance both effectiveness and efficiency, versus efficiency only. IT flexibility is reflective of the IT capabilities at this stage, therefore, IT flexibility increases IT effectiveness.

*IT flexibility and strategic alignment.* Similar to its effect on IT effectiveness, Teece, Pisano, and Shuen (1997) argued that IT flexibility influenced strategic alignment. Weill, Subramani, and Broadbent (2002) observed that “defenders” (Miles & Snow, 1978), or organizations that lacked in the area of IT flexibility, had a more difficult time realizing the value from strategic alignment. Chan, Huff, Barclay, and Copeland (1997) showed that increased levels of innovation (another characteristic of IT flexibility) had a strong correlation to strategic alignment. Priesmeyer (1992) took what might be considered an extreme view of this relationship between IT flexibility and strategic alignment by calling upon the chaos theory of management as a means to suggest that planning is fruitless and that essentially the best IT plan is no plan at all. This view essentially implies that IT flexibility alone can provide firm value and that strategic alignment is not necessary. A similar perspective was offered by Porter (1996), who suggested that flexibility rather than planning is needed as a means of alignment based on today’s dynamic environment. Porter supported this view by suggesting that planning (as part of strategic alignment) is inadequate for today’s dynamic environment. Further, Porter suggested that planning attempts to remove variation from uncertainty and follows the positioning school of theory. According to Sun Tzu (1983) and Mintzberg (1994a),

the positioning school of theory attempts to anticipate winning strategies through analysis, rather than thinking, or syntheses (implying flexibility). IT flexibility was cited by Porter (1996) as a necessary means of compensating for the inherent weakness of planning as a function of strategic alignment in today's environment. Perry, Scott, and Smallwood (1993) added that planning needs to be done in real-time, suggesting that businesses cannot afford to rely on planning as the basis for strategic alignment, but must focus on [IT] flexibility.

*IT flexibility definition, measurement, and constructs.* For the purpose of current research, IT flexibility has been hypothesized to be the key for achieving improved IT effectiveness as well as for strategic alignment. Further, IT resources are viewed as a key enabler towards sustained competitive advantage in the marketplace (DeSantos & Pfeffer, 1991) and firm performance (Sabherwal & Chan, 2001). Duncan (1995) suggested that infrastructure is flexible when it can react quickly and effectively to near-term or immediate business demands. Finally, there appeared to be consistency among several of these authors (especially, Tallon & Kraemer, 2003c; Byrd & Turner, 2000; and Duncan, 1995) suggested that the dimensions used for assessing and measuring IT flexibility consists of connectivity, compatibility, and modularity.

In discussing the use of object-oriented programming and an incremental approach to flexibility in software development, Fichman and Kemerer (1993) applied the terms scalability (connectivity), reusability (compatibility), and modularity to denote the same concepts for IT flexibility as did Feeny and Ives (1990) in their study on sustainability and IT value. Likewise, Vessey, Jarvenpaa, and Tractinsky (1992) applied these same terms as part of their evaluation of computer-assisted software engineering

(CASE) tools, specifically pertaining to the five A's of information availability: any volume, anytime, anybody, anywhere, and anything. These authors provided similar definitions in that reusability implies the ability to use an object (e.g., program code) for reasons other than for its intended purpose, while scalability was defined as the ability for an object to be incrementally implemented yet still provide a net positive value. Finally, modularity implies the feasible decomposition of objects (program logic) into more discreet units/components that each is well defined and self-contained. [For purposes of current research, the term, "IT flexibility" was used to represent the construct for the operational definition provided as well as for the three measurement dimensions of connectivity, compatibility, and modularity.]

As it applies to IT flexibility, Duncan (1995) defined connectivity as the ability for technology components to connect to each other inside or outside the traditional boundaries of the organization. Compatibility is viewed as the ability to share, use, or connect to [a variety of] platforms, while modularity is considered as the loose coupling of technical components (i.e., data, applications, and infrastructure) to reduce rigidity and causal business delays associated with maintaining a complex technical environment having multi-layered dependencies.

Duncan (1995) provided an operational definition for infrastructure flexibility (refer to key definitions) as well as a framework that can be used for further evaluations. As stated earlier, the terms infrastructure flexibility and IT flexibility are interchangeable as they each represent the totality of IT resource management. Therefore, Duncan's research and findings can be substantially leveraged as part of current research. Of particular interest is Duncan's observation that strategic alignment, while generally

considered to be a prerequisite to IT flexibility is in fact merely a substitute for flexibility, implying that IT flexibility is the true enabler of strategic alignment not vice versa.

Duncan identified three dimensions, or measures, for IT flexibility, which are connectivity, compatibility, and modularity. These dimensions were obtained from prior studies (Ginsberg, 1984) and were used in subsequent research by Tallon and Kraemer (2003a). Ginsberg (1984) identified these three dimensions as part of the flexibility typology developed for research, while Tallon and Kraemer (2003) applied them as dimensions of IT flexibility towards their evaluation of the relationship between strategic alignment and IT business value.

Tallon and Kraemer (2003a) extended the work previously performed by both Duncan (1995) and Byrd and Turner (2000) to operationalize IT flexibility as having eight primary attributes: IT connectivity, applications functionality, IT compatibility, data transparency, technology management, business knowledge, management knowledge, and technical skills. In a series of studies, Tallon and Kraemer (1999, 2003a, 2003b, 2003c), and Tallon, Kraemer, and Gurbaxani (1999) provided substantial input as to the operational definitions, measures, correlations, and assessments relative to the relationships among several factors, including strategic alignment, IT flexibility, IT effectiveness, IT business value, and return on IT investment. In a recent study, Tallon and Kraemer (2003c) assessed the impact that IT flexibility and strategic flexibility had on the more traditional variables of strategic alignment and IT business value as being a greater influencer of capability and alignment than other variables previously studied.

Research models and studies define flexibility as the renewal and effective use of available resources (Teece, Pisano, & Shuen, 1997) towards the creation of real options

(Benaroch & Kauffman, 1999). Duncan (1995) supported this view by suggesting that IT flexibility implies the ability to use any given resource for more than one end product. Earlier research conducted by Huber and McDaniel (1986) extended this by reflecting on the ease with which these resources (structures and processes) can be changed. Keen's (1991) perspective is that for technology features to be flexible, they must possess the attributes of reach, which is defined as connectivity to multiple locations and environments, and range, or the compatibility of the technology features across the network. Knoll and Jarvenpaa (1994) and Duncan (1995) both used these definitions as a basis for their research.

Sanchez (e.g. 1997) has authored and co-authored several articles on the topic of strategic flexibility that are closely related to that of IT flexibility. Sanchez suggested that firms have traditionally attempted to gain competitive advantage through operational efficiencies and cost reductions, but ultimately they placed severe limits on their ability to respond to change because they became too narrowly focused. Alternatively, Sanchez suggested that to manage uncertainty, both theory and practice must be applied to enhance the businesses ability to leverage strategic flexibility in response to changing technology and market drivers. According to Sanchez, strategic flexibility is defined as having more options available through the combined use of coordination flexibility and the acquisition of flexible resources. While these aspects of strategic flexibility are important for understanding, they vary from that of IT flexibility in that they represent only the strategic uses of IT as a key enabler of business value versus the ability to scale according to business demand. Therefore, strategic flexibility, while an important concept, is considered outside the scope of current research.

Hatch and Zweig (2001) proposed that smaller firms are able to achieve competitive advantage because of their ability to adapt as a result not being constrained by embedded systems, structures, or processes. Based on limited research, it was found that smaller high-growth firms are characterized by having quick decision-making, concentrated governance, and rapid feedback loops resulted in perfect alignment between decision-making and value creation, despite having had a relatively poor competitive strategy. The authors posited that as these firms continue to grow, so do their need for operational efficiency, leading to greater institutionalization of processes and systems resulting in increased rigidity. These considerations are important for current research, particularly in the area of IT flexibility and effectiveness.

Specific to manufacturing companies, Nemetz and Fry (1988) suggested that the use of automated systems created greater flexibility by making automation programmable rather than fixed. The authors indicated that flexibility could then be measured by assessing the ability of an organization to respond to shifts in business demand through coordinated policies and activities. Further, discussing Flexible Manufacturing Systems (FMS), the authors stated that flexibility is the basis for these firms to be cost competitive while maintaining high levels of product quality and dependability. Finally, the authors suggested that flexibility is a requirement of a firm's ability to cope with uncertain demand, while maintaining high quality, rapid delivery, and lower costs. These elements certainly align with the constructs of IT flexibility and IT effectiveness.

IT flexibility often comes at a high price to the organization (Pierce, 2002). Goranson (1999) provided an example of this by citing the competitive environment that existed between McDonald's and Burger King. At first, McDonald's was built for

efficiency. By being lean, and only offering a limited set of products, they were able to gain a competitive advantage based on cost efficiency and margin. To achieve this leadership position, McDonald's made a substantial investment in machinery that could produce many of the same items (i.e., hamburgers) quickly and efficiently. Goranson went on to describe how Burger King was able to capture significant market share based on their focus on agility and being able to produce hamburgers the way the customer wanted them. In order to prevent Burger King from capturing further market share, McDonald's decided to retool all their equipment, systems, and processes to become more flexible in terms of customizing individual products according to customer demand, and being able to offer a variety of products quickly and more effectively. The result is that now McDonald's and Burger King are considered as competing on a level playing field and are operating in a similar manner. This example not only illustrates the cost of flexibility (especially if not built up-front), but also of the need for businesses to be both efficient and effective simultaneously, which is a key attribute of IT flexibility (Ives, Jarvenpaa, & Mason, 1993). Additionally, this example helps to illustrate the necessity and interplay between the three dimensions of IT flexibility: connectivity, compatibility, and modularity.

*IT flexibility dimension: connectivity.* Connectivity denotes the number of platforms that a firm [or entity] can connect to (Duncan, 1995; Tallon & Kraemer, 2003c). Connectivity originally appears to have been derived from the works of Keen (1991) in the application of the term "reach", implying the number of locations to which the platform or technology can link to, or can be connected. Goldman, Nagel, and Preiss (1995) confirmed this concept when they considered agility as a means of competition

and enablement of the virtual organization. In addition, E-Sourcing (2002) recognized connectivity as a means of delivering IT on demand (e.g., IT flexibility).

As an example, Blodgett (2004) documented how Intelsat underwent a radical and rapid transformation to a for-profit enterprise providing network connectivity for businesses worldwide. They needed an integrated systems infrastructure to facilitate the coordination of the aggressive construction demands. IT built a data warehouse as part of a Business Intelligence (BI) initiative to gather more timely and accurate data. The system was built in only three months and the business realized \$150 million in potential salable existing satellite capacity and \$3 million of revenue through improved billing and receivables.

Enterprise Application Integration (EAI) software also provides a good example for both connectivity and as shall be discussed, modularity. EAI is managed separately from the other components and provides improved flexibility by being able to manage data routing and transformation between components more effectively (Altman & Altman, 2004). For instance, by separating the integration layer from the application layer, the overall architecture is less rigid, has fewer built-in dependencies, and allows changes to be made faster and with less risk.

*IT flexibility dimension: compatibility.* Similar to the concept of range, introduced earlier, compatibility denotes the degree to which technical components can seamlessly communicate with each other (Keen, 1991). An example of compatibility is in the area of systems designed using a services oriented architecture (SOA) approach, whereby each layer of the technical architecture is loosely-coupled and follows strict industry standards to ensure that components having similar qualities can effectively communicate to each



other (Kay, 2004). Flexibility, therefore, includes the ability to vary the connectivity, or reach, of the technology, as well as the compatibility, or range, of the technology features. For example, the Internet is more connected and compatible than a Local Area Network (LAN), in that, it can connect more devices to one another (connectivity) and therefore encompasses a wider variety of technology features to interact, functions to be performed, and/or information to be shared.

*IT flexibility dimension: modularity.* Sanchez (1997) introduced the concept of modularity in the areas of product, process, and knowledge architectures as key aspects of flexibility. Sanchez suggested that strategic flexibility is important to manage demand volatility and environments that are in a continual state of flux. Specific to the concept of resource flexibility, Sanchez offered three criteria for providing increased resource flexibility: a larger range of uses for each resource, lowered switching costs and difficulty, and lowered time required to switch from one resource to another. This concept is important as it helps support the aspect of modularity, a key factor of IT flexibility.

#### *IT Effectiveness*

IT effectiveness is an important element of research in that it supports the hypothesis that firms having enhanced IT capabilities (e.g., IT flexibility) are more productive (e.g., IT effectiveness), and as asserted causally experience improved performance (Santhanam & Hartono, 2003; Greenspan, 2000) and sustained competitive advantage (Clemons & Kimbrough, 1986). IT effectiveness research has typically focused on IT value as a dimension of strategic alignment, or as a result of IT flexibility. Few authors appear to have published studies specific to the assessment and measurement

of IT or information system (IS) effectiveness (IT is used throughout this paper as a surrogate for both terms). However, studies from Delone and McLean (1992) and Pitt, Watson, and Kavan (1995) provided substantial analysis, assessment, and construct reliability and validity, as well as measures to consider for the assessment of this construct.

Pitt, Watson, and Kavan (1995) have asserted that IT is basically a service provider of information to the business. They have leveraged this concept into an end user-based measurement instrument to assess the degree of business satisfaction with IT delivery based on expectations versus perceptions. Building upon the construct dimensions defined by Delone and McLean (1992), Pitt, Watson, and Kavan (1995) added one dimension for service quality consisting of five sub-dimensions (tangibles, reliability, responsiveness, assurance, and empathy), along with a measurement instrument that is end-user (not IT) based consisting of 45 questions, 22 each for expectations and perceptions and one as a general predictor of overall service quality for comparison. The construct developed by the authors for measurement purposes called QUALSERVE, adequately measures the level of IT service quality that exists within an organization. Added to the measures developed by Delone and McLean (1992) this provides a comprehensive survey instrument for IT effectiveness.

Tallon, Kraemer, and Gurbaxani (1999) equated IT effectiveness to the level of performance obtained by the IT organization while IT business value is the result of IT effectiveness in terms of the contribution IT makes to the firm's performance. Further, the authors clarified this definition by stating that IT effectiveness is essentially the delivery of reliable and quality service to the business, supporting their long-term goals.

The distinction here between IT effectiveness and IT business value is important in that from a measurement standpoint the elements used to distinguish between the two are in fact different. The dimensions of IT effectiveness defined by the authors are user satisfaction, quality of service, and helpfulness of the IT staff. In reviewing the results of this study, the authors found that IT effectiveness acts as a moderating variable between strategic alignment and IT business value.

The application of these measures for IT effectiveness have broad support within research (Clemons & Row, 1991; Pierce, 2002, Weill & Broadbent, 1998), but are difficult to quantify (Ginzberg & Zmud, 1988). Economic impact methods such as cost-benefit, return on investment (ROI), improved cost control, and firm performance have often been used as a means of measuring IT effectiveness (Bender, 1986; Ahituv, 1980), however, there are many non-IT controlled factors that could negatively affect economic results that render them ineffective as reliable indicators of IT effectiveness (Kanungo, Duda, & Srinivas, 1999). Tallon and Kraemer (2003c) used a construct similar to that of IT effectiveness called IT business value, which assessed the actual performance of the firm and the degree to which IT contributed to performance as a measure of value; however, this construct measures the degree of improvement experienced *by the business*, rather than IT delivery capabilities. Therefore, IT business value is not considered as being synonymous with IT effectiveness and it will not be considered as part of current research.

Delone and McLean (1992) provided meaningful research and analysis in the area of IT effectiveness as measured across the dimensions of user satisfaction and IT strategic contribution. Pitt, Watson, and Kavan (1995) built upon the work of Delone and

McLean by adding a dimension called IT service quality, providing support for the concept of supply versus demand as a method for modeling and measuring the IT effectiveness construct. In their study, Pitt, Watson, and Kavan (1995) defined service quality as the difference between the business user's expectations for information services and the perceived levels of services actually received. This definition corresponds with the idea of demand versus supply and the state of equilibrium as being the measure of alignment between the two. It follows then that IT flexibility provides the capability to adjust output (supply) based on changes to demand such that the degree of equilibrium (between supply and demand) is maximized, thereby improving the degree of IT effectiveness through actual systems, solutions, or services rendered.

The concept of IT supply versus demand as a model (and measure) of IT effectiveness is somewhat similar to the model used by Tallon and Kraemer (2003a) to illustrate strategic alignment as the relationship between IT support provided versus IT utilization required by the business. According to the authors, IT flexibility is deemed as the means for improved alignment, thus providing consistency in the modeling methods followed. Their study also allowed for the assumed positive relationship between IT flexibility and strategic alignment, as discussed within this study.

With regards to the relationship between IT effectiveness and strategic alignment, Tallon, Kraemer, and Gurbaxani (1999) indicate that IT effectiveness is positively related to strategic alignment in that IT can better meet the needs of the business. This supports the notion that IT supply is able to meet business demand through increased and integrated planning between IT and the business (David, 2003). In their study, the IT effectiveness construct is measured across the three dimensions of user satisfaction,

quality of service, and helpfulness of IT staff. While this third dimension is somewhat self explanatory, past studies are available to assist in the understanding of the first two dimensions. Delone and McLean (1992) defined user satisfaction as the response exhibited by a system user based on the results observed (output). Pitt, Watson, and Kavan (1995) defined quality of service (service quality) as being the difference between what a user expects versus what they actually receive. These elements measured the perceived value of IT, and therefore reflect management's view of actual IT performance and accurately measured the reality of solutions implemented (e.g., IT's ability to meet business demand through real results delivered). In addition, the authors concluded that the responses received from either the business or IT are essentially equivalent, therefore they could be posed to either with equal effect. Their study stated that there was no discernable difference between responses received from either IT or business respondents, which implied that perceptions as to actual IT effectiveness are the same regardless of which group is interviewed.

### *Strategic Alignment*

*Strategic alignment overview, need assessment, and limitations.* Strategic alignment has been, and remains, one of the top concerns for both business and IT management (Galliers, 1993; CSC, 2001). Further the interaction and linkages between business and IT strategies remains one of the top objectives among CIO's (Henderson & Venkatraman, 1991). The role of strategic alignment as an essential aspect of firm performance (Brown, 2004; Kearns & Lederer, 2001) and competitive advantage (Grant, 1991) is clear from the literature and should not readily be dismissed. Strategic alignment has been shown to improve organizational effectiveness (Chan & Huff, 1993), maximize

return on investment (Feidler, Gorver, & Teg, 1995), allows companies to better manage their overall business needs, technology, and competition (Boar & AT&T Bell Laboratories, 1994), and provides balance within the organization (Labovitz & Rosansky, 1997).

Rumelt (1979) viewed strategic alignment as a way to remove ambiguity by restructuring an uncertain or unclear reality into solvable problems. Porter (1996) viewed strategy as a means of focusing on performance, effectiveness, and positioning. According to the positioning school of strategy (Mintzberg & Lampel, 1999), success does not happen by chance, but by a firm's ability to put them in a position to succeed through planning and foresight (Sun Tzu, 1983). In this manner, management can attempt to control the environment through planning and attempt to limit change based on uncertainty.

The concept of "fit", or the optimal use of scarce resources to meet a firm's objectives was introduced by Van de Ven and Drazin (1985) and correlates well with strategic alignment from a planning perspective. This is an important concept from the perspective that business and IT plans and strategies need to align for optimal firm performance (Rau & Rau, 1993). Fit theory therefore encompasses both the inclusion of IT capabilities within the business plan (Rockart & Morton, 1984; Itami & Numagami, 1992) and business strategies as part of IT planning (King, Hufnagel, & Grover, 1988). Strategic alignment is therefore manifested by an understanding between business and IT management of their respective objectives and capabilities. In order for this to succeed, top management from business must be involved and committed to the understanding and use of IT as a strategic ally. Christiansen (1997) explained that business strategy is a

driver of business performance, while IT strategy is a business enabler; therefore, IT and business strategies must be intricately linked to be effective. By sharing this knowledge between business and IT, the strategic use of technology is optimized (Goldsmith, 1991). Conversely, if strategic alignment is not a focus within the organization, then IT activities and efforts will be compromised and limited (Willcocks, 1992).

Austin, Trimm, and Sobczak (1995) wrote that there is a lack of fit between business and IT. The authors continued by stating that often, IT is not even considered as part of the strategic planning process, which limits alignment. Ghoshal and Bartlett (1990) suggested that while fit theory may support organizational strategies and structures, the transnational and global network firm models are undermining fit theory as the nature of these firms do not conform to the traditional firm model and processes. Ives, Jarvenpaa, and Mason (1993) concurred that globalization will highlight problems with the internal fit between business and IT resulting from a highly dynamic business environment. In addition, Dillon, Calantore, and Worthing (1979) supported the notion that strategic alignment is not sufficient for planning in the context of dynamic change.

Finally, Tallon and Kraemer (2003c) asserted that business and IT strategies move at different paces, therefore, strategic alignment will never be perfectly achieved. The authors viewed strategic alignment as an ongoing evolutionary, and dynamic, process that further supports the perspective of business demand versus IT supply and the concept of equilibrium as being a state of perfect alignment. The definition for IT flexibility can be extended as the ability of IT to adjust supply to changes in business demand in an attempt to achieve equilibrium, or strategic alignment. Labovitz and Rosansky (1997) see strategic alignment as a means of responding to turbulence and flux towards a

competitive advantage. This can be viewed in light of strategic alignment as a temporal solution and the businesses optimal use of IT as a strategic enabler of business transformation in the face of dynamic change and uncertainty. As such, strategic alignment is best viewed for current research by ensuring the proper and optimal use of IT resources and capabilities. Strategic alignment can be leveraged to optimize IT flexibility towards IT effectiveness as a way of dealing with global uncertainty, and the dynamic changes in the marketplace.

*Strategic alignment and IT flexibility.* As observed by Labovitz and Rosansky (1997), the connection between strategic alignment and IT flexibility is in the ability of IT to plan for and make available IT capabilities for use by the business, and the business to leverage available IT resources (i.e., “fit”). If these IT resources are not flexible, then their availability in a dynamic environment would be limited for business use (Ives, Jarvenpaa, & Mason, 1993). Conversely, a lack of IT planning can result in slack or situations where available [IT] resources are not used (Clemons & Row, 1991), such as when a computer system is not fully utilized and is waiting for work (Davis & Olson, 1985). While slack can be viewed as a good situation in that the capacity exists to do more work, there is an implication that unused capacity is expensive and therefore undesirable. The goal is to match current demand with available supply so that IT investments are optimized at all levels, yet both efficient and effective for current business needs and causal processing requirements (Barney, 1991). IT strategy needs to follow the business strategy, and include both legacy and strategic activities supporting a rapid delivery capability (Rosser, 1997, 2000).



Gartner (1996) suggested that the optimal IT strategy includes a technology strategy (what technologies to be applied), plus an IT strategic plan (how the technologies align with the business), and finally an architecture plan (how the technologies will be configured for optimal use – e.g., flexibility). Earl (1989) identified three components of an IT strategy: an information systems (IS) strategy (application portfolio focused on providing competitive advantage), and IT strategy (focused on infrastructure), and an information management (IM) strategy (focusing on why, who, and how of technology delivery). The IT strategy in collaboration with the business strategy as part of strategic alignment is a very important aspect of IT flexibility and ultimately towards IT effectiveness. To illustrate this relationship, Kearns and Lederer (2001) discussed the concept of “Information Intensity” as an important aspect of the information component within IT flexibility to facilitate business activities supporting the value chain (customers, suppliers, partners, etc.) for goods and services offered. The importance of information as part of strategic alignment is demonstrated by the degree of accuracy, number of times the information is updated, and the extent to which information is used throughout the organization. The greater the information intensity (accuracy, frequency, and penetration), the greater the degree of strategic alignment achieved.

*Strategic alignment model.* Jointly participating on multiple research projects, the Strategic Alignment Model proposed by Henderson and Venkatraman (1993) is considered one of the early works on the topic of business to IT [strategic] alignment, and it is often cited as a basis for additional construct measurement, validation, and correlation. The authors view IT strategy (as part of strategic alignment) across the two domains of internal and external. Together, these domains represent potential factors

within the IT flexibility and/or strategic flexibility constructs reviewed as part of current research. The Strategic Alignment Model consists of four dimensions, consisting of two for each domain. The external dimensions consist of business strategy and IT strategy; the internal dimensions are organizational infrastructure and processes and IT infrastructure and processes. In addition, four perspectives were offered (strategy execution, technology transformation, competitive potential, and service level) where each perspective provides a different view/strategy of the four quadrants. The triangulation between three of the four quadrants provides varying views that may align well with the use of IT flexibility as a core enabler of integration between business and IT. The paper presented by Henderson and Venkatraman (1993) was intended as a model only and the validation was limited to industry knowledge, case study reference, and earlier research. Actual testing, measurement, and observation were therefore not conducted.

Luftman, Lewis, and Oldbach (1993), Luftman and Brier (1999), and Luftman (2003), built upon the Strategic Alignment Model developed by Henderson and Venkatraman (1993) for research into the various aspects of business transformation through strategic alignment. In the first article published Luftman, Lewis, and Oldbach (1993) presented a framework to identify, measure, and improve the use of information technology to achieve competitive and strategic advantage for the enterprise. The technology potential and service level domains identified within this framework and of particular importance and have relevance to potential measures used to assess IT flexibility and IT effectiveness. In their follow-up article Luftman and Brier (1999) conducted a five-year study that provided a methodology for enabling strategic alignment

through maximizing enablers and minimizing inhibitors identified. This study produced a revision to the Strategic Alignment Model, known as The Twelve Components of Alignment, and further validated earlier research. Luftman (2003) provided a method for assessing the degree of strategic alignment achieved through use of Carnegie-Mellon's Capability Maturity Model (CMM) using six dimensions for assessment. The significance of these studies is the operationalization and validation of the constructs used for current research as well as support for the supposition that strategic alignment has traditionally been viewed within academic circles as the primary means for achieving IT value and business effectiveness.

*Strategic flexibility and IT effectiveness.* Regarding the relationship between strategic flexibility and IT effectiveness, Luftman (2003) suggested that strategic alignment, not IT flexibility, is the basis for IT effectiveness, holding with traditional views held within the academic and IT communities. Pyburn (1983) suggests that the very nature of IT planning, as a component of strategic alignment, determine the degree of IT effectiveness achieved. It was found that business processes must often be modified in accordance with IT solutions delivered in order to maximize IT effectiveness (Venkatraman, 1985).

Chan, et al. (1997), affirmed the hypothesis that strategic alignment is positively correlated with IT effectiveness. GAO (1998) points out that the Information Technology (IT) Management Reform Act of 1996 (e.g., Clinger-Cohen Act) requires that CIO's demonstrate improvements through use of IT as measured by efficiency improvements. The view of strategic alignment as a source of efficiency rather than effectiveness supports the assertion that strategic alignment influences IT effectiveness less than IT

flexibility in its ability to achieve simultaneous efficiency and effectiveness as a requirement for business performance and sustained competitive advantage.

*Strategic alignment construct and measures.* Tallon and Kraemer (2003c) included strategic alignment as one of their constructs for research in terms of its correlation with IT flexibility, strategic flexibility, and IT business value. These authors defined strategic alignment, for modeling purposes, as the interaction between key business activities and IT support for those activities. Applying a theory known as dynamic capabilities, the authors assert that strategic alignment is in fact influenced by (IT) flexibility. This assertion is significant and further supports current research. The measures used to support Tallon and Kraemer's study should be of immense value going forward.

Often cited for research addressing the concept of strategic alignment, Chan et al. (1997) used a model previously developed, known as STROBE (strategic orientation of business enterprises) for validation of the relationship between realized business strategy (independent) and business performance (dependent). The authors extended the STROBE model by adding an IT strategic orientation dimension to measure strategic alignment between the business and IT. The revised model, known as STOEPIS, represents the degree of strategic alignment or orientation that can be observed through the implementation of IT applications and/or IT strategies. The refined model depicts the hypothesis that IT strategic alignment (independent variable is defined as the fit between business strategic orientation and IT strategic orientation) is directly related to IT effectiveness (independent variable). The correlation between the STROBE and

STOEPIIS instruments were then used to measure the degree of strategic alignment between the business and IT.

A separate instrument was developed to measure the degree of IT effectiveness such that the degree of correlation could be assessed between strategic alignment and IT effectiveness, thus, providing further validation and reliability to current research. The IT effectiveness construct leveraged the work of Delone and McClean (1992) as the basis for the construct element definition. The authors chose to only use a portion of the IT effectiveness dimensions as their basis for assessment of user satisfaction, the results are still considered to have a high degree of validity and reliability for current research. Of significance is the research and findings from Chan et al.'s (1997) study on the relationships between strategic alignment and IT effectiveness which provided a high degree of reliability and validity and paved the path for subsequent research by Pierce (2002), Luftman, Lewis, and Oldback (1993), Tallon and Kraemer (2003c), and others.

Premkumar and King (1994) defined the measures for strategic alignment as being awareness, specificity, participation, and strategic formulation (in terms of the IT plan). Venkatraman and Gering (2000) suggested that the balanced scorecard approach (Kaplan & Norton, 1996) is a good way to deploy and measure the success of a business strategy (assumed IT inclusion).

Finally, a dissertation published by Pierce (2002) studied the relationship between strategic alignment (consisting of both business and IT strategies) as the independent variable, and return on IT investment and corporate performance as the dependent variables. Of particular interest is the operationalization and research performed on strategic alignment, where the author characterizes strategic alignment between the

business and IT as spanning multiple years, thereby separating short-term planning (tactical) from that of long-term planning (strategic). The author also provided a review of strategic planning theory, but did not attempt to operationalize it for research purposes. This research is of value in that it provides a point of reference regarding the focus placed on strategic alignment within the research community. It also provides validity to the proposition that alignment does positively contribute to IT value and business effectiveness such that this will not need to be proven through additional research.

### *Summary*

The literature is still evolving in the definition and correlations among IT flexibility, IT effectiveness, and strategic alignment; however, it is clear that the global business and competitive landscape is shifting and becoming more complex and dynamic. In light of this, several authors cited above conducted relevant research leading towards a well-founded body of knowledge offering substantial reliability and validity for current research as to the need for IT flexibility and for its interaction with both IT effectiveness and strategic alignment.

### Chapter 3: Methodology

#### *Description of Research Design*

Prior research was used as the basis for construct elements, measures, and instrumentation, as a means for measuring and determining construct reliability, validity, and correlation. The literature search revealed no previous studies that have been conducted that assess the relationships among IT flexibility, IT effectiveness, and strategic alignment simultaneously. However, several authors provided the elements and instrumentation necessary to measure each construct individually and collectively for the current research. In particular, the studies from Tallon and Kraemer (1999b and 2003c) and Pierce (2002), along with her survey format, were used as a means to achieve construct measurement and instrumentation. To gain a richer set of measurement responses, while retaining identical validity and reliability obtained from prior research methods and instrumentation, a 7-point Likert scale of ordinal values was used. Any risk associated with standardizing from 5- and 10-point scales to a 7-point Likert scale was minimized by strictly applying the same measurement elements used within the studies conducted by the authors previously cited. Consistent with prior research, the resulting questionnaire allowed this assessment to occur in a cross-sectional versus a longitudinal manner.

The analyses of ordinal data values were handled through chi-square testing followed by regression analysis. The use of regression analysis for ordinal data types was consistent with prior research by Tallon and Kraemer (2003c) and Pierce (2002). Support for this technique is provided by Jaccard and Wan (1996), who found that the

occurrences of Type I and Type II errors did not appear to be dramatically affected by these kinds of [severe] departures from interval scales.

Because the basis of research is relational (correlational) versus causal, non-experimental (observation) methods were applied rather than the use of more formal experimental methods used to prove cause-and-effect. This allowed some flexibility in assessing the nature of the relationships as well as eliminating potential issues with extraneous variables, if any, since they did not need to be controlled.

#### *Restatement of the Problem*

As the pace of business and competition becomes increasingly rapid, complex, and dynamic resulting from the global network and the proliferation of information sharing and availability, the ability of business to achieve sustained competitive advantage through traditional means, such as strategic alignment, is rapidly deteriorating. The role of IT as a means to simply automate existing business processes and to achieve cost efficiencies is stifling firms' performance by institutionalizing current business models and inhibiting rapid changes based on competitive pressures and/or economic uncertainty. Businesses must evolve to recognize the extent to which technology has become a primary enabler of products and services offered as well as information and processes applied. IT flexibility is therefore viewed, in the context of this research as the potential cornerstone of business transformation, firm effectiveness, and ultimately sustained competitive advantage through increased IT effectiveness and strategic alignment between business and IT.



*Statement of Hypothesis*

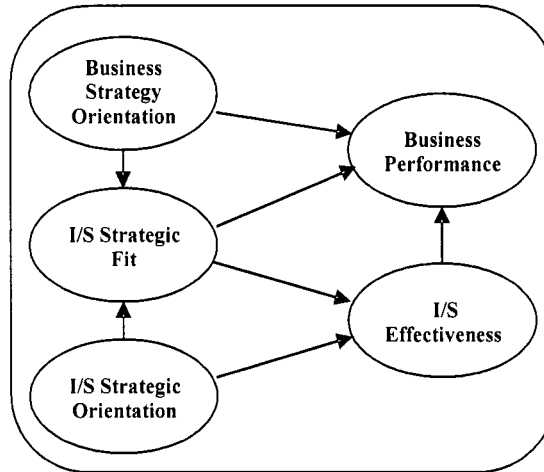
This research provided feedback regarding the validity of the following hypotheses:

- H1<sub>0</sub>:** IT flexibility is not positively correlated with IT effectiveness
- H<sub>1</sub>:** IT flexibility is positively correlated with IT effectiveness
- H2<sub>0</sub>:** Strategic alignment is not positively correlated with IT effectiveness
- H<sub>2</sub>:** Strategic alignment is positively correlated with IT effectiveness
- H3<sub>0</sub>:** IT flexibility is not positively correlated with strategic alignment
- H<sub>3</sub>:** IT flexibility is positively correlated with strategic alignment
- H4<sub>0</sub>:** Strategic alignment has an equal or greater positive correlation with IT effectiveness than does IT flexibility
- H<sub>4</sub>:** IT flexibility has a higher positive correlation to IT effectiveness than does strategic alignment

The relationship between IT effectiveness and strategic alignment (H<sub>2</sub>) was shown to be positively correlated by Tallon and Kraemer (1999a) as well as by Chan et al. (1997). Similarly, the positive correlation between IT flexibility and strategic alignment (H<sub>3</sub>) was shown to be true through the research of Tallon and Kraemer (2003a, 2003b, 2003c). While a direct correlation between IT flexibility and IT effectiveness (H<sub>1</sub>) was not evident in prior research, findings by these same authors indicated that both strategic alignment and IT flexibility were positively correlated to the IT business value construct (as a surrogate for IT effectiveness). Based on this, by implication, it appeared that a positive correlation between IT flexibility and IT effectiveness may be true. What has not been shown through prior research, and which this study addressed, is the extent that IT

flexibility is correlated with *both* strategic alignment and IT effectiveness as opposed to the traditional view that strategic alignment alone is the basis for IT effectiveness. This perspective was clearly observed through the research conducted by Chan et al. (1997, p. 126), and used by Pierce (2002, p. 55) as the basis for her research framework (2002, p. 16). The assertion made, and which the measurement results were expected to confirm, was that IT flexibility has a greater level of positive association with IT effectiveness than does strategic alignment, therefore, it should show a stronger positive correlation (H<sub>4</sub>).

Taken as a whole, the literature reviewed provided significant reliability and validity from which operational definitions can be made as well as the assertion that these constructs are related and a conceptual construct model could be derived (Figure 2). It should be noted that for current research, the “I/S strategic fit” factor shown in Figure 2 is essentially equivalent to strategic alignment as viewed for current research. As a result of this study, further research was performed to assess the nature of these relationships, and to determine where correlations may exist in response to the questions posed and to validate formally the stated hypotheses.



Source: Chan, et al. (1997), and Pierce (2002).

*Figure 2. Traditional perspective (strategic alignment)*

#### *Operational Definition of Variables*

Elements used to assess each of the constructs (IT flexibility, IT effectiveness, and strategic alignment) were primarily obtained from prior research. These elements provided a valuable source for data gathering and measurement as their validity and reliability has been substantiated through prior research and peer review. Specific construct domain definition and elements are as follows:

*IT flexibility.* As previously stated, the primary dimensions used to represent the IT flexibility construct are those used in research by Tallon and Kraemer (2003c - as originally defined by Byrd & Turner, 2000) consisting of connectivity, modularity, and compatibility. The specific research instrument questions (e.g., elements) that were used to assess each dimension are as follows:

- Connectivity (source: Tallon & Kraemer, 2003c p. 36):
  - Our systems are sufficiently flexible to incorporate electronic links to external parties.
  - Our company has a high degree of systems inter-connectivity.
  - All remote offices and mobile personnel can connect to a central office.
  - Our firm applies open systems network mechanisms to boost connectivity (e.g., ATM).
  - Corporate databases are accessed through many different protocols (e.g., SQL).
  
- Modularity (source: Tallon & Kraemer, 2003c, p. 36):
  - Reusable software modules are widely used throughout our systems development group.
  - Legacy systems within our firm do not hamper the development of new IT applications.
  - Functionality can be quickly added to critical applications based on end-user requests.
  - Data is captured and made available to everyone in the company in real time.
  - Data rules and relations (e.g., tax rules, pricing) are not hard coded into applications.
  
- Compatibility (source: Tallon & Kraemer, 2003c, p. 36):
  - Our firm uses enterprise systems to achieve integration (e.g., Oracle, SAP).
  - Our business is not limited by our choice of operating system (e.g., UNIX, Windows).

- Software applications can be easily transported and used across multiple platforms.
- Our company makes extensive use of middleware to integrate key enterprise applications.
- Our company offers multiple interfaces or entry points (e.g., Internet) to external users.

Collectively, the three above dimensions constituted the overall scoring for the IT flexibility construct; however, there existed an optional correlation assessment opportunity to see if one dimension was more dominant than another in determining the degree to which IT flexibility may or may not exist.

*IT effectiveness.* To measure IT effectiveness, and to ensure construct reliability, the elements (e.g., “items”) used by Tallon, Kraemer, and Gurbaxani (1999) to measure strategic flexibility appeared to be closely aligned operationally, and they provided the best source of measurement. These are as follows (source: Tallon, Kraemer, and Gurbaxani 1999 p. 31):

Q. Compared to other IT units with which you are familiar, how do you rate the IT services of your unit in terms of the following dimensions?

- Overall quality of service
- Users’ satisfaction with IT
- Helpfulness of IT staff to users

*Strategic alignment.* Discussing the area of IT strategic planning, Pierce (2002) stated that when implemented, a successful IT plan should improve the business or

reduce IT costs, closely align IT goals with the business focus of the company, include information about the fundamentals of the business, and be dynamic.

Specific elements (or “items”) identified by Pierce in her research regarding the coordination of business and IT plans were very closely aligned to that required for strategic alignment. The elements defined by Pierce were therefore used as the basis for current research, as follows (source: Pierce, 2002 pp. 178-179):

- Our IT planners are aware of the firm’s objectives, business strategies and long-term goals.
- Our firm’s business plans provide clear directions for IT planning.
- Our IT managers participate in strategic business planning.
- Our IT and business planners interact closely in the formulation of the IT strategic plan.
- Our IT strategic plan is independently developed without significant effort to support business strategy using IT.
- Our IT strategy is derived from business strategy.
- Our business and IT strategies are fully integrated and developed together.

The responses to each of the above questions represented the extent to which the respondents agreed or disagreed with each statement as it related to their businesses specific IT functions and/or capabilities. Consistent with the methodology for this study, the 7-point Likert scale was therefore used as the basis for data collection and analysis.

#### *Description of Materials and Instruments*

Appendix A depicts the sources, assessment criteria and elements determined for each construct. Unless otherwise noted, the questions used have not been modified from

their original source. The survey instrument itself (Appendix B) was modified to reflect only the pertinent elements required for the current research topic and constructs, and is based on the questionnaire format developed by Pierce (2002); however, it included only those elements that were pertinent to current research. All construct-specific questions were standardized using a 7-point Likert Scale for assessment. As previously mentioned, these varied somewhat from the 5-, 7-, and 10-point ordinal scales used as part of their specific research instruments; however, it is assumed that the effects of such a change were minimal, as the relative scoring should not influence the validity of the elements used for measurement. In addition, a section was added to gather general and background information to aid in the assessment and follow-up activities anticipated. These additional items were assumed to have no direct bearing on the computational aspects of the construct correlations. The questions used for general and background purposes were modified from their source (Pierce, 2002) in order to better conform to the current research's requirements and overall instrumentation.

#### *Reliability and Validity Analysis*

Reliability and validity are essential characteristics of research because they ensure the adequacy of research and the validity of the conclusions. The ability to repeat these tests over time with the same degree of accuracy and precision is an important component of research design and instrumentation. This section will review prior research and the validity as well as reliability results cited from Tallon and Kraemer (2003c) and Pierce (2002), whose instrumentation was applied in the current research.

With regard to the reliability of each construct, an extensive history of research has been performed for each of the construct operational definitions and measures

applied. Specifically, the IT flexibility construct was referenced by Tallon and Kraemer (2003c) as having links back to research conducted by the authors Byrd and Turner (2000), and Duncan (1995). IT effectiveness, using Tallon and Kraemer's (2003c) strategic flexibility as a surrogate, has links to research conducted by Nemetz and Fry (1988), Sanchez (1995), and others. Finally, several authors, including Pierce (2002), Luftman, Lewis, and Oldbach (1993), Luftman and Brier (1999), and Luftman (2003), Henderson and Venkatraman (1993), Chan et al. (1997), and Tallon and Kraemer (1999, 2003a, 2003b, 2003c) provided an operational definition, and a set of measures for strategic alignment, plus, cited each others' work as the basis for construct reliability and validity.

With respect to reliability and validity assessments performed on existing instrumentation, Tallon, Kraemer, and Gurbaxani (1999) used Confirmatory Factor Analysis (CFA) and Pierce (2002) used Cronbach's Alpha to ensure the validity of their instrumentation. In both cases, the instrumentation displayed a high degree of validity. Using Cronbach's Alpha to assess construct validity for the reliability of the strategic alignment construct, Pierce indicated that the results measured exceeded the 0.5 to 0.6 acceptable baseline levels (Nunnally, 1978). Tallon and Kraemer (2003c) also used Cronbach's Alpha as their basis for assessing the validity for the IT flexibility construct, resulting in a value greater than 0.70, and still considered acceptable for construct validity by Nunnally. Similarly, Tallon, Kraemer, and Gurbaxani (1999) indicated that their composite CFA analysis confirmed construct validity and showed a high degree of reliability, and exceeded the suggested acceptable baseline of 0.80 (Werts, Linn & Jöreskog, 1974).



### *Selection of Subjects*

In terms of the targeted survey respondents, they needed not be both IT and a business executive, but someone who had extensive knowledge of IT and its relationship to the business. In most cases this was identified as the senior IT manager (including CIO or CTO). While it is recognized that parallel surveys distributed to both IT and business executives would provide greater measurement validity, it was viewed as neither being practical nor necessary within the parameters of this study. The effort to send and receive parallel surveys to CEO and CIO respondents would require a significantly higher number of surveys to be distributed to achieve the required number of responses requiring the sample population to be doubled and resulting in anticipated lower response rates. In addition, both Tallon and Chan appear to have supported the notion of distributing a single survey to the CIO, or top IT official. Tallon, Kraemer, and Gurbaxani (1999) recognized that the CIO's survey feedback was a valid and reliable as that of the CEO. Chan et al. (1997) recognized that in many cases the CEO would simply give the survey to the CIO to complete, thus, supporting the notion that the surveys for current research could be sent to the IT head while maintaining a high degree of validity and reliability.

One of the most difficult aspects of this activity was obtaining a reliable and accurate sampling frame of qualified recipients. All studies cited appeared to use different sampling frames, so it didn't seem to matter which source was used as the results appeared to be consistent across all sampling frames (esp. Pierce, 2002, Tallon, Kraemer, & Gurbaxani, 1999, and Tallon & Kraemer, 2003c). Scanning the Internet for sampling frame sources a company called Applied Computer Research, Inc. (ACR) was

identified ([www.ITMarketIntelligence.com](http://www.ITMarketIntelligence.com)). ACR maintains a list of top-ranking IT executives (along with their titles and business addresses) of US-based firms having at least 80 IT employees or listed as a Fortune 1000 or Forbes 500 company. For current research, 3080 names were purchased representing 2872 for-profit firms across the United States (US) having 80 or more IT employees or listed as part of either the Fortune 1000 or the Forbes 500. This combination was important for study validity since a non-profit firm may not strive for competitive advantage in their use of IT as do for-profit firms. In addition, larger firms provided greater assurance that the business had a higher level of reliance on IT effectiveness through strategic planning and/or technology solutions provided (CIO Research, 2004). These larger firms were believed by this author to have greater issues associated with legacy IT infrastructures and/or ineffective strategic alignment leading to reduced levels of IT effectiveness, while having greater opportunities for enhanced performance through IT flexibility. As previously acknowledged, the ability to assess the relationships of organizational size with IT flexibility, IT effectiveness, and strategic alignment would make for valuable research, but is beyond the scope of this study.

### *Procedures*

Questionnaires (Appendix B) were selected as the primary method for data collection and were distributed CIO's and senior IT executives nationwide (see "Selection of Subjects"). In order to determine the minimum number of completed surveys required, a power analysis was performed using G\*Power software (source: <http://www.psych.uni-duesseldorf.de/aap/projects/gpower/>). Applying a high effect size of 0.80 (Cohen, 1988), a significance (alpha) level of .05, and a power of 0.80, the

recommended effective sample size was 42. Because of the inherent nature of the target survey recipients, a low response rate of approximately 3% was assumed, therefore, rather than distributing a random subset of surveys to the sample population, surveys were sent to all 3080 CIO's and senior IT executives at large IT organizations.

Through a memo distributed to the target respondents (Appendix C), a direct link was embedded (i.e., [www.ncu.edu/ness](http://www.ncu.edu/ness)) whereby the recipient could simply complete the survey online (using SurveyMonkey.com). This method for collecting survey responses provided an expedient method for data collection and analysis while adequately representing the written instrumentation leveraged from prior research (see "Description of Research Design"). Pilot testing was deemed unnecessary as the instrumentation used paralleled that of research previously cited. In addition to the survey memos distributed, each respondent was given the option to also participate in a more detailed follow-up interview to assess specific examples or circumstances within the company that the respondent represented. Based on these post-survey interviews (Appendix D), a more complete picture could then be obtained in order to enhance the insights and/or analysis as to the actual relationships at that company and to obtain working examples for citation purposes. Unless the respondent specifically requested follow-up, subject anonymity was protected by not requiring personal information to be submitted within the questionnaire responses, as well as through the use of summary statistics within the final research paper submitted. For all follow-up responses received, respondent anonymity was also maintained by only documenting their responses in terms of their response ID number assigned by SurveyMonkey, and not by any other identifying attribute.

### *Discussion of Data Processing*

With regards to prior studies researched, the primary method used by Tallon, Kraemer, and Gurbaxani (1999), and again by Tallon and Kraemer (2003c) to estimate their conceptual models was structural equation modeling using partial least squares (PLS). The authors preferred this approach to other covariance-based techniques (such as LISREL<sup>®</sup> for causal modeling) as PLS is not restricted by sample size or distribution assumptions. To determine the goodness of fit between variables and the strengths of their relationships, the authors applied Confirmatory Factor Analysis (CFA), with maximum likelihood estimation. To test for discriminant and convergent validity, two-factor pairing was performed.

Pierce (2002) applied the PLS method using least squares estimation rather than maximum likelihood for analyzing her research model. Pierce used SPSS<sup>®</sup> software to calculate Pearson's correlation coefficient to determine the relationship, if any, between the dependent and independent variables. SPSS<sup>®</sup> was also used to determine the probability that the hypotheses may be true by performing a one-way ANOVA analysis. Finally, Pierce calculated the coefficient alpha to determine how well the instrument scaled (based on Nunnally's, 1978, objective of 0.5 – 0.6), and chi-square one-sample test to address possible non-response bias.

For the current research, survey results were assessed through computational analysis using chi-square crosstabs (2x2) to ensure that the hypothesized relationships exist between ITF, ITE, and SA as ordinal response sets (per the Likert-scale used). Multiple regression modeling was then applied using the equation,  $Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_1X_2 + \varepsilon$ , based on one target variable, IT effectiveness (Y), the predictor variables,

IT flexibility ( $X_1$ ) and strategic alignment ( $X_2$ ) and their interaction term ( $X_1X_2$ ). Multiple regression analysis was performed as confirmation to the chi-square results obtained as well as to provide comparative analysis to the results obtained through prior research and for analysis of any potential interaction between IT flexibility and strategic alignment. The regression model was evaluated through multiple analysis techniques (including the stepwise regression method within SPSS<sup>®</sup>). The stepwise method was further analyzed using the higher-order factor values for each construct. The strength of each relationship was then evaluated based on the correlation coefficients and the statistical significance level calculated for each factor and the interaction term. Through the use of the full regression model, the results confirmed both the existence of covariance between factors, as well as whether one or more of the predictor variables ( $X_1$  and/or  $X_2$ ) influenced the target variable ( $Y$ ). By assessing the relative impact of IT flexibility ( $X_1$ ) and strategic alignment ( $X_2$ ) upon IT effectiveness ( $Y$ ) this also provided evidence of whether IT flexibility has a higher correlation to IT effectiveness than does strategic alignment ( $H_4$ ). In addition, the significance of the covariance between the two predictor variables, IT flexibility and strategic alignment was determined through evaluation of the interaction term ( $\beta_3X_1X_2$ ). SPSS<sup>®</sup> for Windows Grad Pack ([www.spss.com](http://www.spss.com)) was used as the basis for the above calculations and analysis.

In summary, the statistical methods applied for current research using chi-square and multiple regression analysis confirmed the research results obtained by Tallon, Kraemer, and Gurbaxani (1999), Tallon and Kraemer (2003c), and Pierce (2002) and produced the results necessary for data analysis, hypothesis testing, and validation of the conceptual model associated with the current research.

### *Methodological Assumptions and Limitations*

This study focused on the larger segment of US-based for-profit corporations. The results should not be construed to represent small-to-medium sized firms, nor non-profit entities. In addition, the results span multiple types of businesses (i.e., financial, service, retail, etc.), and they should not be interpreted as being representative of any specific industry specialization. Finally, the use of the Internet as a method for taking and collecting survey responses was different than the paper-based forms traditionally used, but it seemed to be an acceptable approach in today's "digital age." This method for survey participant was viewed as being in line with the technical inclinations of the target audience of CIO's and IT executives and having negligible effect on actual results obtained.

### *Ethical Assurances*

All work submitted is the work of this author, or has been cited based on research performed, if obtained from outside sources. Measures were taken to help ensure the integrity of research by adequately defining research constructs, hypotheses, and measures to avoid deception, and to provide the recipient's with the data necessary to make an informed consent regarding their participation. Those who provided their consent (by responding to the questionnaire), did so voluntarily, and they had the option to disclose their identity on the survey response form, or leave it blank for anonymity. In terms of participant data, survey names and addresses were obtained through legitimate means and used in a respectful and confidential manner.

The survey memo distributed to each research participant and the survey itself provided sufficient information as to inform them of the nature and purpose of the study,

to reassure them about the confidentiality of their responses, and how the results would be used. The participants were given an opportunity to participate in a follow-up case study and/or to receive a summary of the research results. This provided a viable means for debriefing the participants in case they had any concerns about how their responses may be used, or if answering the questions provides any level of emotion stress or psychological harm.

## Chapter 4: Findings

### *Overview*

This chapter provides data and data analyses pertaining to the results of the methodology previously described in Chapter Three. Information regarding respondent characteristics and data collected for each of the factor measures is presented along with an assessment as to data reliability. Subsequently, an analysis of the findings relative to the conceptual framework developed (Figure 1) is presented, beginning with an analysis of the paired correlations, followed by an examination of hypotheses and validation of the conceptual model. Finally, respondent post-survey feedback is documented as a means of confirming and illustrating the findings and analysis identified through research.

### *Findings*

*Survey distribution and responses.* Survey memos were distributed to the sample population of 3080 CIO's and IT executives for large organizations. Of these, 86 responses were received within the timeframe allotted for statistical analysis and follow-up; however, one was excluded as it only contained a partial response and did not sufficiently cover the elements needed to provide meaningful analysis. As predicted, this represents a relatively low response rate of 2.8% as compared to those received as part of the primary studies referenced for both Pierce (2002) and Tallon and Kraemer (2003c) which were in the 13-15%, or greater, range. The responses were collected through surveymonkey.com, downloaded into an Excel<sup>®</sup> spreadsheet, and then subsequently copied into SPSS<sup>®</sup> as the primary means for statistical data analysis. Of the 85 responses



retained, 16 follow-up interviews were distributed by email with four responses received (see Appendix E).

*Respondent demographic and business/IT practices.* In addition to the 25 questions asked regarding ITF, ITE, and SA, there were seven additional questions and the opportunity to add comments for informational and/or background purposes (see Appendix A). The first three dealt with the respondent's title, number of years in IT, and number of years at the company they currently represented (refer to Table 1). Of particular note is the large percentage of CIO's responding as well as the number of years all respondents have been in the IT field. With 38 of the 85 respondents (44.71%) holding the position and/or title of CIO, and 62 of 85 (72.94%) having at least 20 years of IT experience, this certainly lends much credibility to the responses received along with feedback and insights obtained from the questionnaire and follow-up interviews submitted. These results provide some degree of substantiation that businesses (and especially IT) have been in a high degree of flux with over half of the respondents having 10 years or less of tenure at their current firm. This result is lower than that found by Pierce (2002), in that, she found that the average length of tenure for CIO's at their current firm was 13.6 years.

The results would appear to support the assertion that CIO turnover has increased given the increased levels of uncertainty and competitive pressures in recent years (Martin, 2002). In contrast to this finding is the fact that over a quarter of the respondents have been with their company for over 20 years. This gives some credence to the importance of IT within the business and the value of effective senior IT executives within the corporation in helping to navigate their way through change and to achieve

sustained competitive advantage through IT flexibility, IT effectiveness, and strategic alignment.

*Table 1*

*Characteristics of CIO's and IT Executives (Frequency Distribution)*

Title	%	Years in IT	%	Years with firm	%
CIO	44.71%	1-5	2.35%	1-5	24.71%
Senior VP / VP	23.53%	6-10	5.88%	6-10	30.59%
Director	18.82%	11-15	5.88%	11-15	7.06%
Other	10.59%	16-20	12.94%	16-20	11.76%
No response	2.35%	20+	72.94%	20+	25.88%
Total	100.00%		100.00%		100.00%

To assess the relative frequency of each firm's IT planning efforts and as a way to provide context to the overall scores obtained for the strategic alignment construct, a series of questions was asked to each respondent regarding their IT strategy and planning practices (see Table 2 and Table 3). The findings indicate that IT strategies are considered as being fully documented one-third of the time and on the average are updated yearly. The planning horizons for the IT and business strategies closely align at just under 3.5 years each, while the largest single percentage of responses indicated a three year planning cycle for both.

Table 2

*IT Strategy Planning Practices Frequency Distribution – Part 1*

Is IT strategy fully documented?	%	How often is IT strategy updated?	%
Yes	65.88	Quarterly	10.71
No	34.12	Semi-Yearly	14.29
		Yearly	52.38
		1-3 Years	19.05
		3+ Years	3.57
Totals	100.00		100.00

Table 3

*IT Strategy Planning Practices Frequency Distribution - Part 2*

Planning horizon for IT strategy	%	Planning horizon for business strategy	%
1 Year	4.71	1 Year	8.43
2 Years	11.76	2 Years	13.25
3 Years	54.12	3 Years	44.58
4 Years	5.88	4 Years	6.02
5 Years	22.35	5 Years	20.48
Other	1.18	Other	7.23
Totals	100.00		100.00

The next set of questions was asked to establish context and understanding, beyond those of the construct elements themselves, in the areas of IT effectiveness and IT flexibility. Tables 4 through 6 depict the results of these questions specific to the respondent's perception of delivery capabilities within their firm, including IT flexibility, and internal IT Systems Development Life Cycle (SDLC) processes. When asked how they would rate their IT organizations ability to meet new demand for systems and services, 41.18% responded as a six out of seven (very high), reflecting a high degree of confidence for IT's ability to deliver (i.e., IT effectiveness).

Regarding the flexibility of their IT organization (i.e., IT flexibility), 40% indicated a high degree of flexibility at a rating of six out of seven (high), with over 75% rated as above average to high. Finally, when ranking their SDLC processes as a possible means of effectiveness and flexibility, the responses were less robust at approximately 39% having a ranking of only five out of seven.

*Table 4*

*IT Effectiveness Perceptions (Frequency Distribution)*

How would you rate your IT organization's ability to meet business demand for systems and services?	%
1 (Very Low)	1.18
2	2.35
3	5.88
4	8.24
5	32.94
6	41.18
7 (Very High)	8.24
Total	100.00

*Table 5**IT Flexibility Perceptions (Frequency Distribution)*

---

Is your IT organization flexible?	%
1 (Strongly Disagree)	0.00
2	3.53
3	9.41
4	11.76
5	25.88
6	40.00
7 (Strongly Agree)	9.41
Total	100.00

---

Table 6

*IT Delivery Process Perceptions (Frequency Distribution)*

How would you rate your IT organizations' overall SDLC processes?	%
1 (Very Weak)	4.71
2	3.53
3	11.76
4	12.94
5	38.82
6	21.18
7 (Very Strong)	7.06
Total	100.00

*IT flexibility (ITF) responses.* The survey contained 15 questions to measure the degree of IT flexibility within each firm (see Appendix E). For purposes of data collection, analysis, and reporting, these questions have been assigned variables labeled from ITF1 through ITF15, each corresponding to the questions representing the ITF construct. Each question used an ordinal ranking structure ranging from a response of “disagree” having a value of one, to “agree” having a value of seven. Each group of five questions was then further assigned to their respective ITF dimension of connectivity, modularity, or compatibility. Tables 7 through 9 contain the statistics representing the survey feedback collected from the 85 participants for each of these three dimensions.

Table 7

*IT Connectivity Response Statistics and Frequency Distributions*

Dimension	Connectivity (Mean = 5.59)				
Element / Scale	ITF1	ITF2	ITF3	ITF4	ITF5
	%	%	%	%	%
1 (Disagree)	3.53	0.00	2.35	3.53	2.35
2	4.71	7.06	1.18	2.35	4.71
3	7.06	3.53	1.18	5.88	5.88
4 (Neutral)	5.88	4.71	3.53	9.41	12.94
5	25.88	25.88	5.88	18.82	28.24
6	24.71	25.88	21.18	25.88	21.18
7 (Agree)	28.24	32.94	64.71	34.12	24.71
Total	100.00	100.00	100.00	100.00	100.00
Mean	5.33	5.59	6.32	5.52	5.22



Table 8

*IT Modularity Response Statistics and Frequency Distributions*

Dimension	Modularity (Mean = 5.33)				
	ITF6	ITF7	ITF8	ITF9	ITF10
Element / Scale	%	%	%	%	%
1 (Disagree)	8.24	9.41	3.53	12.94	4.71
2	11.76	14.12	12.94	17.65	8.24
3	16.47	23.53	20.00	22.35	8.24
4 (Neutral)	24.71	12.94	17.65	16.47	12.94
5	22.35	14.12	23.53	11.76	21.18
6	7.06	12.94	15.29	7.06	25.88
7 (Agree)	9.41	12.94	7.06	11.76	18.82
Total	100.00	100.00	100.00	100.00	100.00
Mean	4.00	3.99	4.19	3.65	4.91

Table 9

*IT Compatibility Response Statistics and Frequency Distributions*

Dimension	Compatibility (Mean = 5.01)				
	ITF11	ITF12	ITF13	ITF14	ITF15
Element / Scale	%	%	%	%	%
1 (Disagree)	14.12	3.53	9.41	5.88	4.71
2	10.59	7.06	28.24	8.24	5.88
3	7.06	5.88	12.94	5.88	8.24
4 (Neutral)	9.41	5.88	15.29	17.65	11.76
5	17.65	14.12	21.18	28.24	23.53
6	18.82	31.76	5.88	20.00	22.35
7 (Agree)	22.35	31.76	7.06	14.12	23.53
Total	100.00	100.00	100.00	100.00	100.00
Mean	4.52	5.42	3.56	4.71	5.05

*IT effectiveness (ITE) responses.* The survey contained three questions to measure the degree of IT effectiveness within each firm (see Appendix E). For purposes of data collection, analysis, and reporting, these questions have been assigned variables labeled from ITE1 through ITE3, each corresponding to the questions representing the ITE construct. Each question used an ordinal ranking structure ranging from a response of “disagree” having a value of one, to “agree” having a value of seven. Table 10 contains

the statistics representing the survey feedback collected from the 85 participants, including the frequency distributions as well as each items median, mean, and mode scores.

*Table 10*

*IT Effectiveness Response Statistics and Frequency Distributions*

Element / Scale	ITE1	ITE2	ITE3
	%	%	%
1 (Disagree)	0.00	0.00	0.00
2	2.35	3.53	1.18
3	3.53	3.53	1.18
4 (Neutral)	4.71	8.24	3.53
5	17.65	30.59	21.18
6	51.76	42.35	48.24
7 (Agree)	20.00	11.76	24.71
Total	100.00	100.00	100.00
Mean	5.73	5.40	5.88

*Strategic alignment (SA) responses.* The survey contained seven questions to measure the degree of strategic alignment within each firm (see Appendix E). For purposes of data collection, analysis, and reporting, these questions have been assigned variables labeled from SA1 through SA7, each corresponding to the questions representing the SA construct. Each question used an ordinal ranking structure ranging

from a response of “disagree” having a value of one, to “agree” having a value of seven. Table 11 contains the statistics representing the survey feedback collected from the 85 participants, including the frequency distribution as well as their respective median, mean, and mode scores across each item.

As noted by the asterisk (\*) for element SA5 (Table 11), the structure of questioning used by Pierce (2002) in her dissertation and as used for this study represented a negative response, having opposite values from the rest of the construct elements. As such, these values were normalized by reversing their value such that a response of one, representing a strength in the combined planning of IT and business strategies, became a seven in order to better reflect the overall model being depicted and measured.

*Table 11**Strategic Alignment Response Frequency Distributions and Statistics*

Element / Scale	SA1	SA2	SA3	SA4	SA5*	SA6	SA7
	%	%	%	%	%	%	%
1 (Disagree)	0.00	2.35	2.35	1.18	2.35	0.00	10.59
2	0.00	7.06	8.24	8.24	2.35	1.18	9.41
3	2.35	10.59	9.41	7.06	7.06	3.53	10.59
4 (Neutral)	4.71	15.29	4.71	11.76	9.41	8.24	12.94
5	18.82	23.53	17.65	23.53	17.65	21.18	18.82
6	27.06	24.71	24.71	28.24	22.35	34.12	23.53
7 (Agree)	47.06	16.47	32.94	20.00	38.82	31.76	14.12
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Mean	6.12	4.91	5.33	5.13	5.60	5.79	4.47

*Assessment of Reliability*

The survey sample set and data collected has shown to be both valid and reliable. Based on the power analysis performed in Chapter 3, a sample size of 42 was recommended to achieve sufficient statistical power. This recommendation was exceeded at 85 cases. In addition, the overall Cronbach's Alpha score as a model for internal consistency (based on the average correlation between standardized items) was .70 and is above the 0.5-0.6 range recommended by Nunnally (1978) as a minimum to substantiate the reliability of the measures used.

### *Analysis and Evaluation of Findings*

*Paired Factor Analysis.* Chi-square and multiple regression analyses were performed to analyze each of the paired factor relationships, correlations, and/or significance. Chi-square results are depicted in Table 12 and indicate that Pearson's chi-square is significant for all paired factors at  $\chi^2(1, N = 85) = 16.133, p < .05$  for ITF-ITE;  $\chi^2(1, N = 85) = 4.107, p < .05$  for ITE-SA; and  $\chi^2(1, N = 85) = 8.584, p < .05$  for ITF-SA. These results validate the existence of a statistically significant relationship between each of the factors. In addition, Pearson's R, or Phi, provided evidence that positive correlations exist between ITE and ITF ( $r = .435, p < .001$ ), ITE and SA ( $r = .220, p < .043$ ), and ITF and SA ( $r = .318, p < .01$ ).

Each pair also shows some degree of explanatory value at  $r^2 = .189$  for the pair ITE-ITF,  $r^2 = .048$  for the pair ITE-SA, and  $r^2 = .101$  for the pair ITF-SA. Applying Cohen's Rule of Thumb (Cohen, 1988), the effect size of these correlations is considered small to insubstantial. While it can be observed that the variances explained by each pair are somewhat low, the results are statistically significant ( $p < .05$ ) and therefore validate the results and their respective findings.

Table 12

*Chi-Square Crosstabs Analysis Results (n=85)*

	<b>ITE-ITF</b>	<b>ITE-SA</b>	<b>ITF-SA</b>
Pearson's chi-square <sup>1</sup>	16.133	4.107	8.584
Phi/Pearson's R	.435	.220	.318
R-Square (calculated)	.189	.048	.101
Approx. Sig. <sup>2</sup>	.000	.043	.003

<sup>1</sup> Zero cells (0%) having expected count less than 5. Critical value at  $\chi^2_{.050}=3.841$ .

<sup>2</sup> Based on normal approximation (per SPSS®).

Based on the chi-square results demonstrating the existence of a relationship between the paired factors, further analysis were then performed with ITE as the target (dependent) variable and ITF, SA, as well as the interaction term ITFxSA as the predictor (independent) variables. Individual paired correlations were then performed for each of the primary constructs, ITF, ITE, and SA, and further validated that each of the paired groupings between the target, predictor, and interaction variables were indeed positively correlated (see Table 13). According to the results, ITE and ITF were positively correlated at  $r=.553$  ( $p<.001$ ,  $r^2=.306$ ), and ITE and SA were also positively correlated at  $r=.355$ ,  $p<.001$  although the strength of this relationship was noticeably lower ( $r^2=.126$ ). The two predictor factors of ITF and SA were positively correlated at  $r=.405$ ,  $p<.001$ , showing moderate strength ( $r^2=.164$ ). In addition, the interaction term was positively correlated with ITE at  $r=.517$  ( $p<.001$ ,  $r^2=.267$ ). The corresponding effect sizes are slightly modified upward in that they range from small to moderate (Cohen, 1988).

Table 13

*Inter-scale Correlation Results (n=85)*

	<b>ITE-ITF</b>	<b>ITE-SA</b>	<b>ITF-SA</b>	<b>ITE-ITFxSA</b>
Pearson's Correlation (r)	.553	.355	.405	.517
R-Square (r <sup>2</sup> )	.306	.126	.164	.267
Sig. (p)	<.001	<.001	<.001	<.001

Scatter plots for both of the primary paired factors, ITF-ITE and SA-ITE, were created for the full response set (n=85) to visually demonstrate the results obtained. These can be viewed in Figures 3 and 4, respectively. Figure 3, ITF vs. ITE, demonstrates the linear relationship between IT effectiveness and IT flexibility, but having a high degree of variability as can be observed through the number and relative distance of points away from the regression line, and having a higher probability of being outside of the 1.5 Inter-Quartile Range (IQR), used within this study as the basis for outlier determination. Figure 4, SA vs. ITE, demonstrates a higher level of variability and reflects the reason for having the lower r-squared value. The impact of this will become more apparent as multiple regression analyses are presented later in this chapter.



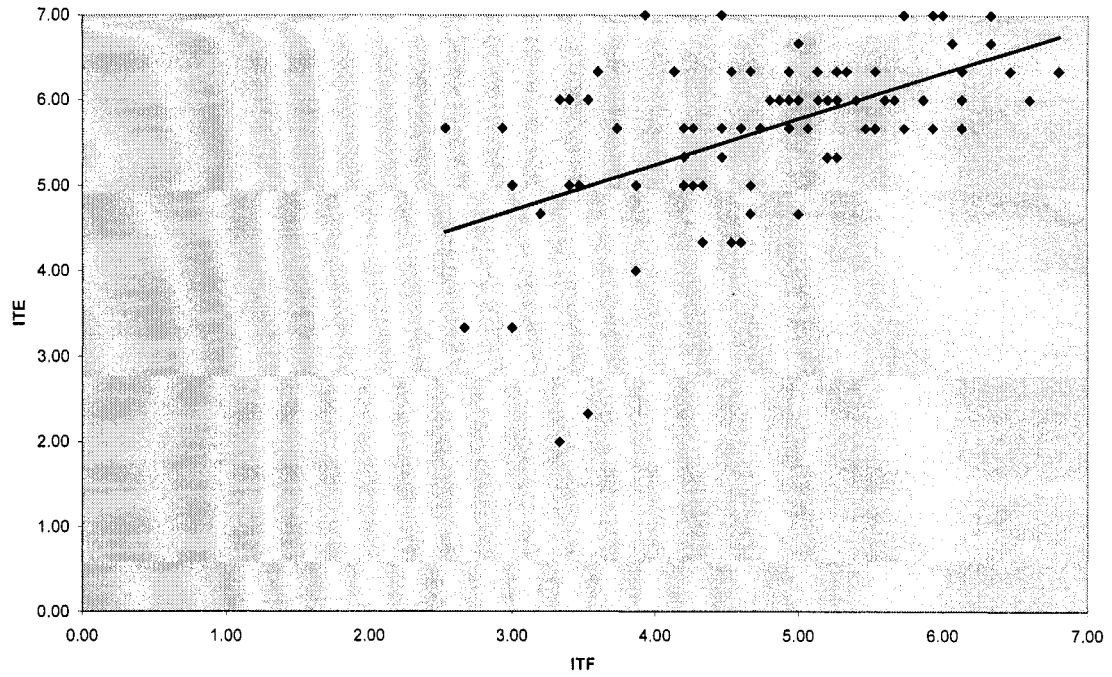


Figure 3. *ITF vs. ITE Scatter plot (n=85)*

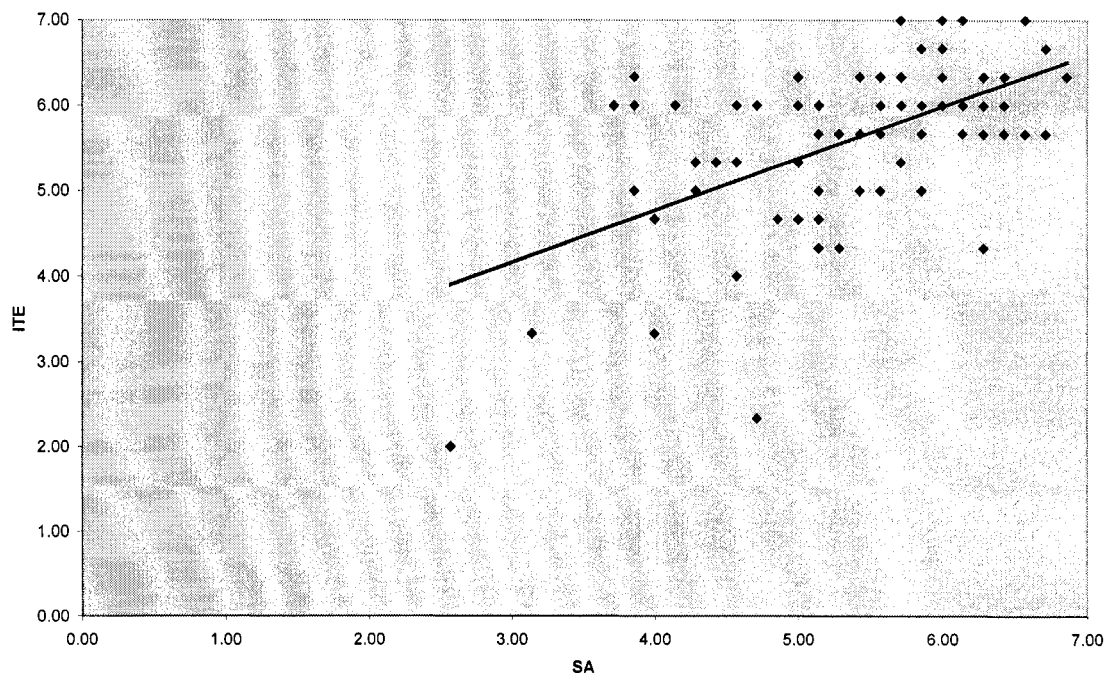
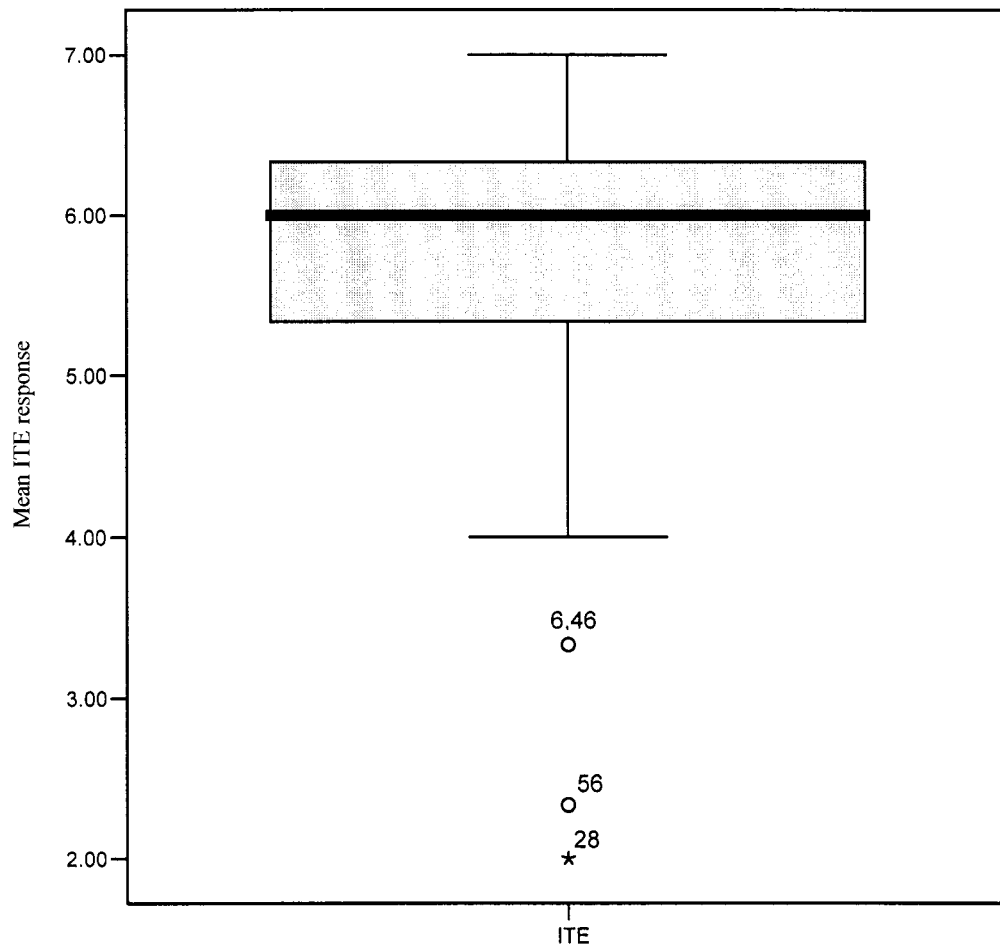


Figure 4. *SA vs. ITE Scatter plot (n=85)*

As can also be observed in reviewing the plots in Figures 3 and 4, there appears to be several outliers that may be significant in terms of their possible impact to the regression results obtained. To objectively confirm the existence of outliers within the target variable ITE, as a basis for removing them from the data set used for regression calculations, a box and whisker plot (see Figure 5) was completed. Any response set outside of 1.5IQR was removed from the full response set (n=85) for further analysis.



*Figure 5. ITE Box and Whisker Plot (n=85)*

The results indicated that four response sets (set numbers 6, 28, 46, and 56) fell outside of the 1.5IQR criteria and were therefore removed, leaving a total of 81 responses for analysis.

Note that the chi-square results for the reduced response set are still significant for all paired factors at  $\chi^2(1, N = 81) = 13.208, p < .05$  for ITF-ITE;  $\chi^2(1, N = 81) = 3.240, p < .05$  for ITE-SA; and  $\chi^2(1, N = 81) = 7.498, p < .05$  for ITF-SA. The associated Pearson's R, or Phi, also continued to provide evidence that positive correlations exist between ITE and ITF ( $r = .404, p < .001$ ), ITE and SA ( $r = .200, p = .073$ ), and ITF and SA ( $r = .304, p < .01$ ). Each pair continues to show some degree of explanatory value at  $r^2 = .163$  for the pair ITE-ITF,  $r^2 = .040$  for the pair ITE-SA, and  $r^2 = .092$  for the pair ITF-SA. Re-applying Cohen's Rule of Thumb (Cohen, 1988), the effect size of these correlations remains small to insubstantial (including the interaction term).

In addition, the inter-scale correlations were recalculated to reflect the reduced sample size ( $n = 81$ ), and are depicted in Table 14. Individual paired correlations were once again derived for each of the primary constructs, ITF, ITE, and SA, and further validated that each of the paired groupings between the target, predictor, and interaction variables were still positively correlated. According to the results, ITE and ITF were positively correlated at  $r = .454$  ( $p < .001, r^2 = .206$ ), and ITE and SA were also positively correlated at  $r = .261$  ( $p < .001, r^2 = .068$ ). The two predictor factors of ITF and SA were positively correlated at  $r = .336$  ( $p < .001, r^2 = .113$ ). In addition, the interaction term remained positively correlated with ITE at  $r = .430$  ( $p < .001, r^2 = .185$ ). The corresponding effect sizes continue to show the same pattern as they move slightly upward from their respective  $r^2$  values in that they range from small to moderate (Cohen, 1988), although at the revised response level of  $n = 81$ , the correlational effect size for the paired factors ITE-SA now become inconsequential according to this same criteria.

Table 14

*Inter-scale Correlation Results (n=81)*

	ITE-ITF	ITE-SA	ITF-SA	ITE-ITFxSA
Pearson's Correlation (r)	.457	.262	.336	.432
R-Square (r <sup>2</sup> )	.209	.069	.113	.187
Sig. (p)	<.001	<.05	.001	<.001

These results confirmed findings previously obtained using the full observation sets at n=85, but better reflect the true correlations due to the removal of outlier responses from the dataset.

After removal of the outliers, the scatter plots depicted in Figures 6 and 7 continued to indicate evidence of heteroscedasticity, albeit to a lesser extent, and therefore had the potential to violate the linear regression assumption of homoscedasticity.

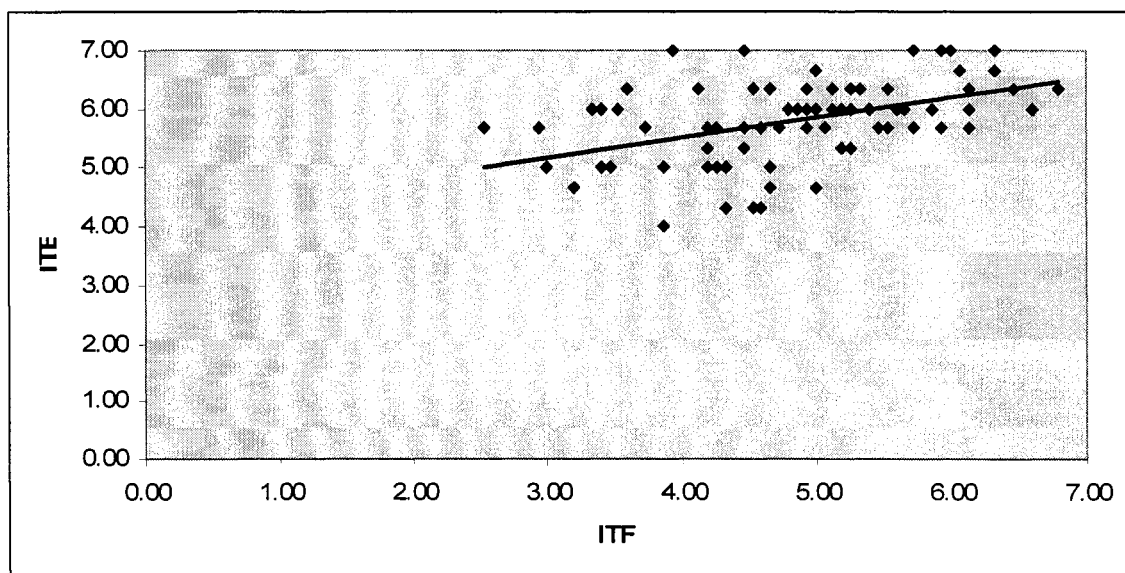


Figure 6. *ITF vs. ITE Scatter plot (n=81)*

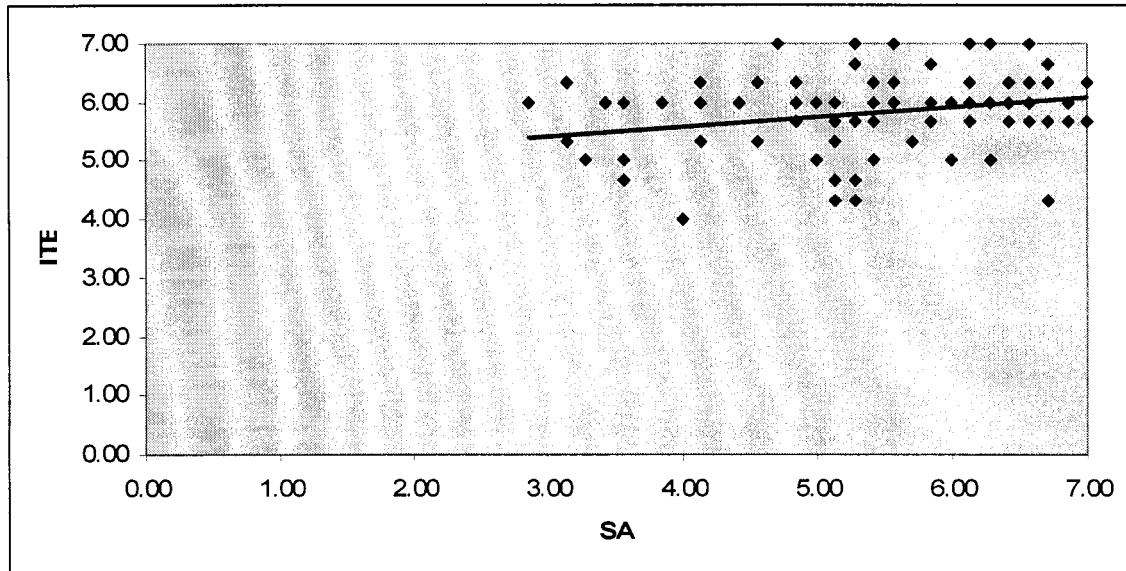


Figure 7. *SA vs. ITE Scatter plot (n=81)*

As a means to address the assumption of homoscedasticity, the dependent variable, IT effectiveness (ITE), was subjected to a square-root transformation. The transformed data can be seen in the scatter plots found in Figures 8 and 9, and show the data points more closely aligned with the regression line.

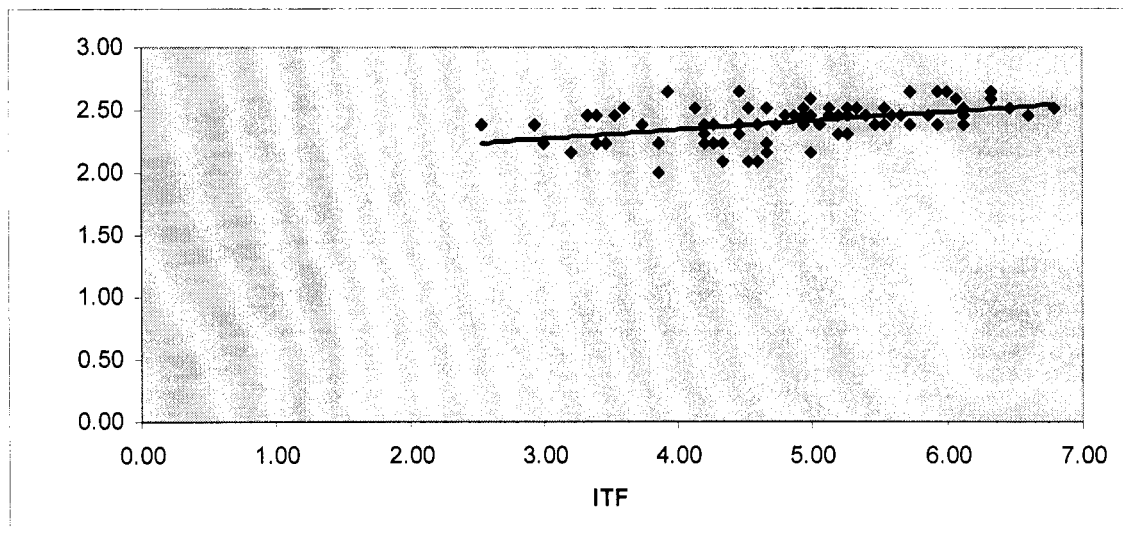


Figure 8. *ITF vs.  $\sqrt{ITE}$  Scatter plot n=81)*

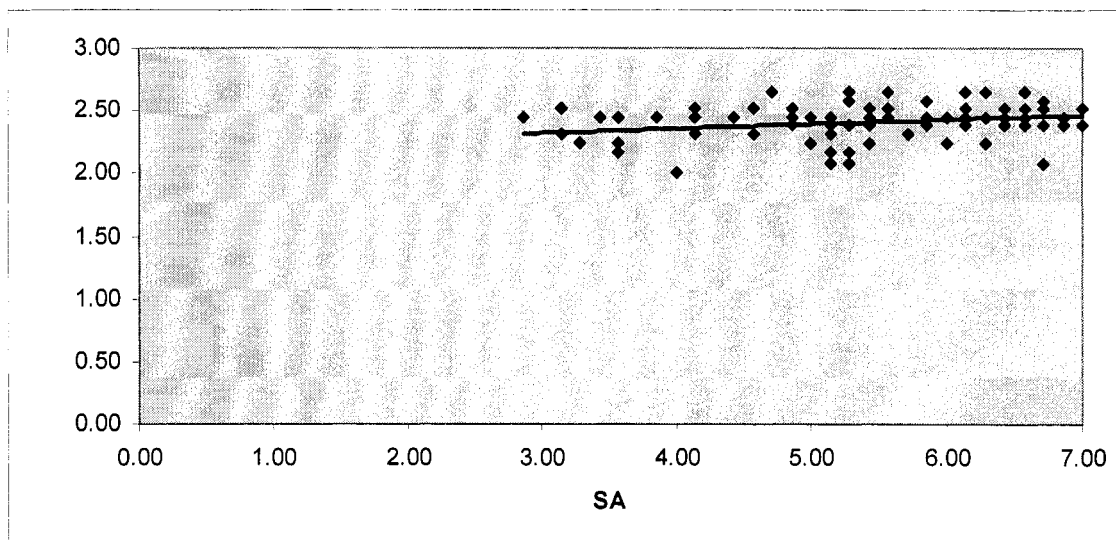


Figure 9. SA vs.  $\sqrt{ITE}$  Scatter plot (n=81)

Subsequent findings and analysis for hypotheses examination and construct model validation are based on the removal of outliers from the response set (n=81) and the application of a square root transformation to ITE to meet the assumption of homoscedasticity. As can be observed within Table 15, the recalculations of the inter-scale correlations, based on these changes, are positive and continue to support results previously obtained.

Table 15

Inter-scale Correlation Results with Transformation (n=81)

	$\sqrt{ITE}$ -ITF	$\sqrt{ITE}$ -SA	ITF-SA	$\sqrt{ITE}$ -ITFxSA
Pearson's Correlation (r)	.454	.261	.336	.430
R-Square (r <sup>2</sup> )	.206	.068	.113	.185
Sig. (p)	<.001	<.05	.001	<.001

*Examination of hypotheses.* This section examines each statement of hypothesis as well as its null value; and it will discuss findings, supporting data, and whether the hypothesis can be accepted (and the corresponding null statement rejected). The values obtained within Table 15 have been used as the basis for each hypothesis examination and resulting acceptance or rejection.

Hypothesis 1: ITF correlation with ITE

**H<sub>10</sub>:** IT flexibility is not positively correlated with IT effectiveness

**H<sub>1</sub>:** IT flexibility is positively correlated with IT effectiveness

**Finding 1:** H<sub>1</sub> accepted. IT flexibility is positively correlated with IT effectiveness

Research findings confirm that a positive correlation exists between IT flexibility and IT effectiveness as identified through correlation analysis, and having values equal to  $r=.454$ ,  $r^2=.206$ ,  $p<0.001$ . Although the definition for ITE has varied somewhat within the research field (Seddon, et al., 1999), this finding is consistent with prior research with respect to the overall importance of flexibility. In addition, this confirms the importance of perceived IT flexibility as being associated with increased levels of effectiveness (Kanungo, Duda, & Srinivas, 1999) and efficiency (Knoll & Jarvenpaa, 1994; Allen & Boyton, 1991). The comparison of these findings with those of past studies will be explored in greater detail in Chapter 5.

Hypothesis 2: SA correlation with ITE

**H<sub>20</sub>:** Strategic alignment is not positively correlated with IT effectiveness

**H<sub>2</sub>:** Strategic alignment is positively correlated with IT effectiveness

**Finding 2:** H<sub>2</sub> accepted. Strategic alignment is positively correlated with IT effectiveness

Research findings indicate that a positive correlation exists between strategic alignment and IT effectiveness as identified through correlation analysis, and having values equal to  $r=.261$ ,  $r^2=.068$ ,  $p<0.05$ . This finding is consistent with prior research suggesting that business to IT alignment (e.g., strategic alignment) remains one of the most important topics among CIO's (Austin, Trimm, & Sobczak, 1995). Although  $r^2=.126$  is still statistically significant, it is noticeably lower than the correlation between ITF and ITE ( $r^2=.206$ ). This raises the question as to whether too much emphasis has been placed on strategic alignment and not enough on IT flexibility (Jarvenpaa & Ives, 1993) as a basis for increased IT effectiveness, and then causally towards firm productivity (Bender, 1986; Santhanam & Hartono, 2003), and for gaining a competitive advantage (Clemons & Kimborough, 1986). This question is addressed in Chapter 5 as part of research conclusions.

Hypothesis 3: ITF correlation with SA

**H<sub>30</sub>:** IT flexibility is not positively correlated with strategic alignment

**H<sub>3</sub>:** IT flexibility is positively correlated with strategic alignment

**Finding 3:** H<sub>3</sub> accepted. IT flexibility is positively correlated with strategic alignment

Research findings indicate that a positive correlation exists between IT flexibility and strategic alignment as identified through regression testing,  $r=.336$ ,  $r^2=.113$ ,  $p=0.001$ . It might be expected that the results would have been negatively correlated as some consider SA as a means to reduce ambiguity and the need for ITF (Rumelt, 1979;



Duncan, 1995) and even as an inhibitor to ITF (Mintzberg, 1994a, 1994b). Contrary to the findings of these authors, a positive correlation between the ITF and SA is consistent with research expectations and that of prior research in this area (Brown, 2004). The finding of a positive correlation supports the assertion that strategic alignment works with IT flexibility to help deliver systems and solutions to the business that are targeted and more consistent with what the business needs. In addition, IT flexibility improves strategic alignment when incorporated into the firm's investment decisions (Jarvenpaa & Ives, 1994), and by allowing the business and IT to be more adaptive to change (economic, political, competitive, etc.). By enabling more rapid adjustments to strategies and planning cycles associated with achieving sustained competitive advantage, the two-way arrow shown within the construct models (Figures 1 and 3), indicates that ITF and SA possess a symbiotic relationship, e.g. they are mutually supportive.

Hypothesis 4: ITF and SA respective correlations with ITE

**H4<sub>0</sub>:** Strategic alignment has an equal or greater correlation to IT effectiveness than does IT flexibility

**H<sub>4</sub>:** IT flexibility has a higher positive correlation to IT effectiveness than does strategic alignment

**Finding 4:** H<sub>4</sub> accepted. IT flexibility has a higher positive correlation with IT effectiveness than does strategic alignment

Research findings confirm that the correlation between IT flexibility and IT effectiveness is stronger than that between strategic alignment and IT effectiveness. As noted in the discussions for hypotheses findings 1 and 2, the correlational strength between ITF and ITE is  $r^2=.206$ ,  $p<.001$ , while it is only  $r^2=.068$ ,  $p<.05$  between SA and

ITE. This is an important finding to current research in that it confirms the importance of ITF as having a stronger predictive capability towards ITE than does SA. It also further supports the results of prior research by several authors including Tallon, Kraemer, and Gurbaxani (1999); Tallon and Kraemer (2003c); and Pierce (2002), among others. Specific results pertaining to the construct model, as obtained through stepwise regression analysis, are reported later in this chapter.

*Construct model validity and analysis.* Using the reduced response set (N=81) and with the ITE normalized through a square root transformation, stepwise regression analysis was performed,  $r^2=.206$ ,  $F_{(1,79)}=20.482$ ,  $p<.001$ , with the model regression equation being  $\sqrt{ITE} = .072(ITF) + 2.056$ , further validating the adequacy of the conceptual model for research purposes (see Figure 10). At the model level, the effect size of  $r^2=.206$ , is considered moderate (Cohen, 1988). Table 16 further illustrates that with the stepwise regression method applied, IT flexibility remains as the only statistically significant predictor variable within the regression model. In addition, an examination of the probability (p) values for the excluded variables in Table 17, shows that both SA and the interaction term, are sufficiently large enough that they would have still been excluded from the regression model even at higher levels of significance (e.g.,  $p<.10$ ).

Table 16

Stepwise Regression Analysis Results – Coefficients<sup>a</sup> (n=81)

Model	Unstandardized		Standardized	t	Sig.	95% confidence	
	coefficients		coefficients			interval for B	
	B	Std. Error	Beta			Lower	Upper
						Bound	Bound
(Constant)	1.513	1.016	-.799	26.079	.000	1.899	2.213
ITF	.134	.313	.427	4.526	.000	.040	.103

a. Dependent variable:  $\sqrt{ITE}$ 

Table 17

Stepwise Regression Analysis Results – Excluded Variables<sup>b</sup> (n=81)

Model	Beta In	t	Sig.	Partial
				Correlation
SA	.122 <sup>a</sup>	1.150	.253	.129
ITFxSA	.172 <sup>a</sup>	.961	.339	.108

a. Predictors in the model: (Constant), ITF

b. Dependent variable:  $\sqrt{ITE}$ 

Although the hypotheses were proven, and the conceptual model validated, the opportunity remains for additional research to be performed as a result of the residual variance left unexplained by the factors applied. This unexplained residual variation

therefore implies the possibility that other factors, or perhaps a different model, might be at play.

To obtain additional information about specific differences among the construct model factors, multiple comparison procedures were used. An ANOVA again confirmed the existence of the hypothesized relationship between ITF and ITE,  $F_{(4,76)}=5.304$ ,  $p=.001$ . Post-hoc testing was conducted, using the Kruskal-Wallis method to determine specific differences (see Table 18). This produced the resulting Bonferroni multiple comparison table (see Table 19) indicating significant differences in ITE between ITF=4 and ITF=7, ITF=5 and ITF=6, and ITF=5 and ITF=7. This leads to the conclusion that the significance between ITF and ITE were most likely within the upper-end of the Likert-scale values. This can be rationalized as previously observed in Tables 7 through 10, in that the response percentages were typically higher above the mid-point of the scale.

Table 18

ITE ANOVA Table

	<b>Sum of Squares</b>	<b>df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Between Groups	8.390	4	2.097	5.304	.001
Within Groups	30.055	76	.395		
Total	38.444	80			

Table 19

Bonferroni Multiple Comparisons Table<sup>a</sup>

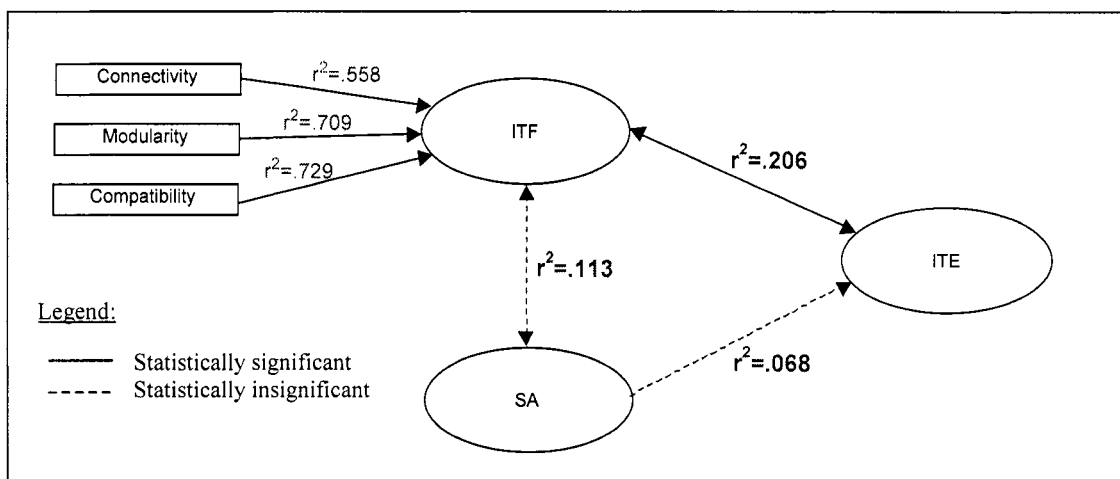
<b>(I)ITF</b>	<b>(J)ITF</b>	<b>Mean Difference (I-J)</b>	<b>Std. Error</b>	<b>Sig.</b>	<b>95% Confidence Interval</b>	
					<b>Lower Bound</b>	<b>Upper Bound</b>
4.00	7.00	-.81818	.28265	.050	-1.6354	-.0010
5.00	6.00	-.56272	.16554	.011	-1.0413	-.0841
5.00	7.00	-.78495	.23811	.015	-1.4734	-.0965

a. Dependent Variable: ITE (only significant results,  $p \leq .05$  are shown)

The above analysis and results further confirm the validity of the construct model, and continue to reflect the significance of ITF as a greater predictor of ITE in that it has a

higher predictive capability towards the outcome of ITE than does SA (Tallon, personal correspondence, February, 19, 2005). In addition, analysis indicates that the inclusion of SA and the interaction term ITFxSA, does not improve the prediction power of the model, and that perceived ITF carries the weight of explanatory effect of ITE within the construct model.

The revised conceptual model depicted in Figure 10, results from the removal of outlier observations and through the transformation of ITE using the square-root method to address the assumption of homoscedasticity. This model visually demonstrates that the relationship between IT flexibility and IT effectiveness is statistically significant and that strategic alignment's relationship to both IT flexibility and IT effectiveness is statistically insignificant when modeled along with IT flexibility.



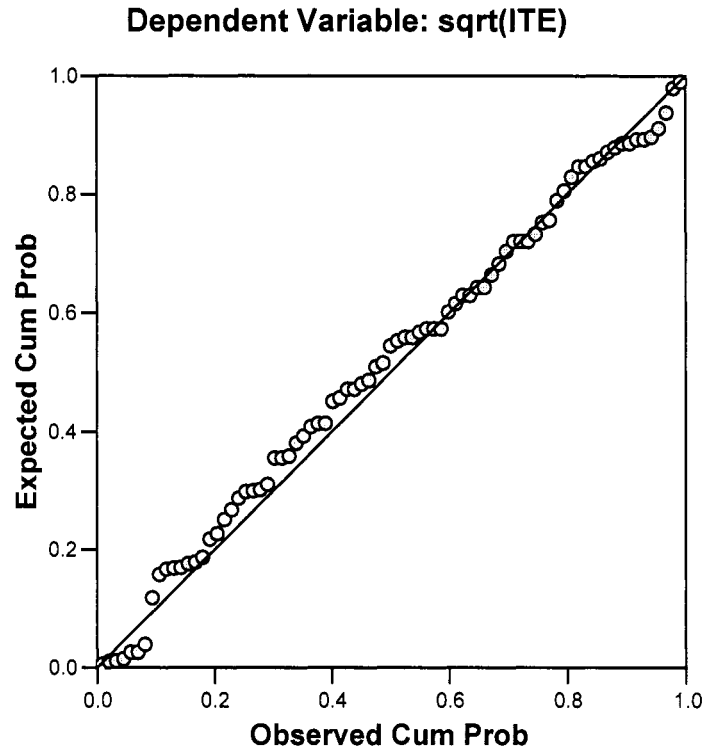
( $n=81$ ;  $r^2=.206$ ;  $F_{(1,79)}=20.482$ ;  $p<0.001$ )

Figure 10. Conceptual model results

With respect to IT flexibility (ITF), it was represented by the 15 questions used by Tallon and Kraemer (2003c), and therefore required further analysis to assess the strengths of its predictor variables of connectivity, modularity, and compatibility with IT

flexibility as the dependent factor. These were evaluated to ensure the strength of their correlations and significance as well as to assess which factor(s) provided the greatest overall association upon ITF. Each first order factor was found to highly predict ITF at  $r^2=.558$ ,  $r^2=.709$ , and  $r^2=.729$  respectively ( $p<0.001$  in all cases), and are considered as having high effect sizes (Cohen, 1988). This is consistent with the results of previous studies and indicates that each is closely aligned, but that modularity and compatibility are better predictors than is connectivity for IT flexibility.

Finally, to demonstrate that the construct model and regression model represented a fair approximation of ITE, the residuals were plotted. As can be seen in Figure 11, the standardized residual plot does appear to be linear and therefore normally distributed. It is concluded; therefore, that the reduced response set adequately represents a normal distribution, conforms to the assumption of homoscedasticity, and is valid for regression analysis and resulting findings as has been presented.



*Figure 11.  $\sqrt{ITE}$  Standardized Residual Regression Plot*

In summary, research provided empirical evidence that IT flexibility, IT effectiveness, and strategic alignment are all positively correlated (hypotheses one, two, and three) and that IT flexibility has a stronger positive correlation with IT effectiveness than does strategic alignment (hypothesis four). The data and research also support the assertion that when combined at the model level, IT flexibility has a more significant positive influence on IT's ability to deliver systems and solutions to the business (IT effectiveness) than does strategic alignment as is supported by prior research (Tallon, Kraemer, & Gurbaxani, 1999; Tallon & Kraemer, 2003c; Pierce, 2002; and others as previously cited). Of equal value to current research is the finding that SA and its interaction with ITF, termed ITFxSA, become statistically insignificant ( $p > .05$ ) as to their ability to predict variability within ITE. As such, ITF is shown to have the far greater



ability to predict the outcome of changes within ITE than does either SA or the interaction term.

*Respondent feedback and case studies.* As a follow-up to the initial survey, each respondent was asked whether they would like to participate in a scripted follow-up interview. Of the 85 survey responses received, 16 respondents agreed to receive the follow-up interview script, of which four responded. Of the four scripted responses received, two held the position of CIO within their firm, one was an Executive Director of IT, and the other was reported as being a Process Leader within IT. The scripted questions asked and responded to by email were generally broken down into each of the primary construct classifications of ITF, ITE, and SA (see Appendix D). Appendix E contains the actual responses for review. Respondent identities have been protected for purposes of this study in order to ensure respondent anonymity.

While survey questions and statistics are a valuable and necessary means towards achieving reliable and valid comparative analysis and interaction of the target and predictor variables, having actual field feedback and experiences are essential in making the statistics real and meaningful. The focus of each set of questions on ITF, ITE, and SA was to assess how the CIO/IT executive would independently view each construct, and to assess its application within their operation. The remainder of this section will focus and summarize each area of the scripted responses and to correlate them with the overall survey results.

*IT flexibility.* When asked how they would define IT flexibility, the respondents used phrases like “be able to change and adapt at the speed of business...not waiting on IT...planned with business...and be ready to change and adapt based on the business

plan”, “respond to varying business needs without delay”, “react to unplanned change”, and “having the capability to respond to ongoing change in the business or infrastructure.” These definitions correlate very closely to those described within academic research by Byrd and Turner (2000), and Tallon and Kraemer (2003c) as well as other industry notables such as Gates (1999). Key observations for these definitions is the focus on the ability to seamlessly change without business interruption, the focus on technology (esp. infrastructure) rather than process, and the alignment with business and strategic planning.

Responding to the importance of flexibility relative to the above definitions, some very pointed and explicit statements were made to drive home the importance of IT flexibility, therefore giving further credence to the strength of ITF to ITE, and its relationship with SA. One respondent stated that [ITF] is “extremely” important and continued to suggest that IT as an organization would not be necessary if not flexible. Another suggested that without IT flexibility “projects become more complex”, “time is added”, and that “project cost is also increased”. In addition, this respondent observed that “where the IT infrastructure has limited flexibility, more time is spent on the technology and less on the business process”, but that “where IT flexibility is at its highest...a greater percentage of time is spent on the business.” These last comments are particularly important as the focus of IT should not be on technology, but on the use of technology to enable the business to optimally perform and to achieve sustained competitive advantage (Feeny, 1988). This focus on where time is spent supports the concept of the competing values framework positioned by Quinn and Rohrbaugh (1983) and others as a means of organizational survival. As such, IT flexibility is a key enabler

of IT effectiveness towards competitive advantage by providing organizational flexibility to exist. Another comment supports this perspective by stating that IT flexibility should provide the capability for 80% of the project to be focused on providing new functionality to the business and not the rework of existing databases or applications. Strengthening this perspective one respondent indicated that “flexibility is not ‘extra’”, but that it a “vital sign”, and yet another comment asserting that “IT can make or break an organization.” Strong words, clearly emphasizing the role that IT plays within the organization and the urgent need for IT flexibility.

In support of the above observations as to the importance of technology relative to IT flexibility, one CIO/IT executive noted that their legacy systems were “incredibly fractured”, and that this was “making speedy response to new business initiatives very difficult.” Because of this fragmentation, their company has had to build thousands of interfaces in order to enable a high degree of interconnectivity, which has offered minimal value because of the “huge cost” involved in maintaining all those interfaces. In addition, while “millions” have been spent in developing an open and secure architecture, they have been “limited by the legacy systems” accessed, although having these open systems in place is “far better” than what was previously in place. To illustrate how pervasive this issue with legacy systems constrains IT flexibility, this respondent goes on to say that even the way data can be accessed is limited, but that they are in the process of migrating extracts to open database architectures to better facilitate connectivity and flexibility. In addition, reusable components are not leveraged because of legacy system restrictions, and applications are difficult to modify since rules are “codified” into the systems. This respondent acknowledged that as a result of having fractured and closed

legacy systems, as well as a multitude of interfaces, each request must be carefully evaluated and weighed as to its do-ability, therefore the lack of IT flexibility has hindered IT's ability to respond to the business. On the other hand, supporting the findings that remote connectivity is a primary factor in measuring IT flexibility, this same respondent argued that remote connectivity enhanced their ability to economically bring in "the best and the brightest" into their environment at any time (assumed IT and business resources).

Finally, while not addressed through current research, the political issues surrounding the ability to implement IT flexibility needs to be observed since it is not often easy to justify and/or convince business management as to the need for flexibility. Such is apparently the case for this particular respondent, who has yet to achieve the desired level of integration with enterprise systems for unstated political reasons. Middleware, as a means of achieving application and data integration, has helped achieve a certain amount of flexibility; however, this is not viewed as addressing the true application issues so as to overcome fragmented legacy systems and the multitude of interfaces. The lack of IT flexibility for this respondent has apparently confirmed their inability to achieve higher levels of IT effectiveness, with or without strategic alignment (see case study remarks for SA).

*IT effectiveness.* With regards to the respondents' views of IT effectiveness, opinions varied, and is consistent with how this has been treated within the research literature reviewed (Cooper & Quinn, 1993). Phrases used to describe ITE included the need to provide "right answers" and "high value" to the business, being "cost effective, reliable, and responsive", "deliver what the business needs and...in a timely manner",

and to “enable the business to meet its strategic goals.” In one case, speed of delivery or “responsiveness” was viewed as the number one priority for IT effectiveness, whereas in another “high value (versus low cost)” was identified as the key ingredient for ITE. “High value” is viewed as being important by this respondent, because the price paid for IT services by the business is too high not to have systems delivered offering a high degree of value to the firm. This is consistent with findings from research conducted by Mason (2004) and others regarding IT value in that IT effectiveness is viewed as optimizing business processes, through cost savings, improved delivery, and higher levels of customer satisfaction.

With respect to IT effectiveness and its ability to meet the strategic goals of a firm, the respondents only viewed ITE as being an important factor if these goals were actually achieved through IT services and solutions delivered. This provides merit for the linkages identified between ITE and SA, in that planning and alignment provide the benchmark for IT value (Sethi & King, 1994), and was measured by these authors as using the dimensions of efficiency, functionality, and sustainability. Consistent with these findings was one respondent’s view that ITE provided a level of measurement towards the effectiveness of the services supplied by IT to the business. Contrary to prior research, indicating that IT effectiveness and IT value were indeed hard to quantify and measure (Chan, 1992), CIO’s and IT executives appear to view ITE as a means of benchmarking their own performance and value to the business.

Consistent in the responses to the follow-up survey script relative to IT effectiveness was the need for a focus on process, staffing, and on customer needs as a way to demonstrate alignment. It was through these areas that one respondent indicated

that IT demonstrated strategic alignment, thus a clear relationship could be seen between ITE and SA. On the other hand, when asked about the strength of their firm's quality of service as a measure of effectiveness, the majority of respondents indicated that where weaknesses existed it was not as a result of having a poor infrastructure (i.e., technology), but because of other causal factors such as poor processes, lack of discipline, inadequate performance measures, and a failure to lead and/or to manage expectations (assumed to be of the business user). This confirms the survey comments received that ITF is not limited to technology, but it extends to other areas surrounding the use of technology and the interaction between IT and the business (but outside the scope of current research). It should also be noted that in the cases where ITE was not adversely affected by the firm's infrastructure, the respondents indicated that a significant amount of effort had already been spent toward infrastructure improvement. Apparent in the responses received was the perspective that being able to measure IT effectiveness was important to improved IT performance and even IT investment, which is consistent with the findings of Weill and Broadbent (1998), and Pierce (2002) in this area of research.

In one case, reducing the use of IT contractors and providing internal IT staff with opportunities for growth has provided an environment where the IT staff is enthused, has reduced the turnover rate, and has better equipped IT staff members to focus on customer needs. In turn, the business was more willing to provide funding for infrastructure upgrades, application projects, and additional employee improvement. Therefore, a relationship can be seen between IT effectiveness and IT flexibility, in that the business may be more willing to fund increased levels of flexibility if IT can prove to be effectively deliver technical solutions and services. This is consistent with the findings of

Kanungo, Duda, and Srinivas (1999), based on Nolen's Framework of Stages of Growth (Nolen, 1979), suggesting significant levels of IT effectiveness could only be observed after reaching stage 5 of the framework. This concludes that within these environments, the IT staff is stable, the necessary level of infrastructure is in place, and that an effective IT management operation is operating. This provides a potential area of analysis for future research to assess the degree that these stability factors actually exist and that Nolen's Framework remains viable within today's global and economic environment.

*Strategic alignment.* The final category of questions in the post-survey script pertains to strategic alignment. The respondents had some very interesting and confirming definitions, which include observations for further insights into IT flexibility and IT effectiveness. Strategic alignment was viewed and defined as providing purpose and priority because the role of IT should not just be limited to technology, but it should align to what the business needs. The perspective from prior research would support this view by suggesting that alignment is the result of the joint collaboration between the business and IT managers towards the development of IT plans (Kearns & Lederer, 2001). From this perspective, one comment was made that any value IT could deliver would be "pure luck" without SA to provide this sense of purpose and priority. This is where strategic alignment and IT flexibility complement each other in that while flexibility is great to have, it only adds value to the business when properly applied (Kanungo, Duda, & Srinivas, 1999). This appears to be confirmed through feedback received. Another respondent suggested that strategic alignment refers to the ability of IT to demonstrate support for organizational goals. This respondent continued by stating that an IT strategy absent these organizational strategies is "expensive and detrimental to the

survival of the organization.” The term “demonstrate”, as used in the response, is a very powerful word in that it implies the ability to deliver systems and services that offer realized value to the business, thus, providing the basis for IT effectiveness, again illustrating the positive correlation between SA and ITE.

In the same vein, feedback was received which stated that strategic alignment is defined as ensuring that the “IT plan aligns with key management objectives.” The suggested method of measurement offered by this respondent was that there should be no surprises for new systems requests, unless the business deviates from their three-year plan. Rau and Rau (1993) viewed long-term planning and alignment as an important aspect of strategic alignment. Planning in this regard is viewed as being very important to the overall strategic alignment process as without it you are “not sure if you are delivering what is expected”, and “changing direction within your base projects frequently.” This correlates well with the “fit” concept defined as the optimal use of scarce resources for meeting the firm’s objectives (Van de Ven & Dazin, 1985), and it assumes a simple and static environment. Ghoshal and Bartlett (1990) found that the global network and the transnational firm model have done much to undermine this perspective in that unplanned change occurs regularly, and that static planning is becoming untenable in today’s competitive and information-intensive environment (Gates, 1999). Firms that can operate in this mode of simplicity and within a static environment, certainly enjoy a luxury for long-term planning that most firms do not realize or rely upon because of the constant frequency of change.

The importance of strategic alignment was summed up as being very important and was even considered the “reason for IT’s existence” by another respondent. From this



came the insightful observation of “ever wonder why CIO’s average tenure is so short?”, confirming the statistics showing that the average current length of stay for over 50 percent of CIO’s and senior IT executives as being ten years or less.

Specific to feedback received as to the achievement and/or value of strategic alignment within their firms, the respondents indicated that there was observed value when a focus was placed on alignment between IT and the business and that it resulted in company effectiveness and upon the bottom line (see also Feidler, Gorver & Teng, 1995; Boar & AT&T Bell Laboratories, 1994). It was also noted by one respondent that alignment was difficult to achieve as a result of the business having to react to external market forces, which made it difficult to define a strategy as it changed constantly and was very dynamic. This observation supports the assertions made within this study as well as those of others including Hirschheim and Sabherwal (2001), and Labovitz and Rosansky (1997).

Responding as to the need for IT and business interaction for strategic planning, another respondent suggested that IT manager credibility plays a key role in convincing the business that they should include IT in their planning process. Understanding and communication were also noted as essential elements for effective alignment in terms of IT knowing what drives the business strategy (see also King, Hufnagel & Grover, 1988), and the business understanding of what IT capabilities exist (see also Itami & Numagami, 1992). Firms appeared challenged to keep their strategies synchronized with strategy changes, even with a good understanding of IT and good communications between the business and IT. Strategic alignment was viewed as an ongoing exercise.

The need for management support and involvement of the strategic planning process and for strategic alignment was very evident in these post-survey responses, as was recognized by Pierce (2002), and others. It is interesting to note, however, that one respondent suggested that alignment was inhibited within their organization because of a lack of discipline, but that a conflict of interest also existed in the way that managers were compensated based on short-term goals, in that they often conflicted with the need for longer-term planning and focus. As a final observation, one respondent stated that without collaboration, technology is only viewed as “toys” (rather than as strategic enablers) for the business.

### *Summary*

These findings provide empirical evidence supporting the research hypotheses that IT flexibility, IT effectiveness, and strategic alignment are all positively correlated, and that the model depicting their relationship is both valid and significant. Further, the hypothesis that ITF has a stronger positive association with ITE than SA, has been shown to be valid through the results of stepwise regression analysis performed applying ITE as the target (dependent) variable, and ITF, SA, and ITFxSA (interaction term) as the predictor (independent) variables. In addition, analysis indicates that the inclusion of SA and the interaction term ITFxSA, does not significantly (at the  $p=.05$  level) improve the prediction power of the model, and that ITF carries the weight of explanatory effect of ITE within the construct model.

Post survey responses received were invaluable in understanding and applying live case studies to the statistical data analyzed. In many ways, their responses support the research data; and provided additional context o the reality behind the need for IT

flexibility, IT effectiveness, and strategic alignment, as well as their relationships, strengths, and limitations. These responses confirmed prior research cited and used throughout this study. Together, the survey data and the post-survey feedback provided excellent material from which to formulate conclusions, recommendations for current research, and possibly to pursue additional research and/or analysis as deemed appropriate or necessary for future studies.

## Chapter 5: Summary, Conclusions, and Recommendations

### *Overview*

In this chapter, a summary of each of the previous chapters will be presented, including an assessment of whether current research findings support or contradict prior research cited throughout this study. Conclusions drawn from responses received and/or derived relative to the original problem statement and research questions are also included. Finally, recommendations will be provided for how this research can be used, and recommendations will be offered for possible follow-on research.

### *Summary*

Technology innovation and the Internet have resulted in the globalization of the firm through the removal of information and geographic barriers; however, this has resulted in increased complexity and competition, along with an uncertain and rapidly changing business climate. Consequently, it is becoming increasingly difficult for businesses to plan and successfully attain, and maintain, a sustained competitive advantage. Technology and the role of IT within large corporations have therefore become paramount in working with the business to achieve optimal value in terms of profitability and competitive advantage. Prior research focused on the role of strategic alignment as the means to achieve greater business value (Austin, Trimm, & Sobczak, 1995; Lederer & Mendelow, 1989; Brown, 2004); however, recent research indicates a growing awareness for the need of IT flexibility as a means of delivering value to the corporation whenever and wherever the business demands (Paik & Jacobson, 2002; Kearns & Lederer, 2001; Young, Karamouzis, Marriott, Iyengar, & Terdiman, 2004). For the purpose of the current research, the degree to which IT services and solutions are

delivered for business consumption has been defined as IT effectiveness. There has been a lack of empirical research to form an adequate understanding and/or gain insights as to the relationship among IT flexibility, IT effectiveness, and/or strategic alignment.

The purpose of this study was to investigate the empirical evidence supporting the research hypotheses that IT flexibility, IT effectiveness, and strategic alignment all possess a positive relationship or correlation to one another, and, more specifically, that perceived IT flexibility has a higher correlation with IT effectiveness than does strategic alignment. The findings for this study are based on the results of survey feedback received from 81 CIO's and IT executives from US-based firms having at least 80 IT employees and/or is listed as a Fortune 1000 or Forbes 500 company.

The 81 responses received represented a sufficient sample exceeding the power requirement established for 42 cases as well as the number of cases used in prior research by Pierce (2002) at 72 (combined CEO and CIO responses). The response rate of 2.66% is distinctly lower than prior research at 10-15% and may be the result of several factors which includes the size of firms selected, the level of the executive involved and their availability, company policy restricting survey responses (several notifications were received to this effect), and many CIO/IT executives and/or their companies that are no longer in place (substantiated by the numerous surveys received back marked "return to sender"). In retrospect, knowing the actual effect size of  $r=.454$  as obtained from the resulting conceptual model (see Figure 10), the power value achieved was approximately .64. To achieve the higher original power value of .80, 122 responses would have been required.

The results of their feedback has provided data that confirms the hypotheses that ITF, ITE, and SA are positively correlated, that the relationship between ITF and ITE is stronger than that which exists between SA and ITE, and that ITF has the highest degree of association with ITE at the construct model level. The alignment of these findings with prior research and their significance will be the subject of the next section focusing on the conclusions of current research.

### *Conclusions*

While many authors have researched flexibility, effectiveness, and alignment, few have focused on how IT flexibility, IT effectiveness, and strategic alignment together relate to organizational effectiveness, IT value, and/or competitive advantage. Specific to current research, Broadbent and Weill (1993) and Duncan (1995) were among the first to begin studying these concepts and relationships, closely followed by Chan, et al. (1997), Pierce (1999), and most recently Tallon and Kraemer (2003c). All have evaluated one or two of the relationships among IT flexibility, IT effectiveness, and/or strategic alignment; however, none have focused solely on the relationship among all three simultaneously. Research findings published by these authors of relevance to current research are as follows:

- Strategic alignment is *critical* for IT effectiveness (as interpreted for current research), and for leveraging IT towards sustained competitive advantage (Broadbent & Weill, 1993)
- IT flexibility is related to IT effectiveness, thus, IT effectiveness itself may be used as a direct indicator of IT flexibility (Duncan, 1995)

- The best performing companies are those where strategic alignment exists and has been demonstrated or realized (Chan, et al., 1999)
- Increased strategic alignment leads to improved returns on IT investments and corporate performance (Pierce, 2002)
- IT flexibility relates to and improves strategic alignment (Tallon & Kraemer, 2003c)
- IT flexibility can enable a dynamic state of strategic alignment (Tallon & Kraemer, 2003c)
- Strategic alignment can be improved through increased IT flexibility (Tallon & Kraemer, 2003c)

These findings, along with analysis and insights obtained from industry sources (Dortch, 2003), were the basis for current research and for the four hypotheses statements. The research findings provided empirical evidence supporting these hypotheses, and each can be compared or contrasted with each of the above findings, as follows:

**H<sub>1</sub>:** IT flexibility is positively correlated with IT effectiveness (accepted)

**H<sub>2</sub>:** Strategic alignment is positively correlated with IT effectiveness  
(accepted)

**H<sub>3</sub>:** IT flexibility is positively correlated with strategic alignment (accepted)

**H<sub>4</sub>:** IT flexibility has a higher positive correlation with IT effectiveness than does strategic alignment (accepted)

These findings showed that at the higher-order construct level, a positive correlation existed among all factors and the interaction term between ITF and SA (ITF $\times$ SA); however, only the relationship between ITF and ITE was statistically significant ( $p < .05$ ). It is evident from the results obtained that ITF is a much better predictor of ITE than is SA, and that at the construct model level, SA and the interaction term, ITF $\times$ SA, are in fact statistically insignificant in relation to their ability to predict changes to ITE when ITF is present. Although the hypotheses were proven and the model validated, the opportunity remains for additional research to be performed because the variance in the model implies that other factors, or a better model, might be at play.

Assessing the findings from the four accepted research hypotheses against those of prior research (above), the findings of Duncan (1995) that are specific to the relationship between ITF and ITE appear to be validated. The corresponding assertion that ITE can be used as an indicator (measure) of ITF can therefore be implied. Similarly, the findings of Tallon and Kraemer (2003c) directly support those of current research in that they found that ITF positively related to and improved SA.

Chan's findings indirectly support the hypothesis that ITE and SA are positively correlated. According to Chan, if IT effectiveness (ITE) can be considered as being the realization of alignment between the business and IT, then it can be further implied that those companies who perform the best demonstrate a positive relationship between SA and ITE. In addition, this same line of reasoning can be indirectly applied to Pierce's finding that increased levels of alignment (SA), lead to increased levels of corporate performance, which implies the relationship between effectiveness and alignment improved performance, as linked between these studies.



In contrast to the above comparisons, the findings of Broadbent and Weill (1993) appear to be contradicted through current research. These authors identified that SA was *critical* to ITE; however, findings from this study have showed that the relationship between ITF and ITE is stronger, bringing into question the *criticality* of SA to ITE relative to ITF. This same finding of ITF's strength in relation to ITE can therefore also be applied towards improved corporate performance, and possibly sustained competitive advantage (Kearns & Lederer, 2001; Bharadwaj, 2000; Santhanam & Hartono, 2003). This finding is important relative to prior research, because while past studies have shown the viability of strategic alignment to that of IT value and sustained competitive advantage (Boar & AT&T Bell Laboratories, 1994; Broadbent & Weill, 1993; Tallon, Kraemer, & Gurbaxani, 2000), the results of current research show that IT flexibility could in fact be of greater importance to corporations than may have been previously considered. Not evident in the findings of prior research; however, is the current finding showing that SA and the interaction term ITFxSA are statistically insignificant ( $p > .05$ ) at the construct model level when ITF is present.

In conclusion, findings from current research validate and/or recast results obtained from similar research previously performed. The importance of IT flexibility to IT effectiveness, and towards corporate performance and/or sustained competitive advantage has been confirmed by IT executives and IT industry research analysts alike in their feedback and analysis provided for this study. This applies to the confirmation of the assertion that IT flexibility should be viewed as a significant factor towards the effective delivery of IT services and solutions, versus that of strategic alignment as the primary focus within the industry and by IT executives over the past decade. This can be

rationalized by noting that alignment typically targets a goal, objective, and/or deliverable towards a fixed point in time within a stable environment (Knoll & Jarvenpaa, 1994). On the other hand, flexibility focuses on the ability to adapt to changes over time, which provides a more powerful and viable approach to delivering efficacious IT solutions and services to the business (e.g., ITE). This does not nullify the fact that strategic alignment has been shown to add value (i.e., positive correlation) to the business and IT. Furthermore, as a stand-alone factor of IT effectiveness, strategic alignment does provide a common basis for communication and coordination towards greater levels of sustained competitive advantage for the firm (Rockart & Morton, 1984).

### *Recommendations*

The research findings presented contribute to and expand the overall understanding of how IT flexibility, IT effectiveness, and strategic alignment relate together. In addition, knowledge of these relationships can be used to create an environment that provides effectiveness towards the timely delivery of IT services and solutions that ultimately provides the business with value as well as the ability to obtain and sustain a competitive advantage.

This researcher recommends that this study be extended to small and medium size organizations and within various market sectors to validate that these findings are consistent across each to verify that they can be universally applied. It is further suggested that the measures for IT flexibility be extended to include IT management processes such as the software development lifecycle (SDLC), the capability maturity model (CMM), as well as robust processes, and other key business functions that affect IT's ability to provide effective and efficient delivery capabilities. This would extend the

current view of flexibility as being limited to technology and/or technical infrastructures and assess whether taking a broader view might strengthen and/or change the results obtain herein.

In addition, it is recommended that the elements used to measure the IT effectiveness construct be extended to include the realization of services and solutions delivered to the business, not just the *perceived* effectiveness of the IT organization. IT effectiveness measures can therefore be broadened and strengthened to include objective evidence that IT flexibility enables the IT organization to adapt to unplanned changes in business demand that may not be reflected in the original strategic planning scenario. This would provide a more comprehensive model that could be used to better assess the current state of equilibrium between business demand and IT supply, as well as IT's ability to adjust to business demand when unplanned changes occur as a measure of true flexibility.

Finally, in conjunction with the above recommendations, this researcher suggests that an IT flexibility evaluation framework, model, and/or matrix be developed to assess and measure IT flexibility, along with IT effectiveness as a measure of its corresponding business value. With this model and methodology in place, it is anticipated that a firm can then independently, or with consultation, evaluate strategies and opportunities to increase IT flexibility and resulting business value through increased IT effectiveness. In addition, as the business and IT agree on the need for growing flexibility towards increased value, then their efforts can certainly be supplemented and kept on track through strategic planning.

It is this author's wish that others find value in this research and that it inspires others to continue to explore and expand on these concepts. It is also hoped that this research extends the path that has been paved before and will continue to be used to help produce a culture where IT is viewed as a positive contributor to business rather than as a hurdle to overcome, or as an impediment to organizational progress. As has been shown, the business's ability to compete is becoming increasingly tied to technology. To the extent that business partners with, and embraces technology rather than accepts it as a necessary evil, then flexibility, alignment and transformation can truly occur and significant organizational effectiveness within the marketplace can be realized.

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Appendix A: Construct element table

Construct	Source/Mods	Scale	Elements
IT Flexibility	Tallon and Kraemer (2003c p.36)		
	7-point scale used	7-point Likert	Our systems are sufficiently flexible to incorporate electronic links to external parties
	“	7-point Likert	Our company has a high degree of systems inter-connectivity
	“	7-point Likert	All remote offices and mobile personnel can connect to a central office
	“	7-point Likert	Our firm applies open systems network mechanisms to boost connectivity (e.g., ATM)
	“	7-point Likert	Corporate databases are accessed through many different protocols (e.g., SQL)
	“	7-point Likert	Reusable software modules are widely used throughout our systems development group
	“	7-point Likert	Legacy systems within our firm do not hamper the development of new IT applications
	“	7-point Likert	Functionality can be quickly added to critical applications based on end-user requests
	“	7-point Likert	Data is captured and made available to everyone in the company in real time
	“	7-point Likert	Data rules and relations (e.g., tax rules, pricing) are not hard coded into applications
	“	7-point Likert	Our firm uses enterprise systems to achieve integration (e.g., Oracle, SAP)
	“	7-point Likert	Our business is not limited by our choice of operating system (e.g., UNIX, Windows)
	“	7-point Likert	Software applications can be easily transported and used across multiple platforms
	“	7-point Likert	Our company makes extensive use of middleware to integrate key enterprise applications
	“	7-point Likert	Our company offers multiple interfaces or entry points (e.g., Internet) to external users
IT Effectiveness	Tallon, Kraemer, and Gurbaxani (1999 p.31)	7-point Likert	Q. Compared to other IT units with which you are familiar, how do you rate the IT services of your unit in terms of the following dimensions?
	10-point scale used		<ul style="list-style-type: none"> <li>▪ Overall quality of service</li> <li>▪ Users' satisfaction with IT</li> <li>▪ Helpfulness of IT staff to users.</li> </ul>



Construct	Source/Mods	Scale	Elements
Strategic Alignment	Pierce (2002 p.178)		
	5-point scale used, "IS" replaced w/ "IT"	7-point Likert	Our IT planners are aware of the firm's objectives, business strategies and long-term goals
	"	7-point Likert	Our firm's business plans provide clear directions for IT planning
	"	7-point Likert	Our IT managers participate in strategic business planning
	"	7-point Likert	Our IT and business planners interact closely in the formulation of the IT strategic plan
	"	7-point Likert	Our IT strategic plan is independently developed without significant effort to support business strategy using IT
	"	7-point Likert	Our IT strategy is derived from business strategy
	"	7-point Likert	Our business and IT strategies are fully integrated and developed together
General and Background	Pierce, 2002 p.179 (as modified)		
	No changes	Yes/No/Narrative	Your title (please print)?
	No changes	Numeric	Number of years you have been with the firm: With IT unit:
	No changes	Yes/No/Narrative	Is your IT strategy fully documented? How often is it updated?
	Added IT Strategy	Numeric	What is the planning horizon (in years) for your IT strategy? Business Strategy?
	New	7-point Likert	In terms of IT's ability to meet business demand for systems and services, how would you rank IT's ability to deliver solutions?
	New	7-point Likert	How would you rank your overall systems development lifecycle (SDLC) capabilities and maturity for IT?
	New	Yes/No	Would you say that your IT organization is flexible? Would you be interested in participating in a case study based on your firm's results?
	No changes	Narrative	Comments



**Q3: The following statements are related to your organization's strategic alignment between the business and IT. Please circle the appropriate number reflecting the extent to which you agree or disagree with each statement as it relates to your business unit's IT functions and/or capabilities.**

	Disagree	Neutral			Agree		
	1	2	3	4	5	6	7
1. Our IT planners are aware of the firm's objectives, business strategies and long-term goals.	1	2	3	4	5	6	7
2. Our firm's business plans provide clear directions for IT planning.	1	2	3	4	5	6	7
3. Our IT managers participate in strategic business planning.	1	2	3	4	5	6	7
4. Our IT and business planners interact closely in the formulation of the IT strategic plan.	1	2	3	4	5	6	7
5. Our IT strategic plan is independently developed without significant effort to support business strategy using IT.	1	2	3	4	5	6	7
6. Our IT strategy is derived from business strategy.	1	2	3	4	5	6	7
7. Our business and IT strategies are fully integrated and developed together.	1	2	3	4	5	6	7

**Q4: Please provide the following background and business information.**

1. Your title (Please print): \_\_\_\_\_
2. Number of years you have been with the firm: \_\_\_\_\_ With IT unit: \_\_\_\_\_
3. Is your IT strategy fully documented? \_\_\_\_\_. How often is it updated? \_\_\_\_\_
4. What is the planning horizon (in years) for your IT strategy? \_\_\_\_\_. Business Strategy? \_\_\_\_\_
5. How would you rate your IT organization's ability to meet business demand for systems and services?  
(1 = very low; 7 = very high) 1 2 3 4 5 6 7
6. Would you say that your IT organization is flexible?  
(1 = strongly disagree; 7 = strongly agree) 1 2 3 4 5 6 7
7. How would you rate your IT organizations' overall systems development lifecycle (SDLC) processes?  
(1 = very weak; 7 = very strong) 1 2 3 4 5 6 7
8. Would you be interested in participating in a case study based on your firm's results? \_\_\_\_\_

If you indicated 'yes' to question 8, above, or would like to receive a summary of the results of this survey, please provide an e-mail address below for follow-up.

\_\_\_\_\_  
Additional comments (please feel free to add additional sheets, if necessary):

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## Appendix C: Survey cover memo

To: [Recipient's Name]  
[Title]

From: Lawrence R. Ness  
Doctoral Student, Northcentral University

Date: [Date Printed]

Subject: Dissertation Survey Participation Request and Questionnaire

Dear [Recipient's Name],

I am a Ph.D. candidate in the School of Business and Management with Northcentral University currently conducting research in the area of IT flexibility and its impact on IT effectiveness and strategic alignment between the business and IT. This research seeks to examine various aspects of IT flexibility, IT effectiveness, and strategic alignment, and then to assess the correlation among them as to their influence upon IT's ability to deliver timely and effective solutions to the business based on competitive pressures and often uncertain demand.

While the concept of IT flexibility is not new, its role in the delivery of timely and effective IT solutions to the business as a means of aligning to a dynamic business environment is not well understood as a means for enabling sustained competitive advantage. To better understand the meaning and interactions among these three areas, numerous resources are being used as a basis to ensure the reliability and validity of research conducted and assessments made. For this purpose, we would like to kindly request your participation in this study as a key executive within the IT field, representing both IT practice and business demand for IT solutions within your company. We believe that your input to this study is vital as a means of validation as well as for providing the information required for assessing these relationships as they currently exist within the field.

Your name was selected at random from a list of IT executives compiled from publicly available sources. Your participation involves completing the online questionnaire and to provide your responses as to either the strength/weakness or agreement/disagreement of each area, as well as some background and clarifying questions as a means of providing general perspective to your responses and for possible future research studies. Completion of the questionnaire should take approximately 20 – 30 minutes. Please complete this questionnaire online at <http://www.ncu.edu/ness>. In addition to the questionnaire, it may be beneficial to contact you for follow-up questions regarding your particular situation. If you would be willing to be contacted for this purpose your acknowledgement at the end of the questionnaire would be very much appreciated.

The information you provide will remain confidential. Although the questionnaire seeks to collect certain demographics about your position within the company, we will not divulge this information to third parties, nor identify individuals or their organizations within the results. You may contact me directly (e-mail: [lrn\\_ncu-phd@comcast.net](mailto:lrn_ncu-phd@comcast.net), phone: 615-749-2812), or my dissertation advisor (Robert Haussmann, [rhaussmann@ncu.edu](mailto:rhaussmann@ncu.edu), phone: 732-512-0581) for any questions and/or clarifications on this research.

Thank you. Your participation is very much needed and appreciated.

Kind Regards,

Lawrence Ness

## Appendix D: Post-survey email script

[Participant name], my name is Lawrence (Lonny) Ness and I would like to thank you for responding to the initial survey request and for agreeing to participate further in this research study. I have a few follow-up questions I'd like to ask that will assist me to better understand the relationships described within your organization between IT flexibility, IT effectiveness, and strategic alignment. These questions may be responded to by email, or via telephone. If by email, simply forward your responses to [lrn\\_ncu-phd@comcast.net](mailto:lrn_ncu-phd@comcast.net). If by telephone, please respond to this email with your telephone number and time(s) you can be reached, or contact me directly at (615)749-2812.

Unless authorized, all information provided is confidential and will only be referenced in general terms as part of the IT-wide study. If authorized, then I would appreciate the opportunity to cite your firm as a specific example of how these areas interact within the context of this research study.

Finally, all responses - in whole or in part, are significant and appreciated. Therefore, feel free to respond to only those questions that are applicable to your operation and/or that you are comfortable in responding to. Additionally, you may revoke your responses at any point up to delivery of the dissertation on or around March 15, 2005 please email me at the above email address.

Again, thank you for your participation. All responses are requested to be submitted no later than February 28, 2005 in order to be considered as part of the dissertation study.

Kind Regards,

Lawrence R. Ness (Lonny)

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*Follow-up Questions:*

### **Q1 – IT flexibility:**

*General questions...*

- A. In your opinion, what does the phrase “IT flexibility” mean?
- B. Do you believe IT flexibility is important? Why or why not?

*Specific questions – based on survey responses:*

1. Why do you [disagree/agree] that your systems are sufficiently flexible to incorporate links to external parties? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

2. Why do you [disagree/agree] that your company has a high degree of systems inter-connectivity? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
3. Why do you [disagree/agree] that the remote office and mobile personnel for your firm can connect to a central office? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
4. Why do you [disagree/agree] that your firm applies open systems network mechanisms to boost connectivity? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
5. Why do you [disagree/agree] that databases are accessed via many different protocols? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
6. Why do you [disagree/agree] reusable software modules are widely used throughout your systems development group? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
7. Why do you [disagree/agree] legacy systems within your firm do not hamper the development of new applications? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
8. Why do you [disagree/agree] that functionality within your area can be quickly added to critical applications based on end-user requests? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

9. Why do you [disagree/agree] data is captured and made available to everyone in the company in real time? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
10. Why do you [disagree/agree] data rules and relations (e.g., tax rules, pricing) are not hard coded into applications within your company? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
11. Why do you [disagree/agree] your firm uses enterprise systems to achieve integration (e.g., Oracle, SAP)? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
12. Why do you [disagree/agree] your business is not limited by our choice of operating system (e.g., UNIX, Windows)? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
13. Why do you [disagree/agree] software applications can be easily transported and used across multiple platforms in your company? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
14. Why do you [disagree/agree] your company makes extensive use of middleware to integrate key enterprise applications? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?
15. Why do you [disagree/agree] your company offers multiple interfaces or entry points (e.g., Internet) to external users? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

**Q2 – IT effectiveness**

*General questions...*

- A. In your opinion, what does the phrase “IT effectiveness” mean?
- B. Do you believe IT effectiveness is important? Why or why not?

*Specific questions – based on survey responses:*

1. Why do you believe that your firm’s overall quality of service is [weak/strong] as compared to other IT units? Has this [hindered/helped] the business? In what way?
2. Why do you believe that user satisfaction with IT is [weak/strong] for your company as compared to other IT units? Has this [hindered/helped] the business? In what way?
3. Why do you believe the IT staff has been [weak/strong] in their helpfulness to users as compared to other IT units? Has this [hindered/helped] the business? In what way?

**Q3 – Strategic Alignment**

*General questions...*

- A. In your opinion, what does the phrase “strategic alignment” mean?
- B. Do you believe strategic alignment is important? Why or why not?

*Specific questions – based on survey responses:*

1. Why do you [disagree/agree] that your IT planners are aware of the firm’s objectives, business strategies and long-term goals? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?



2. Why do you [disagree/agree] that your firm's business plans provide clear directions for IT planning? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?
3. Why do you [disagree/agree] that your IT managers participate in strategic business planning? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?
4. Why do you [disagree/agree] that your IT and business planners interact closely in the formulation of the IT strategic plan? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?
5. Why do you [disagree/agree] that your IT strategic plan is independently developed without significant effort to support business strategy using IT? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?
6. Why do you [disagree/agree] that your IT strategy is derived from business strategy? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?
7. Why do you [disagree/agree] that your business and IT strategies are fully integrated and developed together? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

## Appendix E: Post-survey email script responses

### *Response 1 (#63820292)*

*Note: Participant information omitted for confidentiality...*

Follow-up Questions :

Q1 - IT flexibility:

General questions...

A. In your opinion, what does the phrase "IT flexibility" mean?

*Response: "1) The ability to respond to varying business needs without that response delaying the business in making it. 2) The ability to respond to unusual or catastrophic conditions quickly and not interrupt the business."*

B. Do you believe IT flexibility is important? Why or why not?

*Response: "Yes. The answer is implied in both of my responses above, but, in sum, IT can make or break an organization, I believe, by supporting new business initiatives or being there all of the time."*

Specific questions - based on survey responses:

1. Why do you [disagree/agree] that your systems are sufficiently flexible to incorporate links to external parties? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Our current systems are built on legacy technologies and/or are incredibly fractured making speedy response to new business initiatives very difficult at this time. It is important to be flexible as noted above to be responsive to new business initiatives or in the face of some disaster."*

2. Why do you [disagree/agree] that your company has a high degree of systems inter-connectivity?

*Response: "Because of our very fragmented systems base we have had to build thousands of interfaces, so, yes, we have a high degree of interconnectivity. However, this has delivered little value to us because of the huge cost in maintaining interfaces and as we are seeing greater need to integrate the cost of such interfaces is simply increasing."*

3. Why do you [disagree/agree] that the remote office and mobile personnel for your firm can connect to a central office? If agreed, has this provided value?

*Response: "Significant value in that these mobile workers are able to work remotely and to remain connected."*

How? If disagreed, do you believe this an important area of IT flexibility?

*Response: "This is an important area of IT flexibility because more and more we are seeing the need to bring the best and brightest to any site at any time and to do that economically. Our remote connectivity enhances that capability."*

4. Why do you [disagree/agree] that your firm applies open systems network mechanisms to boost connectivity?

*Response: "Over the last several years we have spent millions developing a comprehensive and secure open systems architecture. It is limited by the legacy systems that we access, but is far better than the very closed systems architecture we had in place previously."*

If agreed, has this provided value?

*Response: "Yes for the reasons noted above."*

5. Why do you [disagree/agree] that databases are accessed via many different protocols? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Our legacy infrastructure limits the ways in which we can access data. We are presently migrating extracts from these data bases to open DBMS architectures to allow other methods of accessing data, but these tools are not fully implemented as yet."*

6. Why do you [disagree/agree] reusable software modules are widely used throughout your systems development group? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Reusable modules are not used significantly because of the legacy systems we operate."*

7. Why do you [disagree/agree] legacy systems within your firm do not hamper the development of new applications? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Partly as a result of the fragmentation of our architecture, but also partly because of the legacy systems we operate we find that we are not able to respond as quickly as I would want us to changing business needs or in the event of disasters."*

8. Why do you [disagree/agree] that functionality within your area can be quickly added to critical applications based on end-user requests? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Again, because of the fragmentation, multitudes of interfaces and legacy systems new functionality must be assessed very carefully before it is implemented."*

9. Why do you [disagree/agree] data is captured and made available to everyone in the company in real time? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "We have a large number of resources for real-time data access and are developing more. In healthcare, my field, the biggest nut yet to be cracked is how to deliver just the right information at the right time to decision-makers, in particular clinicians. Systems in the market today to do this are very primitive and frustrating to use. Much more research is needed in how to provide the right information at the point of care, point of business decision, etc."*

10. Why do you [disagree/agree] data rules and relations (e.g., tax rules, pricing) are not hard coded into applications within your company? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "To the extent that there are rules these are codified into our systems. However, most of these are hard coded into systems and so making changes is very difficult."*

11. Why do you [disagree/agree] your firm uses enterprise systems to achieve integration (e.g., Oracle, SAP)? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "For mainly political reasons we have not yet achieved this degree of integration."*

12. Why do you [disagree/agree] your business is not limited by our choice of operating system (e.g., UNIX, Windows)? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "We operate many operating systems and intend that this will be the way we will work in the future. Taking this position has allowed us to get conscious control over the creep that would have occurred anyway."*

13. Why do you [disagree/agree] software applications can be easily transported and used across multiple platforms in your company? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Again, we have a large legacy structure and much fragmentation of systems. This makes moving anything a very complex affair."*

14. Why do you [disagree/agree] your company makes extensive use of middleware to integrate key enterprise applications? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "We use some middleware applications and have found that these do much to help us interfacing applications. However, they are covering a larger problem by still not supporting the goal of greater integration around the patients we serve."*

15. Why do you [disagree/agree] your company offers multiple interfaces or entry points (e.g., Internet) to external users? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "We have worked hard to provide multiple access points to our information (Internet, wireless, etc.). However, given HIPAA, we have done this within secure frameworks that insure that the privacy of our patients remains insured."*

Q2 - IT effectiveness

General questions...

- A. In your opinion, what does the phrase "IT effectiveness" mean?

*Response: "Two things: the ability to deliver what the business needs and to do that in a timely manner."*

- B. Do you believe IT effectiveness is important? Why or why not?

*Response: "Yes; as noted above with flexibility our ability to deliver systems quickly and reliably that support the business will help to insure we are able to continue our mission."*

Specific questions - based on survey responses:

1. Why do you believe that your firm's overall quality of service is [weak/strong] as compared to other IT units? Has this [hindered/helped] the business? In what way?

*Response: "We are neither of those extremes. We have spent many millions over the last several years to deliver an infrastructure that is robust and supports growing needs; we have also spent millions delivering new applications supporting important areas of our growth and development. Yet, there is much more we can and are doing around DR and operational recovery and standardization of business/clinical processes."*

2. Why do you believe that user satisfaction with IT is [weak/strong] for your company as compared to other IT units? Has this [hindered/helped] the business? In what way?

*Response: "Several years ago satisfaction was relatively low. We have done much to turn that around through the activities mentioned above. This growing support for our unit has insured continued investment in IT infrastructure and applications projects."*

3. Why do you believe the IT staff has been [weak/strong] in their helpfulness to users as compared to other IT units? Has this [hindered/helped] the business? In what way?

*Response: "We have done much in the last several years to decrease our use of consultants and provide growth opportunities to IT staff. This has created a very enthused group, with relatively low turnover, and with high focus on meeting customer/user needs. Our ability to demonstrate alignment and focus on meeting customer needs has resulted in more investment in infrastructure, applications and employee development."*

### Q3 - Strategic Alignment

#### General questions...

- A. In your opinion, what does the phrase "strategic alignment" mean?

*Response: "Demonstrated support for the strategic goals of the organization through operations and IT strategies."*

- B. Do you believe strategic alignment is important? Why or why not?

*Response: "I believe it is. Unless you are an IT services company and drive the strategy of the organization, an IT strategy absent support of organizational strategies is expensive and detrimental to the survival of the organization."*

#### Specific questions - based on survey responses:

1. Why do you [disagree/agree] that your IT planners are aware of the firm's objectives, business strategies and long-term goals? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?



*Response: "Our planning is done as a part of larger organizational strategic planning and so remains aligned. User management and clinical personnel are intimately involved with its preparation."*

2. Why do you [disagree/agree] that your firm's business plans provide clear directions for IT planning? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "Because the structure of our planning efforts incorporates technology as an integral aspect of strategic direction setting."*

3. Why do you [disagree/agree] that your IT managers participate in strategic business planning? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "They do and it has helped to insure that the organization's strategy is clear to all and how we relate to it is clear as well."*

4. Why do you [disagree/agree] that your IT and business planners interact closely in the formulation of the IT strategic plan? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "We are part of the organizational senior leadership groups that set local and system strategy."*

5. Why do you [disagree/agree] that your IT strategic plan is independently developed without significant effort to support business strategy using IT? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "See above."*

6. Why do you [disagree/agree] that your IT strategy is derived from business strategy?

If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "See above."*

7. Why do you [disagree/agree] that your business and IT strategies are fully integrated and developed together? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "While we continue to tweak strategy development, our focus is on insuring that all of the segments of the organization are aligned, not just IT. They are all represented at the planning table and help to set goals, define priorities and then approve the underlying strategies to meet those goals."*

*Response 2 (#70265227)*

*Note: Participant information omitted for confidentiality...*

Follow-up Questions :

Q1 - IT flexibility:

General questions...

A. In your opinion, what does the phrase "IT flexibility" mean?

*Response: "IT flexibility is having the capability to respond to ongoing change in the business or IT infrastructure. I think it would be best described with a couple of examples. If the business wants to implement a supplier portal, elements for reporting, transactions and linkage of the supplier network through the internet must be provided. Having both the application infrastructure in place as well as the internet architecture ready reflects the flexibility of the IT architecture allowing us to turn on this functionality. If major rewrites of applications are required or new communications infrastructure must be implemented to enable the application, I would argue that your flexibility is limited. In an organization where IT flexibility is highest is where 80% of the project is focused on the business process and new functionality to be developed and not on the rework of current database structures or application base."*

B. Do you believe IT flexibility is important? Why or why not?

*Response: "It is critical in order for IT to respond to changing business requirements. Without IT flexibility, projects become more complex to implement, considerable time is added to the development & implementation and project cost is also increased. We also find that in cases where the IT infrastructure has limited flexibility, more time is spent on the technology and less on the business process."*

*Projects where IT flexibility is at its highest will allow a greater percentage of time spent on the business process.”*

Specific questions - based on survey responses:

1. Why do you [disagree/agree] that your systems are sufficiently flexible to incorporate links to external parties? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: “Links to external partners (Customers & Suppliers) is required for a companies IT infrastructure to be considered flexible. The level of criticality increases with the size and demographics of an organization and its supply chain. We could not manage our supply base throughout the Far East, Europe, Mexico, etc without links to these external partners in place and linked in real-time to our core planning systems. Given the speed required to manage the supply chain today as changes demand are managed, having these links in place is a must.”*

2. Why do you [disagree/agree] that your company has a high degree of systems inter-connectivity? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: “I would agree that interconnectivity is required. Think about any supply-chain process. An example is a sales order that feeds into your planning process and results in a demand for components from a supplier in China. Without all of these systems interconnected, there will be a lot of steps within the process to move data and obtain feedback. But, another way to look at this picture is what would happen if you could eliminate the need for inter-connectivity. Lets assume that not only the organization was on a single system or platform but all of their suppliers and customers were using the same system. Now, any changes to demand,*

*inventory levels and supply are reflected. Although you cannot get the entire supply chain on a system, the more you consolidate within your organization the better. You now have to focus on a few critical connections within the organization. Then define the best way to connect and maintain the interconnects with your external partners.”*

3. Why do you [disagree/agree] that the remote office and mobile personnel for your firm can connect to a central office? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: “I agree that within an organization, a central platform is best. It reduces complexity and cost. It also allows new functions, applications and processes to be implemented quickly. The central application platform is the first step. In order to drive key advantages you also then have to standardize on business processes.”*

4. Why do you [disagree/agree] that your firm applies open systems network mechanisms to boost connectivity? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: “Open systems network mechanisms are important if you have many types of uncommon transaction systems linked. In an environment where you have one central system, open systems networks have less of an impact on flexibility. But, there are always 3rd party systems and external partners which need to be linked so open networks are important.”*

5. Why do you [disagree/agree] that databases are accessed via many different protocols? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "We have a single data warehouse globally for all applications. Again, if your infrastructure is centralized and standard, the need for different protocols is reduced."*

6. Why do you [disagree/agree] reusable software modules are widely used throughout your systems development group? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "I would agree that reusable software modules are important. Not only speeds new development but also maintains consistency in the infrastructure. Also reduces total cost as maintenance activities occur to support changes. Reduces the level of support people who must be involved for a change that is driven throughout the infrastructure."*

7. Why do you [disagree/agree] legacy systems within your firm do not hamper the development of new applications? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Legacy systems hamper the development of new applications.*

*Organizations must have a strategy to remove them and consolidate these within the infrastructure. They add support cost and are difficult to support over time, as expertise around these systems is lost over time."*

8. Why do you [disagree/agree] that functionality within your area can be quickly added to critical applications based on end-user requests? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Adding functionality based on business requirements is a measure of the flexibility of the IT infrastructure. We have many areas where functionality can*

*be added quickly. We have others where this is not the case. These are the areas we are reviewing to upgrade within our infrastructure to assure this level of increased flexibility improves over the next 18 to 24 months.”*

9. Why do you [disagree/agree] data is captured and made available to everyone in the company in real time? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: “I both agree & disagree with the need for real time information. I feel that this depends on the process that is being supported. If your order through cash cycle is measured in weeks or months, the need to know a customer in Japan places an order as it happens will have minimal impact if it is known today or tomorrow. But I would also argue that cycle times continue to decrease. So having the infrastructure in place that you can continue drive towards real time information is what you want to be putting in place. This becomes a cost vs benefit analysis.”*

10. Why do you [disagree/agree] data rules and relations (e.g., tax rules, pricing) are not hard coded into applications within your company? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: “Consistent data rules and relations are critical. I would agree that you do not want to build these rules into the applications. They need to be independent so that they can be changed as business requirements are changed. The flexibility and extent of the rules and relationships will impact the flexibility of the IT infrastructure.”*

11. Why do you [disagree/agree] your firm uses enterprise systems to achieve integration (e.g., Oracle, SAP)? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "We are an SAP shop globally. Single system driving 60-plants and all of our sales offices. All of our partners will be linked to this system long-term. I feel strongly that this has been a key driver allowing us to have an IT infrastructure which is flexible and reactive to changes in the business."*

12. Why do you [disagree/agree] your business is not limited by our choice of operating system (e.g., UNIX, Windows)? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "I think this is a question of standardization. We drive standards through our infrastructure that decreases cost and I feel drives speed. It also allows you to improve the level of expertise. If you have 6-UNIX people and now you want to implement Windows or Linux, now you have to dilute the expertise you have. Also, when upgrades are required now you have to consider multiple operating systems in your maintenance schedule. If you have 1-standard infrastructure, your capabilities to support, maintain and upgrade can be very focused around this one standard. I would also argue that this is not a business decision but an IT management decision. The capabilities required by the business and the application base are the decisions the business needs to be involved."*

13. Why do you [disagree/agree] software applications can be easily transported and used across multiple platforms in your company? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?



*Response: "Some applications can be implemented across platforms. But, I do not think that this is critical. If, for some reason, you want to have multiple instances of an application implemented within your organization, you should standardize on a platform for consistency and manageability. I do not think this is a critical factor."*

14. Why do you [disagree/agree] your company makes extensive use of middleware to integrate key enterprise applications? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Today, we do not have middleware in place within our infrastructure. We will be putting in SAP-XI over the next 12-months to reduce even further the multiple interfaces we have in place between the limited applications we have. It will just allow us to build more consistency in our environment. For those organizations with multiple applications, having a strong middleware layer is critical."*

15. Why do you [disagree/agree] your company offers multiple interfaces or entry points (e.g., Internet) to external users? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "We have multiple interfaces for our outside partners. EDI, portals, RosettaNet, etc. This is required in our case because in many cases our customers dictate this to us. With global partners, our flexibility includes the ability to work with any interface which is requested by our larger partners."*

## Q2 - IT effectiveness

### General questions...

- A. In your opinion, what does the phrase "IT effectiveness" mean?

Response: Providing systems capabilities that are:

- Cost effective
- Reliable
- Responsive (speed of delivery). I would rank this the #1 requirement for effectiveness.

B. Do you believe IT effectiveness is important? Why or why not?

*Response: "Yes, it provides a level of measurement of the services you provide as an IT shop. I would argue that we could easily provide everything the business required if there was no focus on cost. But given the cost constraints we face today, providing these services in an effective way allows us to maintain our cost structures."*

Specific questions - based on survey responses:

1. Why do you believe that your firm's overall quality of service is [weak/strong] as compared to other IT units? Has this [hindered/helped] the business? In what way?

*Response: "I would argue that our quality of service is average. We have a lot of improvements to make in this area over the next 2 to 3 years and it is a focus area for our global IT organization. The definition of service levels needs to be clearly stated with specific measurable which allow us to assess our service capabilities on a regular basis. I believe we are strong in our key applications such as SAP. The key for us is to drive this same level of service throughout all of our application and infrastructure as well as within service delivery such as project management."*

2. Why do you believe that user satisfaction with IT is [weak/strong] for your company as compared to other IT units? Has this [hindered/helped] the business? In what way?

*Response: "I believe our satisfaction across all elements of our service delivery is average. Good in some areas and less capable in others. Over the next few years, the goal is to drive more defined processes across all service areas and be able to better measure this performance."*

3. Why do you believe the IT staff has been [weak/strong] in their helpfulness to users as compared to other IT units? Has this [hindered/helped] the business? In what way?

*Response: "I believe our helpfulness to users has been strong. But I would argue this is counter productive at times and drives us to be more reactive than proactive. If the quality is built in on the front end through improved definition of service processes, we would be better able to serve the users ongoing and more consistently."*

### Q3 - Strategic Alignment

General questions...

- A. In your opinion, what does the phrase "strategic alignment" mean?

*Response: Your IT plan aligns with key management objectives defined within the business. We ask ourselves if we get surprised by new system requests during the year. If we do, we are not as aligned as we should be unless this surprise was a new business objective that was not clearly defined in the strategy of 3-year business plan.*

- B. Do you believe strategic alignment is important? Why or why not?

*Response: "Yes, without it you are not sure if you are delivering what is expected. I would also argue that without it, return on your IT investment will be limited and in*

*most cases, you are going to be changing direction within your base projects frequently.”*

Specific questions - based on survey responses:

1. Why do you [disagree/agree] that your IT planners are aware of the firm's objectives, business strategies and long-term goals? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: “Agreed. IT planners or business relationship managers must be fully aware of the business units goals and objectives.”*

2. Why do you [disagree/agree] that your firm's business plans provide clear directions for IT planning? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: “I would disagree that the businesses today provide clear direction for IT planning. In many cases today, the business is changing the organization and reacting to many external forces. This makes it hard to fully define a strategy and in many cases the strategy changes over time. The business units and functions must also be aligned which is not always the case. This is a very dynamic situation.”*

3. Why do you [disagree/agree] that your IT managers participate in strategic business planning? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: “IT managers must participate in the business strategy discussion. The more credibility they (IT managers) have with the business to discuss this strategy, the more aligned the plans will be.”*

4. Why do you [disagree/agree] that your IT and business planners interact closely in the formulation of the IT strategic plan? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "I agree this interaction is important. The IT folks need to understand the issues driving the business strategy and they need to communicate the IT capabilities which are either in place or could be developed to support the business processes. This discussion as planning is taking place is critical."*

5. Why do you [disagree/agree] that your IT strategic plan is independently developed without significant effort to support business strategy using IT? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "IT strategy and their business plan needs to be done in parallel with the business planning process. The challenge is getting these two planning environments in sync. This takes considerable coordination on both sides. But I would argue if the IT organization is plugged into the business on a regular basis, that this is an ongoing exercise and not a once per year task. Also communication of the IT plan and constant reviews to assure alignment are critical."*

6. Why do you [disagree/agree] that your IT strategy is derived from business strategy? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "I agree the IT strategy needs to be derived from the business strategy."*

7. Why do you [disagree/agree] that your business and IT strategies are fully integrated and developed together? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "The two strategies must be developed together. They should be constantly reviewed to assure alignment and reflect changes."*

*Response 3 (#76329088)*

*Note: Participant information omitted for confidentiality...*

Follow-up Questions :

Q1 - IT flexibility:

General questions.

A. In your opinion, what does the phrase "IT flexibility" mean?

*Response: "IT supports the business, so IT needs to be able to change and adapt at the speed that the business is changing to effectively support it. This is primarily supporting key strategic initiatives (are you moving into e-commerce, as an example). The business should not be waiting on IT - the infrastructure and systems should be planned with business and be ready to change and adapt based on the business plan."*

B. Do you believe IT flexibility is important? Why or why not?

*Response: "Extremely, in the context given above. Otherwise - why have IT?"*

Specific questions - based on survey responses:

1. Why do you [disagree/agree] that your systems are sufficiently flexible to incorporate links to external parties? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Disagree - while we are doing some work in this area, in general there are many issues such as security that have not been adequately addressed. In addition, there is an entire business process around B2B that has to be modeled. IT in the absence of the business model is doomed to fail, and as a corporation I am not sure that we are there yet."*

2. Why do you [disagree/agree] that your company has a high degree of systems inter-connectivity? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agreed - we have implemented Oracle ERP, and have standardized on Oracle databases. So, where native connectivity does not exist it is not difficult to integrate the applications through custom code."*

3. Why do you [disagree/agree] that the remote office and mobile personnel for your firm can connect to a central office? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agree - this provides a high level of value, since we have 24X7 systems. Support personnel do not have to drive in during the night if there is a problem. That means that it is better for the employee, as well as better for the business since problems tend to get resolved faster. In addition, while no one measure it - I would guess that there is a fair amount of work that people do that doesn't get put on a time-sheet - i.e more productivity for the salary dollar."*

4. Why do you [disagree/agree] that your firm applies open systems network mechanisms to boost connectivity? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agree - we have standardized on Oracle databases where possible, and try to ensure that all of our applications have open architecture."*

5. Why do you [disagree/agree] that databases are accessed via many different protocols? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Disagree - as noted above we have standardized our databases."*



6. Why do you [disagree/agree] reusable software modules are widely used throughout your systems development group? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agreed - we have many routines that are used by many different packages. In one sense, it makes IT faster and more flexible because you only have to make changes in one place. On the other hand - if you don't know all of the dependencies of a particular code set (dB object, e.g.) - then you can break things and get in trouble quickly. So there is value, but a double-edged sword as well."*

7. Why do you [disagree/agree] legacy systems within your firm do not hamper the development of new applications? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agreed - we have pretty well replaced most of our legacy systems - so this may not apply."*

8. Why do you [disagree/agree] that functionality within your area can be quickly added to critical applications based on end-user requests? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agreed - this is mostly a function of resource assignments in our organization - i.e. what we assign folks to work on. The systems themselves are relatively flexible in this sense. This provides value, but again creates the double-edged sword. It helps the business (where the business can't or won't change their process) - but for vendor supported packages it creates support and upgrade issues that can exponentially increase the cost of upgrades. So - that's the real value? Not sure in the long run."*

9. Why do you [disagree/agree] data is captured and made available to everyone in the company in real time? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Disagreed - we are working on a robust data warehouse, but the data there is day-old. Real-time data puts resource demands on the servers, and current database theory of OLAP and OLTP seem to work against each other - i.e. it is either easy to get data in or it is easy to get data out - but not both. One comes at the price of the other."*

10. Why do you [disagree/agree] data rules and relations (e.g., tax rules, pricing) are not hard coded into applications within your company? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agreed - it is much easier and quicker to update the business rules."*

11. Why do you [disagree/agree] your firm uses enterprise systems to achieve integration (e.g., Oracle, SAP)? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agreed - vendor support and high levels of integration provide good value in terms of meeting business needs without high levels of IT support staff.*

*That changes if you make a lot of customizations, though."*

12. Why do you [disagree/agree] your business is not limited by our choice of operating system (e.g., UNIX, Windows)? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agreed - we have some systems that require UNIX, but we are beginning to migrate to Linux. Also, Oracle databases are available on a number of OS's, so in many cases it is a choice of what we feel is the most stable."*

13. Why do you [disagree/agree] software applications can be easily transported and used across multiple platforms in your company? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Disagreed - while there is some flexibility in choosing OS's, once they are chosen it is not easy to port to another OS. This is probably less important - there are only a handful of OS's so there is no need to change them constantly."*

14. Why do you [disagree/agree] your company makes extensive use of middleware to integrate key enterprise applications? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Agreed - but the double edge sword again. The middle-ware lets the PC desktop be more of a "dumb terminal", but requires a lot more horsepower in servers and other infrastructure. Once that is in place, it is difficult to change."*

15. Why do you [disagree/agree] your company offers multiple interfaces or entry points (e.g., Internet) to external users? If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: "Disagree - we have some external users doing a few things - but their choices are limited. This is less important for the average consumer than B2B work - but we are not heavily in the B2B yet."*

Q2 - IT effectiveness

General questions.

A. In your opinion, what does the phrase "IT effectiveness" mean?

*Response: "Enabling the business to meet its strategic goals."*

B. Do you believe IT effectiveness is important? Why or why not?

*Response: "Yes - but only if meeting the company's strategic goals is important."*

Specific questions - based on survey responses:

1. Why do you believe that your firm's overall quality of service is [weak/strong] as compared to other IT units? Has this [hindered/helped] the business? In what way?

*Response: "We are middle of the road, but getting better compared to others. We have been hindered by a lack of discipline and best-in-class methodology, which we are in process of correcting through implementation of SDLC, ITIL, and CoBIT."*

2. Why do you believe that user satisfaction with IT is [weak/strong] for your company as compared to other IT units? Has this [hindered/helped] the business? In what way?

*Response: "(weak) Same answer as above - lack of discipline and robust processes."*

3. Why do you believe the IT staff has been [weak/strong] in their helpfulness to users as compared to other IT units? Has this [hindered/helped] the business? In what way?

*Response: "(weak) - same as #1."*

### Q3 - Strategic Alignment

General questions.

A. In your opinion, what does the phrase "strategic alignment" mean?

*Response: "IT must understand the business, the business objectives, and the corporate strategic direction. It must then align itself to support the business and*

*the strategic direction.*”

B. Do you believe strategic alignment is important? Why or why not?

*Response: “Yes - very important. It is the reason for IT's existence. Ever wonder why CIO's average tenure is so short?”*

Specific questions - based on survey responses:

1. Why do you [disagree/agree] that your IT planners are aware of the firm's objectives, business strategies and long-term goals? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: “Agree - but only recently and we are starting to realize value through better planning and better supporting the business.”*

2. Why do you [disagree/agree] that your firm's business plans provide clear directions for IT planning? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: “Agree - we have a very clear strategic direction, and part of the strategy speaks to IT and its role specifically.”*

3. Why do you [disagree/agree] that your IT managers participate in strategic business planning? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: “Agree - through the planning process in #2.”*

4. Why do you [disagree/agree] that your IT and business planners interact closely in the formulation of the IT strategic plan? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "Agree - same as #3."*

5. Why do you [disagree/agree] that your IT strategic plan is independently developed without significant effort to support business strategy using IT? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "Disagree - you must have input into the IT plan from the business, or you aren't supporting the business."*

6. Why do you [disagree/agree] that your IT strategy is derived from business strategy? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "Agree - IT now better supports the company, which has an impact on the company effectiveness and the bottom line."*

7. Why do you [disagree/agree] that your business and IT strategies are fully integrated and developed together? If agreed, has this provided value? How? If disagreed, do you believe this an important area of strategic alignment? Why or why not?

*Response: "Mostly agree - we still have more room to grow, but this year we have made a great step forward in this direction."*

*Response 4 (#76886208)*

*Note: Participant information omitted for confidentiality...*

Follow-up Questions :

Q1 - IT flexibility:

General questions...

A. In your opinion, what does the phrase "IT flexibility" mean?

*Response: "At a strategic level (minimum), the ability to keep up with and exploit IT forward thinking without having to live at the frontier of change. On an operational level, the ability to react to unplanned change while maintaining it's day to day 'production balance.'"*

B. Do you believe IT flexibility is important? Response: yes. Why or why not?

*Response: "Flexibility is all about being able to change in an intelligent and responsive manner. In an industry whose hallmark is 'change' flexibility is not 'extra'. It's a 'vital sign.'"*

Specific questions - based on survey responses:

1. Why do you [disagree/agree] that your systems are sufficiently flexible to incorporate links to external parties?

*Response: "Disagree. Our systems require way too tightly coupled too not to make linking to external (outside the firewall) an agonizing exercise in security related mediations prior to work required to multiple systems to accomplish the link."*

a. If agreed, has this provided value? How? If disagreed, do you believe this an important area of IT flexibility?

*Response: "Yes."*

b. Why or why not?

*Response: "Agility, cost and speed all get served in one form or other when we can interact directly with partner or client systems."*

2. Why do you [disagree/agree] that your company has a high degree of systems inter-connectivity?

*Response: "Yes."*

- a. If agreed, has this provided value?

*Response: "Yes."*

- b. How?

*Response: "Greatly lower costs and error rates. As business has accelerated our systems have insulated the damaging effects on our workers by absorbing that increase in speed."*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: No Response.*

3. Why do you [disagree/agree] that the remote office and mobile personnel for your firm can connect to a central office?

*Response: "60% of or work force is mobile."*

- a. If agreed, has this provided value?

*Response: "Yes."*

- b. How?

*Response: "Gives workers a line of sight and common base for timely feedback and immediate re-direction when and if required."*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?



*Response: No Response.*

4. Why do you [disagree/agree] that your firm applies open systems network mechanisms to boost connectivity?

*Response: "Agreed."*

- a. If agreed, has this provided value?

*Response: "Yes."*

- b. How?

*Response: "Leverage other solutions."*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: No response.*

5. Why do you [disagree/agree] that databases are accessed via many different protocols?

*Response: "Agree."*

- a. If agreed, has this provided value?

*Response: Somewhat.*

- b. How?

*Response: "This is a matter of necessity rather than by design."*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: No Response.*

6. Why do you [disagree/agree] reusable software modules are widely used throughout your systems development group?

*Response: "Disagree."*

- a. If agreed, has this provided value? How?

*Response: No Response.*

- b. If disagreed, do you believe this an important area of IT flexibility?

*Response: "Very important."*

- c. Why or why not?

*Response: "Reuse combines the best of low cost, speed to market and low risk."*

7. Why do you [disagree/agree] legacy systems within your firm do not hamper the development of new applications?

*Response: "Agree."*

- a. If agreed, has this provided value?

*Response: "Yes."*

- b. How?

*Response: "As I tell our architects, 'Legacy systems are the ones that work' and as such need to be in place while we evolve to better practices."*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: No Response.*

8. Why do you [disagree/agree] that functionality within your area can be quickly added to critical applications based on end-user requests?

*Response: "Disagree."*

- a. If agreed, has this provided value? How?

*Response: No response.*

b. If disagreed, do you believe this an important area of IT flexibility?

*Response: "Yes."*

c. Why or why not?

*Response: "The functionality requests are 'customer orders'. Today we provide 'good customer service' by working around the clock at times. It's simply too hard and not feasible to continue the pace with all of the requests in a tightly coupled world."*

9. Why do you [disagree/agree] data is captured and made available to everyone in the company in real time?

*Response: "Disagreed."*

a. If agreed, has this provided value? How?

*Response: No Response.*

b. If disagreed, do you believe this an important area of IT flexibility?

*Response: "For some but not for my company."*

c. Why or why not?

*Response: "The services that we render make real time info less important than [at] other firms."*

10. Why do you [disagree/agree] data rules and relations (e.g., tax rules, pricing) are not hard coded into applications within your company?

*Response: "Agreed."*

a. If agreed, has this provided value?

*Response: "Yes."*

b. How?

*Response: "By enabling simple and reliable change (i.e. loosely coupled beats embedded logic every time)."*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: No Response.*

11. Why do you [disagree/agree] your firm uses enterprise systems to achieve integration (e.g., Oracle, SAP)?

*Response: "Agree, but only historically."*

- a. If agreed, has this provided value?

*Response: "Yes."*

- b. How?

*Response: "Enabled high degree of integration at the time of adoption."*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: No Response.*

12. Why do you [disagree/agree] your business is not limited by our choice of operating system (e.g., UNIX, Windows)?

*Response: "Agree."*

- a. If agreed, has this provided value?

*Response: "Yes."*

- b. How?

*Response: "For ENTERPRISES: this is about maturity. At time of adoption, different operating system based choices were more about who got their first,*

*who was the most widely deployed, who was the best supported versus best feature and function.”*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: No Response.*

13. Why do you [disagree/agree] software applications can be easily transported and used across multiple platforms in your company?

*Response: “AGREE.”*

- a. If agreed, has this provided value?

*Response: “Not yet.”*

- b. How?

*Response: “In this case, belief is in place based on not doing this.”*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: No Response.*

14. Why do you [disagree/agree] your company makes extensive use of middleware to integrate key enterprise applications?

*Response: “Agree.”*

- a. If agreed, has this provided value?

*Response: “Interface challenges faced once and only once.”*

- b. How?

*Response: “Recurring savings after initial investment.”*

- c. If disagreed, do you believe this an important area of IT flexibility? Why or why not?

*Response: No Response.*

15. Why do you [disagree/agree] your company offers multiple interfaces or entry points (e.g., Internet) to external users?

*Response: "Disagree."*

- a. If agreed, has this provided value? How?

*Response: No Response.*

- b. If disagreed, do you believe this an important area of IT flexibility?

*Response: "multiple interfaces are hard to build, hard to maintain and support."*

- c. Why or why not?

*Response: No Response.*

## Q2 - IT effectiveness

### General questions...

- A. In your opinion, what does the phrase "IT effectiveness" mean?

*Response: "1. Right answers, and 2. High value."*

- B. Do you believe IT effectiveness is important?

*Response: "Yes."*

- C. Why or why not?

*Response: "IT is too expensive not to maximize leverage and deliver high value (versus low cost alone)."*

### Specific questions - based on survey responses:

1. Why do you believe that your firm's overall quality of service is [weak/strong] as compared to other IT units?

*Response: "It is strong."*

- a. Has this [hindered/helped] the business?

*Response: "No."*

- b. In what way?

*Response: No Response.*

2. Why do you believe that user satisfaction with IT is [weak/strong] for your company as compared to other IT units?

*Response: "Medium satisfaction."*

- a. Has this [hindered/helped] the business?

*Response: "Not really."*

- b. In what way?

*Response: "Focus on exclusive goal to lower costs: failure to lead. Failure to manage expectations."*

3. Why do you believe the IT staff has been [weak/strong] in their helpfulness to users as compared to other IT units?

*Response: "Strong."*

- a. Has this [hindered/helped] the business?

*Response: "Helped."*

- b. In what way?

*Response: No Response.*

### Q3 - Strategic Alignment

General questions...

- A. In your opinion, what does the phrase "strategic alignment" mean?

*Response: "Strategic alignment means thinking beyond technology to business purpose and priority."*

B. Do you believe strategic alignment is important?

*Response: "Yes."*

C. Why or why not?

*Response: "Without purpose, value achieved is pure luck."*

Specific questions - based on survey responses:

1. Why do you [disagree/agree] that your IT planners are aware of the firm's objectives, business strategies and long-term goals?

*Response: "Agreed."*

a. If agreed, has this provided value?

*Response: "Yes."*

b. How?

*Response: "Focused finite funding on the right targets that best achieve business objectives."*

c. If disagreed, do you believe this an important area of strategic alignment?

Why or why not?

*Response " No Response.*

2. Why do you [disagree/agree] that your firm's business plans provide clear directions for IT planning?

*Response: "Disagree."*

a. If agreed, has this provided value? How?

*Response: No Response.*

b. If disagreed, do you believe this an important area of strategic alignment?

*Response: "Yes."*

c. Why or why not?



*Response: "Lack of discipline. Conflict of interest based on short-term compensation."*

3. Why do you [disagree/agree] that your IT managers participate in strategic business planning?

*Response: "Agree."*

- a. If agreed, has this provided value?

*Response: "Yes."*

- b. How?

*Response: "Business leadership leveraged the "knowledge workers" that compensate highly."*

- c. If disagreed, do you believe this an important area of strategic alignment?

Why or why not?

*Response: No Response.*

4. Why do you [disagree/agree] that your IT and business planners interact closely in the formulation of the IT strategic plan?

*Response: Agree. "This has improved recently."*

- a. If agreed, has this provided value?

*Response: "The collaboration has improved both the business and the technology application."*

- b. How?

*Response: No Response.*

- c. If disagreed, do you believe this an important area of strategic alignment?

Why or why not?

*Response: No Response.*

5. Why do you [disagree/agree] that your IT strategic plan is independently developed without significant effort to support business strategy using IT?

*Response: "Disagree."*

- a. If agreed, has this provided value? How?

*Response: No Response.*

- b. If disagreed, do you believe this an important area of strategic alignment?

*Response: "Yes."*

- c. Why or why not?

*Response: "Without collaboration, technology turns into toys for their own sake."*

6. Why do you [disagree/agree] that your IT strategy is derived from business strategy?

*Response: "Agree."*

- a. If agreed, has this provided value?

*Response: "Yes."*

- b. How?

*Response: "Alignment brings funding and business value."*

- c. If disagreed, do you believe this an important area of strategic alignment?

Why or why not?

*Response: No Response.*

7. Why do you [disagree/agree] that your business and IT strategies are fully integrated and developed together?

*Response: "Somewhat agree."*

- a. If agreed, has this provided value?

*Response: "Yes."*

b. How?

*Response: "At this point 'full' integration is a stretch but it is a goal and is valued and we will get there."*

c. If disagreed, do you believe this an important area of strategic alignment?

Why or why not?

*Response: No Response.*