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Application of Strategic Institutional-information Technology Alignment Model in Four-year Institutions of Higher Education

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APPLICATION OF STRATEGIC INSTITUTIONAL-INFORMATION TECHNOLOGY

ALIGNMENT MODEL IN FOUR-YEAR INSTITUTIONS OF HIGHER EDUCATION

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by

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ABSTRACT

This study examined an existing corporate model of business-information technology alignment for application in higher education and tested the findings by surveying executive and technology leaders in higher education. The purpose of this study was to gain a better understanding of the factors that impact alignment between institutional strategic planning and information technology strategy in higher education. The existing alignment model was examined in the context of mid-size four-year colleges and universities.

This study used a combination of Delphi technique and a survey process. The sequence followed was to examine an existing theoretical model for its applicability to higher education by a Delphi expert panel, to pilot test the results of the Delphi in a survey of mid-size four-year institutions of higher education and to analyze the results. In the first phase, the Delphi method was used in two rounds to examine the Strategic Alignment Model (SAM) for application in higher education. An assembled panel of experts examined SAM, its components and questionnaire instrument, and reached a consensus after two rounds about the model's applicability to higher education. The second phase of the study tested the Delphi panel's findings by asking Chief Information Officers and Chief Executive Officers from four-year U.S. institutions of higher education to complete SAM's instrument that was modified by the Delphi.

The Delphi panel findings supported the use of the Strategic Alignment Model in higher education with some revisions of its terms to reflect the higher education environment more accurately. Several factors affecting institutional-IT alignment in higher education were

identified. Factors associated with domain components of the SAM model as well as factors

relating to bivariate linkages between the components of the model were revealed.

To my parents, Antoni and Teresa,

With love and gratitude

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

Introduction

"It is important that leaders make conscious, informed policy decisions about how technology should complement and facilitate an institution's strategic initiatives."

Ronald A. Phipps and Jan V. Wellman

The Institute for Higher Education Policy

One of the most important determinants of successful investment in information technology is a strategic alignment between IT and the organization's business objectives (IBM, 1981; Luftman et al. 1993; Sabherval, 2001; de Leede et al., 2002; Irani, 2002; Board, 2003; Kearns and Lederer, 2003; Sledgianowski, 2004; Luftman et al., 2005; Chan et al., 2006; Nash, 2006; Chan, 2007; Khadem, 2007). Although the concept and the application of strategic alignment in the corporate environment have been studied for three decades (IBM, 1981; Earl, 1983; Mills, 1986; Brancheau and Wetherbe, 1987; Parker and Benson, 1988; Henderson and Vankatraman, 1990; Dixon and John, 1991; Niederman et al., 1991; Watson and Brancheau, 1991; Liebs, 1992; Luftman, et al., 1993; Goff, 1993; Sabherval and Chan, 2001), there have been no empirical studies of strategic alignment in higher education during that time. The majority of the published articles and books that document the changes that accompanied

information technology in higher education have been either descriptive or prescriptive (e.g., Austin and Ahearn, 1997; Bates, 2000; Slowey, 1995).

Higher education executives and technology leaders needed a model that explained the relationship between information technology and the organizational strategic direction and processes. Given the idiosyncratic challenges of the higher education environment (Birnbaum, 1988; Orton and Weick, 1990; Gilmore et al. 1999), coupled with recent cuts in external funding (Mote, 2004; Kaiser, 2009) and the largely unmeasured returns on IT investments (Glick, 2001; Graves, 2005; U.S. Department, 2006; Abel, 2007), the postsecondary education industry faced the increasingly difficult task of planning for IT in an environment where a technology could be obsolete within three years (Tuller, 1999) and the institutional objectives and scope varied from one institution to another. The need for a higher education model that addressed the alignment of institutional and information technology strategy was clear.

Aligning information technology strategy and goals with organizational strategy and goals represented one of the most critical issues facing executives because of its impact on technology management and the organization's performance (Sabherval, 2001; Luftman et al., 2005). A substantial volume of literature exists on Information Technology's significant role in organizational strategies in the corporate sector (e.g., Henderson, 1996; Ayers and Grisham, 2003; Dehning et al., 2003; Norris and Olson, 2003; Kim, 2006; Goh, 2007). However, the specific research on IT's role in higher education remained very limited. Because there was no single uniform approach to strategic decision-making with respect to information technology throughout the academy (McCredie, 2003), higher education institutions needed a tool to assist leaders with integrating and aligning information technology with institutional objectives. The need for research in the strategic alignment of IT in higher education had many origins in the

higher education institution itself, where the intrinsic value of technology to the institution was recognized but not assessed (Pirani, 2004). Identifying or developing a strategic alignment model that fit higher education would provide colleges and universities with a much needed tool to align IT with institutional priorities.

Statement of the Problem

The foundational problem of this study was defined by two primary themes: 1) the lack of alignment in higher education between the institutional strategic direction and the Information Technology strategy, and 2) the lack of a mechanism to understand and assess alignment. Moreover, the factors affecting institutional-IT alignment in higher education were not adequately understood or defined.

Statement of the Purpose

The purpose of this study was to gain a better understanding of the factors that affect the alignment between institutional strategic planning and IT strategy in higher education in order develop a model that could be used to assist higher education administrators in making informed decisions that facilitate the alignment of information technology with institutional strategic direction. To better understand and assess the alignment and to identify factors that affect the alignment process, an existing corporate strategic alignment model was examined for application in higher education. This model was studied within the context of mid-size four-year institutions of higher education.

Research Questions

This research examined the Strategic Alignment Model (SAM) developed by Henderson and Venkatraman (1993) for application in higher education (see the full definition of the model p. 7). Based on a broad theoretical framework of cross-domain perspectives, the Strategic

Alignment Model was adopted in many industries in the last two decades but had not been applied to higher education. SAM was used in this study as the starting point to gain an understanding of the strategic alignment of Information Technology in higher education and to identify factors that affect the alignment process. The findings were tested by surveying a random sample of executive and technology leaders in four-year higher education institutions. The study addressed the following research questions:

1. What factors affecting strategic alignment of Information Technology in higher education can be identified?

2. Does the corporate Strategic Alignment Model (SAM) developed by Henderson and Venkatraman apply to higher education in part or in its entirety?

3. If the model applies in part, what modifications were necessary for the model to apply to higher education (additions, modifications, deletions)?

Statement of the Methodology

This research study used a non-experimental qualitative Delphi technique to examine the applicability of a business Strategic Alignment Model in a higher education environment. The results of the Delphi were tested by surveying a randomly selected group of higher education leaders. The survey was used as triangulation of the Delphi findings. The study was executed in two sequential phases, which, at the conclusion, resulted in the development of a model that helps explain the alignment of institutional and Information Technology strategies and objectives in four-year higher education institutions.

Statement of Assumptions

In order to complete this study, the following assumptions were made:

Assumptions Governing Delphi Panel. For the purpose of this study, it was assumed that the method of panel member selection created a panel that was representative of experts on strategic alignment and on higher education IT governance in the United States. It was assumed that the panel members were aware of, could analyze and could express (in the instrument and to other members of the panel) the applicability of a strategic alignment model to higher education and that the panel members willingly participated in this study and did so with altruistic purposes. It was assumed that the panel members did not possess hidden agendas. It was further assumed that there was no impact to the final results of the study as to whether the communication was electronic or on paper.

Statement of Limitations

The study was limited by the following constraints:

1) Two thirds of the Delphi panelists were researchers, as opposed to IT practitioners, which may be perceived as a limiting factor; one third of the panelists for the Delphi phase of this study came from Information Technology professionals working in higher education institutions;

2) Two-year institutions of higher education were not included, and therefore the results may not apply;

3) The results may not be generalized to other four-year colleges and universities.

Use of Delphi. Sackman (1975) and Woudenberg (1991) raised questions about the scientific bases of the Delphi method. Linstone and Turoff (1975), Martino (1983), and Loo (1997) confirmed the good performance of the Delphi technique. In order to mitigate the limitations of the Delphi method, Dootson (1995) suggested adopting a triangulation approach,

using other complementary methods as well, which was adopted in this study. Triangulation was accomplished through the use of a follow-up survey.

Statement of Terminology

Definition of Consensus. Consensus amongst the Delphi panel members for the purpose of this study was the point where all panelists reached an agreement whether the business-IT strategic alignment model was applicable to higher education.

The investigator used a percentage of votes to develop a consensus (Miller, 2006). One measure proposes that consensus is achieved when 80 percent of panel members' votes fall within two categories on a seven-point scale (Ulschak, 1983). Green (1982) suggested that at least 70 percent of Delphi subjects needed to rate three or higher on a four-point Likert-type scale. Because ranking on a Likert-type scale was not utilized in this Delphi study, the researcher used the agree-disagree format to develop consensus. If at least 80 percent of the panelists agreed with their collective modifications to the instrument, then the researcher would conclude that the panel reached consensus.

Definition of Information Technology. For the purpose of this study, the definition of information technology was expanded from Henderson's and Thomas's (1992) definition of "hardware and software" (p. 85) to encompass two areas: 1) information technology (IT) strategy; and 2) information technology infrastructure. IT strategy consisted of technology governance, technologies and applications that support the institution's initiatives, and information about the institution's constituents, products, accessibility, and reliability. IT infrastructure consists of IT architecture (hardware, software, data, applications, and communication platforms), development of specific IT practices (application development,

systems management, and maintenance functions), and IT skills, which include experience, competence and values of technology employees (Papp, 2001).

Definition of Strategic Alignment. Strategic alignment was the degree of fit and integration among institutional strategy, information technology strategy, institutional infrastructure and IT infrastructure (Henderson and Venkatraman, 1993). McKeen and Smith (2003) argued that strategic alignment of IT exists when an institution's goals and the supporting information technology remained in harmony.

Definition of Strategic Alignment Model. The Strategic Alignment Model (SAM) was defined in terms of "four domains of strategic choice: business strategy, information technology strategy, organizational infrastructure and processes, and information technology infrastructure and processes" (Henderson, 1993, p. 472). Each domain had its underlying components (Henderson, J., Venkatraman, N., & Oldach, S. (1996) (see Figure 1.1).

Figure 1.1.

Strategic Alignment Model developed by Henderson and Venkatraman (1993).

Table 1.1

Strategic Alignment Model (SAM).

Business strategy domain:	IT strategy domain:
• Business scope (products and markets) • Distinctive competency (characteristics that distinguish the organization from others, such as superior service or product design) • Business governance (strategic alliances and joint ventures)	• Technology scope (critical information technologies that support business initiatives) • Distinctive competencies (attributes of IT strategy that complement well the existing and impact positively the creation of new business strategies) • IT governance (choices regarding joint ventures and strategic partnerships to advance key IT components)
Organizational infrastructure/processes:	IT infrastructure/processes:
• Administrative infrastructure (the organizational struc2ture and infrastructure/definitions of roles and responsibilities in the respective areas) • Business processes (product development and delivery, customer service) • Skills (modification of existing skills, other HR considerations of those who carry out strategy)	• IT architecture (configuration of hardware, software, processes and communications in the IT area; definitions of roles and responsibilities in the respective areas) • IT processes (processes by which IT systems are planned, developed, implemented and operated) • IT skills (professional skills, competencies, experience, values of those who operate IT) Source: Papp, 2001

The Strategic Alignment Model's survey instrument consisted of 36 questions that were divided into two parts, one part addressing the four quadrants of SAM (Table 1.1) and the second part addressing the relationships among the four quadrants.

Definition of Four-Year Institutions of Higher Education. The category was based on the Carnegie Foundation basic classification of universities and colleges and included both private and public institutions. Using the Carnegie category, both residential and non-residential

four-year medium, with enrollment between 3,000 and 9,999, institutions were included in this category. A total of 437 colleges and universities met this category.

Definition of CEOs and CIOs. In Phase II of this study, a survey was sent to Chief Executive Officers (CEO) and Chief Information Officers (CIO) from the population of four-year institutions of higher education. The CEO was defined as the president, chancellor or vice president or vice chancellor of the institution. The CIO was defined as the highest ranking Information Technology officer at the university. The latter included titles of CIOs, provosts, associate provosts, and directors.

Definition of SAM Instrument. The survey used in Phase II of this study was the Strategic Alignment Model instrument modified by the Delphi panel. The result of the Delphi was a modified form of the original SAM instrument. The survey was divided into two parts: background information and the SAM modified instrument.

Summary

Aligning information technology strategy and goals with organizational strategy and goals represented a critical issue facing executives because of its impact on the organization's performance and productivity (Sabherval, 2001; Luftman et al., 2005). Although institutional-IT alignment in higher education was advocated by IT professionals as an important step to achieve alignment between investments and objectives, there was no existing research identifying an alignment model that could be used to align IT with institutional strategy and objectives. With the exception of a case study and some commentaries calling for the need for alignment in higher education, empirical research on alignment that enabled IT planning in harmony with institutional objectives in higher education was practically nonexistent. Considering the lack of

current research on this subject, a research opportunity existed to examine existing strategic alignment models for application in the higher education environment.

The purpose of this study was to gain a better understanding of the alignment between institutional strategic planning and IT strategy in higher education in order to identify a model that could be used to assist higher education administrators in making informed decisions that facilitate the alignment of information technology with institutional strategic direction. The use of an existing corporate strategic alignment model used by hundreds of corporations provided the basis for the development of a much needed model that assists higher education leaders guide decisions that allow the information technology environment to align with institutional mission and objectives. This research adds to the knowledge base seeking to improve higher education through effective planning and technology management.

Chapter 1 contains a description of the problem, purpose and need of this study, as well as the assumptions, definitions and limitation of this study. A review of literature impacting this study is found in Chapter 2. The methodology used to conduct this study is included in Chapter 3, and Chapter 4 contains the data obtained in the research for this study. Chapter 5 of this study provides a summary of the research, discussion of the conclusions to be drawn from the research results and recommendations for further research and study.

CHAPTER 2

Literature Review

Overview

To be successful, businesses frequently developed new strategies to accommodate the changes in consumer demand, technologies, market competition and other factors in the past several decades. In other words, being able to adjust internally to external changes became a top priority even for the most successful of businesses that enjoyed an unprecedented competitive advantage at any given time (Boar, 1997, p. IX). One of the major concerns for executives and information technology leaders has been how to integrate and align technological thinking and expertise of information technology with an organization's performance (Keen, 1993). Aligning information technology strategy and goals with organizational strategy and goals represented one of the most critical issues facing executives because of its impact on the organization's performance and productivity (Broadbent and Weil, 1993; Papp, 1995; Prairie, 1996; Xia, 1998; Croteau and Bergeron, 2001; Sledgianowski, 2004; Sabherval, 2001; Kearns and Lederer, 2003; Luftman et al., 2005).

Because of the nature of higher education, which "enjoyed a long period of prestige and self-governance largely unfettered by external interference" (Barone, 2003, p.44), such a vigilant approach to institutional strategic planning was not necessary until the late 1980s, when the first voices demanding IT integration could be heard. Much of the calling was motivated by digital

technologies, which enabled new delivery methods and resulted in the changing of societal

expectations as well as campus dynamics (Barone, 2003). But some of the need for strategic

planning in higher education stemmed from recent "significant budgetary restrictions facing

most higher education institutions" (McCredie, 2003, p. 22) caused by shortfalls of foundations'

aid (Kaiser, 2009) and decline in state and federal funding (Mote, 2004). Higher education, like

corporate America, has made significant investments in technology, but it remains unclear how

much it has profited from this investment (Ayers, 2003, p.42; Carr, 2003, p. 26). In its 2006

report, the Spellings Commission identified the "mission-to-technology alignment" as one of the

most significant challenges facing higher education (U.S. Department, 2006). Because there is no

single uniform approach to strategic decision-making with respect to information technology

throughout the academy today (McCredie, 2003), higher education institutions would benefit

from a better understanding of how to integrate and align technology with institutional strategic

goals.

Definition of Information Technology

One definition identified information technology as an organization's total investment in

computing and communications technology (Weill, 1998, p. 6). Another way of defining IT was

by its components: the workstations, the shared-access distributive databases and knowledge

bases, the communications network, and the specialized processors (Morton, 1991, p. 34). Yet

another view of IT was derived from the definition of infrastructure, or operations, which

included an array of services, such as problem management (help desk), LAN/WLAN

infrastructure management, system and security management, E-mail system support, disaster

recovery, etc. (Baschab, 2003, p. 153). Thus many operations departments are called information

technology (IT) departments or information systems (IS) departments. Generally, IT is an

umbrella term for information managing and processing—creating, exchanging, storing, and using information—with computers being central to the process. Boar (1997) offered the following definition:

> Information Technology (IT) comprises those technologies engaged in the operation, collection, transport, retrieval, storage, access presentation, and transformation of information in all its forms (voice, graphics, text, video, and image). Movement of information can take place between humans, between humans and information processing machines, or just between multiple information processing machines. Management of IT insures the proper selection, deployment, administration, operation, maintenance and evolution of the IT assets consistent with organization goals and objectives (p. 28).

A very detailed definition of Information Technology infrastructure has been compiled by the Institute for Higher Education Policy for the purpose of research on IT funding in higher education (Phipps, 2001). In the definition were included the following components: building infrastructure with cables and electric wiring, system infrastructure with data systems and voice and video systems, as well as personnel infrastructure with network management and course content development as well as student support services.

For the purpose of this study, information technology combined two areas: 1) information technology (IT) strategy; and 2) information technology infrastructure. IT strategy consists of technology governance, distinctive competencies and technology scope. IT infrastructure consists of IT architecture (hardware, software, data, applications, and communication platforms), development of specific IT practices (application development, systems management,

and maintenance functions), and IT skills, which include experience, competence and values of technology employees (Papp, 2001).

Historically, information technology was viewed by business organizations, including higher education, as an administrative non-strategic support function. This view of IT as a utility was supported by the allocation of funding (Morton, 1991, p. 125) until the last two decades, when IT emerged as a critical enabler of business transformation or, in the least, was elevated to the strategic level of organizational planning in the corporate enterprise, and substantial investments in IT have been considered "undisputedly and universally beneficial" (Baschab, 2003, p. 8). Today, IT is an integral part of business operations and plays a strategic role in many organizations (Nair, 1995; Dehning, 2003; Rathnam, 2004-2005).

The view voiced by a small minority of scholars today that Information Technology is a mere commodity whose strategic importance has diminished—an opinion such as that presented by Nicolas G. Carr in the May 2003 issue of the *Harvard Business Review*—provoked a vigorous professional and scholarly debate, which seemed only to reaffirm the significance of Information Technology in strategic planning for business (Hagel and Schrage, 2003, p. 30; McFarlan, 2003, p. 5; Norris &Olson, 2003, p. 91; Ayers and Grisham; 2003, p. 40).

Technologically, the migration from mainframe computing to personal computers and network computing in the 1990s shifted the responsibilities for architecture from vendors—under the proprietary host-centered computing model—to in-house designers, who created an architecture that was open to new technologies, met all individual users' needs and maintained information technology integration throughout the enterprise. IT architecture became one of the top priorities for IT and business executives during the 1990s (Cox, 1999, p. xvi).

Information Technology in Higher Education

Although the fundamental activities of the university have been affected by advancing technologies (Devlin, 2002), the transformation driven by IT, which has been ubiquitous throughout the corporate sector, did not occur in higher education. The notion that "quality" education must be delivered in person, and scholarship is best when practiced in its traditional form—without integrating new technologies—continued to dominate the way in which scholarship and learning occurred in most institutions of higher education. Edward L. Ayers, Dean of the College and Graduate School of Arts and Sciences and the Hugh P. Kelly Professor of History at the University of Virginia, wrote in the November 2003 issue of *Educause Review* that notwithstanding substantial investments that higher education made in Information Technology during the last three decades, "the vast majority of our classes proceed as they have for generations—isolated, even insulated, from the powerful networks we use in the rest of our lives" (p. 42). Ayes argued that because upper administrators themselves lacked the incentives to innovate the learning experience, they saw "little reason to hire or promote others who [did] use the technology" (p. 42). There is a need for a study to increase the understanding of planning for IT within the strategic context of the higher education institution. Similar studies, which revealed corporate leadership habits with regard to IT, have been conducted in the corporate sector (Cox, 1999, p. 14).

Until recently, this lack of interest in information technology as a transforming power in scholarly endeavors on the part of higher education leaders often resulted in short-term planning for IT at various levels of the respective institutions. IT was labeled as infrastructure or utility, not as an enabler for creative approaches to higher education. Consequently, there has been no single uniform approach to strategic decision-making with respect to information technology

throughout the academy. McCredie (2003), associate vice chancellor and CIO at the University of California, Berkeley, argued that higher education institutions needed to determine whether their "long-term goals were served best by an innovator, early-adopter, or follow-the-pack approach to their information technology environment. This decision should be made by the senior leadership of the campus as part of its overall strategic planning effort" (p.22).

Strategic Planning

Strategy and its associated terminology may be compared to other academic disciplines, like logic or politics. The purpose of strategy is to provide direction, focus and "constancy of purpose" to build and sustain competitive advantage (Boar, 1997, 61). Michael Porter (1996) summarized strategy as a way of helping managers transform daily decisions into an organized process and estimate their company's position in its environment. He wrote that strategy makes trade-offs and provides guidance for decision-making throughout the organization (Porter, 1996). The strategy is the organization's collective intention, where formulation and implementation of strategy merge (Mintzberg, 1998).

Literature that deals with planning for business organizations abounds, but few books and articles advise and help in planning for non-business organizations. A substantial amount of knowledge about strategic business planning has been derived from military planning and adapted in for-profit organizations. It follows logically that the remaining group to benefit from it should be the not-for-profit sector (Vaghefi, 1999), such as higher education.

Vaghefi and Huellmantel (1999) provided a definition of non-business strategic planning, which they derived from the following definition of business planning:

Strategic business planning is a process that uses competitive strategies to allocate

its resources to projects that can exploit industry opportunities or defend threats

caused by change in the marketplace for the purpose of meeting the long-range

objectives of the organization (p. 166).

The non-business definition was no more than a paraphrase of the business planning one:

Strategic non-business planning is "a process that uses competitive strategies to

allocate its resources to projects that can exploit opportunities" to fill the unfilled

needs of its clients, or members, to meet long-range objectives of the organization

(p. 166).

The biggest difference between strategic planning and other long-term planning, Vaghefi

and Huellmantel argued, was that strategic planning resources were allocated to specific projects

that the organization wanted to achieve; these projects then compete with each other to activate

the resources (p. 167). The strategic plan "monitors the change taking place in the industry" (p.

169); it is a plan that determines the future of the organization. The main roles of the two other

types of plans, the operational plan and the administrative plan, are to support the strategic plan

(p.169).

Bernard H. Boar (1997) argued that the information age fundamentally changed the

methods of production and exchange; consequently, demands for superior business strategies

intensified. He wrote, "Success will go to those who have the ability to develop and implement

strategy in a superior manner" (p. 59). Boar's definition of strategic thinking included three

elements: time, substance and cardinality. Strategists think across time about problems in terms

of their concrete and abstract nature, and they think about several issues concurrently (p. 67).

The purpose of strategic planning for business is to develop a plan to build competitive

advantage, "to move the business from its current state to the desired future state," Boar

contended (p.103). A traditional strategy concept divides strategic management into three levels:

corporate, business or strategic business unit, and functional. At the corporate level, the strategy develops a vision and sets the agenda for business-level strategies, which, in turn, dictate functional strategies. While the three levels are linked through strategic planning processes, IT remained at the bottom of this pyramid, with its funding based on administrative decisions rather than business investments choices (Morton, 1991).

In the last three decades, IT has emerged in a more strategic role, and the corporate management has been faced with having to rethink the traditional three-level model to account for the change in the function of IT. Venkatraman (Papp, 2001) proposed that senior general management first align the three levels of strategy—corporate, business and function—and, second, reposition IT from its support function to one of a strategic partner (p. 123). Changing the role of IT within an organization is an evolutionary process, Venkatraman claimed. He identified a hierarchy of five levels of business reconfiguration with a focus on the role of IT. These five levels include "localized exploitation, internal integration, business process redesign, business network redesign and business scope redefinition" (p. 127).

At the localized exploitation level, IT is exploited within existing business functions, such as marketing or manufacturing. At the next level, IT capabilities continue to be exploited in all the possible functions within the business process, with emphasis on technical integration (using common Information Technology platform to potentially enhance efficiency) and organizational integration. The next three levels are less evolutionary in nature and more revolutionary—requiring more fundamental changes. The business process redesign requires **"**the reconfiguration of business processes using IT as a central" part. Level four—business network redesign—involves the reconfiguration of the network tasks, and the fifth level—business scope redefinition—is concerned with the corporation's *"raison d'être"* (127-128).

IT Infrastructure as a Strategic Resource

Many organizations have realized the potential of their IT infrastructure with a varied

level of success. Some successful examples include Merrill Lynch's Cash Management System,

American Airlines' SABRE system, United Airlines' APOLLO system, and Baxter-American

Hospital Supply's ASAP System (Morton, 1991, p. 151). These organizations have consistently

used IT infrastructure as a basis of their strategy. At times, though, business investment in IT has

produced dubious results. Some corporate giants, like Nike, Hershey Foods, Denver International

Airport and Cisco Systems, could serve as examples of high-profile IT failures as their IT

projects cost their companies hundreds to billions of dollars (Baschab, 2003).

The Standish Group, a technology research group and consultants, found in its seven-year

study that IT initiatives have a high failure rate, with as high as 53 percent of IT projects

overrunning their schedules and budgets, with the average time overrun being 222 percent of the

original estimate (Baschab, 2003). Standish findings revealed that only 16 percent of IT projects

were completed on time and within the original budgets. Of those completed, only 42 percent

delivered the planned benefits. In terms of perception, the group's research reveals that IT

departments are often targets of dissatisfaction, from the help desk to the management level

(Baschab, 2003). To some extent because of these criticisms of IT, the outsourcing of IT

functions has been proposed as a common solution (Papp, 2001, p.153).

The lessons learned from both successful and failed implementations of IT infrastructure

into strategic business planning have led researchers in one direction—to develop a working

model that enables effective IT management and places IT infrastructure as a strategic resource.

Venkatraman (1993) concluded that in every successful example, significant changes in IT

infrastructure were "predicated on the role of IT to enable new strategic thrusts in the

marketplace" (p. 151). In the context of the new strategic role IT took in strategic management,

Venkatraman divided IT infrastructure into three categories: independent, reactive and

interdependent (Figure 2.1). The independent IT infrastructure is developed outside the strategic

process; the reactive one implies that while the organization acknowledges the significance of IT,

the function of IT infrastructure remains reactive to a certain strategy selected at the higher level.

Finally, the third type combines the strategic context with the IT infrastructure as equal partners

with bidirectional implications (p. 151).

Citing examples of IT project failures, John Baschab and Jon Piot (2003) proposed in

their *Executive's Guide to Information Technology* several solutions for effective IT

management, which could be categorized in two groups: improving internal IT management

practices and improving relationship with business users (p. 33). While Baschab suggested

improvements of a practical nature that are mostly limited in scope, he saw the significance of

tying IT infrastructure to the framework of the entire organization, a process that resembles in

some degree the third type of Venkatraman's categorization of IT infrastructure from the first

"dysfunctional" type, which lacks any link between the infrastructure and strategy formation,

through the intermediate stage of reactive IT infrastructure to the final and ultimate position of

interdependence between IT infrastructure and strategic management (Henderson, 1996, p. 24).

Figure 2.1.

IT infrastructure vision: movement from type I to type III (Papp, 2001, p. 153).

Evolution

Interdependent (III)

Reactive to the strategic context (II)

Independent (I)

Time
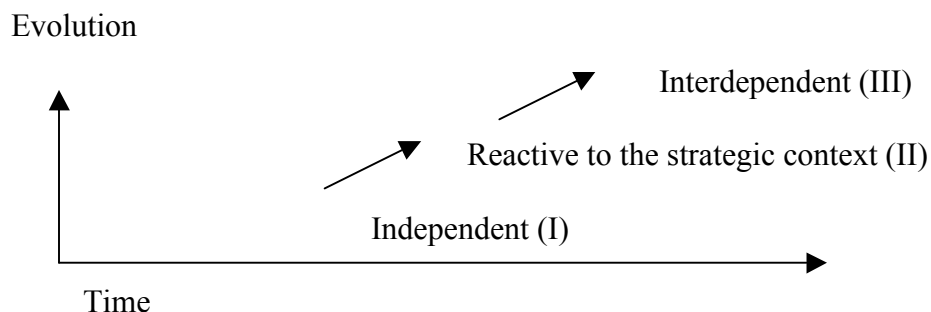
For Venkartraman the emerging view of IT infrastructure and its role in the strategic planning and management was derived from the following changes:

- shift from isolated systems to IT platform for the enterprise;

- focus on business transformation rather than technology sophistication;

- consideration of business criteria rather than cost-benefit criteria alone;

- impact on business domain, not limited to IT;

- guiding principle of strategy-IT alignment, not IT for implementation (Papp, 2001, p. 154).

Strategic Planning in Higher Education

For decades strategic planning has been an integral element of business organizations. While the technology specialists decided how to implement the decisions to pursue a particular IT capability, the drivers for those decisions were strategic, not technical. Institutions of higher education have not followed the corporate lead (Vaghefi, 1999). Higher education leaders have not settled on any one IT strategic planning model that would be both applicable and replicable in colleges and universities. As a matter of fact, the discourse about information technology in higher education continues, as many academic leaders and information services *practitioners* remain divided on the purpose, function and value of IT in their respective institutions (Norris, *Syllabus,* p. 12). Academic and IT leaders acknowledge the effect of IT on most aspects of a university life, but they are still divided on the value of IT. In an *Educause*-sponsored study, Ronald Yanosky found that because IT affects "all aspects of the university's academic and business affairs" (Key Findings, 2008, p. 1), the governance of IT in the higher education environment requires more attention. Yanosky noted that measurement of IT performance remains in the bottom half of the leaders' agenda (Key Findings, 2008).

Technology Expenditures in Higher Education

Although Information Technology has changed the landscape of higher education, relatively little attention has been devoted to studying the financing of technology in education (Phipps, 2001). The findings of the study conducted by Phipps and Wellman indicate that higher education executives, not just IT executives, should focus on planning for technology (Phipps, 2001). The authors claimed that most higher education institutions "continue to fund technology through a series of *ad hoc* initiatives" (p. 12; emphasis in original), which meant IT remained often in its traditional role in higher education—as supporting infrastructure. Phipps and Wellman (2001) wrote, "Colleges and universities must think of technology, not as an add-on, but as an ongoing part of the new way the institutions must do business—in distance learning, teaching, research and service functions" (p. 12). The study also postulated that higher education institutions must identify strategic priorities for themselves, and planning should include all components of technology infrastructure.

Although higher education has not invested in IT at the corporate rate of nearly 50 percent of capital expenditures in the 1990s (Carr, p.5), the spending on technology has been unprecedented in higher education. For example, the projected information technology spending by all U.S. higher-education institutions was $6.94 billion in 2006, a 35% increase compared with the prior year, with 53% devoted to academic and 47% to administrative uses (Emerging, 2008). IT funding remained at the very top of IT professionals' concerns in higher education (Voyles, 2004; Camp, 2007) with returns on this significant investment remaining largely undefined. Milton Glich wrote in *Educause*, "Institutions have often been directed more by the capability of the technology than by their strategic goals" (2001, p. 36). Despite some benchmarking data gathering and distributing by *Educause* Core Data Service in an effort to

understand the complexity of campus IT operations (Green, 2003), the exact role that information technology plays in education, and thus, in institutional strategic planning, remains to be identified (Norris, *Syllabus*, p. 12; Phipps, 2001, p. 1; Green, 2003).

With advances in technology and consumers' demand for greater control of their educational environment and services, institutional expenditures in the area of information technology have increased. Because state and federal resources are scarce, the burden of financing IT rests heavily with the institutions' leaders.

A number of approaches to IT strategic planning in higher education exist, but they are outdated or incomplete. As Donald M. Norris, president of Strategic Initiatives, Inc., wrote in the November 2003 issue of *Syllabus*, much of IT planning is limited to the extrapolation of a "more efficient version of current practices into the future, five years at a time" (p. 16). In this regard, Norris seemed to echo Bernard Boar's (1997) contention that if businesses engage in doing more of the same, they will sustain "a constant level of mediocrity" (p. 198). Norris (2003) argued in favor of IT to be integrated into the education process and included in a continuous strategic planning at the highest decision-making level (p. 16). Many higher education executives argued for more IT involvement in developing strategic plans, but their opinions were based predominantly on their professional experience, rather than research data (Ayers, 2003; Barone, 2003; McCredie, 2003; McFarlan, 2003; Norris, 2003; Hanna, 2003).

Institutional-IT Alignment

Researchers have long recognized the significance of alignment between institutional planning and IT (McLean and Soden, 1977; Henderson and Sifonis, 1988). From the earliest examination of linking the business and IT plans, their perspectives progressed to a study of the fit between business objectives and IT concerns. The findings of both empirical and case studies

of the business and IT alignment in the last decade (Chan et al., 1997; Irani, 2002; de Leede et al., 2002; Kearns, 2003) support the hypothesis that institutions that align their business and IT strategies successfully perform overall better than those organizations that achieve only a low or no degree of such alignment (Broadbent and Weil, 1993; Prairie, 1996; Croteau and Bergeron, 2001; Kearns and Lederer, 2003). Alignment leads to a more effective use of IT that, in turn, leads to maximizing the value of information technology (Henderson, Venktraman and Oldach, 1996).

Information technology alignment was defined by Luftman as "applying IT in an appropriate and timely way, in harmony with business strategies, goals and needs" (1999). Alignment has also been defined by other terms, which are sometimes used interchangeably, including "fit" (Chan, 1992; Henderson and Venkatraman, 1993), "linkage" between the business and IT domains (Reich, 1993), and "functional integration" between business and IT (Henderson and Venkatraman, 1993). In the management information systems literature, the term "fit" often refers to the measurement of alignment (Bergeron, 2001). The term alignment may be said to be the dominant one in the MIS literature, but it is not the case in the strategy literature, where "fit, congruence and covariation" are used interchangeably (Chan, 2007).

Research has demonstrated that one of the most important determinants of successful IT investment is the alignment between information technology and the organizational strategy (Luftman et al. 1993; Sabherval and Chan, 2001). Luftman et al. (1993) argued that business success depends on the alignment of business strategy, IT strategy, organizational structure and processes, and IT infrastructure and processes.

Strategic alignment was defined by Henderson and Venkatraman (1993) as the degree of "strategic fit and functional integration" (p.474) among "four domains of strategic choice:

business strategy, IT strategy, business infrastructure and IT infrastructure" (p. 472).

Organizations achieve strategic alignment when their business objectives and organizational

structure and the information systems that support them work in harmony (McKeen, 2003).

Among the four dimensions of alignment identified in research—"strategic/intellectual,

structural, social, and cultural"—strategic IT alignment receives significantly more attention

(Chan, 2007, p. 300). However, all dimensions, including social and cultural, influence

performance (Reich, 1996; Chan, 2001).

Strategic alignment can be defined as the degree to which the business strategy and

planning and the information technology strategy and planning complement each other (Chan,

2007). The intellectual alignment is characterized by formal business and IT plans (Lederer,

1989; Reich and Benbasat, 2000; Wang, 2003). Structural alignment was defined by Chen (2007)

as "the degree of structural fit between IT and the business," where "the location of IT decision-

making, reporting relationships, (de)centralization of IT, and the deployment of IT personnel"

influence structural alignment (p. 300).

As defined by Reich and Benbasat (2000), the social dimension of strategic alignment is

the state in which "business and IT executives within an organizational unit understand and are

committed to the business and IT mission, objectives, and plans." Reich and Benbasat argued

that the social and strategic/intellectual dimensions of alignment should be studied together.

In an early study, Pyburn (1983) indicated the importance of cultural fit between business

and information technology, or technology planning aligned with cultural elements such as

management style, as a prerequisite to successful technology planning. Chan (2007) argued that

a "strong company culture is a precondition to the type of informal structure that fosters

alignment" (p. 301).Van Der Zee and de Jong (1999) noted the lack of a common "language"

between business and IT executives as a social barrier to alignment. They argued in favor of both executives' use of the same terms to discuss the same topics in order to achieve alignment in thought and action. Burn (1993) suggested "a cultural audit" to explore the relationships between organizational and IT strategy processes.

Some scholars pointed out that alignment may not be desirable in all cases. The criticism ranges from the literature being too theoretical (Ciborra, 1997) to the specified outcomes being too rigid, or limiting, in a constantly changing outside environment (Ciborra, 1996; Orlikowski, 1996) to IT being reduced to the follower role, in which IT simply implements the organization's vision (Chan and Huff, 1993). Sauer and Burn (1997) cautioned that alignment may result in pathological outcomes—misalignment, IT stagnation, and IT cultural and scale challenges associated with globalization. Others pointed out that IT is strategic in itself only if it is unique and difficult to imitate for competitors (Levy, 2000).

While there are some theoretical arguments implying that alignment may not always be a desirable goal for an organization, the information technology practitioners have ranked the business-IT alignment consistently as one of their top priorities, and researchers have developed an array of business alignment models in an effort to help IT decision makers to allocate resources more effectively to meet the organization's goals. In 2005 alignment topped the priority list of management concerns in a survey conducted by the Society for Information Management (Luftman et al., 2005). It was also ranked as the top management concern in two previous years. Alignment was ranked 7th in 1983, 5th in 1986, 7th in 1990, and 9th in 1994 (Luftman et al., 2005).

The Abraham Maslow's hierarchy of needs is replicated in various forms of alignment models. As basic needs are satisfied, higher-level needs emerge (Figure 2.2).

Figure 2.2.

Maslow's hierarchy of needs replicated in alignment models.

In information technology, as basic needs are met, infrastructure investments are treated as a commodity and new levels of investment are sought. The IT pyramid begins with computing infrastructure at its base, Internet and enterprise software as the next level of needs, and knowledge assets management and finally control/sharing of information at the top of the pyramid. The purpose of developing a traditional IT hierarchy of needs is to help organizations categorize their IT investments. As IT takes on a new, more strategic role in an organizations' planning, new models of IT integration are developed.

Four leading alignment models have been offered to assess the harmony between institutional objectives and information technology—Henderson and Venkatraman (1991), Weill and Broadbent (1993), Sauer and Yetton (1997) and Smaczny (2001). Of these four alignment models, the first three are based on the concept of the strategic alignment model developed by Henderson and Venkatraman.

The Integration Hierarchy Model, for example, seems to follow the Maslow's hierarchy in that it identifies IT needs from the very basic to the strategic ones. It attempts to identify the degree of cross-functional integration of IT and business strategies. There are five levels of the integration hierarchy in this model, with the lower levels addressing more basic needs (disintegration) for an effective working relationship and the higher levels focusing on effective cross-functional integration (partnerships replace committees) (Papp, 2001).

The Information Technology Strategic Vision and Planning Model is a conceptual framework for the development, communication and potential benefits of a strategic vision for IT and its alignment with the organizational strategic vision at each stage of the process. To avoid potentially conflicting and confusing IT models that are created by various individuals at different levels of an organization, this model proposes to create an overall strategic IT vision for an organization to help to achieve the organization's overall strategic vision (Papp, 2001).

Michael Porter (1980) argued that all organizations have strategic plans, whether explicit or implicit. Emphasizing the significance of the explicit strategic planning, Porter developed a framework to "help a firm analyze its industry as a whole and predict the industry's future evolution, to understand its competitors and its own position, and to translate this analysis into a competitive strategy for a particular business" (p. xiv). He proposed analysis of five competitive forces—rivals, new entrants, suppliers, buyers and substitute products—and their impact on the organization. He also defined three generic strategies—low cost, differentiation and niche—and considered how the five forces affect the three strategies.

The strategic alignment concept is more than twenty years old (Earl, 1993; Watson and Brancheau, 1991; Luftman, 1993; Goff, 1993). When the original Strategic Alignment Model (SAM) was introduced as a theoretical construct, it examined one single industry, the health care

industry (Henderson and N. Venkatraman, 1990). Since then, the model has been adapted for use by many industries looking to incorporate their information technology into their business strategies (Papp, 1995). The significance of alignment to the IT community cannot be underestimated in the last two decades.

When the business-information technology strategic alignment model was introduced by John C. Henderson and N. Venkatraman in the mid1980s (Henderson, 1992), it set out to help provide an effective solution to the IT planning process. The authors argued that aligning business and technology is an ongoing executive responsibility, but many executives need more help understanding the complexity of IT and enforcing often conflicting sets of priorities. This model attempted to provide a framework to conceptualize the nature of alignment of the business strategic context and the IT strategic context (Henderson, 1992).

As mentioned earlier, the strategic planning for technology has evolved in three stages, according to Venkatraman. These stages include the independent, the reactive and the interdependent stage. In the third and final stage thus far, IT is perceived as both "a means of functional integration and an opportunity to enhance the competitive" advantage of the organization (Henderson, 1992). Understanding IT planning becomes significant also for the executive, who makes decisions to position the organization in the evolving market of technology, from which the organization acquires significant resources, as well as to organize IT services to meet business goals (Henderson, 1996).

The Strategic Alignment Model acknowledged that business decisions are often made at various times and by different people within an organization who are not always knowledgeable about the company's overall business strategy. It also recognized that decisions must be

coordinated and based on an understanding of a number of internal and external factors, including the organization's resources, competitors' positioning and market demands.

Henderson and Venkatram's argument that the strategic alignment model should be viewed as a dynamic model of strategic IT management was based on previous research about the alignment concept as well as comments from managers interviewed during the authors' research. They likened the dynamics of the strategic alignment model to Miles and Snow's argument that "the organizational adaptive cycle . . . is a central concept of strategic management" (Henderson, 1992, p. 111; Miles, 1978, p. 27). They also derive it from Thomson's reasoning that alignment is not a grouping of simple elements; Thomson argued that each component has its own dynamics and is influenced by forces outside of the organization:

> . . . if the elements necessary to the co-alignment are in part influenced by powerful forces in the organization's environment, then organization survival requires *adaptive* as well as *directive* action in those areas where the organization maintains discretion. . . . As environments change, the administrative process must deal not just with domain, but how and how fast to change the design, structure, or technology of the organization (1967, pp. 147-148; emphasis in original; Henderson, 1992, p.111).

Henderson and Venkatram argued that the major IT management challenge lies in the development of a dynamic alignment between the business strategy and the IT strategy (Henderson, 1992). They argued that the alignment perspective must include a minimum of four domains, or quadrants, each comprising three components. The four domains are as follows: business strategy; organizational infrastructure and processes; IT strategy; and IS infrastructure and processes (Henderson, 1992; Henderson, 1996; Luftman, 1993; Luftman, 1996; Papp, 2001).

The SAM model suggests considering two types of integration of information technology: functional (external versus internal factors) and cross-dimensional (business versus IT). Henderson's and Venkatraman's field research led them to conclude that "inadequate fit between external and internal domains of IT is a major reason for failure to derive benefits from IT investments" (Luftman, 1996, p. 68). Misalignment at any level would result in a dysfunctional relationship between IT and the business, according to this model (Boar, 1994).

The authors defined *business strategy* in terms of choices that position the organization in the competitive market. The *business strategy* domain is an external domain and includes three dimensions: business scope (products and markets), distinctive competencies (characteristics that distinguish the organization from others, such as superior service or product design), and business governance (alliances and joint ventures). The *organizational infrastructure and processes domain, the internal domain,* is concerned with choices that define the administrative structure, the design of critical business processes (product development and delivery, customer service), and human resource skills (Henderson, 1996).

Because the purpose of the Strategic Alignment Model is to help in integrating technology with institutional strategy and objectives, the interrelationships among the four domains are at the core of its purpose. Raymond Papp (2001) argued, "While each of the domains is important in its own context, they only gain value when employed as a cohesive whole" (Papp, 3). The model derives its value from the different types of relationships possible among the fours domains or quadrants.

Institutional-IT Alignment in Higher Education

In its 2006 Report, the Spellings Commission identified the "mission-to-technology alignment" as one of the most significant challenges facing higher education (U.S. Department,

2006). The Report defined "leadership" in the IT area in higher education as working closely

with the institution's cabinet to monitor the developments outside of the institution and to align

organizational strategies to these developments and the institution's core purposes (Abel, 2007).

The Spellings Commission report indicated that IT leaders should take an active role in

institutional planning and assessment. In his analysis of the report, Rob Abel, CEO of IMS

Global Learning Consortium, argued that in pursuit of accountability and measurements of IT

innovation and investments in higher education, aligning Information Technology strategies with

the organization's purpose and policies is a challenge. Abel wrote, "Navigating this gap and

achieving alignment is the key to enhancing institutional performance via technology" in

education (Abel, 2007).

In a higher education survey of top IT and cabinet-level executives, 74% of surveyed

Chief Information Officers ranked aligning IT with institutional goals as one the top drivers for

pursuing IT governance (Yanosky, 2008). Sponsored by *Educause*, the 2007 study of IT

governance in higher education found that most Chief Information Officers agreed with their

executives that IT governance was effective at their institutions, a fact that they attributed to

frequent constituents' participation and effective communication (Yanosky, 2008). Two of the

key mechanisms that the respondents identified as associated with good IT governance in higher

education were participation in institutional budgetary processes and incorporation of

measurement and review into the IT governance process (Yanosky, 2008). Effective

communication, explicit link of IT plans to institutional budget and measurement/assessment

tools as main drivers of alignment were also among the chief findings of the 2004 study of the IT

alignment in higher education (Pirani, 2004). Both the 2004 and 2007 studies concluded that

given higher education's idiosyncrasies—shared decision making, independence of academic

units and diversified yet parallel products, such as teaching and research—a distinct

organizational culture typical of colleges and universities presented unique challenges for IT

governance and IT alignment with the organizational purposes and priorities. Yanosky concluded

"that higher education IT administrators can and should work within the cultural norms of

inclusion and shared decision making that typify colleges and universities" (Yanosky, 2008).

Summary

Researchers have explored the significance of alignment between business and IT for the

last three decades (e.g. McLeanand Soden, 1977; Bruce, 1998; Henderson and Sifonis, 1988;

Sabherval and Chan, 2001). The definition of institutional-IT alignment has evolved from those

initial studies decades ago, when the term often meant linking the business and the IT plans, to a

concept of congruence between the business strategy and the IT strategy (Kroes, 2007), to a

perspective that examines the fit between business and IT objectives (Chan, 2007). Institutional-

IT strategic alignment is defined as "applying IT in an appropriate way, in harmony with

business strategies, goal and needs" (Luftman, 1999). In their studies of the benefits of the

institutional-IT alignment, researchers' approaches range from the investigation of strategic

alignment maturity levels (Nash, 2006) to organizational performance (Sanchez, 2003) to the

role of legislation on alignment (Kissinger, 2007) to the applicability of a number of alignment

models.

Four leading alignment models have been offered to assess the harmony between

institutional objectives and Information Technology—by Henderson and Venkatraman (1991),

by Weill and Broadbent (1993), by Sauer and Yetton (1997) and by Smaczny (2001). Of these

four alignment models, the first three are based on the concept of the strategic alignment model

developed by Henderson and Venkatraman.

Mutual understanding of priorities between the institution and its information technology sector lies at the center of institutional-IT alignment. But higher education priorities cloud the process because colleges and departments often function as independent entities, "creating distinct organizational cultures and managing many academic, research and administrative activities locally" (Orton and Weick, 1990). Thus information technology leaders may face contradictory priorities at the different institutional levels making alignment difficult. Aligning technology with institutional priorities, planning and actions and with evolving goals of the individual colleges and departments continues to be a challenge for both IT leaders and administrators in higher education.

Although strategic alignment in higher education has been advocated by professionals and government officials in the last decade, there is no existing instrument to assess such alignment. What is clearly called for, as a logical extension of the current information technology governance in higher education literature, is a better understanding of the present alignment, or lack thereof, in order to formulate strategies that will maximize the value of the IT investments in the educational and research-driven environment.

CHAPTER 3

Research Methodology

Overview

This study's primary research method was based upon the Delphi technique followed by a survey. The sequence used was to examine an existing model for its applicability to higher education by a Delphi expert panel, to test the results of the Delphi using a survey and to analyze the results. The data gained from the research are presented in Chapter 4. The analysis of the results is presented in Chapter 5.

The research method was based on the "specific ways and methods one uses to understand the world better" (Trochim, 2007). The method selected for this study comprised a non-experimental qualitative Delphi technique and a subsequent quantitative survey technique.

The Delphi technique was used to collect valuable opinions and experiences of researchers and professionals about the applicability of a corporate model in a higher education environment. Using a survey technique, the results of the Delphi were tested on a randomly selected group of higher education leaders from mid-size four-year institutions of higher education.

Appropriateness of Design

Patten (2004) argued that "some research questions inherently lend themselves more to a quantitative than the qualitative approach" (p. 21). Conversely, a qualitative rather than

quantitative approach is more suitable for addressing some research questions. The broad

framework of the qualitative research method seeks to explore phenomena and holistically

understand the "rich, contextual and detailed data" (Nason, 1996). Qualitative research is

"interpretivist in the sense that the researcher is interested in how the social world is interpreted,

understood and experienced" (Skulimoski, 2007). In the qualitative research process, the

researcher is engaged in a conversation with the research participants in a natural setting as

opposed to a laboratory (Creswell, 1994). Qualitative methods are effective in identifying factors

"whose role in the research issue may not be readily apparent" (Mack, Woodsong, MacQueen,

Guest & Namey, 2005, p. 2). When used in conjunction with quantitative methods, qualitative

research enables us to interpret and understand better the implications of quantitative data (Mack,

et al.).

Quantitative research, on the other hand, seeks to test hypothesis about phenomena

(Mack, et al., 2005) and requires that the variables under consideration be measured. The use of

numbers in quantitative research allows for greater precision in reporting results as well as the

use of mathematical analysis (Wimmer and Dominick, 1987).

Both research approaches differ in their analytical objective. While the qualitative

research method's analytical objective is to describe, the goal of the quantitative research

approach is to quantify (Mack et al.). Both research methods are rich in traditions and have been

used to address research questions (Trochim, 2007). Trochim stated that "there is value in

consciously combining qualitative and quantitative methods in what is referred to as a mixed-

methods approach" (p. 154). The term triangulation in research refers to the use of both

qualitative and quantitative methods to understand fully the nature of a research problem

(Wimmer and Dominick, 1987, p. 51). Robson (2002) refers to this design as "flexible" because

the investigator expects "that the design will emerge and develop during data collection" (p. 164).

This study used the Delphi method to refine an existing model. A survey method was selected to triangulate the results of the Delphi. The purpose of a survey was to provide statistical estimates of the characteristics of a target population (Fowler, 2009, p. 11). The results of the Delphi, a modified strategic alignment model's instrument, was tested on randomly selected executive and information technology leaders from mid-size four-year institutions of higher education. The goal was to modify a corporate model for use in the higher education environment.

Research Design Theory

This study used a mixed method procedure, as described by Creswell (2003), which combines qualitative and quantitative approaches. The factors and characteristics required for the qualitative research problem described by Morse (1991) make a good fit for this process of adoption of IT alignment model in higher education. The characteristics include: 1) an immature concept evidenced by a lack of theory and previous research, 2) a notion that available information and theories may not accurately reflect the actual environment, 3) a perceived need to explore and/or describe a phenomenon or to develop a theory, and 4) a target of study (phenomenon) that was not suitable for quantitative measures. The qualitative approach utilizes strategies of inquiry, such as narratives and case studies, and data collection methods, such as observation, interviews and diary (Creswell, 2003). The quantitative approach employs strategies of inquiry, such as surveys and experiments (Creswell, 2003).

The qualitative design was selected for this study to discover information, through the process of induction, about an existing institutional-IT alignment model and its application to

higher education, that is not easily derived through the use of quantitative methods. Marshall and Rossman (1995) describe qualitative research as "[research] that is exploratory or descriptive, that assumes the value of context and setting, and that searches for a deeper understanding of the participants' lived experiences of the phenomenon" (p. 39). Based on the feedback provided by participant experts (Merriam, 1988), an inductive qualitative process was used to identify elements of the existing model that may need to be modified or revised in order for the model to be applied in higher education.

Rather than developing a new model or beginning with preconceived revisions to an existing institutional-IT alignment model in order to apply such a model to higher education, the researcher employed a technique that allowed a panel of experts to make conjectures about an existing model's adoption to a higher education environment. Based on rational judgment and their expertise feedback, the panel of experts examined the existing institutional-IT alignment model for its applicability to higher education.

The study began with a review of literature and the selection of an existing theoretical strategic alignment model. The Henderson and Venkatraman model was selected as being sufficiently abstract to apply to the unique environment of higher education. The selected model was the starting instrument for the Delphi panel in Phase One. Based on the panel's feedback in two consecutive rounds, a revised model was developed. The next step tested the adapted model by applying it to higher education and collecting quantitative data in Phase Two. Finally, the results were interpreted and included the conclusions drawn from the entire process.

Phase One: The Delphi Method

    Definition. A Delphi study is a "systematic process of obtaining a consensus view from a panel of experts" (MacCarthy and Atthirawong, 2003). The Delphi method is "an iterative process to collect and distill the judgments of experts using a series of questionnaires interspersed with feedback," where each subsequent questionnaire is a result of the previous one (Skulmoski et al., 2007, p. 2). It is well suited as a research instrument "when there is incomplete knowledge about a problem or phenomenon" (p. 2). The Delphi method is defined by Linstone and Turoff (1975) as:

> A method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem. To accomplish this "structured communication" there is provided: some feedback of individual contributions of information and knowledge; some assessment of the group judgment or view; some opportunity for individuals to revise views; and some degree of anonymity for the individual responses (p. 3.)

    Background. The beginnings of the Delphi method date back to a 1944 U.S.-sponsored military project to study intercontinental warfare by the Douglas Aircraft Company (McNeil, 2006; Skulmoski, 2007). The Delphi method was developed by Norman Dalkey and Olaf Helmer at the RAND Corporation in the 1950s (Cope, 1981; Yousuf, 2007). The "classical" Delphi method (Skulmoski, 2007, p. 2) used an iterative feedback technique to build consensus among military experts (Yousuf, 2007). In the 1960s, the Delphi was used principally by corporations as a forecasting tool (2007). Later use of the Delphi technique in research ranged from forecasting changes in the educational environment (Reeves, 1978; Wells, 1994) and social sciences to

assessing trends in the areas of science and technology. In the 1970s, a modified Delphi technique was used in the management disciplines (Yousuf, 2007).

Significance. Several factors contributed to the selection of the Delphi technique as the research methodology. First, the problem "does not lend itself to precise analytical techniques but can benefit from subjective judgments on a collective basis" (Linstone & Turoff, 1975, p. 4). Second, the panelists contributing their expertise have no history of organizational ties and represent "diverse backgrounds with respect to experience or expertise" (p. 4). Third, the Delphi technique is a cost- and time-efficient method of seeking expert opinion and arriving at group consensus. Finally, individuals' responses remain anonymous to other panel members when respondents receive group feedback from the previous round. This anonymity can prevent disagreement among individuals, "domination by quantity or by strength of personality" (p. 4), intimidation and difficulties in publicly contradicting individuals of higher rank (Daily, 1990).

This method has served as an investigative instrument for executives to learn and understand the factors that contribute to decision-making on a specific issue as well as a tool for building consensus (p. 76). Inaki, Landin and Fa (2006) noted that the group's collective knowledge is "superior to the knowledge of even the best-prepared participant, since the knowledge of all the participants is mutually complemented" (p. 816). Lindstone and Turoff (1975) and MacCarthy and Atthirawong (2003) observed that a single opinion may represent a narrow view that results from a variety of factors, whereas the Delphi method reduces those factors by representing a group opinion on the issue under investigation. Riggs (1983) and Rohrbaugh (1979) concluded that the Delphi method is more accurate than other group consensus techniques.

Expert Panel. The purpose of the study determines the type of Delphi used. The selection of the Delphi panel is the main element determining the method's success because the composition of the panel directly relates to the quality of the results generated (Judd, 1972; Scheele, 1975; Reid, 1988; Taylor & Judd, 1989; Jacobs, 1996; Powell, 2003; Inaki, 2006). Scheele (1975) argued that "three kinds of panelists are ingredients for creating a successful mix: stakeholders, . . . experts, . . . and facilitators" (p. 68) and that the proportion of a panel from each category is determined by the application of the Delphi. Because the Delphi method solicits expert opinions, the selection of panel members should be based on their areas of expertise relevant to the specific issue in question (Hsu & Sandford, 2007, p.3). Reid (1988) and Inaki (2006) noted that one of the keys to success in using the Delphi method is the selection of appropriate panel members: "They should be selected for their capabilities, knowledge and independence" (Inaki, 2006, p. 814). The exploratory nature of this study determined the selection of experts and stakeholders in the two areas under investigation—institutional strategic alignment and information technology management.

The term "expert" is subjective. The definition of an expert was derived from Hsu and Sandford (2007) who noted that "Delphi subject should be highly trained and competent within the specialized area of knowledge related to the target issue" (p. 3). Therefore, the researcher quantified, in measurable terms, what constitutes an expert for the purposes of this study. The panel of experts included a group of researchers with at least 10 years of publishing on the subject of business-IT alignment and a group of researchers with a record of at least five years of publishing on the subject of information technology in higher education. The panel also included IT professionals who were recognized nationally by their peers for their leadership in higher education and had at least five years of experience in their profession. Both groups were drawn

into this study with relative ease and at minimal cost. Because expert opinion was sought, a purposive sample was selected "not to represent the general population but rather the expert ability to answer the research questions" (Fink and Kosecoff, 1985).

The three groups of experts were identified in the following manner. The business strategy and alignment scholars were identified using databases EBSCOhost, ProQuest and ProQuest Dissertations and Theses-Full Text to generate a list of those who had published articles on strategic alignment in the last decade. If the author's name appeared at least three times in the references of dissertations or other articles, his or her name was retained on the list.

The second list of researchers was generated using the Educause Resource Center and included ECAR fellows who published on the subject of strategic alignment and technology governance.

The third list was to be initially generated by approaching the CIO magazine, an online professional magazine for Chief Information Officers. CIO never responded to the request to use of the CIO advisory list to identify individual CIOs in higher education. Instead, award winners recognized by their professional peers for excellence were considered; winners of the Educause Leadership award and CIO Magazine Ones to Watch awards were selected for both their relevance to the topic of this study and for the level of professional peer recognition they represented.

The Delphi panel varies in size ranging from 9 to 1,685 (Powell, 2003; Skulimoski, 2007). This study was designed using a panel of 12 subject matter experts, the number depending upon the availability of appropriate experts willing to contribute the time to the study. The invitation to participate went out to 17 individuals. At the onset, 12 members agreed to serve on the panel, but after the first materials were distributed to the panel and before the end of the first

round, three members declined for lack of time on their part, leaving a nine-member panel, which was deemed sufficient. Dalkey (1969) noted that accuracy increases as the size of the panel increases up to 11 members but levels off and does not improve significantly beyond 11 panel members. Dalkey, Brown and Cochran (1970) observed that a panel size of seven was the lower limit. Although smaller groups may not be representative of a wider population, Powell (2003) noted that "the Delphi does not call for the expert panel to be representative for statistical purposes" (p. 378). In this study the panelists were selected based on their unique experience and knowledge.

To ensure broad opinion, the nine-member panel for the Delphi study was structured in the following manner. Three panelists were scholars specializing in business strategy and alignment research; three panelists were scholars who specialize in information technology in higher education research; and three were professionals who worked as Chief Information Officers in colleges or universities and recognized by their peers nationally.

Approval from the Indiana State University Institutional Review Board for Protection of Human Subjects was obtained prior to beginning the study.

Delphi Process. The study was conducted in two phases. In the first phase, the Delphi method was used. The necessary number of rounds of a Delphi depends on the purpose of the research. A two- or three-iteration Delphi is sufficient for most research (Delbecq, Van de Ven and Gustafson, 1975). As the number of rounds increases, a fall in response rate may be noticed (Rosenbaum, 1985; Alexander, 2004). The two-round Delphi process enabled the participating experts to formulate their opinions about the applicability of the existing model, its components and its survey instrument to the higher education environment. The experts were able to finalize their observations and opinions after considering the entire group's views. This process enabled

the researcher to gain a consensus from experts about the applicability of the existing strategic alignment model.

For the purpose of this study, the Delphi included two rounds. In the initial round the Delphi method was employed to examine the Henderson and Venkatraman Strategic Alignment Model (SAM) as it applies to higher education. After the first round, the panelists reached a general agreement on how they viewed the alignment model. The second round provided the panelists with others' feedback and the opportunity to provide comments and critique others' opinions. Throughout both rounds, the expert panelists remained anonymous to each other.

Round One*:* It is recommended that the initial round of the Delphi be open-ended (Delbecq, Van de Ven and Gustafson, 1975; Inaki, Landin and Fa, 2006). The purpose of the first round is to aggregate information for review and revision in subsequent rounds of the study. For this study, a panel of researchers and information technology professionals were asked whether the existing model of institutional-Information Technology alignment that was developed by Henderson and Venkatraman (Henderson, 1993) applies to higher education or whether any part of the model could be applied to higher education. The panelists were also asked to review the model's instrument, a questionnaire, and provide feedback on the instrument's relevance to higher education. The participating experts answered the questions and stated their rationale for their opinions. They provided comments on the instrument's relevance to higher education. The researcher combined the panelists' answers and modified the instrument as suggested by the panelists.

Round Two: The results from Round One were shared and then the panelists were asked to re-examine their answers in view of all the panelists' responses; they were also asked whether they agreed with each of the modifications made by the researcher based on the panel's Round

One recommendations. They were given another opportunity to amend the model and those modifications.

Validity and Reliability. The Delphi method has qualitative aspects (Day and Bobeva, 2004). Powell (2003) noted that Sackman (1975) said that "Delphi studies are often oblivious to reliability measurements and scientific validation of the findings" (p. 382). Powell continued in the same article that "Murphy et al. (1998) noted that the Delphi technique . . . should not be viewed as a scientific method for creating new knowledge, but rather as a process for making the best use of available data"(p. 382). Consequently, such a process is not subject to the same validation criteria. However, Day and Bovbeva (2005) argued that "the trustworthiness criteria of confirmability, credibility, transferability, and dependability could complement or replace the positivist criteria of objectivity, validity, and reliability" (p. 1). Because the Delphi technique relies on the experiential knowledge of the panel, the scientific value of the results may be derived from its consensus. Mitroff and Turoff (1975) argued that "An empirical generalization or communication is judged objective, true or factual if there is sufficient widespread agreement on it by a group of experts" (p. 21). Powell (2003) points out that although Delphi methodologists may not use traditional criteria of scientific rigor, they offer an "alternative means of demonstrating the scientific merit of the findings" (p. 380). The goodness criteria concept, which was proposed by Heshusius (1990), constitutes an appropriate measure for validation (Powell, 2003).

A proposed definition of validity is "the best approximation to the truth of a given proposition, inference, or conclusion" (Trochim, 2001, p.20). In this study the Delphi panel examined a strategic alignment model for application in higher education in order to facilitate more effective integration of IT strategy and objectives with institutional strategy and objectives.

On the second round the panel reached a consensus as to the applicability of the model. That would suggest that a group of researchers in strategic planning and the use of technology in higher education and a group of IT officers in institutions of higher education were able to reach a consensus as to the applicability of a corporate strategic alignment model to higher education environment. This result was the intended outcome of this study. This would suggest that this outcome has validity in regards to the purpose of this study.

A proposed definition of reliability for this study is consistency. Trochim (2001) noted, "A measure is considered reliable if it would give you the same result over and over again (assuming that what you are measuring isn't changing)" (p. 92). In this study an existing theoretical model and its survey instrument were examined. The expert panel added no questions, and none of the questions was eliminated. The panelists found the resultant survey instrument to be valid for use in higher education, and the fact that their consensus from two rounds did not change suggests that the model and its instrument are repeatable and consistent.

Limitations. The scope of the study was limited to examining one institutional-information technology strategic alignment model for a fit in a higher education environment. If the study had examined more business models for application in higher education, the results might have been different. Factors that affect such alignment in higher education and that were identified as a result of this study were limited to the scope of this model.

Another limitation that may have affected the results of the study was the selection of both researchers and practitioners for the Delphi panel, as opposed to IT practitioners in higher education exclusively. It was the intention of this researcher to use a panel of experts with not only the knowledge and experience of the issue but also with the depth of understanding of the issue, its complexity and significance for IT decision makers in higher education. The latter

limitation was overcome, at least in part, by selecting one third of the Delphi panel from among the practitioners and by administering of the model's instrument to both executive and technology leaders in randomly selected four-year institutions of higher education during Phase II of the study.

Linstone and Turoff (1975, 2002) noted that a Delphi may result in an "artificial" consensus when a strong minority view is not explored because the dissenters may drop out of the study. Another reason for a lack of true consensus among the Delphi group may be manipulation on the part of the researcher Yousuf (2007).

Similar limitations of consensus discussed by Yousuf (2007) include unique, but not representative, decisions of the panel, elimination of extreme positions, disregard of disagreement among the members, imposition of researcher's views and poor summary and presentation of responses. Powell (2003) pointed out several weaknesses of the consensus model including watering down the opinion by people modifying their opinions to reflect what they believe is the lowest common denominator.

Population and Sampling Frame. For purposes of this study, a nine-member panel was selected in the following manner. Three panelists were selected from among the scholars who have done substantive research and published the results of their work in peer-reviewed journals in the last 10 years. The second three-member group was selected from *Educause* fellows who have published research on the use of information technology in higher education in the last five years. (*Educause* is a non-profit association whose mission is to advance higher education by promoting the intelligent use of Information Technology.) The third group of three IT professionals who lead and manage technology in higher education was selected from among the winners of professional awards in the last five years, including the CIO Magazine Ones to Watch

List and the *Educause* Leadership Award for Distinguished Performance and Outstanding

Service, as well as a working IT professional member of the Center for Higher Education Chief

Information Officer Studies, a non-profit research group focusing on studies of CIOs in higher

education.

Strategies for Delphi group selection depend on the nature of the research problem. Day

and Bobeva (2005) noted, "The narrower the scope, the greater the depth and specificity of

expertise needed and the more likely a purposive approach is appropriate" (p. 109). The choices

for selecting the Delphi group are "between probability and non-probability (purposive)" (p.

109). The sampling method used in this study was purposive. In this study Delphi panelists were

selected based on their experience and knowledge.

For the purpose of this study the term expert was defined as an individual with

knowledge derived from conducting research or from professional experience. In the absence of

existing knowledge about the status of alignment in higher education, a qualitative analysis using

the Delphi method was used in the process of consolidating opinions from a group of research

experts and professionals to modify the existing Strategic Alignment Model to higher education.

Delphi Procedure. Witkin and Altschuld (1995) noted that electronic technology

enabled researchers to use the Delphi process by taking advantage of "the storage, processing,

and speed of transmission capabilities of computers; the maintenance of respondents' anonymity;

and the potential for rapid feedback" (p. 204). All panelists were contacted via email requesting

their participation and explaining the study, the Delphi process, and the availability of the results

upon request. All panel members had access to the Internet and email software.

The initial email to all panelists included the following information in accordance with

Internet Research guidelines at Indiana State University: email addresses of the investigator and

IRB; no claim about the superiority, safety, or effectiveness of procedures, interventions, devices, or any other materials used in research; a description of the process for completing the online activity; information on subsequent contacts that will be made if the individual agrees to participate; no promise of anonymity; and information about future contacts (see Appendix C). It was important that the researcher be able to identify each participant's responses because those responses needed to be returned to the panel for feedback in the next round. The researcher also needed to know the response status for each participant in order to assist that member in providing a timely response.

The contacted individuals acknowledged willingness to participate in the study by sending an email expressing their availability and readiness to participate in the Delphi. Those who agreed to participate in the Delphi were not provided with a pseudonym or user name as they were provided with the materials via email directly by the researcher, and they returned their feedback directly to the researcher. Participants had no contact with each other at any time during the two rounds of Delphi. After the first round the data was reviewed by the researcher and presented back to the panelists in the following round. The researcher removed all identifying information before submitting any materials in the next round.

Delphi Instrumentation. Rather than use a preliminary pilot study, the first round of Delphi served as a brainstorming phase (Schmidt, 1997). In Round One of the Delphi, the panel members were provided some background materials. They received a description of the Strategic Alignment Model (SAM) by Henderson and Venkatraman (1993), including four domains, each comprising three internal or external factors that may influence alignment. In addition, the panelists received definitions of terms used in the SAM instrument (questionnaire) and the assessment instrument for examination. The distribution of this material allowed the panelists to

review pertinent information as it relates to each of their areas of expertise. The shared information helped to achieve a common understanding of the strategic alignment concepts.

The panelists were asked to examine the model and its components and to identify any components of the model that may somewhat apply and those that may not apply to higher education. They were also asked to review the related survey instrument and identify the questions on the survey that may not apply to higher education or propose new questions. Open-ended questions in Round One of the Delphi allowed the panelists to write comments about the model and the survey instrument as they would be applied to higher education.

Continuous verification throughout the Delphi process is critical to improve the reliability of the results (Linstone & Turloff, 1975). It was the intention of the researcher that the panelists themselves edit their answers for redundancy, repetitiveness, and vagueness. The panel experts returned their responses in an allotted time by electronic mail. The participants were given the opportunity to verify their feedback from Round One and to modify their responses after having a chance to review other participants' comments. In Round Two the panelists were asked to review a consolidated list of answers to all the questions from Round One and to mark if they agree or disagree with each comment. Panelists were allowed to provide additional comments. They were also asked to examine the modified survey instrument, a combined result of their revisions and suggestions, and mark if they agree or disagree with each change or modification.

The investigator used a percentage of votes to determine consensus (Miller, 2006). Green (1982) suggested that at least 70 percent of the Delphi sample needs to rate three or higher on a four-point Likert-type scale. Ulschak (1983) recommended that consensus be achieved by having 80 percent of participants' votes fall within two categories on a seven-point scale. Because ranking on a Likert-type scale was not utilized in this Delphi study, the researcher used the

agree-disagree format to develop consensus. If at least 80 percent of the panelists agreed with their collective modifications to the instrument, then the researcher concluded that the panel reached consensus.

Consensus amongst the Delphi panel members for the purpose of this study occurred when at least 80% of the panelists agreed that the institutional-IT strategic alignment model was applicable to higher education, which was accomplished after Round Two. Consensus in this phase of the study was reached when no objections were raised against the application of the existing model with some terminology adjustments for the higher education environment.

The revised model's instrument and the participants' responses were kept confidential. They were available only to the panel members. The panel members did not have contact with one another.

Data Collection. The nine-member Delphi panel was asked to examine all the components of the Strategic Alignment Model (SAM) and its survey instrument for application in higher education. The panelists were asked to explain briefly their responses and provide any comments that may help in adapting that model for use in higher education. Comments regarding the model, its components and the survey instrument were welcome, if the panelists wished to include them. The revised model and participants' responses were sent back for further evaluation in the second round of the Delphi (Appendix D). Panelists were instructed to either agree or disagree with each revised or unrevised form of the question of the survey instrument and provide their rationale for their decision if they chose to do so.

The researcher maintained an email folder for Round One of the Delphi responses and a folder for Round Two responses. After Round One the researcher collected the information from panelists, combined and organized the data and sent the results as an attached Word document to

all panelists for their examination in Round Two. Their feedback was solicited inside the Word document file. Panelists returned the Round Two document with their feedback as an attachment to the researcher.

Data Analysis. The researcher conducted a qualitative analysis of responses from the first round of the Delphi. Emphasis was placed on whether all or some of the elements of the Strategic Alignment Model may apply to higher education and whether the model's assessment instrument is applicable to higher education. Data was analyzed to identify patterns among the responses using the following conceptual steps for pattern analysis: identify and combine related data and patterns into meaningful groups under each of the researcher's questions and under each of the instrument's questions; identify sub-patterns and how they relate to patterns; synthesize small themes or patterns to obtain a broad understanding of data; and articulate such patterns to test panelists' comments about the model or modifications to the instrument.

The researcher modified the survey instrument of the model after taking into consideration the patterns that emerged from the panelists' comments. This revised instrument was sent, in Round Two of the Delphi, to the panelists, who were asked whether they agree or disagree with each of the modifications. The expert panelists were given the opportunity to revise their modifications to the instrument and to provide additional comments.

Phase Two: Testing the Delphi-Generated Model

The second phase of the study was a triangulation of the Delphi results. The findings generated by the Delphi panel were tested by applying the Delphi-modified Strategic Alignment Model (SAM) instrument to higher education. The application of the instrument to higher education institutions enabled the researcher to test whether the Delphi-arrived model could be used in higher education. The level of correlation between the elements of the model and the

status of alignment, as perceived by executive and technology officers at their respective institutions, measured the degree to which the Delphi model explained alignment.

Survey method is a quantitative description of a research of sample-derived data from the participants' responses to a set of predetermined questions. The analysis of the data obtained from the survey allowed the researcher to draw conclusions about the population from which the sample was taken as well as test for relationships between variables through cause-and-effect analysis (Fowler, 2009).

The content of the survey in this study was the result of the Delphi and the research questions. The survey used in Phase Two of this study was a modified, by the Delphi panel, Strategic Alignment Model instrument. The survey in Phase Two of this study was divided into two parts: background information about the participating institution and the SAM modified instrument (Appendix E).

The first section of the survey gathered background data by requesting the participants to select the response that best described their institution's size and public or private designation. Those surveyed were asked to evaluate the alignment at their institutions on a four-step scale— from no alignment to strong alignment. The participants were also asked to describe the role of IT in their respective institutions—as a support function, core competency or publicly recognized for its use of IT.

The second section of the survey used the Delphi-modified SAM instrument. The participants were asked to rate their level of agreement with each of the statements describing communication, governance, processes, scope and structure of Information Technology and administration in their respective institutions.

Population and Sample Size. The target population for Phase Two of this study included four-year colleges and universities as defined in the Carnegie Foundation classification. The category was based on the Carnegie Foundation's basic classification of universities and colleges and included both private and public institutions. Using the Carnegie category, both residential and non-residential four-year medium, with enrollment between 3,000 and 9,999, institutions were included in this category. The total number of four-year institutions with a minimum enrollment of 3,000, which fell into the "medium" category, was 437.

A random sample of 150 institutions was generated. Two leaders, the Chief Information Officer and the Chief Executive Officer, from each institution were identified through their institutions' Web pages. Executive and IT administrators self-reported the degree of institutional-IT alignment and the role of IT at their institution, and they completed the model (SAM) instrument survey. Approval from the Indiana State University Institutional Review Board for Protection of Human Subjects was obtained prior to beginning the study.

Each of the universities and colleges was assigned a number with a range from 1 to 437. The method for generating a sequence of random numbers was used. Random sampling is a procedure used by researchers in which all subjects or units in the population have an equal chance of being selected (Wimmer & Dominick, 1987). The website that was used to generate a sample from the population by a process that provides every sample of the population an equal probability of being selected was http://www.randomizer.org.

The sample size for an ά level .05 and an effect size Cohen's d=0.5 (medium) (Cohen, 1988) was at least 210 (105 for each group: CIOs and CEOs) using G power software to determine the sample size (Faul, Erdfelder, Land, & BUchner, 2007). A random sample of 150

higher education institutions, representing 150 CIOs and 150 CEOs combined, was generated for a total sample size of 300.

Each of the institutions chosen by the randomizer maintained a website. The website included a list of senior administrators and their email addresses. The top senior institution's administrator and the top senior technology administrator in each of the selected universities were recorded, including their respective email addresses.

Confidentiality. The researcher used Indiana State University survey software, *Qualtrics*, to design the survey, distribute it and collect data. After obtaining a *Qualtrics* account at ISU, the researcher used *Qualtrics* software to build the survey, two distribution lists and secured the collected data by the researcher's user name and password created when the researcher opened the account at ISU. Through *Qualtrics,* the researcher collected data from participants through the Internet. The participants received an email generated through *Qualtrics* that included a link with unique Web address to the survey.

The participants did not have any direct interaction with other participants. The initial email inviting participants to take the survey included, in addition to the unique survey URL link, an outline of the purpose of the study, the process of the study, the approximate time required to complete the survey, explanation of the volunteering nature of their participation, and information detailing how to contact the researcher and the Institutional Research Board at Indiana State University. The information to the subjects provided a telephone and email address for the researcher if the respondents were interested in receiving the results of the survey. Participation in the survey was voluntary. Confidentiality was maintained because of the absence of any identifying information on the survey forms, thus keeping the information anonymous.

Data Collection. The participants were sent an email generated by the *Qualtrics* software at ISU with the URL for *Qualtrics* (2009), a secure survey Web site affiliated with ISU. The researcher maintained a list of all the participants by position and institution. The list was used to match responses during analysis to determine correlation between CEOs and CIOs. *Qualtrics* (2009) secured the data by researcher's user name and password. Each participant was granted access by a specific URL to a single survey only. Participants had no access or information about other participants' responses. Information about starting the survey and completing the survey was stored in the *Qualtrics* software, and the researcher was the only one who had access to this information. The researcher had access to the results of the survey, which were stored in *Qualtrics,* after each participant completed the survey.

Data Analysis. Statistical analysis was conducted using correlation methods and t-test. For all of the statistical analyses, SAS (SAS Institute, Inc., http://www.sas.com) statistical and data management software was used.

The linear regression method was used to analyze the data obtained from the survey of randomly selected Chief Executive Officers and Chief Information Officers from four-year institutions of higher education. The term "linear" indicates that the regression equation is linear in the parameters, and not that the relationship between the dependent variable and independent variable is presented graphically as a straight line (Wadsworth, 1990). It was assumed that the randomly selected sample was representative of the population, the error "ε" was normally distributed and the relationship between the dependent and the independent variables was linear.

T-Test was used to test for significant differences between the responses from executive and technology leaders. Correlation performed two functions: summarized data (descriptive statistics) and examined it for statistically significant trends (inferential statistics).

Summary

Chapter 3 described the methodology used in this study. The research technique was described, followed by the process to examine an alignment model and its survey instrument, the two rounds of the Delphi process in coming to a consensus on the applicability of the model to higher education, and the triangulation process that ascertained whether the modified model applies to four-year institutions of higher education. Chapter 4 delineates the actual results from each of the steps just outlined.

CHAPTER 4

Results

Introduction

One of the most important determinants of successful investment in information technology is the alignment between IT strategy and the organizational strategy (Luftman et al. 1993; Sabherval and Chan, 2001). Higher education faces a challenge to align organizational plans and actions with institutional priorities and with evolving goals of colleges, schools and departments. Because there was no existing effective framework to assess alignment in higher education, the primary objective of this study was to test an existing theoretical Strategic Alignment Model (SAM) (Henderson and Venkatraman, 1993), which had been used in the corporate sector for almost three decades, for application in the higher education environment.

The purpose of this study was to gain a better understanding of the factors that affect the alignment between institutional strategic planning and IT strategy in higher education in order to develop a model that could be used to assist higher education administrators make informed decision that facilitate the alignment of information technology with institutional mission and objectives. This was accomplished by identifying an existing theoretical model, examining it for application to higher education, modifying it and testing the revised model in four-year mid-size universities.

This study was guided by three Research Questions described in Chapter 1:

1. What factors affecting strategic alignment of information technology in higher education can be identified?

2. Does the corporate Strategic Alignment Model (SAM) developed by Henderson and Venkatraman apply to higher education in part or in its entirety?

3. If the model applies in part, what modifications are necessary for the model to apply to higher education (additions, modifications, deletions)?

Research questions 2 and 3provided a general context to frame the responses from the Delphi panelists with regard to the adaptability of the existing strategic institutional-IT alignment model to a higher education environment. The model instrument modified by the Delphi expert panel was tested by surveying four-year institutions of higher education. The results of the survey were subjected to appropriate statistical technique to determine the relationship and significance of observed differences based on perception of institutional and IT alignment by executive and technology leaders in four-year higher education institutions.

Qualitative Findings Phase One: Delphi Round One

Delphi responses were analyzed to identify themes and patterns of modifications to the Strategic Alignment Model and its instrument for application in higher education. The responses from the Delphi experts about the model's elements were aligned with the following two themes: 1) All SAM components apply to higher education; and 2) All components apply with modified definitions and terms. The responses about SAM's instrument fell into similar categories:

- application of the instrument to CEOs and CIOs as too limiting;

- problems with terminology;

- problems with measuring criteria (ranking scale);

- problems with the scope of the questions.

The rationale offered by the Delphi panel for modifications of definitions and the instrument's ranking scale fell within the three categories, discussed in Chapter 2, that characterized higher education: independence of academic units, diversified, yet parallel, products and shared decision-making process. In addition, another category emerged: constituents that IT served or supported, such as faculty, students, and administrators. This category was referred to as a service area in support of core missions in higher education, for example teaching and research, with more attention given to the constituents. The rationales offered by the Delphi panel demonstrated a need for a lexicon that would describe the idiosyncratic environment of higher education.

Specifically, the Delphi panel answered the following five questions prompting the panel members to review the Strategic Alignment Model and its instrument:

1). Which Strategic Alignment Model components do not apply to higher education and why?

2). What components, if any, are missing from SAM and could be added to make the model applicable in higher education? Please elaborate.

3). Which components of SAM apply somewhat, in a limited way, to higher education and why?

4). List the questions from the SAM assessment survey that you find not applicable or somewhat applicable to higher education and explain briefly why they are not a good fit in the higher education environment.

5). Propose a question that might serve more effectively in the SAM assessment survey when used in the higher education environment

Delphi Question 1: Which Strategic Alignment Model components do not apply to higher education and why?

With the exception of the participant identified as Member 5, all panelists stated that the SAM components apply to higher education (8, 88.89%). Four of these eight participants stated that the model required a different terminology to reflect the idiosyncratic environment of higher education (4, 50%), and one stated that some of the business components were of "questionable value" in higher education (1, 12.5%).

Delphi Question II: What components, if any, are missing from SAM and could be added to make the model applicable in higher education? Please elaborate.

Seven of the nine panelists (7, 77.77%) listed several components that were missing from the model if SAM were to be applied in higher education. These components included:

- distinguishing between core and critical services;

- redefining business and IT scope and IT governance;

- identifying known weaknesses on both the institution and technology sides;

- acknowledging strategies crafted by units and functions;

- accounting for the degree of centralization;

- including performance indicators;

- governance;

- and resources or capability maturity.

The only rationale provided by one of the three panelists who did not list any missing components was that SAM was "flexible enough to be specific for all industries." Two categories—that of governance and redefining business strategy—were noted by five (5, 71.43%) of the seven participants who suggested to include new components (Members 1, 2, 3, 4, and 5).

Delphi Question III: Which components of SAM apply somewhat, in a limited way, to higher education and why?

When asked to identify SAM components that would apply to higher education in a limited way, six participants (Members 1, 3, 4, 5, 6, and 8) stated that all components of SAM applied to higher education (6, 66.67%), with four of them conditioning the application on modification of the terms and definitions. For example, Member 4 stated that while all components applied, "the definitions should probably change a bit to reflect the mission and context of the higher education community. . . .Rather than 'Business Scope' looking at products and markets, it would include things like 'academic mission,' 'community outreach,' etc." In addition, one of the two participants who did not answer this question, Member 7, who added to the six who stated that all components apply (7, 77.78%), as that was the panelist's response to Delphi Question I.

Delphi Question IV: List the questions from the SAM assessment survey that you find not applicable or somewhat applicable to higher education and explain briefly why they are not a good fit in the higher education environment.

After examining the SAM instrument, which included a set of 36 questions, four participants (4, 44.44%) stated that business-related questions are not applicable or need to be modified to reflect the higher education environment. Member 8 noted in comments that the questions "continue to use business-related terminology that is not applicable in higher education." Three participants (3,33.33%) said that the rating for the instrument questions was inappropriate. As Member 2 stated, "I do not like the wording of 'defined, communicated, effective, efficient, valuable.' It could be 'communicated' but not 'valuable,' for example." One participant, Member 7, did not respond to this question. This participant's response to Delphi

Question I was that SAM applied to higher education and was flexible enough to accommodate the needs of every industry, including higher education, thus it could be inferred that this participant did not find any questions of the instrument problematic if applied to higher education. Member 6 stated that all questions apply to higher education.

Delphi Question V: Propose a question that might serve more effectively in the SAM assessment survey when used in the higher education environment.

Three of the participants (3, 33.33%) stated that the instrument could be used in higher education under the condition that the language, terms and definitions be modified to reflect the higher education environment. Four participants (4, 44.44%) did not propose any questions for inclusion in the instrument survey. Two participants (2, 22.22%) proposed questions about administrative and IT functions and about "signature academic programs."

Qualitative Findings Part Two: Delphi Round Two

In Round Two of the Delphi, nine panel experts responded to two sets of questions: 1) a review of their Round One collective responses and 2) a review of their modifications to the SAM's survey instrument (see Appendix D).

Review of Collective Responses. Delphi Question I: Which Strategic Alignment Model components do not apply to higher education and why?

With one refraining from answering, all other participants agreed that all the components of the modified Strategic Alignment Model apply to higher education when the terminology was modified to reflect the different environment of higher education. With the exception of one participant who disagreed that all components applied without modifications to the terms and definitions, all other participants agreed (7, 87.5%) on the revisions of business-related terms.

All participants stated that they agreed with statements that all model's components apply to higher education with the modified terminology (8, 100%).

Delphi Question II: What components, if any, are missing from SAM and could be added to make the model applicable in higher education?

All participants agreed with the four additions to the model suggested in Round One (8, 100%). These include the following:

- strategies crafted by unit and function,

- degree of centralizations accounted for,

- performance indicators, and

- governance.

All but one participant agreed to three additions: redefining business and IT scopes as well as IT governance, core as opposed to critical functions, and resources or capabilities (7, 87.5%). One participant indicated very strong disagreement with the statement that "the model is flexible enough to be specific," while other participants agreed with the statement (7, 87.5%).

Delphi Question III: Which components of SAM apply somewhat, in a limited way, to higher education and why?

All participants in Round Two agreed that all components may apply if the terminology is modified to reflect the higher education environment. Four participants disagreed (4, 50%) with one response from Member 9 that IT infrastructure and processes are applicable in a limited way only, with three participants agreeing (3, 37.5%) and one abstaining (1, 12.5%).

Delphi Question IV: List the questions from the SAM assessment survey that you find not applicable or somewhat applicable to higher education and explain briefly why they are not a good fit in the higher education environment.

All participants, except Member 4, agreed that all instrument questions apply to higher education, but the rating scale is too unclear (7, 87.5%). All participants (8, 100%) agreed that business scope, distinctive competencies, business governance and administrative structure somewhat applicable and requiring changes in definitions of terms and some concepts (Appendix F). One participant did not agree in one response and abstained from expressing agreement with another response on the same response from Round One that all questions apply to higher education; the remaining seven participants agreed with the statement (7, 87.5%).

Delphi Question V: Propose a question that might serve more effectively in the SAM assessment survey when used in the higher education environment.

Only two participants, Member 1 and Member 3, actually responded to this question by formulating an additional question for the survey instrument. The remaining participants made comments about the existing survey questions and proposed no new questions for the instrument.

All participants agreed with Member 1, who suggested questions about business and IT functions and their relationship to the overall strategy of the institution in higher education (8, 100%). Except for one, all participants agreed with Member 3, who proposed to ask a question addressing "signature academic programs" and to identify the technologies that are "essential to support them." All participants agreed with Member 5 (8, 100%), who made comments rather than formulated additional questions; the comments reflected the "arcane" and "elaborate" nature of the model and included changes to the terminology, for example from "customer" to "students or constituents." Seven participants (one did not respond to any Round Two questions, and one did not respond to Question 5) agreed with Member 8 and Member 9 comments (7, 87.5%).

Review of SAM Instrument. All participants agreed with 18 of the 36 modified questions on the instrument survey (see Appendix D). Two of the participants, Member 4 and

Member 5, disagreed with 18 of the revised instrument's questions. The two common themes of these 18 questions they disagreed on were a list of functions that IT supported—education, administration and marketing/recruiting—and the scope of the institution, which included products/services, customers/clients and competitors. The comments made by Member 4 indicated that the participant found the separating of the different functions and the scopes problematic. Together with members 4 and 5, Member 6 found five questions on the instrument to be problematic. All five of these questions (Survey Questions 1, 2, 3, 4, and 13) were the same ones that Member 4 and 5 questioned as well; these questions separated the functions into subgroups.

Consequently, the functions were not separated in the revised instrument. Member 9 did not agree with question 8 on the instrument because of the term "systemic competencies," which the member suggested removing entirely.

Quantitative Findings: Four-Year Institutions' Survey

The purpose of the survey was to validate the Delphi results (see Appendix F). The modified SAM instrument, which was the product of the Delphi panel, was sent to a random sample of Chief Executive Officers and Chief Information Officers in four-year U.S. institutions of higher education classified as "medium" by the Carnegie Foundation for the Advancement of Teaching. The medium classification includes all colleges and universities—private for-profit, private not-for-profit and public—with student enrollment between 3,000 and 9,999.

Each of the universities and colleges was assigned a number with a range from 1 to 437. The method for generating a sequence of random numbers was used. The sample size for an ά level .05 and an effect size Cohen's d=0.5 (medium) (Cohen, 1988) was at least 210 (105 for each group: CIOs and CEOs) using G power software to determine the sample size (Faul,

Erdfelder, Land, & BUchner, 2007). A random sample of 150 higher education institutions,

representing 150 CIOs and 150 CEOs, was generated for a total sample size of 300.

The initial invitation to participate in the survey was generated by the *Qualtrics* software

at Indiana State University and sent to 300 perspective participants (Appendix F). In the email

the 300 participants received a unique URL that would take them directly to the online survey.

Because emails sent by *Qualtrics* contained a "no reply" wording, there was a possibility that at

least some of the emails generated by the software would be routed automatically to the

recipient's spam or junk email box at their respective institutions. In an effort to reach each

participant, three follow-up reminder emails were sent using *Quatrics* software, one follow-up

email was sent from the researcher's student email account at Indiana State University and one

letter was mailed using U.S. Postal Services to each of the participants (Appendix F).

Demographics. Survey responses were received from 74 respondents, which represented

24.6% of the sample. All surveys were reviewed for general accuracy and completion. Surveys

deemed to be incomplete or unfinished were removed from the sample, which brought the

response rate to 22.3%. Because the response rate was somewhat lower than desired, the

researcher analyzed the demographic makeup of the population, the sample and the respondent.

Based on the results of that analysis, the researcher concluded that the respondent group was

sufficiently representative to continue the research analysis.

The 65 complete responses were received from 55 institutions of higher education, which

was 36.7 % of the 150 institutions surveyed. Of the 65 complete responses, 66% represented

public institutions of higher education and 34% represented private institutions, which was a

perfect reflection of the composition of the entire sample of 300 participants (one CEO and one

CIO from each of the 150 institutions), in which 196 participants (65.3%) were from public and

104 participants (34.6%) were from private institutions. The population consisted of 259 public

four-year institutions (59.3%) and 178 private four-year institutions (40.7%) (see Table 4.1).

Table 4.1

Institution type frequency by survey, sample and population.

Institution type	Survey Frequency/percentage	Sample Frequency/percentage	Population Frequency/percentage
Public	48 / 66%	196 / 65.3%	259 / 59.3
Private	26 / 34%	104 / 34.6%	178 / 40.7%
Total	74 / 100%	300 / 100%	437 / 100%

The randomly selected sample of universities and colleges from the population of 437

four-year institutions represented a slightly higher percentage of institutions from the Northeast,

Midwest and West regions than those the population. The survey respondents from the Midwest

and the South regions represented the highest response rate, 29.2% and 31% respectively, despite

the fact that both the population and the sample placed the Midwest region third in terms of the

number of institutions (see Table 4.2). The Northeast institutions, on the other hand, responded

with fewer answers (26%) than could be expected based on the sample (34%) and the population

(31%).

Table 4.2

Geographic region frequency by survey, sample and population.

Geographic Region	Survey Frequency/percentage	Sample Frequency/Percent	Population Frequency/percent
Northeast	17 /26%	51 / 34%	136 / 31%
Midwest	19 / 29.2%	33 / 22%	96 / 22%
South	20 / 31%	44 / 29.3%	144 / 33%
West	9 /13.8%	22 / 14.7%	61 / 14%
Total	65 / 100%	150 / 100%	437 / 100%

The 65 respondents represented 55 colleges and universities. In the Midwest region 67% of the 55 responding institutions were classified as either exclusively or highly undergraduate (Appendix G). The higher percentage of undergraduates in institutions from the two regions that responded in higher numbers—Midwest and South—are worth noting. At the same time, institutions from the two regions—Northeast and West—that responded at a lower rate have the highest percentage of graduate students.

The review of the size of academic programs in the participating institutions by geographic region revealed that the percentage of responses from institutions with small to medium programs in the Midwest and South regions was greater than the percentage of those institutions in the sample. Smaller and medium-size programs accounted for 72% of the participating institutions from the Midwest in contrast to the Midwest portion of the sample of institutions, which included 59% of small-to-medium-size programs (see Table 4.3). Midwest participation represented the largest group of institutions with smaller programs with 72%, followed by the South region with 47%.

Institutions from both Northeast and West regions responded in numbers that reflected their sample distribution in the program size category, with a difference of 3% and 4% between large-program institutions and schools highly focused on research (Table 4.3).

Table 4.3

Geographic region and size of programs frequency in survey.

Geographic region	Small-to-medium programs Survey/Sample	Large programs Survey/Sample	High research activity Survey/Sample
Northeast	18% / 20%	50% / 48%	24% / 24%
Midwest	72% / 59%	22% / 32%	6% / 9%
South	47% / 43%	41% / 33%	12% / 24%
West	17% / 16%	50% / 53%	17% / 21%

With respect to the differences between residential and non-residential institutions, the responding colleges and universities generally followed the distribution of the sample with the exception of highly residential colleges and universities, from which the response rate was 20%. The sample and the population were 28% and 26% respectively (Appendix G). When highly residential and primarily residential categories were combined, they represented 60% of the responses, 64% of the sample and 63% of the population.

Of the 65 responses, 29 were provided by Chief Executive Officers (44.6%) and 36 by Chief Information Officers (55.4%). The majority of initial responses after only two rounds of email invitations to all participants were provided by technology leaders (80%); it was after the fourth consecutive follow-up email and a letter sent using U.S. Postal Services that the number of responses leveled off between the executive and the technology leaders. With each subsequent contact, the responses from executive leaders increased to account for the final 44.6%.

Descriptive Statistics. Survey responses were received from 67 respondents; the

final two of the 11 questions on the survey were completed by 61 respondents. Of the 67

respondents, 27, or 40%, described the alignment of their institution's IT strategy to their

institutional strategy as "fairly good," 23, or 34%, as "strong" and 14, or 21%, as "some

alignment." Three respondents agreed that their institutional strategy was "not well aligned" with

IT strategy (Table 4.4). Thirty of the administration executives (73.3%) described the alignment

as "fairly good" or "strong"; 37 of the IT leaders (75.7%) described the alignment as "fairly

good" or "strong."

Table 4.4

SAM Survey Question 3: Which of the following best describes the alignment of your Information

Technology (IT) strategy to your institutional strategy?

Responses, n=67	Frequency	Percent	Valid percent	Cumulative percent
Your IT strategy is not well aligned with your institutional strategy	3	4	4.5	4
There is some alignment between your IT strategy and your institutional strategy	14	21	20.9	25.4
The alignment between your IT strategy and your institutional strategy is fairly good	27	40	40.3	65.7
There is a strong alignment between your IT strategy and your institutional strategy	23	34	34.3	100
Total	67	100	100	

In SAM Survey Question 4 the participants were asked to select the answers that best

described the role of IT at their institution. Slightly more than 50% of respondents selected the

answer in which IT was viewed as a "core competency" and was used moderately in their

marketing efforts. IT was viewed as a support function by 20 participants (30%), and 13

respondents chose to describe their institution as being "publicly recognized for its use of IT" (Table 4.5).

Table 4.5

SAM Survey Question 4: Please select the answer that best describes the role of Information Technology (IT) at your institution.

Responses, n=67	Frequency	Percent	Valid percent	Cumulative percent
IT is viewed as a support function; IT is not used publicly for competitive marketing advantage	20	30	30	30
IT is viewed as a core competency but is used modestly in your marketing efforts	35	52	52	82
Your institution is publicly recognized for its use of Information Technology	12	18	18	100
Total	67	100	100	

In SAM Survey Question 5 the participants were asked to evaluate the communication within their institution with respect to institutional strategy, institution's infrastructure, information technology strategy and information technology infrastructure. SAM Survey Question 5 included 12 possible answers. The first three answers (q5_123) corresponded to the first domain, or quadrant, of the SAM model (see pages 7 and 8) and described communication about the institutional strategy (Table 4.6). The next set of three answers (q5_456) was related to the institution's infrastructure. The third set (q5_789) was relevant to the third quadrangle of IT strategy, and the fourth set (q5_012) was relevant to the fourth quadrangle of IT infrastructure.

Answering the first three of the 12 questions (q5_123), 50 respondents, or 74.5%, "agreed" or "strongly agreed" that the scope of their institution's services and products was defined and communicated effectively. Only five participants, or 7.5%, did not agree with that statement. Fifty-seven participants, or 70.2%, "agreed" or "strongly agreed" that distinct

competencies of their institution were defined well and communicated effectively. The smallest

number of participants, 43, or 64.2%, agreed or strongly agreed that the governance of their

institutions was defined well and communicated effectively; 10 participants, or 14.8%, disagreed

or strongly disagreed with that statement.

Table 4.6

SAM Survey Question 5_123: The following questions relate to COMMUNICATION within your

institution. Please select the answer that best describes your institutional environment.

Responses, n=67	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The SCOPE of your institution's services/products, such as instruction/degrees, research/patents and recruiting/marketing, is defined and communicated effectively.	1 1.5%	4 6%	12 18%	40 59.5%	10 15%	67 100%
The distinctive COMPETENCIES, or unique characteristics, of your institution's services, including instruction, research, and recruitment/marketing, are defined and communicated effectively.	2 3%	7 10.4%	11 16.4%	37 55.2%	10 15%	67 100%
The GOVERNANCE of your institution, defined as processes by which institutional priorities are set, funded, and managed and by whom (governing bodies, committees, advisory groups or individuals), is defined and communicated effectively.	1 1.5%	9 13.3%	14 21%	29 43.2%	14 21%	67 100%
Total	4 2%	20 10%	37 18.4%	106 52.7%	34 17%	201 100%

The second set of answers under SAM Survey Question 5 (q5_456) was related to institution's infrastructure quadrant in the Strategic Alignment Model (see pages 7 and 8) and described communication about the infrastructure of the institution (Table 4.7).

Table 4.7

SAM Survey Question 5_456: The following questions relate to COMMUNICATION within your institution. Please select the answer that best describes your institutional environment.

Responses, n=67	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
Your institution's ADMINISTRATIVE STRUCTURE, defined as organization arrangement and responsibilities, including centralized, decentralized, and networked structures or autonomous groups, and which includes reporting relationships and roles, is defined and communicated effectively.	0 0%	6 9%	3 4.5%	43 64.1%	15 22.4%	67 100%
The essential administrative and academic PROCESSES, such as standard operating procedures, cross-functional processes, and associated information and flows, are defined and communicated effectively.	2 3%	10 15.4%	20 30.8%	32 47.8%	1 1.5%	65 100%
The acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out your institutional strategy, are defined and communicated effectively.	1 1.5%	15 23%	24 37.2%	21 32.3%	4 6%	65 100%
Total	3 1.5%	31 16%	47 23.5%	96 49%	20 10%	197 100%

Almost 65% of respondents "agreed" that the institution's administrative structure was defined and communicated well; if combined with "strongly agreed," the total agreement with the statement that administrative structure was well defined and communicated reached 86%. Only 6% of respondents disagreed with that statement. The academic and administrative processes were well defined and communicated in the opinion of 49.3% of respondents, while 10% did not agree with this statement. In the area of human skills to carry out the institution's strategy, 32% agreed that those were defined and communicated well, and 23% disagreed with that statement.

The third set of answers under SAM Survey Question 5 was relevant to the third quadrant of the Strategic Alignment Model (see pages 7 and 8) about the information technology strategy (Table 4.8). More than 50% of respondents agreed with the statement that IT scope was defined and communicated well at their respective institutions. If combined with the "strongly agree" category, a total of 65.2% found their IT scope to be well defined and communicated. Slightly more than 10% respondents disagreed with this statement, and 20% neither agreed nor disagreed with it. More than 50% of participants responded that the IT systemic competencies such as speed, reliability and connectivity, were defined and communicated well, whereas 20% disagreed with that statement. On the question on governance of IT the responses were evenly divided between those who disagreed (16.7%) and those who strongly agreed (16.7%) that their IT governance was defined and communicated well at their institution. More than 40% agreed that IT governance was defined well at their institutions.

Table 4.8

SAM Survey Question 5_789: The following questions relate to COMMUNICATION within your

institution. Please select the answer that best describes your institutional environment.

Responses, n=66	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The IT SCOPE of your institution, including the range and type of information technologies critical to your institution's services/products, is defined and communicated effectively.	1 1.5%	7 10.6%	15 22.7	34 51.5%	9 13.7%	66 100%
The systemic competencies, or important characteristics, of your IT infrastructure, including access to information, reliability, speed, and connectivity in support of your institution's services, are defined and communicated effectively.	1 1.5%	13 20%	10 15.4%	34 52.3%	7 10.8%	65 100%
The GOVERNANCE of IT, including processes by which IT priorities are set, funded, and managed and by whom (committees, advisory groups or individuals), is defined and communicated effectively.	3 4.5%	11 16.7%	13 19.7%	28 42.4%	11 16.7%	66 100%
Total	5 2.5%	31 15.7%	38 19.3%	96 48.7%	27 13.7%	197 100%

The last set of answers under Question 5 was related to the fourth quadrant (see pages 7

and 8) of the Strategic Alignment Model about Information Technology infrastructure. More

than 40% of the respondents agreed that IT scope, IT systemic competencies and IT processes

were defined and communicated well, with 10% participants disagreeing with these statements

(Table 4.9). A combination of "agreed" and "strongly agreed" was almost identical for all three

answers (from 55.7% to 57.6%) related to IT architecture, IT processes and IT skills.

Table 4.9

SAM Survey Question 5_012: The following questions relate to COMMUNICATION within your

institution. Please select the answer that best describes your institutional environment.

Responses, n=65	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
Your IT ARCHITECTURE, which defines the choices and policies that enable the systems, applications, data, software, and hardware in a cohesive platform to provide support for instruction, research, and recruiting/marketing, are defined and communicated effectively.	2 3%	7 10.6%	19 28.8%	28 42.4%	10 15.2%	66 100%
Your IT work PROCESSES associated with the development, delivery, and use of information systems, including application development, security, and other system management controls and service level agreements to support instruction, research and recruiting/marketing, are defined and communicated effectively.	2 3%	7 10.8%	19 29%	28 43%	9 13.8%	65 100%
The acquisition or modification of IT SKILLS and experience related to the development, operation, and use of information systems in your organization to match IT skills to your institution's needs to support its services and products, are defined and communicated effectively.	1 1.5%	7 10.8%	21 32%	31 48%	5 7.7%	65 100%
Total	5 2.6%	21 10.7%	59 30.1%	87 44.4%	24 12.2%	196 100%

Question 6 included two sets of answers related to how well defined and effective the relationship between the institutional strategy and infrastructure was, and between the institutional strategy and the IT strategy.

Table 4.10

SAM Survey Question 6_123: The following questions relate to your institutional STRATEGIES. Please select the answer that best describes your institutional environment.

Responses, n=65	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between your institutional strategy and your ADMINISTRATIVE STRUCTURE, including centralized, decentralized, and networked structures or autonomous groups, and reporting relationships and roles, is well defined and effective.	1 1.5%	6 9.2%	15 23%	31 47.7%	12 18.5%	65 100%
The relationship between your institutional strategy and the design of your essential work PROCESSES to provide support for our services (instruction, research and recruiting/marketing,) is well defined and effective.	1 1.5%	9 13.8%	16 24.6%	35 53.8%	4 6.2%	65 100%
The relationship between your institutional strategy and the acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out your institutional strategy to support instruction, research, and recruiting/marketing, is well defined and effective.	1 1.5%	11 17%	28 43%	23 35.4%	2 3%	65 100%
Total	3 1.5%	26 13.4%	59 30.2%	89 45.6%	18 9.3%	195 100%

The first set of answers (6_123) covered the relationship between the institutional strategy and the institution's infrastructure, which are related to the first and the second quadrangles of the Strategic Alignment Model (see pages 7 and 8). Forty-three, or 66.2%, of participants "agreed" or "strongly agreed" that the relationship between the institutional strategy and the administrative structure was defined well and effective, with 23% neither agreeing nor disagreeing with the statement (Table 4.10). More than 50% of respondents agreed that the relationship between the institutional strategy and the institution's processes, such as instruction, research and recruitment, was defined well and effective, but only 35% agreed that the relationship between the institutional strategy and the human skills necessary to carry out the strategy was defined well and effective. Almost 19% "disagreed" or "strongly disagreed" with the last statement.

The second set of answers under Question 6 (6_456) was related to the relationship between the institutional strategy and the IT strategy, which represented the third and the fourth quadrangles of the SAM model (see pages 7 and 8). While 47.7% "agreed" or "strongly agreed" that the relationship between the institutional strategy and the IT scope are defined well and effective, 33.8% neither agreed nor disagreed with that statement (Table 4.11). More than 20% participants "disagreed" or "strongly disagreed" with the statement that the relationship between their IT governance and their institutional strategy was well defined and effective, while slightly more than 50% "agreed" or "strongly agreed" with that statement.

Table 4.11

SAM Survey Question 6_456: The following questions relate to your institutional

STRATEGIES. Please select the answer that best describes your institutional environment.

Responses, n=65	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between institutional strategy and IT SCOPE, the determination of the range and type of information technologies critical to your institution, is well defined and effective.	2 3%	10 15.4%	22 33.8%	26 40%	5 7.7%	65 100%
The relationship between institutional strategy and the SYSTEMIC COMPETENCIES of your IT infrastructure—reliability and connectivity and applications—is well defined and effective.	1 1.5%	9 13.8%	19 29%	31 48%	5 7.7%	65 100%
The relationship between institutional strategy and your IT GOVERNANCE, including processes by which IT priorities are set, funded, and managed and by whom (committees, advisory groups or individuals), is well defined and effective.	3 4.6%	12 18.5%	16 24.6%	30 46%	4 6.2%	65 100%
Total	6 3%	31 16%	57 29.2%	87 44.6%	14 7.2%	195 100%

SAM Survey Question 7 (q_123) examined the relationship between the institution's infrastructure and the institutional strategy, which were equivalent to the second and first SAM's quadrangles (see pages 7 and 8). More than 70% of participants agreed or strongly agreed that the relationship between the institution's infrastructure and the institutional strategy was defined well and effective (Table 4.12).

Table 4.12

SAM Survey Question 7_123: The following questions relate to your institutional structure and

processes. Please select the answer that best describes your institutional environment.

Responses, n=65	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between your institutional structure and processes and the SCOPE of your organization, encompassing the services, customers, competitors, and the geographic area your organization serves, is well defined and effective.	0 0%	10 15.4%	9 13.8%	40 61.5%	6 9.2%	65 100%
The relationship between your institutional structure and processes and the distinctive COMPETENCIES, or unique characteristics, of your services, including instruction, research, and recruitment/marketing, is well defined and effective.	0 0%	5 7.7%	19 29.2%	31 47.7%	10 15.4%	65 100%
The relationship between your institutional structure and processes and how you carry out the GOVERNANCE of your INSTITUTION, processes by which institutional priorities are set, funded, and managed and by whom (governing bodies, committees, advisory groups or individuals), is well defined and effective.	0 0%	9 13.8%	15 23%	30 46%	11 17%	65 100%
Total	0 0%	24 12.3%	43 22%	101 52%	27 13.7%	195 100%

Similarly, 63.1% of respondents agreed or strongly agreed that the relationships between

the institution's infrastructure and the distinctive competencies and 63% of respondents agreed

that the relationship between the institution's infrastructure and the institutional governance were

well defined and effective. Conversely, 15% and almost 14% of respondents disagreed that the

relationship between their institution's infrastructure and their organization's scope and between the infrastructure and the institution's governance were defined well effective.

SAM Survey Question 8 covered two sets of answers that related to information technology strategy in relation to IT infrastructure (q8_123), which reflected the third and the fourth quadrants of SAM's model (see pages 7 and 8), and in relations to the institutional strategy (q8_456), which reflected the third and the first of the four quadrangles of the Strategic Alignment Model.

Within the first set of answers with regard to the relationship between the IT strategy and the IT architecture (q8_123), there was a 75% of agreement or strong agreement among the respondents about the relationship's effectiveness and clarity of its definition (Table 4.13). Only 3% of participants disagreed with a well-defined and effective relationship between the IT strategy and IT architecture. Similarly, 77% agreed with the statement that the relationship between IT strategy and IT processes was defined well and effective, while 6.2% disagreed. The statement about the effectiveness of the acquisition of human skills in order to carry out the IT strategy received 10.8% disagreement from the respondents, and 32.3% of the respondents neither agreed nor disagreed with this statement. 56.9% agreed or strongly agreed with this statement of effective relationship between IT strategy and human skills and experiences.

Table 4.13

SAM Survey Question 8_123: The following questions relate to your Information Technology

(IT) strategy. Please select the answer that best describes your institution.

Responses, n=65	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between IT strategy and your IT ARCHITECTURE, including applications, databases, and hardware, is well defined and effective.	0 0%	2 3%	14 21.5%	33 50.8%	16 24.7%	65 100%
The relationship between IT strategy and the work PROCESSES required, such as data center operations, is well defined and effective.	0 0%	4 6.2%	11 17%	38 58.5%	12 18.5%	65 100%
The relationship between IT strategy and the acquisition or modification of SKILLS and experience related to the development, operation, and use of information systems in your institution to match IT skills to your institution's needs, is well defined and effective.	0 0%	7 10.8%	21 32.3%	32 49.2%	5 7.7%	65 100%
Total	0 0%	13 6.7%	46 23.7%	103 52.8%	33 17%	195 100%

The second part of SAM Survey Question 8 dealt with the IT strategy and its relation to the institutional strategy (q8_456). More than 70% respondents agreed and slightly less than 10% disagreed that the relationship between IT strategy and the scope of the organization was defined well and effective (Table 4.14). The statement that the relationship between the IT strategy and the governance of the institution was defined well and effective received 35.4% agreement and 17% strong agreement from the respondents; 10.8% respondents did not agree with that statement, and 32.3% neither agreed nor disagreed with it. The statement that the relationship between IT strategy and institution's distinctive competencies was defined well and was

effective received 48% agreement and 9% strong agreement from the respondents, but 7.7% did

not agree with it.

Table 4.14

SAM Survey Question 8_456: The following questions relate to your Information Technology

(IT) strategy. Please select the answer that best describes your institution.

Responses, n=65	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between IT strategy and the SCOPE of your organization, encompassing the services (instruction, research, recruiting/marketing) and the geographic area your institution services, is well defined and effective.	0 0%	6 9.23%	13 20%	40 61.53 %	6 9.23%	65 100%
The relationship between IT strategy and the distinctive COMPETENCIES, or unique characteristics, of your services, including instruction, research, and recruitment/marketing, is well defined and effective.	1 1.5%	5 7.7%	22 34%	31 48%	6 9%	65 100%
The relationship between IT strategy and how you carry out the GOVERNANCE of your INSTITUTION, processes by which institutional priorities are set, funded, and managed and by whom (governing bodies, committees, advisory groups or individuals), is well defined and effective.	3 4.5%	7 10.8%	21 32.3%	23 35.4%	11 17%	65 100%
Total	4 2%	18 9.2%	56 28.7%	94 48.3%	23 11.8%	195 100%

In SAM Survey Question 9 the participants were asked to evaluate the relationship

between the IT infrastructure and the IT strategy. Those who agreed or strongly agreed with the

statement that the relationship between the IT infrastructure and IT scope was defined well and

effective represented 69.4% of the respondents (Table 4.15). Those who did not agree with that

statement represented 7.6%, and those who neither agreed nor disagreed accounted for 23% of

the respondents. The statement that the relationship between the IT infrastructure and IT

systemic competencies is defined well and effective was agreed on by 68.9% of the respondents,

with 20.3% neither agreeing nor disagreeing and 10.8% disagreeing or strongly disagreeing. The

relationship between IT infrastructure and the governance of IT was defined well and effective in

the opinion of 37 respondents (57.9%) who agreed or strongly agreed with it.

Table 4.15

SAM Survey Question 9_123: The following questions relate to your information technology

infrastructure. Select the answer that best describes your institution.

Responses, n=64	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between IT infrastructure and IT SCOPE, the determination of the range and type of information technologies critical to your institution, is well defined and effective.	2 3%	3 4.6%	15 23%	35 54%	10 15.4%	65 100%
The relationship between IT infrastructure and the SYSTEMIC COMPETENCIES of your IT infrastructure, such as reliability and connectivity, is well defined and effective.	2 3%	5 7.8%	13 20.3%	33 51.6%	11 17.3%	64 100%
The relationship between IT infrastructure and the GOVERNANCE of IT, including processes by which IT priorities are set, funded, and managed and by whom (committees, advisory groups or individuals), is well defined and effective.	3 4.7%	9 14%	15 23.4%	29 45.3%	8 12.6%	64 100%
Total	7 3.6%	17 8.8%	43 22.3%	97 50.3%	29 15%	193 100%

Question 10 covered the topic of the relationship between the institution's infrastructure and IT infrastructure (q10_123), which represented the second and the fourth quadrangles of the Strategic Alignment Model (see pages 7 and 8).

Table 4.16

SAM Survey Question 10_123: The following questions relate to your institution's infrastructure. Please select the answer that best describes your institutional environment.

Responses, n=63	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between institution's infrastructure and your IT ARCHITECTURE, including critical applications, databases, or hardware, is well defined and effective.	0 0%	6 9.4%	16 25%	32 50%	10 15.6%	64 100%
The relationship between institution's infrastructure and your IT PROCESSES and operations, such as systems development, application development, and data center operations, is well defined and effective.	0 0%	3 4.8%	20 31.7%	33 52.4%	7 11.1%	63 100%
The relationship between institution's infrastructure and IT SKILLS and experience related to the development, operation, and use of information systems in your organization to match IT skills to your institution's needs, is well defined and effective.	1 1.5%	5 8%	22 35%	29 46%	6 9.5%	63 100%
Total	1 %	14 7.4%	58 30.5%	94 49.5%	23 12%	190 100%

Forty-two respondents, or 65.6%, agreed or strongly agreed that the relationship between the institution's infrastructure and IT architecture was defined well and effective, while six, or 9.4%, disagreed; 25% of respondents neither agreed nor disagreed (Table 4.16). Forty respondents, or 63.5%, agreed or strongly agreed that the relationship between the institution's

infrastructure and IT processes was defined well and effective; three, or 4.8%, disagreed and

31.7% neither agreed nor disagreed. Thirty-five participants, 55.5%, agreed or strongly agreed

that the relationship between the institution's infrastructure and IT human skills was defined well

and effective, while six, or 9.5%, disagreed; 35% of respondents neither agreed nor disagreed.

Table 4.17

SAM Survey Question 11_123: The following questions relate to IT architecture. Please select

the answer that best describes your institution.

Responses, n=61	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between IT architecture and your ADMINISTRATIVE STRUCTURE, which defines organization arrangement and responsibilities, including centralized, decentralized, and networked structures or autonomous groups, and which includes reporting relationships and roles, is well defined and effective.	2 3.2%	6 9.5%	18 28.6%	28 44.4%	9 14.3%	63 100%
The relationship between IT architecture and the PROCESSES of your institution, such as services development and delivery, customer service, and associated information and flows, is well defined and effective.	2 3.2%	5 8.2%	14 23%	36 59%	4 6.6%	61 100%
The relationship between your IT architecture and the acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out our institutional strategy, is well defined and effective.	2 3.3%	7 11.5%	25 41%	24 39.3%	3 4.9%	61 100%
Total	6 3.2%	18 9.7%	57 30.6%	88 47.3%	16 8.6%	186 100%

Question 11 was related to IT architecture, one of the three components of the fourth

quadrant in the Strategic Alignment Model (see pages 7 and 8), and its relationship to the

institution's infrastructure, which was the second quadrant. The last bloc of questions was

completed by 61 of the 65 respondents. Forty of them, or 65.6%, agreed or strongly agreed with

the statement that the relationship between the IT architecture and the institution's processes was

defined well and effective; seven, or 11.4%, did not agree and 23% neither agreed nor disagreed

with the statement (Table 4.17). Thirty-seven, or 58.7%, of respondents agreed or strongly

agreed that the relationship between the IT architecture and administrative structure of the

institution was defined well and effective; 12.7 respondents did not agree and 28.6% neither

agreed nor disagreed. The relationship between IT architecture and the acquisition or

modification of skills was perceived as defined well and effective by 44.2% of the respondents;

14.8% did not agree with that statement and 41% neither agreed nor disagreed with it.

Inferential Statistics. Statistical analysis was conducted using correlation methods. The

linear regression method was used to analyze the data obtained from the survey of randomly

selected Chief Executive Officers and Chief Information Officers from four-year institutions of

higher education. For all of the statistical analyses, SAS (SAS Institute, Inc.,

http://www.sas.com) statistical and data management software was used.

Statistical Question: Is there a correlation between the perception of institutional-IT

alignment (SAM Survey Question 3) and the following elements:

1). effective communication about the institutional strategy (q5_123);

2). effective communication about the institution's infrastructure (q5_456);

3). effective communication about the IT strategy (q5_789);

4). effective communication about the IT infrastructure (q5_012);

5). how well the relationship between institutional strategy and institutional infrastructure is defined (q6_123);

6). how well the relationship between institutional strategy and IT strategy is defined (q6_456);

7). how well the relationship between the institution's infrastructure and institutional strategy is defined (q7_123);

8). how well the relationship between IT strategy and institutional strategy is defined (q8_456);

9). how well the relationship between IT infrastructure and IT strategy is defined (q9_123);

10). how well the relationship between institution's infrastructure and IT infrastructure is defined (q 10_123)?

Null hypothesis: There is no correlation between the respondents' perception of alignment and the following elements:

1). effective communication about the institutional strategy (q5_123);

2). effective communication about the institution's infrastructure (q5_456);

3). effective communication about the IT strategy (q5_789);

4). effective communication about the IT infrastructure (q5_012);

5). how well the relationship between institutional strategy and institutional infrastructure is defined (q6_123);

6). how well the relationship between institutional strategy and IT strategy is defined (q6_456);

7). how well the relationship between the institution's infrastructure and institutional
strategy is defined (q7_123);

8). how well the relationship between IT strategy and institutional strategy is defined
(q8_456);

9). how well the relationship between IT infrastructure and IT strategy is defined
(q9_123);

10). how well the relationship between institution's infrastructure and IT infrastructure is
defined (q10_123).

To answer the question, a linear regression analysis was used. The purpose of regression analysis includes description, prediction, estimation and control (Wadsworth, 1990). The term "linear" indicates that the regression equation is linear in the parameters (the betas), and not that the relationship between the dependent variable and independent variable is presented graphically as a straight line (Wadsworth, 1990). If all points are close to the line, there is a strong linear relationship between "y" and "x"; such a relationship must exist for a linear regression equation to be of value.

The assumptions for a regression analysis include the sample being representative of the population, the error term "ε" being normally distributed with a mean of 0 and variance of 1, and the relationship between "x" and "y" being linear, which should be tested by a scatter plot. The regression is robust to this assumption (Wadsworth, 1990).

A regression analysis was performed with SAM Survey Question 3, about the perception of alignment, and the abovementioned ten independent variables, which are sums of the respondents' answers to questions grouped by themes relevant to the Strategic Alignment Model.

To understand which among the independent variables are related to the dependent variable, the respondents' assessment of their institutional-IT alignment, a regression analysis was performed. The following linear regression equation was used:

$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \varepsilon$

where

y = dependent variable

β = unknown parameters

x = independent variable

ε = error term, which is assumed to be normally distributed with a mean of 0 and variance of 1.

The above equation was used to obtain linear regression model, by SAS Software, with response to SAM Survey Question 3 and the independent variables listed above:

Q3 = 0.99773 + 0.01127*q5_123-0.11016*q5_456-0.03153*q5_789 + 0.02070*q5_012 + 0.16135*q6_123 + 0.03383*q6_456 + 0.04421*q7_123 + 0.07601*q8_456-0.01492*q9_123-0.00057691*q10_123

Table 4.18

Regression analysis of Question 3 and q5_123, q5_456, q5_789, q5_012, q6_123, q6_456, q7_123, q8_456, q9_123 and q10_123.

Root MSE	0.82340	R-Square	0.2758
Dependent Mean	3.00000	Adj R-Sq	0.1217
Coefficient Variable	27.44665		

The coefficient R^2 was 0.2758 (Table 4.18), which was too low to denote any linear relationship between the dependent variable and the independent variables: SAM Survey Questions 5, 6, 7, 8, 9 and 10.

Table 4.19

Parameter estimates of the full regression model, all variables included.

Parameter Estimates							
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	Intercept	1	0.99773	0.71768	1.39	0.1710	0
q5_123		1	0.01127	0.07799	0.14	0.8857	2.67616
q5_456		1	-0.11016	0.10749	-1.02	0.3107	3.79176
q5_789		1	-0.03153	0.09639	-0.33	0.7450	5.32249
q5_012		1	0.02070	0.07249	0.29	0.7765	2.76187
q6_123		1	0.16135	0.09762	1.65	0.1050	4.54970
q6_456		1	0.03383	0.11021	0.31	0.7602	6.49565
q7_123		1	0.04421	0.08353	0.53	0.5991	3.04568
q8_456		1	0.07601	0.10335	0.74	0.4657	4.27094
q9_123		1	-0.01492	0.08675	-0.17	0.8641	4.18306
q10_123		1	-0.00057691	0.08053	-0.01	0.9943	2.53345

As evidenced from the estimate of the regression model parameters (Table 4.19), the p

values of q5_123, q5_789, q5_012, q6_456, q9_123 and q10_123 were much higher than 0.05.

Thus those variables were discarded. Another regression analysis without these six variables —

q5_123, q5_789, q5_012, q6_456, q9_123 and q10_123 — was calculated and the output was

generated by SAS (Table 4.20).

Table 4.20

Regression analysis of SAM Survey Question 3 and q5_456, q6_123, q7_123 and q8_456.

Root MSE	0.75892	R-Square	0.3031
Dependent Mean	3.03175	Adj R-Sq	0.2551
Coefficient Variable	25.03250		

The coefficient R^2 was 0.3031 (Table 4.20), which was higher than 0.2758 in Table 4.18

but too low to denote any linear relationship between the dependent variable SAM Survey

Question 3 and the independent variables q5_456, q6_123, q7_123 and q8_456.

From the parameter estimate in Table 4.21, it could be seen that the p-values were all

acceptable and the variance inflations of variables were not very high. The correlation table

(Table I.1, Appendix I) suggested that q5_456 was highly related with q6_123. The probability

value of q6_123 was .04<.05 while the p-value of q5_456 was 0.2529>.05 (Table 4.21). In

regression analysis, it is expected that all variables are uncorrelated. Thus q5_456 was dropped

because q6_123 was relatively more related with the response.

Table 4.21

Parameter estimates for Q3 and q5_456, q6_123, q7_123 and q8_456.

			Parameter	Standard			Variance
Variable	Label	DF	Estimate	Error	t Value	Pr > |t|	Inflation
Intercept	Intercept	1	0.83655	0.56963	1.47	0.1473	0
q5_456		1	-0.10310	0.08928	-1.15	0.2529	3.17917
q6_123		1	0.15998	0.07628	2.10	0.0403	3.38676
q7_123		1	0.06024	0.06118	0.98	0.3289	2.11666
q8_456		1	0.08809	0.06716	1.31	0.1948	2.39186

(Table header: Parameter Estimates)

The regression analysis was run on the reduced model to three variables, which were q6_123, q7_123 and q8_456. The result of the regression analysis with three remaining variables (Table I.2, Appendix I) was the following linear model: Q3 = 0.62192 + 0.11695*q6_123 + 0.04174*q7_123 + 0.06482*q8_456.

The R^2 did not improve considerably (Table I.3, Appendix I). Only about 28% of the total variation in "y" could be explained by the linear relationship between "x" and "y." The remaining 72% of the total variation in "y" remained unexplained. The correlation matrix was not as good as expected after dropping the last variable, q5_456 (Table I.4, Appendix I). Subsequently, the assumptions and outliners needed to be checked. Tables 4.22 and 4.23 display cumulative distribution and residual versus predicted value as generated by SAS software.

Figure 4.1.

Residual Plot of Q3 and q6_123, q7_123 and q8_456.

Q3 = 0.6219 +0.117 q6_123 +0.0417 q7_123 +0.0683 q8_456
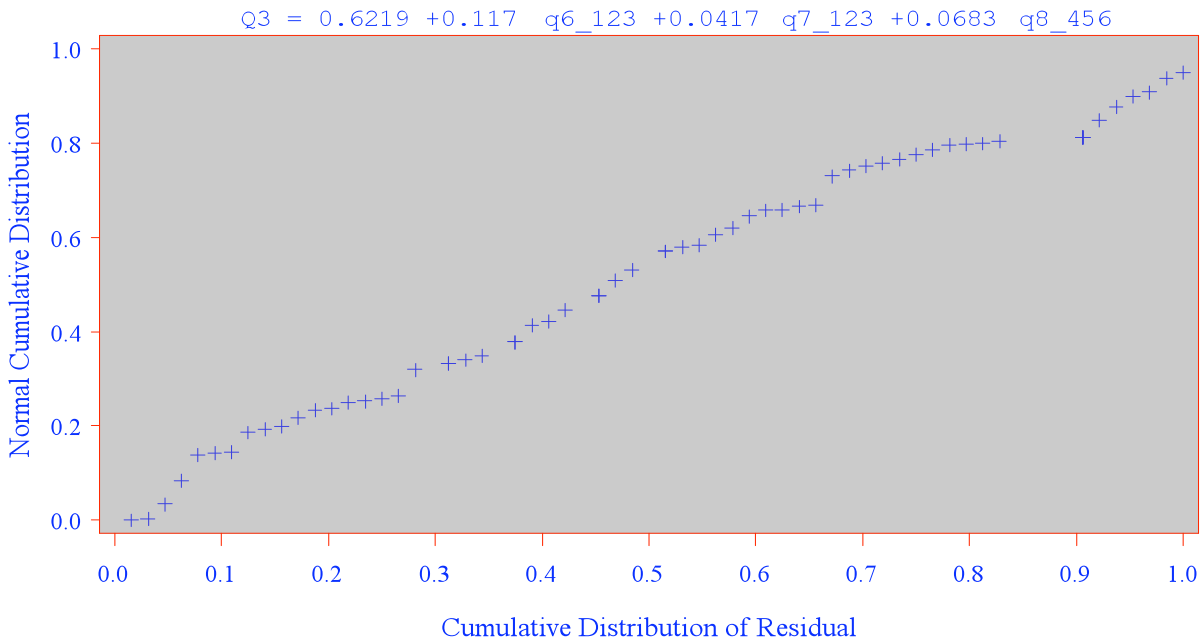
The residual plot in Figure 4.1 was consistent with normal assumptions about the error term and showed homoscedasticity, or homogeneity of variance. The error term was assumed to be normally distributed. The residual plot was almost a straight line. The error terms of regression model could be deemed normal; the distribution of the variables was normal and corresponded to the assumption of normality, which obeyed the assumption of regression model. The standard deviations of the error terms were constant and did not depend on the x-value (predictor).

Figure 4.2.

Residual versus predicted value plot of Q3 and q6_123, q7_123 and q8_456.

$$Q3 = 0.6219 + 0.117 \ q6\_123 + 0.0417 \ q7\_123 + 0.0683 \ q8\_456$$

Residual (y-axis) versus Predicted Value (x-axis) scatter plot.
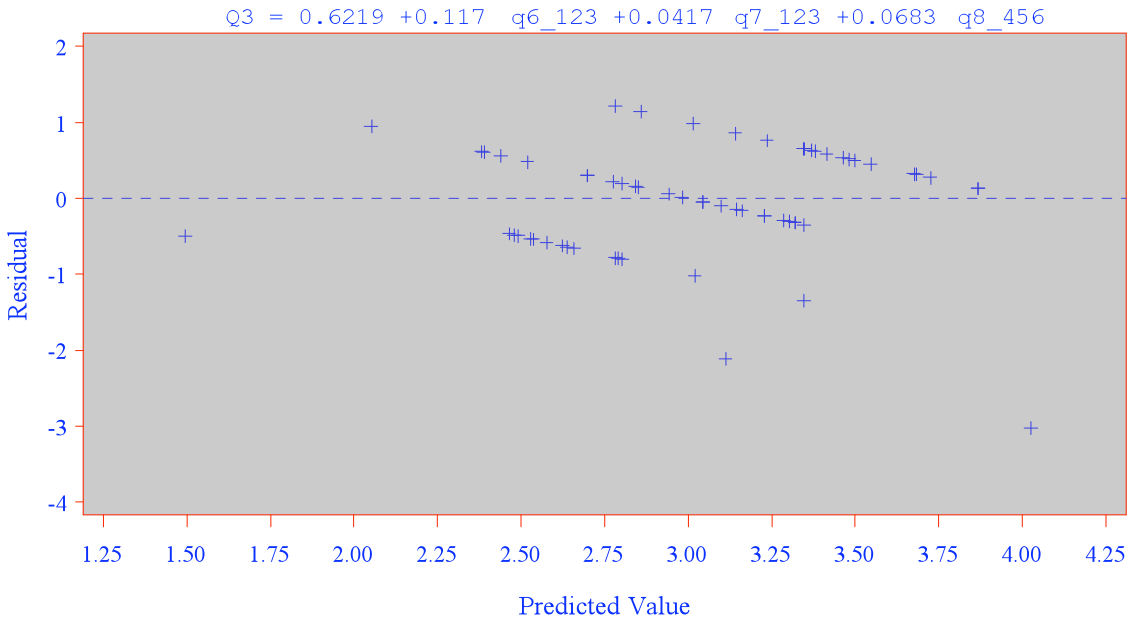
The residual versus predicted value plot showed that all the residuals fell between (-2,2), while there may have been one possible outliner (Figure 4.2). SAS output identified observation 54 was the outliner (Table I.5, Appendix I). To improve the regression model, a mean shift variable D54 was used (Table I.6, Appendix I). It was defined as D54=1 if n=54, 0 else. If the outlier were eliminated, some information would have been missing.

The regression line of the new model was as follows: Q3 = 0.08484 + 0.14167*q6_123 + 0.05127*q7_123 + 0.08943*q8_456-3.32052*D54.

The R-square was 0.4947 (Table I.7, Appendix I), after using a mean shift variable D54. To further improve the model, another mean shift variable was introduced. The median of the response to Question 3 was 3. The new mean shift variable ZZ was defined as follows: ZZ = 1 if Q3<3, else ZZ = 0 (Table I. 8, Appendix I).

The regression line of the modified model was as follows: Q3 = 2.02415 + 0.13024*q6_123-0.00875*q7_123 + 0.01169*q8_456-1.70089*D54-1.32100*ZZ.

Table 4.22

Regression analysis of q6_123, q7_123, q8_456, D54 and ZZ.

Root MSE	0.38999	R-Square	0.8160
Dependent Mean	3.03125	Adj R-Sq	0.8001
Coeff Var	12.86563		

The R^2 coefficient of determination, which is a statistical measure of how well the regression line approximates the data points, was raised to 0.8160 in the output generated by SAS (Table 4.22), which was satisfactory. An R^2 of 1.0 indicates that the regression line perfectly fits the data, while $R^2 = 0$ indicates no linear relationship. The R-square value of 0.8160 may be interpreted to indicate that approximately 80 percent of the variation in the dependent variable can be explained by the independent variables. The remaining 20 percent can be explained by unknown or inherent variability. Correlation, however, does not imply causation. Although two variables may be highly correlated, such correlation does not represent enough evidence to claim that changes to one variable would result in changes to another variable.

The final regression model was as follows: Q3=2.02415+0.13024*q6_123-0.00875*q7_123+0.01169*q8_456-1.70089*D54-1.32100*ZZ+ε, $\varepsilon \sim N(0,1)$

As the SAS output demonstrated, only the p-value of q6_123 was below 0.05. Thus it was reasonable to conclude that SAM Survey Question 3 (the degree of institutional-IT alignment) was highly related to SAM Survey Question 6_123 (the relationship between institutional strategies and institutional infrastructure). The null hypothesis was rejected for SAM

Survey Question 3 and q6_123. There was correlation between the perception of strategic alignment by all respondents and how well the relationship between institutional strategy and infrastructure was defined.

The remaining part of the null hypothesis was not rejected. No significant correlation was found between the perception of alignment and effective communication in the following areas:

1). institutional strategy,

2). Institution's infrastructure,

3). IT strategy, and

4). IT infrastructure.

No statistically significant correlation was found between respondents' perception of alignment and how well the following relationships were defined within their respective universities:

1). the relationship between institutional strategy and IT strategy;

2). the relationship between institution's infrastructure and institutional strategy;

3). the relationship between IT strategy and institutional strategy;

4). the relationship between IT infrastructure and IT strategy, and institution's infrastructure and IT infrastructure.

Summary

The Delphi panel agreed that the Strategic Alignment Model is abstract enough to be applicable to higher education if the language, terms and definitions were modified to reflect the higher education environment. The main concern regarding the terminology expressed by the panel was the lack of relevance of business-like terms of the corporate model, such as "customers," "business strategy" and "business scope." Instead, the panel proposed to replace

such terms, for example, with "students," "institutional strategy" and "academic mission."
Definitions of the terms used in SAM's instrument survey were found to be too business-like as
well. The panel suggested to include academic, research and learning-related definitions that
would reflect the decentralized characteristic of higher education institutions and within the
function that IT supports to list three areas—education, administration, and marketing/recruiting.
The SAM survey instrument's rating scale was modified to clarify the distinction between
communicating about institutional units and strategies and defining relationships between those
units and strategies.

Complete survey responses were received from 65 participants (22.3% of the sample of
300) representing 55 institutions of higher education (36.7% of the sample of 150 institutions).
The response was representative of both the sample and the population in terms of institution
type and residency status and differed with respect to geographical region with the Midwest
institutions' response being the highest.

It is worth noting that 73.3% of the administration executives and 75.7% of the IT leaders
described the strategic alignment at their respective institutions as "fairly good" or "strong."
Descriptive statistics also demonstrated that 70% of the survey respondents "agreed" or "strongly
agreed" that the scope, competencies and the governance of their institutions were
communicated well; 59% "agreed" or "strongly agreed" that their institution's administrative
structure, processes and skills were communicated well; 62.4% "agreed" or "strongly agreed"
that IT scope, systemic competencies and IT governance were communicated well; and 57%
"agreed" or "strongly agreed" that IT architecture, processes and skill were communicated well.

With regard to how well relationships are defined between units, 66.2% of the
respondents "agreed" or "strongly agreed" that the relationship between the institutional strategy

and administrative structure was defined well and was effective at their institutions (Table 4.10).

In addition, 60% "agreed" or "strongly agreed" that the relationship between institutional

strategy and the institutional processes was defined well and was effective. Conversely, only

38.4% "agreed" or "strongly agreed" that the relationship between institutional strategy and the

acquisition of human skills was defined well and was effective; 43% neither agreed nor

disagreed with that statement.

     An analysis of the data related to the survey of four-year institutions revealed that the

only correlation found was between the respondents' perception of alignment and how well the

relationship between institutional strategy and the institution's infrastructure is defined.

CHAPTER 5

Summary and Findings

Overview

This study sought to gain a better understanding of the factors that affect the alignment between institutional strategic planning and IT strategy in higher education and to identify a strategic alignment model to assist administrators in making informed decisions to facilitate such alignment. To better understand and assess the alignment of information technology with institutional mission and objectives in higher education, an existing corporate Strategic Alignment Model (SAM) was examined for application in higher education. This model was studied within the context of mid-size four-year universities.

The principal problem addressed by this study was derived from two primary themes: 1) the lack of alignment in higher education between the institutional strategic direction and the information technology strategy, and 2) the lack of a mechanism to understand and assess alignment. Moreover, the factors affecting institutional-IT alignment in higher education were not adequately understood or defined.

A review of literature established the significance of alignment between institutional strategy and information technology strategy (Sabherval, 2001; Luftman et al., 2005). Past research and literature on information technology, strategic alignment models and higher

education environment provided a background and framework on which this research was conducted.

Summary of Findings

An analysis of research findings suggests the degree of alignment between institutional strategic direction and information technology depends on the following:

- the degree to which the institutional scope (strategic direction) and information technology scope (strategic direction) is defined and communicated clearly;

- the degree to which institution's distinctive competencies (core functions) are delineated and reflected in institutional strategic direction;

- the degree to which the administrative structure and administrative processes are defined and communicated clearly;

- the degree to which information technology infrastructure (IT architecture, processes and skills) supports IT strategy (technology scope, distinctive competencies and governance);

- the degree to which institutional infrastructure (administrative infrastructure, processes, and skills) supports institutional strategy (institution's scope, distinctive competencies, and governance);

- the degree to which a clearly defined and communicated information technology scope (strategic direction) supports a clearly defined and communicated institution's scope (strategic direction);

- the degree to which information technology distinctive competencies (core functions) support the institution's distinctive competencies (core functions).

Discussion of Findings

     Strategic Alignment Model. Based on the work of the Delphi panel, it is reasonable to conclude that the corporate Strategic Alignment Model can be applied to higher education with the stipulation that the terms and definitions related to business and products be modified to reflect adequately the academic environment and the rating scale be refined to assure clarity. The revisions of the SAM model made by the Delphi panel did not affect the model itself, nor did they affect its survey instrument in ways that would change the model's application. The Delphi panel recommended that the following definitions included in the model's instrument be modified: business scope, distinctive competencies, business governance and administrative structure. A common thread among additional comments from the panelists was the need to change key terms, such as "business," "customer" and "product" to "institution," "students" or "constituents" and "services" in order to reflect the higher education organization accurately.

     The SAM model was assessed as abstract and "flexible enough" to be applicable in higher education. Consequently, the Delphi panel's findings provided the answers to Research Questions 2 and 3 ("Does the corporate Strategic Alignment Model (SAM) developed by Henderson and Venkatraman apply to higher education in part or in its entirety?" and "If the model applies in part, what modification was necessary for the model to apply to higher education?"). The Strategic Alignment Model can be applied to higher education in its entirety with the abovementioned modifications.

     Factors Impacting Strategic Alignment. Several factors affecting institutional-IT alignment in higher education were identified based on the Delphi responses. The survey of four-year institutions of higher education confirmed that the factors could be used to describe institutional-IT alignment in response to Research Question 1 ("What factors affecting strategic

alignment in higher education can be identified?"). When viewed in the context of the four

domains, or quadrants, of the Strategic Alignment Model (see pages 7 and 8), two groups of

factors emerged: those pertaining to domain components and those relating to the linkages

between the domains.

The alignment factors that could be viewed as domain components include clearly

defined and communicated institutional scope, IT scope, the institution's distinctive

competencies (core functions), administrative structure and administrative processes. The factors

relating to the linkages between the model's domains represent a bivariate fit (relationship

involving two domains either vertically or horizontally):

1). Strategic fit between IT strategy and IT infrastructure (vertical relationship linking a

clearly defined and communicated IT strategy domain to the IT infrastructure domain);

2). Strategic fit between institutional strategy and infrastructure (vertical relationship

linking a clearly defined and communicated institutional strategy to the institution's

infrastructure);

3). Functional integration of the institution's scope and the IT scope (horizontal

relationship linking a clearly defined and communicated institution's scope to the IT

scope);

4). Functional integration of the institution's distinctive competencies (core functions)

and IT distinctive competencies (horizontal relationship linking clearly defined and

communicated institutional core functions to IT distinctive competencies).

The one commonality among the group of component factors is a clearly articulated

definition of, and an effective communication about, the purpose, structure and processes of the

institution. These findings supported the results of the 2004 study of IT alignment in higher

education sponsored by Educause Center for Applied Research (see Chapter 2) in which effective communication was identified as one of the main drivers of institutional-IT alignment.

With the exception of IT scope, all of the component factors represent the two institutional domains of the SAM model—institutional strategy and institutional infrastructure. A possible explanation for this concentration of emphasis on the institutional side of the model, as opposed to the IT side, may be derived from the rationale offered by the Delphi for revising the model's terminology. The institutional components were modified by the Delphi because the business terms were not compatible with the higher education environment and because the mission and core functions of universities are not always clearly articulated, and neither are the administrative structure and processes in support of those objectives. The pattern of Delphi responses suggests that clarity of with which the institutional components are defined and communicated has a significant impact on strategic alignment in higher education.

Both the institutional strategy and the institutional infrastructure domains were found to be statistically correlated when the results of the survey of four-year institutions of higher education were analyzed. The strategic alignment factor identified as a result of the survey analysis was the relationship between institutional strategy and the institution's infrastructure (strategic fit between institutional strategy and infrastructure factor), thus suggesting that how well the relationship between strategy and infrastructure is defined and how effective it is may predict the institutional-IT alignment at four-year mid-size institutions of higher education. The bivariate vertical linkage between these two domains (institutional strategy and infrastructure), which were found to be correlated in this study, is referred to as a strategic fit in the SAM model. The strategic fit focuses on the linkage between making decisions that determine the mission and

objectives of the institution with its administrative structure, processes and skills that guide the internal procedures necessary to achieve the institutional objectives.

Knowing that institutional-IT alignment in higher education is contingent upon the effectiveness of institution's infrastructure (administrative structure, processes and skills) support for clearly articulated institutional goals and core functions affords both executive and technology leaders in higher education a significant insight into the underpinning of a successful strategic alignment between organizational purposes and priorities and information technology strategy and resources. The fact that two distinct research methods—the Delphi panel and the survey of higher education institutions—led to the identification of the same alignment factor indicates that this factor exhibits a very strong impact on institutional-IT alignment in higher education. It seems reasonable to conclude that even the best institutional strategy that is defined and communicated in the clearest of terms to IT leadership may not be sufficient to lead to institutional-IT alignment if the administrative structure, processes and people skills are not in place to support and sustain the institutional objectives in higher education.

The significance of the strategic fit (vertical) relationship between institutional strategy and infrastructure suggests that the other type of bivariate relationship of the SAM model, the functional integration, is subordinate to the strategic fit in the higher education environment. Consequently, making strategic decisions that determine institutional goals and core functions in tandem with administrative structure, processes and skills necessary to achieve these goals has been identified as the leading factor of, or driver for, strategic alignment in higher education. It is reasonable to conclude that a strong strategic fit between institutional strategy and infrastructure may lead to a strong corresponding functional integration between the institution and the IT division, thus resulting in the institutional-IT strategic alignment.

The implications for higher education administrators are two-fold. It is important that they not only define and articulate clearly institutional goals and core functions of their respective institutions but also define and communicate clearly the administrative structure and processes that enable the delivery of these goals. The strategic fit between the strategy and the infrastructure to support it should be strong in order to achieve institutional-IT alignment in higher education.

Once the strategic fit is distinctive and strong, administrators should communicate effectively the goals and the structures, processes and skills in support of those goals to IT leaders along with instructions to use the institutional goals to frame the development of IT goals. IT leaders, in turn, should ensure that the strategic fit between IT goals and IT infrastructure is strong and subsequently develop a strong functional integration between IT strategy and institutional strategy and between IT infrastructure and the institution's infrastructure as functional integration maximizes the value of information technology (Henderson, Venkatraman and Oldach, 1996).

An additional challenge for IT leaders lies in a clear articulation of the IT goals and in how those goals support institutional goals and infrastructure. IT leaders must communicate not only with IT professionals within the IT division but also with campus-wide constituents to enable the latter to understand how IT goals and processes support the institutional goals and processes. Clearly, in order for IT leaders to be able to build both a strategic fit within the IT division and a functional integration between IT and the institution, a strong strategic fit needs to be in place first and foremost on the institution side.

Finally, the factors representing the interrelationships among the four domains of the Strategic Alignment Model are parallel to the domain component-related factors, thus

reaffirming the significance of clear definitions and effective communication vertically and horizontally within the model. Consequently, being able to articulate clearly the institution's mission, goals and core functions as well as the internal mechanisms in support of those objectives and to communicate them effectively to IT leaders, so the latter develop IT goals in parallel with institutional objectives, has emerged as the leading factor, or driver, of strategic institutional-IT alignment in higher education.

Implications for Future Research

There are a number of implications for further research that result from this study's findings. Because of this study's relatively narrow quantitative scope, which was limited to the triangulation survey, researchers have an array of avenues to pursue to advance the understanding of the dynamic of strategic institutional-IT alignment and the factors impacting such alignment in higher education. Two directions of research in particular seem to present a logical extension to this study's findings, both using the modified instrument of the Strategic Alignment Model.

First, with respect to the resultant instrument of the Strategic Alignment Model, further research could include testing of the instrument on various populations in the higher education environment. Because institutions of higher education differ in a variety of categories, further research may include a stratified approach in which institutions in various subsets are studied, and their responses to institutional strategy alignment with IT strategy and infrastructure are investigated. An analysis of such data may advance the understanding of the factors affecting strategic alignment and effective planning for information technology in higher education.

Another way of utilizing the resultant SAM instrument in further research could include testing a single category of institutions with an expanded pool of respondents to include CEOs,

CIOs, and dean, faculty and student representatives, as some of the Delphi panel members suggested in this study. The data obtained from a variety of constituents and stakeholders may provide further insight into the institutional-IT alignment factors.

To advance the understanding of the strategic alignment between institutional objectives and information technology and the factors that impact it in higher education, case studies of universities and colleges could offer a more comprehensive assessment of the strategic alignment factors in higher education. Data collected from the SAM instrument could be combined with other sources of information, such as strategic plans and interviews, to produce a more comprehensive analysis of the factors underlying the strategic alignment in higher education that this study has achieved.

Second, further research could incorporate some of the unplanned findings of this study that relate to the differences of responses between executive and technology leaders. While the question of differences between Chief Executive Officers' and Chief Information Officers' perceptions was not the objective of this research, responses were received from 12 institutions (37% of the 65 completed surveys) in which both the CEO and the CIO answered the survey instrument. An analysis of the data revealed a high degree of agreement between CEOs and CIOs from the same institution, which reflected a commonality of perception of issues related to institutional strategy and infrastructure and to IT strategy and IT infrastructure.

It may be worth noting that the only exceptions to this commonality were CIOs' responses indicating that the effectiveness of communication about institutional strategy and infrastructure and IT strategy and infrastructure was related to one strategic fit and two functional integration linkages—a finding that independently confirmed the Delphi results. Similarly, the only departure from the commonality of perceptions among the CEOs was to mark

the significance of clearly communicated institutional and IT strategies vis-à-vis their

infrastructures. The analysis demonstrated that effective communication about institutional and

IT strategies was an alignment factor. The implications of this finding were the same as those for

the Delphi and the survey results.

A study analyzing the differences between the responses of CEOs and CIOs from the

same institutions to the survey instrument and their perceptions of strategic alignment at their

respective institutions may produce data that would contribute to a better understanding of the

dynamic of strategic alignment in higher education through the analysis of the linkages between

the four quadrants of the Strategic Alignment Model. By identifying the weakest (pivot) and the

strongest (anchor) domains, which may be accomplished by leaders of the same institutions only,

a strategic alignment perspective would emerge addressing both strategic fit and functional

integration. This type of research is particularly recommended taking into consideration the

commonality of perceptions of CEOs and CIOs in this study.

The conceptual framework for this research was based on the literature review, which, in

turn, was used to design this research. The Strategic Alignment Model selected for this research

derived its value and robustness from the different types of interrelationships among the four

domains, or quadrants. One of the four domains did not emerge as strongly as the literature may

have suggested: IT strategy domain. This could be an aspect of the model that future research

examines to find out whether it is, as the dynamics of the model suggest, the weakest domain in

the Strategic Alignment Model when SAM is applied to higher education, and why. One possible

way of assessing the level and extent of strategic alignment within the institution could be

application of the model to CEOs and CIOs from the same institutions, as they are "the two best

people to determine those strategies" (Papp, 2001, p. 12).

Conclusion

The results of this Delphi study and the triangulation of the panel's findings provided some insights into factors influencing institutional-IT alignment in mid-size higher education institutions. In addition, the findings identified and tested a model that could be used to assist higher education administrators and technology leaders to make informed decisions to facilitate the alignment of information technology with institutional strategic direction. These findings build a solid foundation for future investigation of the strategic alignment and the factors impacting it in higher education.

The initial question that led to the development of this research asked whether a model existed that could be used in higher education to assess the degree of strategic alignment and whether factors impacting that alignment could be identified. After having conducted the Delphi study, this researcher concluded that an existing corporate model could be applied to higher education and that some factors influencing alignment in higher education were identified. The obvious question remaining is what other factors play a significant role in institutional-IT alignment in higher education.

This researcher hopes that this study and the results from this study will become a catalyst for future research relating to institutional-IT alignment and factors impacting it in higher education. It is the hope of this researcher that the factors identified in this study and the model resulting from it will serve as a practical tool for higher education leaders who are interested in aligning their institution's objectives with information technology.

References

Abel, Rob. (2007). Innovation, adoption, and learning impact: Creating the future of IT. *Educause Review,* March/April 2007, pp. 13-30.

Aral, S., & Weill, P. (2007, September). IT Assets, Organizational Capabilities, and Firm Performance: How Resource Allocations and Organizational Differences Explain Performance Variation. *Organization Science, 18*(5), 763-780.

Austin, M.J. and Ahearn, F.L. (1997). Guiding organizational change. *New Directions for Higher Education,* 25(2), San Francisco: Jossey-Bass.

Ayers, E.L., & Grisham, C.M. (2003, November/December). Why IT has not paid off as we hoped (yet). *Educause review*, 40-51.

Bates, A.W. (2000). Managing technological change: Strategies for college and university leaders. San Francisco: Jossey-Bass.

Baets, W. (1992). Aligning Information Systems with Business Strategy, *Journal of Strategic Information Systems* 1 (4): 205-213.

Baets, W.J. (1996). Some Empirical Evidence on IS Strategy. Alignment in banking, *Information & Management* 30 (4): 155-177.

Barone, C.A. (2003, September/October). The changing landscape and the new academy. *Educause review*, 40-47.

Baschab, J., & Piot, J. (2003) *The executive's guide to information technology*. Hoboken: John Wiley & Sons, Inc.

Bergeron, F., Raymond, L., Rivard, S. (2001). Fit in strategic information technology management research: An empirical comparison of perspectives. *The International Journal of Management Science*, 29(2): 125-142.

Birnbaum, R. (1988). How colleges work: The cybernetics of academic organizations and leadership. San Francisco: Jossey-Bass.

Boar, Bernard B. (1994*). Practical steps for aligning information technology with business strategies: How to achieve a competitive advantage*. New York, John Wiley & Sons, Inc.

Boar, B. (1997). *Strategic thinking for information technology*. New York: John Wiley & Sons, Inc.

Board Briefing on IT Governance, 2nd Edition (2003). *IT Governance Institute* Retrieved from http://www.itgi.org/template_ITGI.cfm?template=/ContentManagement/ContentDisplay.cfm&ContentID=39652

Bogdan, R. C. & Biklen, S. K. (2006). *Qualitative research in education: An introduction to theory and methods.* Boston: Allyn & Bacon.

Bolman, L.D. and Deal, T.E. (1997). Reframing organizations: Artistry, choice, and leadership. San Francisco: Jossey-Bass.

Brancheau, J. and Wetherbe, J. (1987). Issues in Information Systems management. *MIS Quarterly* 11(1): 23-45.

Broadbent, M. and Weill, P. (1993). Improving Business and Information Strategy Alignment: Learning from the Banking Industry, *IBM Systems Journal* 32(1). 162-179.

Brooks, K.W. (1979). Delphi technique: Expanding applications. *North Central Association Quarterly*, 53(3). 377-385.

Bruce, K. (Nov.-Dec. 1998). Can you Align IT with Business Strategy? *Strategy & Leadership*, 26(5): 16.

Burn, J.M. (1993). Information Systems strategies and the Management of Organizational Change – A strategic alignment model. *Journal of Information Technology*, 8(4): 205-216.

Camp, John S, and DeBlois, Peter B. (2007). Current issues survey report, 2007. *Educause Quarterly*, 2 (2007).

Campbell, B., Kay, R., Avison, D. (2005). Strategic alignment: A practitioner's perspective. Journal of Enterprise Information Management, 18(5/6): 653-664.

Carr, N.G. (2003, May). IT doesn't matter. *Harvard Business Review*, 5-12.

Cegielski, C.G., Reithel, B.J. and Rebman, C.M. (2004, January). Issues affecting the integration of emerging information technologies into corporate information technology strategy: a Delphi study. Academy of Information and Management Sciences Journal, 7.1:p. 27(16).

Chan, Y.E. and Huff, S.L. (1993). Strategic information system alignment. *Business Quarterly*, 58(1), 51-55.

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

Chan, Y.E. (2001). Information systems strategy, structure and alignment, in R. Papp (ed.) Strategic Information Technology: Opportunities for competitive advantage, 1st edn, Hershey, PA: Idea Group Publishing, pp. 56-81.

Chan, Y.E., Sabherwal, R. and Thatcher, J.B. (2006). Antecedents and Outcomes of Strategic IS Alignment: An Empirical Investigation, *IEEE Transactions on Engineering Management* 51(3): 27-47.

Chan, Y.E. and Blaize Horner Reich. (2007). IT alignment: what have we learned? *Journal of Information Technology*, 22(4), 297-315.

Churchman, C. and Schamblatt, A. (1965). The Researcher and Manager: A Dialect of Implementation. Management Science. 2(4), February, 69-88.

Ciborra, C.U. (1996). *Groupware and Teamwork*, New York: John Wiley and Sons.

Ciborra, C.U. (2007). De Profundis? Deconstructing the Concept of Strategic Alignment, *Scandinavian Journal of Information Systems* 9(1): 57-82.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed). New Jersey: Lawrence Erlbaum.

Cope, R. W. (1981). Education 1990: A delphi study of possible future problems or issues for public education in Missouri (Doctoral dissertation, University of Missouri, 1981). Dissertation Abstract International, 43(06), 1761A.

Cox, J. (1999). *Executive's guide to information technology: Shrinking the IT gap*. New York, John Wiley & Sons, Inc.

Creswell, J.W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc.

Croteau, A. and Bergeron, F. (2001). An Information Technology Trilogy: Business Strategy, Technological Deployment and Organizational Performance, *Journal of Strategic Information Systems* 10(2): 77-99.

Dailey, A.L (1990). Delphi: A catalytic strategy for motivating curriculum revision by faculty. *Community/Junior College Quarterly of Research and Practice, 14* (2), 129-36.

Dehning, B., Richardson, V.J., and Zmud, R.W. (Dec. 2003). The Value Relevance of Announcements of Transformational Information Technology Investments. *MIS Quarterly*, 27(4): p, 637-656.

Dalkey, N.C. (1969). The Delphi method: An experimental study of group opinion. Pamphlet RM-588-PR, prepared for the U.S. Air Force Project Rand. Santa Monica, CA: Rand.

Dalkey, N.C., Brown, B & Cochran, S. (1970). Use of self-ratings to improve group estimates: Experimental evaluation of Delphi procedures. *Technological Forecasting and Social Change*, 1, 283-291.

Dalkey, N.C. & Helmer, O. (1963). An Experimental Application of the Delphi Method to the Use of Experts. *Management Science*. (April), 458-467.

Day, J., & Bobeva, M. (2004). Seeking the truth: The use of Delphi studies for IS research, in Grant, K., Edgar, D.A., and Jordan, M. (eds) *Reflection on the past, making sense of today and predicting the future of information systems*, 9th Annual UKAIS Conference Proceedings, Annual Conference, 5-7 May 2004, Glasgow Caledonian University, Glasgow.

Day, J., & Bobeva, M. (2005). A generic toolkit for the successful management of Delphi studies. *The Electronic Journal of Business Research Methodology*. 3(2), 103-116. Retrieved November 11, 2009 from http://www.ejbrm.com/vol3/v3-i2/v3-i2-art2-day.pdf

De Leede, J., Looise, J.C. and Alders, B. (2002). Innovation, Improvement and Operations: An Exploration of the management of Alignment, *International Journal of Technology Management* 23(4): 353-368.

Dedrick, J., Gurbaxani, V., and Kraemer, K.L. (2003). Information Technology and Economic

Performance: A Critical Review of the Empirical Evidence, ACM Computing Surveys,

(35:1), pp. 1-28.

Devlin, M., Larson, R, Meyerson, J. (Eds.). (2002). The Internet and the university: Forum 2000.

Educause.

Dixon, P. and John, D. (1989). Technology Issues Facing Corporate Management in the 1990s.

MIS Quarterly, 13(3):247-55.

Dootson, S. (1995). An in-depth study of triangulation. *Journal of Advanced Nursing*, 22: 183-7.

Duderstadt, J, (1999). The 21st century university: A tale of two futures. In M.W. Peterson, L.A.,

Mets, A. Trice, and Dill, D.D. (Eds.), ASHE reader on planning and institutional research

(pp. 145-157). Needham Heights, MA: Pearson Custom Publishing.

Earl, M.J. (1983). Corporate Information Systems Management. Homewood, Illinois, Richard D.

Irwin, Inc.

Earl, M.J. (1989). *Management Strategies for Information Technology*. London: Prentice Hall.

Earl, M.J. (1993). Experience in strategic information systems planning. *MIS Quarterly*, 17(1),

1-24.

Educause Core Data Service Fiscal Year 2007 Summary Report (2007).

Emerging Technologies. (2008, Oct. 11). Ed Tech: Focus on Higher Education. CDW

Corporation. http://www.edtechmag.com/higher/october-november-2006/metrics.html

Faisal, H. (2002). *The alignment effect: how to get real business value out of technology*. Upper

Saddle River, Financial Times/Prentice Hall.

Faul, F., Erdfelder, E., Lang, A.-G. & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175-191.

Feeny, D.F., Edwards, B.R., Simpson, K.M. (1992). Understanding the CEO/CIO Relationship. *MIS Quarterly*, 16(4): 435-448.

Fowler, Jr., F. (2009). *Survey Research Methods*. Thousand Oaks, California: Sage Publications, Inc.

Garibay, R., Alberto, J. (2008). The relationships among environmental turbulence, Information Technology convergence, strategic innovation management and overall firm performance: A cross-border case. D.B.A. dissertation, Alliant International University, San Diego, United States -- California.

Gilmore, T., Hirschhorn, L. and Kelly, M. (1999). Challenges of Leading and Planning in Higher Education, Draft, Center for Applied Research. Retrieved from http://www.cfar.com/Documents/Lead_ed.pdf

Glich, Milton, and Kupiec, Jake. (2001). The answer is still technology—strategic technology. *Educasue review*, November/December 2001, pp. 33-44.

Goff, L. (1993, November 1). You say tomatto, I say tomahto, *Computerworld*. 129.

Goh, Kim Huat (2007). Process and outcome-related IT value: Innovations in theory and methods for measurement. Ph.D. dissertation, University of Minnesota, United States -- Minnesota.

Graves, William, H. (2005). *Educause review*, November/December 2005, pp.79-98.

Green, Kenneth. (2006, November/December). Bring Data: A New Role for Information

Technology after the Spellings Commission. *EducauseReview,* vol. 41, no. 6, pp. 30–47.

Retrieved from http://www.educause.edu/er/erm06/erm0661.asp

Green, K. (2003). Follow the money. *Campus Technology*, September 26, 2003. Retrieved from

http://www.campustechnology.com/article.aspx?aid=39512

Green, P. J. (1982, March). *The content of a college-level outdoor leadership course*. Paper

presented at the Conference of the Northwest District Association for the American

Alliance for Health, Physical Education, Recreation, and Dance, Spokane, WA.

Hawkins, B. L., and Oblinger, D. G. (2007). IT myths: The myth abou6 IT as a utility. *Educause

review*, July/August 2007, pp. 10-11.

Henderson, J.C., and Sifonis, J.G. (1988). The Value of Strategic IS Planning: Understanding

consistency, validity, and IS market, *MIS Quarterly*, 12(2): 187-200.

Henderson, J., & Thomas, J. (1992). Aligning business and information technology domains:

Strategic planning in hospitals. *Hospital and Health Services Administrative*, 37(1), pp.

71-87.

Henderson, J., & Venkatraman, N. (1992). Strategic alignment: A model for organizational

transformation via information technology. In T.A. Kochan & M. Useem (Eds.),

Transforming organizations (pp. 97-117). New York: Oxford University Press.

Henderson, J.C. and Venkatraman, N. (1993). Strategic Alignment: Leveraging information

technology for transforming organizations, *IBM Systems Journal* 32 (1): 472-484.

Henderson, J., Venkatraman, N., & Oldach, S. (1996). Aligning business an IT strategies. In J.N.

Luftman (Ed.), *Competing in the information age: Strategic alignment in practice* (pp.

21-42). New York: Oxford University Press.

Heshusius, L. (1990). Goodness Criteris. In The paradigm dialog (Guba, E.G. ed.). Newbury

      Park, CA: Sage, pp. 198-201.

Hsu, C.C., Sanford, B.A. (2007). The Delphi technique: Making sense of consensus. *Practical*

      Assessment, Research & Evaluation. 12(10), 1-8. Retrieved November 10, 2009 from

      http://pareonline.net/pdf/v12n10.pdf

IMB Corporation. (1981). Business Systems Planning-Information Systems Planning Guide,

      GE20-0527-3.

Inaki, H.S., Landin, G.A., and Fa, M.C. (2006). A Delphi study on motivation for ISO 9000 and

      EFQM. International Journal of Quality & Reliability Management, 23(7), 807-827.

Irani, Z. (2002). Information Systems Evaluation: Navigating through the problem domain,

      Information Management 40(1): 11-24.

Kaiser, M. (5/5/2009). Arts and the Economy. *The Washington Post Online.*

Kaplan, R. S., & Norton, D. P. (2004). Measuring the strategic readiness of intangible assets,

      Harvard Business Review, 82(2): 52-63.

Kearns, G.S. and Lederer, A.L. (2003). A Resource-Based View of Strategic IT Alignment: How

      Knowledge Sharing creates competitive Advantage, *Decision Sciences* 34(1): 1-29.

Keen, P.G. (1993). Information Technology and the management difference, *IBM Systems*

      Journal 32(1): 17-39.

Khadem, Kambiz. (2007). Aligning Enterprise and Information Technology Strategy: A Study of

      the Correlation Between Strategic Alignment and Adaptation of Enterprise-wide Strategy

      Formulation Processes. Ph.D. Dissertation, Capella University, United States.

Kiernan, Vincent. (2005, February 9). Colleges' spending on technology will decline again this

      year, survey suggests. *The Chronicle of Higher Education*.

Kim, Yong-Mi (2006). An investigation of the effects of IT investment on firm performance: The role of complementarity. Ph.D. dissertation, The University of Oklahoma, United States -- Oklahoma.

Kissinger, Bryan C. (2007). The effect of Sarbanes-Oxley compliance efforts on business and information technology (IT) alignment: An exploratory study. Ph.D. dissertation, Capella University, United States -- Minnesota.

Kobelsky, K., Richardson, V., and Zmud, R. (2002). Determinants of Budgeted Information Technology Expenditures. *Twenty-Third International Conference on Information Systems*, pp. 459-468.

Kroes, James R. (2007). Outsourcing of supply chain processes: Evaluating the impact of congruence between outsourcing drivers and competitive priorities on performance. Ph.D. dissertation, Georgia Institute of Technology, United States -- Georgia.

Lederer, A.L., Mendelow, A.L. (1989). Coordination of Information Systems plans with business plans. *Journal of Management Information Systems*, 6(2): 5-19.

Lentz, Christine Marie Anderson (2001). From comprehensiveness to cohesiveness: An organizational capability for achieving value from strategic information technology initiatives in the life insurance industry. D.B.A. dissertation, Boston University, United States -- Massachusetts.

Levy, D.L. (2000). Applications and Limitations of Complexity Theory in Organization Theory and Strategy, in J. Rabin. G.J. Miller and W.B. Hildreth (eds.) *Handbook of Strategic Management*, 2nd edn., New York: Marcel, pp.67-87.

Lewis, N. (2009). Identifying Critical Dimensions that Shape the Business and Information
   Technology Alignment Process: A Case Study of a University. Ph.D. Dissertation,
   Capella University, United States – Minnesota.

Liebs, S. (1992). We're All in This Together. *Information Week*, Oct. 26, p. 8.

Lim, Jee-Hae (2006). Three essays on information technology and firm performance. Ph.D.
   dissertation, The University of Kansas, United States -- Kansas.

Linstone, H. A., & Turoff, M. (1975). The Delphi method: techniques and application. Reading,
   MA: Addison-Wesley Publishing Company.

Linstone, H. A., & Turoff, M. (1978). The Delphi method. Reading, MA: Addison-Wesley
   Publishing Company.

Linstone, H. A., & Turoff, M. (2002). The Delphi method: techniques and application. Retrieved
   January 2009 from http://is.njit.edu/pubs/delphibook/delphibook.pdf

Loo, R. (2002). The Delphi method: A powerful tool for strategic management. *International
   Journal of Police Strategies and Managemen*t, 25 (4): 762-9.

Luftman, J. (1996). Applying the strategic alignment model. In J.N. Luftman (Ed.), *Competing in
   the information age: Strategic alignment in practice* (pp. 43-69). New York: Oxford
   University Press.

Luftman, J., Kempaiah, R. and Nash, E. (2005). Key Issues for IT Executives 2005, *MIS
   Quarterly Executives* 5(2): 81-101.

Luftman, J., Lewis, P., and Oldach, S. (1993). Transforming the enterprise: The alignment of business and information technology strategies. *IBM Systems Journal*, 32(1), pp. 198-221.

Luftman, J., Papp, R., & Brier, T. (1999, March). Enablers and inhibitors of business-IT alignment. *Communications of the AIS*, 1(11).

Mack, N., Woodsong, C., MacQueen, K.M., Guest, G. & Namey, E. (2005). *Qualitative Research Methods: A data collector's field guide.* Durham, NC: Family Health International. Retrieved November 11, 2009 from http://www.fhi.org/en/RH/Pubs/booksReports/QRM_datacoll.htm

Martino, J.P. (1983). *In Introduction to Technological Forecasting*. London, Gordon and Breach

McCredie, J. (2003, November/December). Does IT matter to higher education? *Educause review*, pp. 14-22.

McKeen, J.D. and Smith, H. (2003). *Making IT Happen: Critical issues in IT management*, Chichester, Hoboken, NJ: Wiley.

McLean, E.R. and Soden, J.V. (1997). *Strategic Planning for MIS*, New York: Wiley.

Miles, R.E., & Snow, C.C. (1978). *Organizational strategy, structure and process*. New York, McGraw-Hill.

Miller, L. E. (2006, October). *Determining what could/should be: The Delphi technique and its application*. Paper presented at the meeting of the 2006 annual meeting of the Mid-Western Educational Research Association, Columbus, Ohio.

Mills, P. (1986). *Managing Service Industries*. New York:Ballinger.

Morse, J.M. (1991). Approaches to qualitative=quantitative methodological trangulation. *Nursing Research*, 40, 120-23.

Morton, M.S. (Ed.) (1991). *The corporation of the 1990s: Information technology and organizational transformation*. New York: Oxford University Press.

Mote, C.D. (6/28/20004). Education Facing a Graceful Decline. *The Daily Californian Online*.

Nair, S. (1995). Modeling strategic investment decisions under sequential technological change. *Management Science*, 41(2), pp. 282-297.

Nash, Elby M. (2006). Assessing IT as a driver or enabler of transformation in the pharmaceutical industry employing the Strategic Alignment Maturity Model. Ph.D. dissertation, Stevens Institute of Technology, United States -- New Jersey

Niederman, F., Brancheau, J. and Wetherbe, J. (1991). Information Systems Management Issues for the 1990s. MIS Quarterly, 15(4): 475-95.

Norris, D.M., & Olson, M.A. (2003). The business value web: Resourcing business processes and solutions in higher education. Washington, D. C.: *NACUBO*, 91.

Norris, D. M., & Keehn, A.K. (2003, November). IT planning cultivating innovation and value. *Syllabus*, 11-16.

O'Donoghue, T., Punch K. (Editors) (2003). *Qualitative Educational Research in Action: Doing and Reflecting.* New York: Routledge.

Orton, J. D. and K. E. Weick (1990). Loosely coupled systems: A reconceptualization. *Academy of Management Review*, 15: 203-223.

Paliwoda, S. (1983). Predicting the Future Using Delphi, Management Decision. 21(1), 31-38.

Papp, R. (1995). Determinants of strategically aligned organizations: A multi-industry, multi-perspective analysis. Ph.D. dissertation, Hoboken, NJ: Stevens Institute of Technology. *Dissertation Abstracts International*, 57-06, A, 2569.

Papp, R. (1999). Business-IT alignment: Productivity paradox payoff? Industrial Management and Data System, 99(8) 367-373.

Papp, R. (2001). *Strategic Information Technology: Opportunities for Competitive Advantage.* London: Idea Group Publishing.

Patten, M.L. (2004). *Understanding Research Methods*. Glendale, CA. Pyrczak Publishing.

Phipps, R.A., and Wellman, J.V. (2001, April). Funding for 'Infostructure': A guide to financing technology infrastructure in higher education. *The Institute for Higher Education Policy*, 3(2), 1-16.

Pierce, Amy Chen (2002). The effect of business and information technology strategic alignment on information technology investment returns and corporate performance. D.B.A. dissertation, Nova Southeastern University, United States -- Florida.

Pirani, A. J., and Salaway, G. (2004, June). Key Findings: Information Technology Alignment in Higher Education, Educause Center for Applied Research.

Porter, M. E. (1980). *Competitive Strategy: Techniques for Analyzing Industries and Competitors.* New York: Free Press.

Porter, S.R., and Whitcomb, M. E. (2003). "The Impact of Contact Type on Web Survey Response Rates." *Public Opinion Quarterly*, 67, 579-588.

Powell, C. (2003). The Delphi technique: myths and realities. *Journal of Advanced Nursing*. 41(4), 376-382.

Pyburn, P.J. (1983). Linking the MIS plan with corporate strategy: An exploratory study. *MIS Quarterly*, 7(2): 1-14.

Rathnam, R.G, Johnsen, J, Wen, J. (Winter 2004-2005). Alignment of business strategy and IT strategy: A case study of a Fortune 50 financial services company. *Journal of Computer Information Systems*, pp. 1-8.

Reich, B. H., & Benbasat, I. (1996). Measuring the linkage between business and information technology objectives. *MIS Quarterly,* 20(1), 55-81.

Reich, B. H., & Benbasat, I. (2000). Factors that influence the social dimension of alignment between business and information technology objectives. *MIS Quarterly*, 24(1), 81-114.

Riggs, W. (1983). The Delphi Technique: An Experimental Evaluation. Technological Forecasting and Social Change. 23, .89-94.

Robson, C. (2002). *Real world research: A resource for social scientists and practitioners.* Madden, MA: Blackwell Publishers.

Rohrbaugh, J. (1979). Improving the Quality of Group Judgments: Social Judgments Analysis and the Delphi Technique. Organization Behavior and Human Performance. 24, 73-92.

Sabherwal, R. and Chan, Y.E. (2001). Alignment Between Business and IS Strategies: A Study of Prospectors, analyzers, and Defenders, *Information Systems Research* 12(1): 11-33.

Sabherwal, R., Hirschheim, R. and T. Goles. (2001). The Dynamics of Alignment: A Punctuated Equilibrium Model, *Organization Science*, Vol.12, No.2, 2001.

Sackman, H. (1975). *Delphi critique*. London, Lexington Books.

Sanchez Ortiz, Aurora (2003). Testing a model of the relationships among organizational performance, IT-business alignment, and IT governance. Ph.D. dissertation, University of North Texas, United States -- Texas.

Schmidt, R.C. (1997). Managing Delphi surveys using nonparametric statistical techniques. *Decision Sciences*. 28(3), 763-778.

Segars, A. H., Gover, V. & Teng, J. T.C. (1998). Strategic Information Systems Planning: Planning System Dimensions, Internal Coalignment, and Implications for Planning Effectiveness. *Decision Sciences*. 29(2), Spring, 303--347.

Shao, Benjamin B. M. (2000). Investigating the value of information technology in productive efficiency: An analytic and empirical study. Ph.D. dissertation, State University of New York at Buffalo, United States -- New York.

Skulmoski, G.J., Hartman, F.T, and Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education*. 6, 1-20.

Sledgianowski, Deb (2004). Identification of factors affecting the maturity of IT-business strategic alignment. Ph.D. dissertation, Stevens Institute of Technology, United States -- New Jersey.

Slowey, M. (1995). Implementing change from within universities and colleges: Ten personal accounts. London: Kogan Press.

Sundaresan, Shankar (1997). Standardization policies for corporate information systems. Ph.D. dissertation, The University of Rochester, United States -- New York.

Tallon, P. P., Kraemer, K. L., & Gurbaxani, V. (2000).Executives' perceptions of the business value of information technology: A process-oriented approach. *Journal of Management Information Systems*, 16(4), 145-173.

Taylor, R. & Meinhardt, D. (1985). Defining Computer Information Needs for Small Business: A Delphi Method. *Journal of Small Business Management*. 23(2), 3-10.

Trochim, W.M.K. (2007). *The research methods knowledge base* (3rd ed.). Cincinnati, OH: Atomic Dog Publishing.

Tuller, C., and Oblinger, D. (1999). Information Technology as a transformation agent. Cause/Effect, 23(2), 6-14.

Twig, C. (1994). Navigating the transition. *Educom Review*, 29(6), 6-10.

Ulschak, F. L. (1983). *Human resource development: The theory and practice of need assessment*. Reston, VA: Reston Publishing Company, Inc.

U.S. Department of Education. (2006). A test of leadership: Charting the future of U.S. higher education. *A report of the Commission appointed by Secretary of Education Margaret Spellings*. Washington, D.C., 2006. Retrieved from http://www.ed.gov/about/bdscomm/list/hiedfuture/reports/final-report.pdf

Vaghefi, R.M, & Huellmantel, A.B. (1999). *Strategic management for the XXIst century*. Boca Raton, St. Lucie Press.

Van de Ven, A. L., & Delbecq, A.H. (1974). The effectiveness of nominal, Delphi, and interacting group decision making processes. Academy of Management Journal, 17(4), 605-621.

Van Der Zee, J.T.M., De Jong, B. (1999). Alignment is not enough: Integrating business and information technology management with the balanced business scoreboard. *Journal of Management Information Systems*, 16(2): 137-156.

Vaughan, Derek. (2007). Planning for Information Technology: A Comparative Case Study of the Factors Affecting the Alignment of Institutional Strategic Plans and Information Technology Plans, Ph.D. Dissertation, University of Michigan, United States – Michigan.

Voyles, Bennett. (2004, September 29). IT Spending: Where's the Value? *Campus Technology*.

Wang, E.T.G., Tai, J.C.F. (2003). Factors affecting Information Systems planning effectiveness: Organizational contexts and planning systems dimensions. *Information Management*, 40(4): 287-303.

Watson, R., & Brancheau, J. (1991). Key issues in information systems management: An international perspective. *Information & Management*, 20, pp. 213-23.

Wimmer, R.D., Dominick, J.R. (1978). *Mass media research: An introduction.* Belmont, CA: Wadsworth Publishing Company.

Witkin, B.R., and Altschuld, J.W. (1995). *Planning and conducting needs assessment: A practical guide.* Thousand Oaks, CA: Sage Publications, Inc.

Woudenberg, F. (1991). An evaluation of Delphi. *Technological Forecasting and Social Change*, 40: 131-50.

Yanosky, Ronald, & Borreson Caruso, J. (2008). Key Findings: Process and Politics: IT Governance in Higher Education. EDUCAUSE.

Yousuf, M.I. (2007). Using expert's opinion through Delphi technique. *Practical Assessment, Research and Evaluation*. 12-4, 1-8.

Xia, Weidong (1998). Dynamic capabilities and organizational impact of IT infrastructure: A research framework and an empirical investigation. Ph.D. dissertation, University of Pittsburgh, United States -- Pennsylvania.

APPENDIX A

Invitation to Participate in the Delphi

Dear Dr. XXXXXX,

My name is Barbara Lach-Smith. I am a doctoral student in the School of Technology at Indiana

State University, and I am conducting a study of institutional-IT alignment in higher education.

The purpose of this email is to kindly invite you to participate in a 9-member Delphi panel that

will examine the Strategic Alignment Model as it applies to higher education. The findings of the

Delphi panel will be tested in a survey of randomly selected 4-year institutions of higher

education. This research will identify whether the existing corporate alignment model makes a

good fit in higher education.

You are invited to the panel because of your expertise in the field of Information Technology and

alignment. If you choose to participate, you will receive materials on the Strategic Alignment

Model developed by Henderson and Venkatraman that you will be asked to examine in the

context of higher education.

In the two-round Delphi, you will be asked how the existing alignment model may apply to

higher education, whether all of its elements apply and whether some elements are missing in

order for the model to work effectively in the higher education environment. You will be asked

to review your response in the second round, when you will receive descriptive information

about how all the members of the Delphi group respond. You will be contacted only by this researcher, and you will have no contact with other panel members.

Research results will be made available upon request. You will be contacted through email to an email address of your choosing. Please respond by [date]. There will be no more than one follow-up email.

This research is being conducted under the supervision of Dr. Edward Kinley [Email…]. If you have any questions or concerns about completing the survey or about participating in this study, you may contact me at [Tel….] or at [Email…]. If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Research Board (IRB) by mail [Address…], by phone at [Tel….], or by e-mail at [Email…].

Sincerely,

Barbara Lach-Smith

Ph.D. Candidate

School of Technology

Indiana State University

APPENDIX B

Delphi Round One Questions

Dear Panel Members:

Thank you for agreeing to participate in this study. This document represents Round I of the

Delphi inquiry.

The aim of this study is to examine if the Strategic Alignment Model (SAM) developed by

Henderson and Venkatraman can be used effectively in higher education.

Round I Part A:

After considering each of the four quadrants of the SAM model developed by Henderson and

Venkatraman (pages 3 and 4) with all its components in the context of higher education, please

answer the following questions:

1.1A). Which SAM components do not apply to higher education and why?

1.2A). What components, if any, are missing from SAM and could be added to make the model

applicable in higher education?

1.3A). Which components of SAM apply somewhat, in a limited way, to higher education and

why?

Round I Part B:

Consider the two-part SAM assessment instrument, included in this document (pages 5 through

8), for application in higher education. The tool includes 36 questions divided by topics that

correlate with the four quadrants of the model. The typical respondents in the corporate environment would include a Chief Information Officer and a top executive of the company. They would rank their responses on a scale from 1 to 7, from "poor" to "extraordinary."

After reviewing the survey instrument, please answer the following questions:

1.1B). List the questions from the SAM assessment survey that you find not applicable or somewhat applicable to higher education and explain briefly why they are not a good fit in the higher education environment.

1.2B). Propose a question that might serve more effectively in the SAM assessment survey when used in the higher education environment.

The open-ended questions give you an opportunity to write comments about the model and the survey instrument.

I would be grateful if you could email back your answers to me within six days (date) after receiving my email. If you have any further queries, please email me at [Email…].

I estimate it will take about three days to summarize the results from this round. I will send you a comprehensive list of answers and comments in the second round of Delphi.

Thank you for your time and participation.

Yours truly,

Barbara Lach-Smith

Ph.D. Candidate

Technology Management

School of Technology

Indiana State University

APPENDIX C

Delphi Round One Materials

Strategic Alignment Model (SAM)

Source: Henderson, J., Venkatraman, N., & Oldach, S. (1996). Aligning business an IT

strategies. In J.N. Luftman (Ed.), *Competing in the information age: Strategic alignment in*

practice (pp. 21-42). New York: Oxford University Press.

This model is defined in terms of four fundamental domains of strategic choice: business

strategy, information technology strategy, organizational infrastructure and processes, and

information technology infrastructure and processes. Each domain has it underlying

components.

Domains: **Components:**

Business strategy   **Business scope** (*products and markets*)

                               Distinctive competency (*characteristics that distinguish the*

organization from others, such as superior service or product design)

                               Business governance *(strategic alliances and joint ventures)*

IT strategy   **Technology scope (**critical information technologies that support

business initiatives)

Distinctive competencies (*attributes of IT strategy that complement well the existing and impact positively the creation of new business strategies)*

IT governance (*choices regarding joint ventures and strategic partnerships to advance key IT components*)

Organizational Infrastructure   **Administrative structure (**the organizational structure and definitions of roles and responsibilities in the respective areas)

Business processes (product development and delivery, customer service)

Human resource skills

IT infrastructure   **IT architecture** (configuration of hardware, software and communications in the IT area; definitions of roles and responsibilities in the respective areas))

IT processes (processes by which IT systems are planned, developed, implemented and operated)

IT skills (professional skills, competencies, experience, values of those who operate IT)

Because the purpose of the strategic alignment model is to help in assessing strategic alignment within the organization, the interrelationships among the four domains are at the core of its purpose. The model derives its value from the different types of relationships possible among the four domains, or quadrants.

Strategic Alignment Model (SAM)
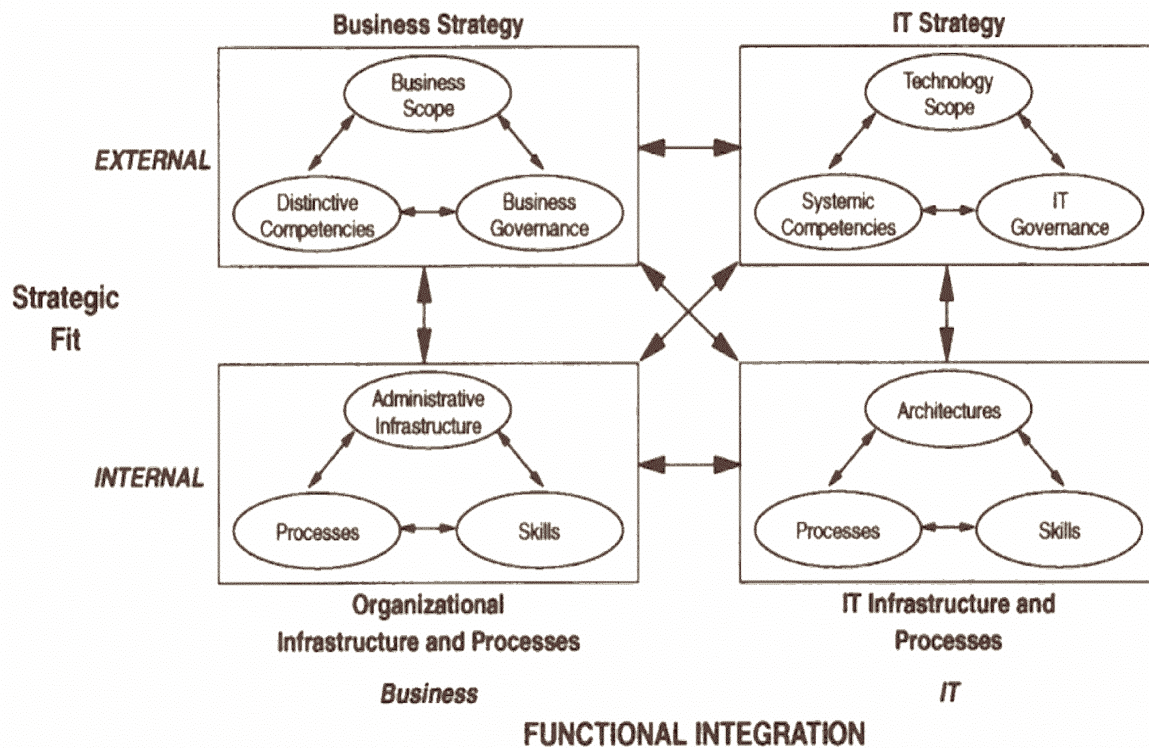
The top two domains represent the strategic level, at which we make IT choices that potentially shape and support business strategy. The bottom two domains represent the operational level, where we study the link between organizational infrastructure and processes and IT infrastructure and processes. It is worth noticing that the IT strategy is distinct in this model from IT infrastructure, processes and skills.

Both vertical and horizontal linkages are used. The vertical links suggest a "strategic fit," the

extent to which business and IT strategies are linked to their related infrastructures and

processes. The corresponding horizontal linkage is described as "functional integration." This

linkage broadens the principle of strategic fit to include the functional domains of business and

Information Technology. In other words, the IT strategy must adjust to the changes in business

strategy, and the components of the two lower boxes—infrastructure, processes and skills—must

change to reflect either business or IT strategy changes. Functional integration brings about

competitive advantage and maximizes the value of Information Technology

The strategic alignment model allows for complete integration of the strategy and function

through the different types in relationships among the four domains. In particular, three main

kinds of relationships can be delineated in this model: bivariate fit, cross-domain alignment, and

strategic alignment (Henderson, 1992).

SAM Survey Instrument

The questions are divided into two parts. The 12 questions in Part 1 address the four quadrants of the Strategic Alignment Model. There are three questions (one page) for each quadrant of the model.

Part 1

To what extent do you believe the following components are defined, communicated, effective, efficient, valuable:

  (1 of 12) the SCOPE of your business, encompassing the products, services and geography your organization serves and the services you provide.

  (2 of 12) the DISTlNCTIVE COMPETENCIES or unique characteristics of your products or services, such as pricing, distribution channels and quality of service.

  (3 of 12) how you carry out the GOVERNANCE of your BUSINESS, the manner in which you choose to operate and compete, either as single entity or by forming alliances with customers, suppliers, and other providers.

To what extent do you believe the following components are defined, communicated, effective, efficient, valuable:

  (4 of 12) your ADMINISTRATIVE STRUCTURE, which defines organization arrangement and responsibilities, including centralized, decentralized, and networked structures.

  (5 of 12) the design of your essential PROCESSES, such as standard operating procedures, cross-functional processes, and associated information flows.

(6 of 12)   the acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out your strategy.

To what extent do you believe the following components are defined, communicated, effective, efficient, valuable:

(7 of 12)   your IT SCOPE, the determination of the range and type of information technologies critical to your organization, such as image processing, expert systems, and local area networks.

(8 of 12)   the SYSTEMIC COMPETENCIES or important characteristics of your information technology infrastructure, including access to information, reliability , speed, and connectivity.

(9 of 12)   your GOVERNANCE of IT, including steering committees, contracting for IT services, and establishing partnerships with organizations to obtain needed services.

To what extent do you believe the following components are defined, communicated, effective, efficient, valuable:

(10 of 12)   your IT ARCHITECTURE, which defines the choices and policies that enable the systems, applications, data, software, and hardware in a cohesive platform.

(11 of 12)   your IT work PROCESSES associated with the development, delivery, and use of information systems, including application development, standard security procedures, and other system management controls.

(12 of 12) the acquisition or modification of SKILLS and experience related to the development, operation, and use of information systems in your organization to match IT skills to your business needs.

The 24 questions in Part 2 address the relationships among the four quadrants of the Strategic Alignment Model. The vertical relationships are called "strategic fit". The horizontal relationships are called "functional integration". These relationships are illustrated in the figure below. The relationships are two- way between adjacent quadrants of the model. There are three questions for each relationship. The next 12 questions pertain to "strategic fit". The last 12 questions relate to "functional integration."

Part 2

To what extent do you believe that the relationship between the business strategy (entering new markets, changing services) and the following organizational infrastructure decisions are defined, effective, efficient:

(1 of 24) your ADMINISTRATIVE STRUCTURE, including reporting relation- ships and roles.

(2 of 24) the design of your critical work PROCESSES, such as work flows and standard operating procedures.

(3 of 24) the SKILLS needed for human resources for line or functional areas to carry out the strategy.

To what extent do you believe that the relationship between the organizational structure and processes (authority structure, business processes and skills) and the following business strategy decisions are defined, effective, efficient:

  (4 of 24)   the SCOPE of your business, including clients and services.

  (5 of 24)   the DISTINCTIVE COMPETENCIES of your products and services, such as quality of service.

  (6 of 24)   the GOVERNANCE of your BUSINESS, or the way in which you operate.

To what extent do you believe that the relationship between the information technology strategy (which types of information technology are critical, the appropriate level of connectivity and reliability, IT strategic alliances) and the following IT infrastructure decisions are defined, effective, efficient:

  (7 of 24)   your IT ARCHITECTURE, including applications, databases, and hardware.

  (8 of 24)   the work PROCESSES required, such as data center operations.

  (9 of 24)   the IT human SKILLS needed to apply information systems in your organization to meet your business needs.

To what extent do you believe that the relationship between the information technology infrastructure (specific hardware, databases, and development processes) and the following *UT* strategy decisions are defined, effective, efficient:

  (10 of 24)   IT SCOPE, such as networks, image processing, and knowledge- based systems.

  (11 of 24)   the SYSTEMIC COMPETENCIES of your I/T infrastructure, such as reliability and connectivity.

  (12 of 24)   the GOVERNANCE of IT, whether you build your own systems or establish partnerships to obtain needed services.

To what extent do you believe that the relationship between the business strategy (entering new markets, changing services) and the following *UT* strategy decisions are defined, effective, efficient:

  (13 of 24)   IT SCOPE, such as image processing and networks.

  (14 of 24)   the SYSTEMIC COMPETENCIES, such as reliability, connectivity, and speed.

  (15 of 24)   your IT GOVERNANCE, such as application ownership or alliances to develop software or other products.

To what extent do you believe that the relationship between the *UT* strategy (which types of *UT* are critical, the appropriate level of connectivity) and the following business strategy decisions are defined, effective, efficient:

  (16 of 24)   your BUSINESS SCOPE, the essential products and services you provide.

  (17 of 24)   the DISTINCTIVE COMPETENCIES of your products and services, such as quality, and service level.

  (18 of 24)   the GOVERNANCE of your BUSINESS, operating as a single entity or in partnership.

To what extent do you believe that the relationship between the organizational infrastructure {administrative structure, work processes, and human skills required to carry out your business strategy) and the following IT infrastructure decisions are defined, effective, efficient:

  (19 of 24) your IT ARCHITECTURE, including critical applications, databases, or hardware.

  (20 of 24) your IT PROCESSES and operations, such as systems development, application development, and data center operations.

  (21 of 24) the IT human resources and SKILLS you need to meet business requirements.

To what extent do you believe that the relationship between the information technology architecture (IT architecture and processes such as specific hardware and development processes) and the following organizational infrastructure decisions are defined, effective, efficient:

  (22 of 24) your ADMINISTRATIVE STRUCTURE, including authority levels, roles, and responsibilities.

  (23 of 24) the PROCESSES of your business, such as standard operating procedures and cross-functional processes.

  (24 of 24) the SKILLS required of your people to carry out your business.

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APPENDIX D

Delphi Round Two Materials

Dear Panel Members:

Thank you for your participation in Round I. This document represents Round II of the Delphi inquiry.

I have compiled your responses from Round I. Under each of the questions below you will find the responses I received.

1). Please mark whether you agree with each comment by placing an "x" under "**agree**" or "**disagree.**" If you wish to add *comments*, or more details, please use the space under each answer.

2). In a separate document attached I am including a revised list of SAM questions. The revisions are based the panel members' suggestions. I ask that you review the revisions and mark under each revision whether you "**agree**" or "**disagree**" with it and/or comment on it.

I would be grateful if you could email back your answers to me by [date].

Should you have any further queries, please email me at [Email…].

Thank you for your time and participation.

Yours truly,

Barbara Lach-Smith

Ph.D. Candidate

Technology Management

School of Technology

Indiana State University

Round Two, Part Two: SAM Instrument modified by the Delphi panel in Round One

Strategic Alignment Model Assessment questions

The questions are divided into two parts. The 12 questions in Part 1 address the four quadrants of the Strategic Alignment Model. There are three questions (one page) for each quadrant of the model.

Changes in blue are additions; changes in orange are parts taken out.

Part 1

To what extent do you believe the following components are ~~defined,~~ communicated, effectively, ~~efficient, valuable~~:

Your comments: Agree Disagree

  (1 of 12) the SCOPE of your organization, ~~encompassing the products, services and the geographic area your organization serves and the services you provide~~ :

a)   products/services,

b)   customers/clients,

c)   competitors.

Your comments: Agree Disagree

  (2 of 12)   the DISTlNCTIVE COMPETENCIES, or unique characteristics, of your ~~products or~~ services, ~~such as~~ including education, research, administration and recruitment/marketing ~~pricing, distribution channels and quality of service.~~

Your comments: Agree Disagree

  (3 of 12)   how you carry out the GOVERNANCE of your EDUCATIONAL INSTITUION, ~~the manner in which you choose to operate and compete, either as a single entity or by forming alliances with suppliers, and other providers.~~

- GOVERNANCE defined as processes by which institutional priorities are set, funded, and managed and by whom (governing bodies, committees, advisory groups or individuals)

Your comments: Agree Disagree

- GOVERNANCE defined as the manner in which you choose to operate and compete, either as a single entity or by forming alliances with IT providers

Your comments: Agree Disagree

To what extent do you believe the following components are ~~defined,~~ communicated, effectively, ~~efficient, valuable~~:

Your comments: Agree Disagree

  (4 of 12)   your ADMINISTRATIVE STRUCTURE, which defines organization arrangement and responsibilities, including centralized, decentralized, and networked structures or autonomous groups, and which includes reporting relationships and roles.

Your comments: Agree Disagree

  (5 of 12)   the design of your essential PROCESSES, such as standard operating procedures, cross-functional processes, and associated information and flows.

Your comments: Agree Disagree

  (6 of 12)   the acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out your institutional strategy.

Your comments: Agree Disagree

To what extent do you believe the following components are ~~defined,~~ communicated, effectively, ~~efficient, valuable~~:

Your comments: Agree Disagree

  (7 of 12)   your IT SCOPE, the determination of the range and type of information technologies

critical to your organization's ~~image processing, expert systems, and local area networks~~.

a). educational support,

b). administrative support,

c). recruiting/marketing support.

Your comments: Agree Disagree

  (8 of 12)   the SYSTEMIC COMPETENCIES or important characteristics of your IT

infrastructure, including access to information, reliability, speed, and connectivity for:

a). educational support,

b). administrative support,

c). recruiting/marketing support.

Your comments: Agree Disagree

  (9 of 12)   your GOVERNANCE of IT, including ~~steering~~ processes by which IT priorities are

set, funded, and managed and by whom (committees, advisory groups or individuals)

~~contracting for IT services, and establishing partnerships with organizations to obtain needed~~

~~services~~ in the area of:

a). educational support,

b). administrative support,

c). recruiting/marketing support.

Your comments: Agree Disagree

To what extent do you believe the following components are ~~defined,~~ communicated, effectively, ~~efficient, valuable~~:

Your comments: Agree   Disagree

  (10 of 12)   your IT ARCHITECTURE, which defines the choices and policies that enable the

systems, applications, data, software, and hardware in a cohesive platform to provide:

a). educational support,

b). administrative support,

c). recruiting/marketing support.

Your comments: Agree   Disagree

  (11 of 12)   your IT work PROCESSES associated with the development, delivery, and use of

information systems, including application development, standard security procedures, and

other system management controls to provide:

a). educational support,

b). administrative support,

c). recruiting/marketing support.

Your comments: Agree   Disagree

  (12 of 12)   the acquisition or modification of IT SKILLS and experience related to the

development, operation, and use of information systems in your organization to match IT skills

to your institution's ~~business~~ needs to provide:

a). educational support,

b). administrative support,

c). recruiting/marketing support.

Your comments: Agree Disagree

The 24 questions in Part 2 address the relationships among the four quadrants of the Strategic

Alignment Model. The vertical relationships are called "strategic fit". The horizontal

relationships are called "functional integration". These relationships are illustrated in the figure

below. The relationships are two- way between adjacent quadrants of the model. There are three

questions for each relationship. The next 12 questions pertain to "strategic fit". The last 12

questions relate to "functional integration."

Part 2

To what extent do you believe that the relationship between the ~~business~~ institutional strategy

(~~entering new markets,~~ changing services) and the following organizational infrastructure

decisions are defined, effective, efficient:

Your comments: Agree Disagree

  (1 of 24)   your ADMINISTRATVE STRUCTURE, which defines organization arrangement

and responsibilities, including centralized, decentralized, and networked structures or

autonomous groups, and reporting relationships and roles to provide:

a). educational support,

b). administrative support,

c). recruiting/marketing support.

Your comments: Agree Disagree

(2 of 24) the design of your essential PROCESSES, such as standard operating procedures, cross-functional processes, and associated information and flows to provide:

a). educational support,

b). administrative support,

c). recruiting/marketing support.

Your comments: Agree Disagree

  (3 of 24) the acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out your institutional strategy to provide:

a). educational support,

b). administrative support,

c). recruiting/marketing support.

Your comments: Agree Disagree

To what extent do you believe that the relationship between the organizational structure and processes (authority structure, ~~business~~ processes and skills) and the following ~~business~~ institutional strategy decisions are defined, effective, efficient:

Your comments: Agree Disagree

(4 of 24) the SCOPE of your organization, encompassing the ~~products,~~ services and the geographic area your organization serves ~~and the services you provide~~ :

a)   products/services,

b)   customers/clients,

c)   competitors.

Your comments: Agree   Disagree

  (5 of 24) the DISTlNCTIVE COMPETENCIES, or unique characteristics, of your ~~products or~~

services, ~~such as~~ including education, research, administration and recruitment/marketing

~~pricing, distribution channels and quality of service.~~

Your comments: Agree   Disagree

  (6 of 24) how you carry out the GOVERNANCE of your ORGANIZATION, processes by

which institutional priorities are set, funded, and managed and by whom (governing bodies,

committees, advisory groups or individuals) ~~the manner in which you choose to operate and~~

~~compete, either as a single entity or by forming alliances with suppliers, and other providers.~~

Your comments: Agree   Disagree

To what extent do you believe that the relationship between the IT strategy (which types of

Information Technology is critical, the appropriate level of connectivity and reliability, IT

strategic alliances) and the following IT infrastructure decisions are defined, effective, efficient:

  (7 of 24) your IT ARCHITECTURE, including applications, databases, and hardware.

Your comments: Agree   Disagree

  (8 of 24) the work PROCESSES required, such as data center operations.

Your comments: Agree   Disagree

  (9 of 24) the acquisition or modification of SKILLS and experience related to the

development, operation, and use of information systems in your organization to match IT skills

to your institution's ~~business~~ needs, including educational support, administrative support and

marketing/recruiting support.

Your comments: Agree   Disagree

To what extent do you believe that the relationship between the IT infrastructure (specific

hardware, databases, and development processes) and the following IT strategy decisions are

defined, effective, efficient:

  (10 of 24) IT SCOPE, the determination of the range and type of information technologies

critical to your organization, including education support, administrative support and

recruiting/marketing support. ~~image processing, expert systems, and local area networks~~.

Your comments: Agree   Disagree

  (11 of 24)   the SYSTEMIC COMPETENCIES of your IT infrastructure, such as reliability and

connectivity.

Your comments: Agree   Disagree

  (12 of 24) the GOVERNANCE of IT, including ~~steering~~ processes by which IT priorities are

set, funded, and managed and by whom (committees, advisory groups or individuals)

~~contracting for IT services, and establishing partnerships with organizations to obtain needed~~

~~services.~~

Your comments: Agree   Disagree

To what extent do you believe that the relationship between the ~~business~~ institutional strategy

(entering new markets, changing services) and the following IT strategy decisions are defined,

effective, efficient:

Your comments: Agree   Disagree

  (13 of 24) IT SCOPE, the determination of the range and type of information technologies

critical to your organization, ~~image processing, expert systems, and local area networks~~.

- including education support,

- administrative support,

- recruiting/marketing support.

Your comments: Agree Disagree

  (14 of 24) the SYSTEMIC COMPETENCIES of your IT infrastructure, such as reliability and connectivity.

Your comments: Agree Disagree

  (15 of 24)   your IT GOVERNANCE, such as application ownership or alliances to develop software or other products.

the GOVERNANCE of IT, including ~~steering~~ processes by which IT priorities are set, funded, and managed and by whom (committees, advisory groups or individuals) ~~contracting for IT services, and establishing partnerships with organizations to obtain needed services.~~

Your comments: Agree Disagree

To what extent do you believe that the relationship between the IT strategy (which types of IT are critical, the appropriate level of connectivity) and the following ~~business~~ institutional strategy decisions are defined, effective, efficient:

Your comments: Agree Disagree

  (16 of 24) the SCOPE of your organization, encompassing the ~~products,~~ services and the geographic area your organization serves ~~and the services you provide~~ :

a)   products/services,

b)   customers/clients,

c)   competitors.

Your comments: Agree   Disagree

  (17 of 24) the DISTlNCTIVE COMPETENCIES, or unique characteristics, of your ~~products or~~

services, ~~such as~~ including education, research, administration and recruitment/marketing

~~pricing, distribution channels and quality of service.~~

Your comments: Agree   Disagree

  (18 of 24) how you carry out the GOVERNANCE of your ORGANIZATION, processes by

which institutional priorities are set, funded, and managed and by whom (governing bodies,

committees, advisory groups or individuals) ~~the manner in which you choose to operate and~~

~~compete, either as a single entity or by forming alliances with suppliers, and other providers.~~

Your comments: Agree   Disagree

To what extent do you believe that the relationship between the organizational infrastructure

(administrative structure, work processes, and human skills required to carry out your ~~business~~

institutional strategy) and the following IT infrastructure decisions are defined, effective,

efficient:

Your comments: Agree   Disagree

  (19 of 24)   your IT ARCHITECTURE, including critical applications, databases, or hardware.

Your comments: Agree   Disagree

  (20 of 24)   your IT PROCESSES and operations, such as systems development, application

development, and data center operations.

Your comments: Agree   Disagree

  (21 of 24) IT SKILLS and experience related to the development, operation, and use of information systems in your organization to match IT skills to your institution's ~~business~~ needs, including educational support, administrative support and marketing/recruiting support.

Your comments: Agree Disagree

To what extent do you believe that the relationship between the information technology architecture (IT architecture and processes, such as specific hardware and development processes) and the following organizational infrastructure decisions are defined, effective, efficient:

  (22 of 24) your ADMINISTRATIVE STRUCTURE, which defines organization arrangement and responsibilities, including centralized, decentralized, and networked structures or autonomous groups, and which includes reporting relationships and roles.

Your comments: Agree Disagree

  (23 of 24) the PROCESSES of your business, such as standard operating procedures, cross-functional processes, and associated information and flows.

Your comments: Agree Disagree

  (24 of 24) the acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out your institutional strategy.

Your comments: Agree Disagree

APPENDIX E

Modified Strategic Alignment Model by Delphi

Table E.1

Strategic Alignment Model (SAM) modified by the Delphi panel

Institutional strategy domain:	IT strategy domain:
• Institution's scope: education, research and service (usually within a geographic area) • Distinctive competency: unique characteristics that distinguish the institution from others, such as superior research or teaching • Institutional governance: process by which institutional priorities are set, funded, and managed and by whom (governing bodies, committees, advisory groups, individuals, consultants, etc.; collaborations with other organizations in support of core functions, such as teaching, research and service; strategies crafted by unit and function; performance indicators	• Technology scope: -information technologies that support core functions, such as teaching and research • Distinctive competencies: attributes of IT strategy that complement well the existing and impact positively the creation of new institutional strategies, such as connectivity and reliability • IT governance: process by which IT priorities are set, funded and managed and by whom; choices regarding – resources and capabilities; performance indicators
Organizational infrastructure/processes:	IT infrastructure/processes:
• Administrative infrastructure: the organizational arrangement and responsibilities, including centralized, decentralized and networked structures or autonomous groups, including reporting relationships and roles • Processes: product and services development and delivery, constituents' services, including students and faculty • Human resource skills	• IT architecture: configuration of hardware, software, processes and communications in the IT area; definitions of roles and responsibilities in the respective areas, including the degree of centralization of IT decisions—centralized vs. autonomous • IT processes: processes by which IT systems are planned, developed, implemented and operated, such as data center operations • IT skills: professional skills, competencies, experience, values of those who operate IT

APPENDIX F

Invitations to Participate in Survey

Initial invitation email sent through Qualtrics software at Indiana State University to 150 Chief

INFORMATION Officers of four-year colleges and universities.

Dear Participant,

My name is Barbara Lach-Smith. I am a doctoral student in the School of Technology at

Indiana State University, and I am conducting a study of institutional-IT alignment in higher

education.

The purpose of this email is to invite you to participate in a survey that examines an

alignment model that helps institutions derive an integrated Information Technology strategy and

institutional strategy as they apply to higher education.

The following web address will take you to the survey that asks questions about your

perception of your institution's alignment between the university strategy and the IT strategy. I

am asking you to follow the link and look over the questionnaire; answering the questionnaire

does not take more than 10 minutes of your time.

A leading executive administrator in your institution is also receiving this invitation.

Responses from both of you will result in a more complete assessment of your institution's

alignment perspective. The results of this study, in the form of existing alignment perspective

and its future direction, will be available to you upon request, which you may send at any time to my email address at (email address).

If you choose to participate, do not write your name anywhere on the survey. I do not need to know who you are. Your response will not be identified with you personally in any way. Nothing you say on the survey can in any way influence your present or future employment with your institution.

I hope you will take a few minutes to complete this assessment questionnaire. Without the help of professionals like you, research on institutional alignment in higher education could not be conducted. Your participation is voluntary, and there is no penalty if you do not participate.

This research is being conducted under the supervision of Dr. Edward Kinley (Email address). If you have any questions or concerns about completing the survey or about participating in this study, you may contact me at (phone number) or at (email address). If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Research Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or by e-mail at (Email address).

Sincerely,
Barbara Lach-Smith
Ph.D. Candidate
School of Technology
Indiana State University

Follow this link to the Survey:
${l://SurveyLink?d=Take the Survey}
Or copy and paste the url below into your internet browser:
${l://SurveyURL}

Initial invitation email sent through Qualtrics software at Indiana State University to 150 Chief

EXECUTIVE Officers of four-year colleges and universities.

Dear Participant,

My name is Barbara Lach-Smith. I am a doctoral student in the School of Technology at Indiana

State University, and I am conducting a study of institutional-IT alignment in higher education.

The purpose of this email is to invite you to participate in a survey that examines an

alignment model that helps institutions derive an integrated Information Technology strategy and

institutional strategy as they apply to higher education.

The following web address will take you to the survey that asks questions about your

perception of your institution's alignment between the university strategy and the IT strategy. I

am asking you to follow the link and look over the questionnaire; answering the questionnaire

does not take more than 10 minutes of your time.

A leading technology administrator in your institution is also receiving this invitation.

Responses from both of you will result in a more complete assessment of your institution's

alignment perspective. The results of this study, in the form of existing alignment perspective

and its future direction, will be available to you upon request, which you may send at any time to

my email address at (email address).

If you choose to participate, do not write your name anywhere on the survey. I do not need

to know who you are. Your response will not be identified with you personally in any way.

Nothing you say on the survey can in any way influence your present or future employment with

your institution.

I hope you will take a few minutes to complete this assessment questionnaire. Without the help of professionals like you, research on institutional alignment in higher education could not be conducted. Your participation is voluntary, and there is no penalty if you do not participate.

This research is being conducted under the supervision of Dr. Edward Kinley (email address). If you have any questions or concerns about completing the survey or about participating in this study, you may contact me at (phone number) or at (email address). If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Research Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or by e-mail at (Email address).

Sincerely,
Barbara Lach-Smith
Ph.D. Candidate
School of Technology
Indiana State University

Follow this link to the Survey:

${l://SurveyLink?d=Take the Survey}

Or copy and paste the url below into your internet browser:
${l://SurveyURL}

Follow-up letter sent using U.S. Postal Services to Chief Information Officers of four-year colleges and universities.

Dr. <Name>

<Title>

<Address>

Dear Dr. <Name>,

This is a follow-up invitation to an online survey that examines strategic alignment in higher education. You have probably received an earlier email requesting your participation.

My name is Barbara Lach-Smith. I am a doctoral student in the School of Technology at Indiana State University; my dissertation is based on this study. I would truly appreciate if you could take a few minutes to complete the survey through the URL below.

A leading executive administrator in your institution has also received this invitation. Responses from both of you will result in a more complete assessment of your institution's alignment perspective. The results of this study, in the form of existing alignment perspective and its future direction, will be available to you upon request, which you may send at any time to my email address at (email address).

 The following web address will take you to the survey that asks questions about your perception of your institution's alignment between the university strategy and the IT strategy. I am asking you to follow the link and look over the questionnaire; answering the questionnaire does not take more than 10 minutes of your time.

<URL address>

If you choose to participate, do not write your name anywhere on the survey. I do not need to know who you are. Your response will not be identified with you personally in any way. Nothing

you say on the survey can in any way influence your present or future employment with your institution.

This research is being conducted under the supervision of Dr. Edward Kinley (email address). If you have any questions or concerns about completing the survey or about participating in this study, you may contact me at (Phone number) or at (email address). If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Research Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or by e-mail at (Email address).

Sincerely,

Barbara Lach-Smith

School of Technology, ISU

Follow-up letter sent using U.S. Postal Services to Chief Executive Officers of four-year colleges and universities.

Dr. <Name>

<Title>

<Address>

Dear Dr. <Name>,

This is a follow-up invitation to complete an online survey that examines strategic alignment in higher education. You have probably received an earlier email requesting your participation.

My name is Barbara Lach-Smith. I am a doctoral student in the School of Technology at Indiana State University; my dissertation is based on this study. I would truly appreciate if you could take a few minutes to complete the survey through the URL below.

A leading technology administrator in your institution has also received this invitation. Responses from both of you will result in a more complete assessment of your institution's alignment perspective. The results of this study, in the form of existing alignment perspective and its future direction, will be available to you upon request, which you may send at any time to my email address at (email address).

The following web address will take you to the survey that asks questions about your perception of your institution's alignment between the university strategy and the IT strategy. I am asking you to follow the link and look over the questionnaire; answering the questionnaire does not take more than 10 minutes of your time.

<URL address>

If you choose to participate, do not write your name anywhere on the survey. I do not need to know who you are. Your response will not be identified with you personally in any way. Nothing you say on the survey can in any way influence your present or future employment with your institution.

This research is being conducted under the supervision of Dr. Edward Kinley (email address). If you have any questions or concerns about completing the survey or about participating in this study, you may contact me at (phone number) or at (email address). If you have any questions about your rights as a research subject, you may contact the Indiana State University Institutional Research Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN 47809, by phone at (812) 237-8217, or by e-mail at (Email address).

Sincerely,

Barbara Lach-Smith

School of Technology, ISU

APPENDIX G

Demographics of Institutions Participating in the Survey

Table G.1

Institution type frequency in survey

Institution type	Frequency	Percent	Valid percent	Cumulative percent
Public	48	65	66	66
Private	26	35	34	100
Total	74	100	100	

Table G.2

Institution type frequency in sample

Institution type	Frequency	Percent	Valid percent	Cumulative percent
Public	196	65.3	65.3	65.3
Private	104	34.6	34.6	100
Total	300	100	100	

Table G.3

Institution type frequency in population

Institution type	Frequency	Percent	Valid percent	Cumulative percent
Public	259	59.3	59.3	59.3
Private	178	40.7	40.7	100
Total	437	100	100	

Table G.4

Geographic region frequency in sample

Geographic Region	Frequency	Percent	Valid percent	Cumulative percent
Northeast	51	34	34	34
Midwest	33	22	22	56
South	44	29.3	29.3	85.3
West	22	14.7	14.7	100
Total	150	100	100	

Table G.5

Geographic region frequency in survey

Geographic Region	Frequency	Percent	Valid percent	Cumulative percent
Northeast	17	26	26	26
Midwest	19	29.2	29.2	55.2
South	20	31	31	86.2
West	9	13.8	13.8	100
Total	65	100	100	

Table G.6

Geographic region frequency in population

Geographic Region	Frequency	Percent	Valid percent	Cumulative percent
Northeast	136	31	31	31
Midwest	96	22	22	53
South	144	33	33	86
West	61	14	14	100
Total	437	100	100	

Table G.7

Geographic region and undergraduate enrollment frequency

Geographic Region	Exclusively undergraduate and 90% or more undergraduate	75% or more undergraduate	51% or more undergraduate	Majority graduate/ professional	Total
Northeast	57%	22%	14%	7%	100%
Midwest	67%	17%	16%	0%	100%
South	59%	29%	6%	6%	100%
West	50%	0%	33%	17%	100%

Table G.8

Midwest and program size frequency in survey

Size	Frequency	Percent	Valid percent	Cumulative percent
Small/medium	13	72	72	72
Large	4	22	22	94
Research	1	6	6	100
Total	18	100	100	

Table G.9

South and program size frequency in survey

Size	Frequency	Percent	Valid percent	Cumulative percent
Small/medium	8	47	47	47
Large	5	29	29	76
Research	4	24	24	100
Total	17	100	100	

Table G.10

Northeast and program size frequency in survey

Size	Frequency	Percent	Valid percent	Cumulative percent
Small/medium	3	21	21	21
Large	7	50	50	71
Research	4	29	29	100
Total	14	100	100	

Table G.11

West and program size frequency in survey

Size	Frequency	Percent	Valid percent	Cumulative percent
Small/medium	2	33	33	33
Large	1	17	17	50
Research	3	50	50	100
Total	6	100	100	

Table G.12

Midwest and program size frequency in sample

Size	Frequency	Percent	Valid percent	Cumulative percent
Small/medium	11	59	59	59
Large	6	32	32	91
Research	2	9	9	100
Total	19	100	100	

Table G.13

South and program size frequency in sample

Size	Frequency	Percent	Valid percent	Cumulative percent
Small/medium	9	43	43	43
Large	7	33	33	76
Research	5	24	24	100
Total	21	100	100	

Table G.14

Northeast and program size frequency in sample

Size	Frequency	Percent	Valid percent	Cumulative percent
Small/medium	4	22	22	22
Large	9	50	50	72
Research	5	28	28	100
Total	18	100	100	

Table G.15

West and program size frequency in sample

Size	Frequency	Percent	Valid percent	Cumulative percent
Small/medium	1	11.1	11.1	11.1
Large	5	55.6	55.6	66.7
Research	2	33.3	33.3	100
Total	9	100	100	

Table G.16

Geographic region and size of programs frequency in survey

Geographic region	Small-to-medium programs Responses/Sample	Large programs Responses/Sample	High research activity Responses/Sample
Northeast	18% / 20%	50% / 48%	24% / 24%
Midwest	72% / 59%	22% / 32%	6% / 9%
South	47% / 43%	41% / 33%	12% / 24%
West	17% / 16%	50% / 53%	17% / 21%

Table G.17

Participants by residential and non-residential campuses

	Responses	Sample	Population
Highly residential	20%	28%	26%
Primarily residential	40%	36%	37%
Primarily nonresidential	40%	36%	37%
Total	100%	100%	100%

APPENNDIX H

Descriptive Statistics, Four-Year Institutions

Table H.1

SAM Question 5 responses, q5_123

The following questions relate to COMMUNICATION within your institution. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The SCOPE of your institution's services/products, such as instruction/degrees, research/patents and recruiting/marketing, is defined and communicated effectively.	1 1.5%	4 6%	12 18%	40 59.5%	10 15%	67 100%
The distinctive COMPETENCIES, or unique characteristics, of your institution's services, including instruction, research, and recruitment/marketing, are defined and communicated effectively.	2 3%	7 10.4%	11 16.4%	37 55.2%	10 15%	67 100%
The GOVERNANCE of your institution, defined as processes by which institutional priorities are set, funded, and managed and by whom (governing bodies, committees, advisory groups or individuals), is defined and communicated effectively.	1 1.5%	9 13.3%	14 21%	29 43.2%	14 21%	67 100%
Total	4 2%	20 10%	37 18.4%	106 52.7%	34 17%	201 100%

Table H.2

SAM Question 5 responses, q5_456

The following questions relate to COMMUNICATION within your institution. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
Your institution's ADMINISTRATIVE STRUCTURE, defined as organization arrangement and responsibilities, including centralized, decentralized, and networked structures or autonomous groups, and which includes reporting relationships and roles, is defined and communicated effectively.	0 0%	6 9%	3 4.5%	43 64.1%	15 22.4%	67 100%
The essential administrative and academic PROCESSES, such as standard operating procedures, cross-functional processes, and associated information and flows, are defined and communicated effectively.	2 3%	10 15.4%	20 30.8%	32 47.8%	1 1.5%	65 100%
The acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out your institutional strategy, are defined and communicated effectively.	1 1.5%	15 23%	24 37.2%	21 32.3%	4 6%	65 100%
Total	3 1.5%	31 16%	47 23.5%	96 49%	20 10%	197 100%

Table H.3

SAM Question 5 responses, q5_789

The following questions relate to COMMUNICATION within your institution. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The IT SCOPE of your institution, including the range and type of information technologies critical to your institution's services/products, is defined and communicated effectively.	1 1.5%	7 10.6%	15 22.7	34 51.5%	9 13.7%	66 100%
The systemic competencies, or important characteristics, of your IT infrastructure, including access to information, reliability, speed, and connectivity in support of your institution's services, are defined and communicated effectively.	1 1.5%	13 20%	10 15.4%	34 52.3%	7 10.8%	65 100%
The GOVERNANCE of IT, including processes by which IT priorities are set, funded, and managed and by whom (committees, advisory groups or individuals), is defined and communicated effectively.	3 4.5%	11 16.7%	13 19.7%	28 42.4%	11 16.7%	66 100%
Total	5 2.5%	31 15.7%	38 19.3%	96 48.7%	27 13.7%	197 100%

Table H.4

SAM Question 5 responses, q5_012

The following questions relate to COMMUNICATION within your institution. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
Your IT ARCHITECTURE, which defines the choices and policies that enable the systems, applications, data, software, and hardware in a cohesive platform to provide support for instruction, research, and recruiting/marketing, are defined and communicated effectively.	2 3%	7 10.6%	19 28.8%	28 42.4%	10 15.2%	66 100%
Your IT work PROCESSES associated with the development, delivery, and use of information systems, including application development, security, and other system management controls and service level agreements to support instruction, research and recruiting/marketing, are defined and communicated effectively.	2 3%	7 10.8%	19 29%	28 43%	9 13.8%	65 100%
The acquisition or modification of IT SKILLS and experience related to the development, operation, and use of information systems in your organization to match IT skills to your institution's needs to support its services and products, are defined and communicated effectively.	1 1.5%	7 10.8%	21 32%	31 48%	5 7.7%	65 100%
Total	5 2.6%	21 10.7%	59 30.1%	87 44.4%	24 12.2%	196 100%

Table H.5

SAM Question 6 responses, q6_123

The following questions relate to your institution's STRATEGIES. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between your institutional strategy and your ADMINISTRATIVE STRUCTURE, including centralized, decentralized, and networked structures or autonomous groups, and reporting relationships and roles, is well defined and effective.	1 1.5%	6 9.2%	15 23%	31 47.7%	12 18.5%	65 100%
The relationship between your institutional strategy and the design of your essential work PROCESSES to provide support for our services (instruction, research and recruiting/marketing,) is well defined and effective.	1 1.5%	9 13.8%	16 24.6%	35 53.8%	4 6.2%	65 100%
The relationship between your institutional strategy and the acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out your institutional strategy to support instruction, research, and recruiting/marketing, is well defined and effective.	1 1.5%	11 17%	28 43%	23 35.4%	2 3%	65 100%
Total	3 1.5%	26 13.4%	59 30.2%	89 45.6%	18 9.3%	195 100%

Table H.6

SAM Question 6 responses, q6_456

The following questions relate to your institutional STRATEGIES. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between institutional strategy and IT SCOPE, the determination of the range and type of information technologies critical to your institution, is well defined and effective.	2 3%	10 15.4%	22 33.8%	26 40%	5 7.7%	65 100%
The relationship between institutional strategy and the SYSTEMIC COMPETENCIES of your IT infrastructure—reliability and connectivity and applications—is well defined and effective.	1 1.5%	9 13.8%	19 29%	31 48%	5 7.7%	65 100%
The relationship between institutional strategy and your IT GOVERNANCE, including processes by which IT priorities are set, funded, and managed and by whom (committees, advisory groups or individuals), is well defined and effective.	3 4.6%	12 18.5%	16 24.6%	30 46%	4 6.2%	65 100%
Total	6 3%	31 16%	57 29.2%	87 44.6%	14 7.2%	195 100%

Table H.7

SAM Question 7 responses, q7_123

The following questions relate to your institutional structure and processes. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between your institutional structure and processes and the SCOPE of your organization, encompassing the services, customers, competitors, and the geographic area your organization serves, is well defined and effective.	0 0%	10 15.4%	9 13.8%	40 61.5%	6 9.2%	65 100%
The relationship between your institutional structure and processes and the distinctive COMPETENCIES, or unique characteristics, of your services, including instruction, research, and recruitment/marketing, is well defined and effective.	0 0%	5 7.7%	19 29.2%	31 47.7%	10 15.4%	65 100%
The relationship between your institutional structure and processes and how you carry out the GOVERNANCE of your INSTITUTION, processes by which institutional priorities are set, funded, and managed and by whom (governing bodies, committees, advisory groups or individuals), is well defined and effective.	0 0%	9 13.8%	15 23%	30 46%	11 17%	65 100%
Total	0 0%	24 12.3%	43 22%	101 52%	27 13.7%	195 100%

Table H.8

SAM Question 8 responses, q8_123

The following questions relate to your Information Technology (IT) strategy. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between IT strategy and your IT ARCHITECTURE, including applications, databases, and hardware, is well defined and effective.	0 0%	2 3%	14 21.5%	33 50.8%	16 24.7%	65 100%
The relationship between IT strategy and the work PROCESSES required, such as data center operations, is well defined and effective.	0 0%	4 6.2%	11 17%	38 58.5%	12 18.5%	65 100%
The relationship between IT strategy and the acquisition or modification of SKILLS and experience related to the development, operation, and use of information systems in your institution to match IT skills to your institution's needs, is well defined and effective.	0 0%	7 10.8%	21 32.3%	32 49.2%	5 7.7%	65 100%
Total	0 0%	13 6.7%	46 23.7%	103 52.8%	33 17%	195 100%

Table H.9

SAM Question 8 responses, q8_456

The following questions relate to your Information Technology (IT) strategy. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between IT strategy and the SCOPE of your organization, encompassing the services (instruction, research, recruiting/marketing) and the geographic area your institution services, is well defined and effective.	0 0%	6 9.23%	13 20%	40 61.53%	6 9.23%	65 100%
The relationship between IT strategy and the distinctive COMPETENCIES, or unique characteristics, of your services, including instruction, research, and recruitment/marketing, is well defined and effective.	1 1.5%	5 7.7%	22 34%	31 48%	6 9%	65 100%
The relationship between IT strategy and how you carry out the GOVERNANCE of your INSTITUTION, processes by which institutional priorities are set, funded, and managed and by whom (governing bodies, committees, advisory groups or individuals), is well defined and effective.	3 4.5%	7 10.8%	21 32.3%	23 35.4%	11 17%	65 100%
Total	4 2%	18 9.2%	56 28.7%	94 48.3%	23 11.8%	195 100%

Table H.10

SAM Question 9 responses, q9_123

The following questions relate to your Information Technology (IT) infrastructure. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between IT infrastructure and IT SCOPE, the determination of the range and type of information technologies critical to your institution, is well defined and effective.	2 3%	3 4.6%	15 23%	35 54%	10 15.4%	65 100%
The relationship between IT infrastructure and the SYSTEMIC COMPETENCIES of your IT infrastructure, such as reliability and connectivity, is well defined and effective.	2 3%	5 7.8%	13 20.3%	33 51.6%	11 17.3%	64 100%
The relationship between IT infrastructure and the GOVERNANCE of IT, including processes by which IT priorities are set, funded, and managed and by whom (committees, advisory groups or individuals), is well defined and effective.	3 4.7%	9 14%	15 23.4%	29 45.3%	8 12.6%	64 100%
Total	7 3.6%	17 8.8%	43 22.3%	97 50.3%	29 15%	193 100%

Table H.11

SAM Question 10 responses, q10_123

The following questions relate to your institution's infrastructure (structures, processes and skills necessary to carry out your institutional strategy). Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between institution's infrastructure and your IT ARCHITECTURE, including critical applications, databases, or hardware, is well defined and effective.	0 0%	6 9.4%	16 25%	32 50%	10 15.6%	64 100%
The relationship between institution's infrastructure and your IT PROCESSES and operations, such as systems development, application development, and data center operations, is well defined and effective.	0 0%	3 4.8%	20 31.7%	33 52.4%	7 11.1%	63 100%
The relationship between institution's infrastructure and IT SKILLS and experience related to the development, operation, and use of information systems in your organization to match IT skills to your institution's needs, is well defined and effective.	1 1.5%	5 8%	22 35%	29 46%	6 9.5%	63 100%
Total	1 %	14 7.4%	58 30.5%	94 49.5%	23 12%	190 100%

Table H.12

SAM Question 11 responses, q11_123

The following questions relate to IT architecture. Please select the answer that best describes your institutional environment.	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Total
The relationship between IT architecture and your ADMINISTRATIVE STRUCTURE, which defines organization arrangement and responsibilities, including centralized, decentralized, and networked structures or autonomous groups, and which includes reporting relationships and roles, is well defined and effective.	2 3.2%	6 9.5%	18 28.6%	28 44.4%	9 14.3%	63 100%
The relationship between IT architecture and the PROCESSES of your institution, such as services development and delivery, customer service, and associated information and flows, is well defined and effective.	2 3.2%	5 8.2%	14 23%	36 59%	4 6.6%	61 100%
The relationship between your IT architecture and the acquisition of new SKILLS, the modification of the existing skills, and other human resource considerations of those who will carry out our institutional strategy, is well defined and effective.	2 3.3%	7 11.5%	25 41%	24 39.3%	3 4.9%	61 100%
Total	6 3.2%	18 9.7%	57 30.6%	88 47.3%	16 8.6%	186 100%

APPENDIX I

Statistical Analysis of Survey Data

Statistical analysis of the results of the triangulation survey of four-year institutions of higher education.

Table I.1

Correlation table of Question3 and q5_456, q6_123, q7_123 and q8_456

Correlation						
Variable	Label	q5_456	q6_123	q7_123	q8_456	Q3
q5_456		1.0000	0.8013	0.6540	0.6979	0.3712
q6_123		0.8013	1.0000	0.6758	0.7100	0.5062
q7_123		0.6540	0.6758	1.0000	0.6466	0.4391
q8_456		0.6979	0.7100	0.6466	1.0000	0.4667
Q3	Q3	0.3712	0.5062	0.4391	0.4667	1.0000

Table I.2

Parameter estimates for Q3 and q6_123, q7_123 and q8_456

Parameter Estimates							
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	Intercept	1	0.62192	0.51641	1.20	0.2332	0
q6_123		1	0.11695	0.06323	1.85	0.0693	2.34740
q7_123		1	0.04174	0.05812	0.72	0.4755	2.02265
q8_456		1	0.06831	0.06482	1.05	0.2962	2.26902

Table I.3

Regression analysis of Question 3 and q6_123, q7_123 and q8_456

Root MSE	0.75580	R-Square	0.2850
Dependent Mean	3.03125	Adj R-Sq	0.2493
Coeff Var	24.93355		

Table I.4

Correlation table of Q3 and q6_123, q7_123 and q8_456

Correlation					
Variable	Label	q6_123	q7_123	q8_456	Q3
q6_123		1.0000	0.6643	0.7085	0.5062
q7_123		0.6643	1.0000	0.6496	0.4295
q8_456		0.7085	0.6496	1.0000	0.4649
Q3	Q3	0.5062	0.4295	0.4649	1.0000

Table I.5

Identified outliner

Obs	nn	yhat	e	h	t	outlier
1	54	3.91456	-2.91456	0.10594	-4.75978	yes

Table I.6

Parameter estimates with shift variable D54

Parameter Estimates							
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|	Variance Inflation
Intercept	Intercept	1	0.08484	0.45106	0.19	0.8515	0
q6_123		1	0.14167	0.05383	2.63	0.0108	2.36780
q7_123		1	0.05127	0.04931	1.04	0.3027	2.02575
q8_456		1	0.08943	0.05512	1.62	0.1100	2.28272
D54		1	-3.32052	0.67112	-4.95	<.0001	1.07990

Table I.7

Regression analysis of q6_123, q7_123, q8_456 and D54

Root MSE	0.64075	R-Square	0.4947
Dependent Mean	3.03125	Adj R-Sq	0.4604
Coeff Var	21.13824		

Table I.8

Parameter estimates with mean shift variable ZZ

Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	2.02415	0.33542	6.03	<.0001
q6_123		1	0.13024	0.03279	3.97	0.0002
q7_123		1	-0.00875	0.03060	-0.29	0.7759
q8_456		1	0.01169	0.03443	0.34	0.7354
D54		1	-1.70089	0.43904	-3.87	0.0003
ZZ		1	-1.32100	0.13127	-10.06	<.0001