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THE STRATEGIC ALIGNMENT OF INFORMATION TECHNOLOGY

WITH ACADEMIC STRATEGY:

A CONTENT ANALYSIS OF UNIVERSITY WEB SITES

Dissertation

by

BERTA RIOS-MALDONADO

submitted in partial fulfillment of the requirements

for the degree of Doctor of Philosophy

September 2000

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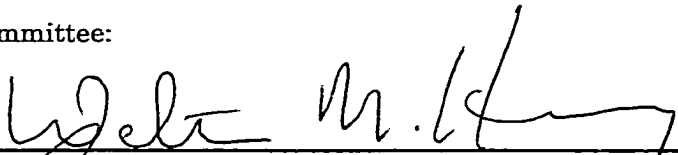The dissertation of

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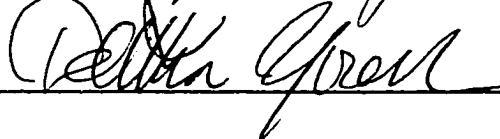
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The Strategic Alignment of Information Technology with Academic Strategy:

A Content Analysis of University Web Sites

Berta Ríos-Maldonado

Dissertation Director: Dr. Walter Haney

The strategic alignment of information technology and academic strategy was the focus

of this research. This was accomplished through the content analysis of a random sample

of Web sites belonging to 78 research universities. Private and public institutions were

compared in terms of (a) the content of academic and information technology strategies;

(b) the integration of academic and information technology strategies; (c) the strategic

uses of information technology in teaching, research, and administration, and (d) the

relationship between the content of academic and information technology strategies and

the strategic uses of information technology. Web pages relevant to the operational

constructs and variables were downloaded as text and condensed using an emergent

coding scheme. The Chi-square test of independence was used to test the null hypotheses

of no difference between public and private institutions or of no relation between

variables. Differences between public and private institutions were statistically significant

in the use of CourseInfo as Web courseware software and the use of Web sites for (a)

graduate online applications; (b) in-house online undergraduate applications; (c) in-house

graduate online applications, and (d) online undergraduate applications submitted via

Embark.com. Public institutions outnumbered private institutions across categories of use

of information technology. The only exceptions were the use of two proprietary

applications: Embark online applications for undergraduate admissions and CourseInfo

Web courseware, where private institutions outnumbered public institutions in use. The

results of this investigation confirmed that the use of electronic inquiries and online

inquiries for graduate admissions is related to its use for undergraduate admissions. On

the other hand, the relationship between alignment and the strategic uses of Web sites in

teaching and research were not statistically significant. However, alignment was only

related to the use of downloadable applications for graduate admissions. The findings

overwhelmingly suggest that universities are using the Web strategically and beginning

to realize the need to align their institutional missions and technology plans.

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Chapter 1: The Research Problem

Introduction

In the environment of universities, which is dominated by competition for students, faculty, and economic resources, the linking of information technology to academic strategy has become a critical factor for success. In recent years, this coupling has become even more important. As institutions of higher learning increasingly use the World Wide Web as a platform for instruction, scholarly inquiry, and student recruitment, the choice of bestowing a strategic role upon technology has acquired greater significance because it leads to creating or sustaining competitive advantages in these areas.

This process of alignment affects how universities formulate academic and information technology strategies. First, it demands creating strategies that bestow a strategic role upon information technology. Equally important, it requires information technology strategies to be in alignment with the institution's mission. As a result, these alignments lead universities to the strategic uses of information technology in teaching, research, and administration.

The research presented herein looks at the strategic alignment of information technology in research universities. The first chapter of this dissertation specifies the problem of the study and presents the general assumptions of the research. The chapter concludes by describing the significance of the study and defining the special terms that are used in the study.

Statement of the Problem

The strategic alignment of information technology with academic strategy was the focus of this research. This was accomplished through the content analysis of a random sample of Web sites belonging to 78 research universities. Specifically, private and public institutions were compared in terms of four aspects that were examined in depth. These were: (a) the content of academic and information technology strategies; (b) the integration of academic and information technology strategies; (c) the strategic uses of information technology in teaching, research, and administration; and (d) the relationship between the content of academic and information technology strategies and the strategic uses of information technology.

Basic Assumptions

This study was conducted under three major assumptions. First, educational institutions use information technology to gain and sustain competitive advantage. Second, information technology provides opportunities to gain a competitive advantage in academic and administrative computing. Third, strategic alignment occurs at the formulation and implementation stages of a planning process.

Research Questions

This study included nine research questions. They were categorized according to three areas: the integration of academic and information technology strategies, the strategic uses of information technology, and the relationship between both areas.

The Integration of Academic and Information Technology Strategies

This research explored the integration of information and academic strategies in public and private research universities. The content of academic and information technology mission statements emerged as the focus of the investigation. Hence, three central research questions and their corresponding null and alternative hypotheses guided this area of investigation:

Research question #1: What is the content of the academic mission statements?

Null hypothesis #1: Traditional or technological content in a mission statement is not related to institutional control.
Alternative hypothesis #1: Traditional or technological content in a mission statement is related to institutional control.

Research question #2: What is the content of the information technology mission statements?

Null hypothesis #2: Strategic or supportive content in an information technology mission statement is not related to institutional control.
Alternative hypothesis #2: Strategic or supportive content in an information technology mission statement is related to institutional control.

Research question #3: Do cross-references exist between the content of the academic and information technology mission statements?

Null hypothesis #3: The content of information technology mission statements is not related to the content of academic mission statements.
Alternative hypothesis #3: The content of information technology mission statements is related to the content of academic mission statements.

The Strategic Uses of Information Technology

This investigation also examined the implementation of information technology strategies by universities. The institutions' Web sites became the focus of this

investigation as a concrete manifestation of an information strategy. By looking at the use of these Web sites, this research sought to shed light on the value attached by universities to the Web as a strategic tool for teaching, research, and administration. Three central questions and their corresponding null and alternative hypotheses directed this area of investigation:

> Research question #4: Are Web sites used as strategic resources in teaching?
>
> Null hypothesis #4: The use of online courseware is not related to institutional control.
> Alternative hypothesis #4: The use of online courseware is related to institutional control.
>
> Research question #5: Are Web sites used as strategic resources in research?
>
> Null hypothesis #5: The availability of online research databases in Web sites is not related to institutional control.
> Alternative hypothesis #5: The availability of online research databases in Web sites is related to institutional control.
>
> Research question #6: Are Web sites used as strategic resources in administration?
>
> Null hypothesis #6a: The use of electronic inquiries for undergraduate admissions is not related to institutional control.
> Alternative hypothesis #6a: The use of electronic admissions inquiries for undergraduate admissions is related to institutional control.
>
> Null hypothesis #6b: The use of electronic admissions inquiries for graduate admissions is not related to institutional control.
> Alternative hypothesis #6b: The use of electronic admissions inquiries for graduate admissions is related to institutional control.
>
> Null hypothesis #6c: The concurrent use of electronic admission inquiries for both undergraduate and graduate admissions is not related to institutional control.
> Alternative hypothesis #6c: The concurrent use of electronic admission inquiries for both undergraduate and graduate admissions is related to institutional control.

Null hypothesis #6d: The use of electronic admission inquiries for graduate admissions is not related to its use for undergraduate admissions.
Alternative hypothesis #6d: The use of electronic admission inquiries for graduate admissions is related to its use for undergraduate admissions.

Null hypothesis #6e: The use of downloadable applications for undergraduate admissions is not related to institutional control.
Alternative hypothesis #6e: The use of downloadable applications for undergraduate admissions is related to institutional control.

Null hypothesis #6f: The use of downloadable applications for graduate admissions is not related to institutional control.
Alternative hypothesis #6f: The use of downloadable applications for graduate admissions is related to institutional control.

Null hypothesis #6g: The concurrent use of downloadable applications for both undergraduate and graduate admissions is not related to institutional control.
Alternative hypothesis #6g: The concurrent use of downloadable applications for both undergraduate and graduate admissions is related to institutional control.

Null hypothesis #6h: The use of downloadable applications for graduate admissions is not related to its use for undergraduate admissions.
Alternative hypothesis #6h: The use of downloadable applications for graduate admissions is related to its use for undergraduate admissions.

Null hypothesis #6i: The use of online applications for undergraduate admissions is not related to institutional control.
Alternative hypothesis #6i: The use of online applications for undergraduate admissions is related to institutional control.

Null hypothesis #6j: The use of online applications for graduate admissions is not related to institutional control.
Alternative hypothesis #6j: The use of online applications for graduate admissions is related to institutional control.

Null hypothesis #6k: The concurrent use of online applications for both undergraduate and graduate admissions is not related to institutional control.
Alternative hypothesis #6k: The concurrent use of online applications for both undergraduate and graduate admissions is related to institutional control.

Null hypothesis #6l: The use of online applications for graduate admissions is not related to its use for undergraduate admissions.
Alternative hypothesis #6l: The use of online applications for graduate admissions is related to its use for undergraduate admissions.

Null hypothesis #6m: The use of in-house or proprietary online applications is not related to institutional control
Alternative hypothesis #6m: The use of in-house or proprietary online applications is related to institutional control.

The Relationship between Alignment and the Strategic Use of Web sites

Finally, the relationship between the alignment of information and academic strategies and its observed manifestations was explored. The focus shifted to the relationship among: (a) the content of institutional and information technology mission statements; (b) the content of technology plans; and (c) the use of Web sites as strategic resources. It sought to determine whether a university's use of the Web complies with its mission statements and if its technology strategies support institutional missions. Three principal questions with corresponding null and alternative hypotheses arose in this area of investigation:

Research question #7: Do institutions that align information technology with academic strategy use Web sites as strategic resources in teaching?

Null hypothesis #7a: The use of online courseware is not related to the alignment of academic and information technology missions.
Alternative hypothesis #7a: The use of online courseware is related to the alignment of academic and information technology missions.

Null hypothesis #7b: The use of online courseware is not related to the alignment of information technology missions with instruction.
Alternative hypothesis #7b: The use of online courseware is related to the alignment of information technology missions with instruction.

Research question #8: Do institutions that align information technology with academic strategy use Web sites as strategic resources in research?

Null hypothesis #8a: The availability of online research databases in Web sites is not related to the alignment of academic and information missions.
Alternative hypothesis #8a: The availability of online research databases in Web sites is related to the alignment of academic and information missions.

Null hypothesis #8b: The availability of online research databases in Web sites is not related to the alignment of information missions with scholarship.
Alternative hypothesis #8b: The availability of online research databases in Web sites is related to the alignment of information missions with scholarship.

Research question #9: Do institutions that align information technology with academic strategy use Web sites as strategic resources in administration?

Null hypothesis #9a: The use of electronic inquiries, downloadable applications or online applications is not related to the alignment of academic and information missions.
Alternative hypothesis #9a: The use of electronic inquiries, downloadable applications or online applications is related to the alignment of academic and information missions.

Null hypothesis #9b: The use of electronic inquiries is not related to the alignment of information missions with administration.
Alternative hypothesis #9b: The use of electronic inquiries is related to the alignment of information missions with administration.

Null hypothesis #9c: The use of downloadable applications is not related to the alignment of information missions with administration.
Alternative hypothesis #9c: The use of downloadable applications is related to the alignment of information missions with administration.

Null hypothesis #9d: The use of online applications is not related to the alignment of information missions with administration.
Alternative hypothesis #9d: The use of online applications is related to the alignment of information missions with administration.

Significance of the Study

The strategic use of information technology by colleges and universities is becoming increasingly important because it can help establish sustained competitive advantage in three fundamental areas: teaching, research, and administration. Although the topic has been addressed in academic computing literature, most of the articles tend to present opinions, descriptive accounts, or cursory analyses that are not grounded in theoretical frameworks. The present study addresses this deficiency by developing and testing a research framework for universities inspired by both McFarlan and McKenney's (1983) Strategic Grid and the Strategic Alignment Model proposed by Henderson and Venkatraman (1993,1999). As Keen (1991) suggests, the key to alignment is relationships, not strategy. The thorough investigation of these relationships significantly contributes to both business and higher education literature.

This investigation also advances the development of the emerging area of Web site research. From a methodological point of view, it demonstrates the application of content analysis to the evaluation of Web sites. From a theoretical stance, it presents and tests a framework for conceptualizing the strategic functionality of academic sites. From an empirical perspective, it shows valuable comparative data on the strategic use of the World Wide Web by universities as a repository of information that is accessible on demand without limitations imposed by geographic or temporal boundaries. The dissemination of these results will raise awareness and promote further exploration of the topic.

<u>Definition of Terms</u>

A realm of corporate strategy research focuses on the use of information technology to gain a competitive advantage. Drawing definitions from this literature required translating these terms into the context of institutions of higher learning. The definitions pertaining to the strategic fit and integration of information technology in higher education were derived from the work of Henderson and Venkatraman (1989, 1990, 1993, 1999). Porter's conceptualization of competitive advantage was left intact, although administrators of colleges and universities do not refer to institutions, high schools, and students as firms, suppliers, and buyers. The following concepts were critical to this research:

1. <u>Academic computing</u>: the use of computers to support research and instruction (Green & Eastman, 1992);

2. <u>Administrative computing</u>: the use of computers to support administration in such areas as registration, student transcripts, personnel records, budget control, and financial management (Green & Eastman, 1992);

3. <u>Competitive advantage</u>: the offensive or defensive actions that are taken to create a position in an industry to cope successfully with the bargaining power of suppliers and buyers, the threat of new entrants, substitute products or services, and the rivalry among existing competitors, whereby yielding a superior return on investment for the firm (Porter, 1980);

4. <u>Home page</u>: the primary page of a Web site;

5. Information technology: the set of non-human resources dedicated to the storage, processing, and communication of information (Bakopoulos, 1985);

6. Mission statement: the statement of purpose (Lang & Lopers-Sweetman, 1991);

7. Strategic alignment: the alignment of academic strategy, information technology strategy, academic infrastructure and processes, and information technology infrastructure and processes (Henderson & Venkatraman, 1993, 1999);

8. Strategic fit: the interrelationship between the formulation and implementation of strategy (Henderson & Venkatraman, 1993, 1999);

9. Strategic integration: the link between academic and information technology strategy;

10. Strategic planning: the process of deciding the goals of the organization and the strategies for attaining these goals (Anthony, 1988);

11. Strategy: the pattern of objectives, purposes, or goals and major policies and plans for achieving these goals (Andrews, 1971);

12. Strategy formulation: the decisions pertaining to competitive product-market choices (Henderson & Venkatraman, 1993, 1999);

13. Strategy implementation: the choices pertaining to the structure and capabilities of the firm to execute its product-market choices (Henderson & Venkatraman, 1993, 1999);

14. URL (the uniform resource locator): a string of characters that uniquely

identifies each page of information on the World Wide Web (Harnack &

Kleppinger, 1997);

15. Web courseware: digital learning resources designed and developed for

instructional delivery via the World Wide Web. They include *expositive*

documents that are viewed by the user without entailing any degree of

involvement other than navigation; *active documents* such as multiple-choice

questionnaires, simulations, auto evaluations, exercises, and self-assessment

tools; and *interactive documents* that consist of materials produced by

synchronous or asynchronous communication (Retalis & Skordalakis, 1998);

16. Web site: any location on the World Wide Web (Harnack & Kleppinger,

1997);

17. World Wide Web: a space within the Internet that employs a standard method

of organizing and displaying pictures, words, video, sound, links, and

information to any other resource that adheres to Web conventions anywhere

- on the Internet (Keen, Mougayar, & Torregrossa, 1998).

The following chapter reviews various higher education and business literature

that covers the strategic use of information technology and establishes the background for

this investigation.

Chapter 2: Review of Literature

Introduction

The study of the strategy-technology connection[1] encompasses the development

of explanatory frameworks, the planning of information technology strategies, and the

research on the impact of the use of technology. The first area of study focuses on the

development of theoretical models that conceptualize the strategic use of information

technology. The second area deals with planning methodologies that foster or inhibit the

strategic use of information technology. The final area centers on the structural and

performance effects that accompanies the use of technology as a competitive tool. The

first two areas —explanatory models and management information systems planning—

substantiate this research project. For that reason, they are reviewed in detail in the

following section.

Explanatory Frameworks

Explanatory frameworks on the strategic use of information technology are

derived from the research area of corporate strategy. The principal models use Porter's

(1980) classical work on competitive strategy as a foundation. Specifically, these models

are based on two central constructs from Porter's work:

---

[1] An expression from Kantrow (1980).

1. The five forces that determine the state of competition in an industry: (a) the threat of new entrants; (b) the bargaining power of suppliers; (c) the bargaining power of buyers; (d) the threat of substitute products or services; and (e) the jockeying among current competitors.

2. The three generic strategies to gain and sustain a competitive advantage: (a) overall cost leadership, (b) differentiation, and (c) focus.

There are seven principal explanatory models. Although they were developed in the early 1980s, these models have become classic interpretations of the strategic use of information technology and have withstood the test of time.

Parson's Model

In Parson's Model (1983), the impact of information technology occurs at three levels: industry, firm, and strategy. The author combines Porter's conceptualization of the five forces that shape competition with Porter's three generic competitive strategies. According to Parsons, at the industry level, information technology changes an industry's products and services, markets, and production economics. At the firm level, information technology affects the relationship between a firm and its buyers, suppliers, substitutes, new entrants, and rivals. At the strategy level, information technology affects the execution of a firm's strategy.

McFarlan's Framework

McFarlan's Framework for the analysis of the impact of information systems technology on competition is based on Porter's conceptualization of the forces that shape strategy. According to McFarlan (1984a), five issues are central to the determination of a

company's potential use of information technology as a strategic resource. These issues

are the potential of information systems technology to: (a) build barriers to entry; (b)

build in switching costs; (c) change the basis of competition; (d) change the balance of

power in supplier relationships; and (e) generate new products.

Porter and Millar's Conceptualization

In Porter and Millar's Model (1985), information technology creates a competitive

advantage by lowering costs, enhancing differentiation, and changing competitive scope.

As a result, the authors indicate that information technology creates competitive

advantage by providing companies with new ways to outperform rivals.

Strategic Option Generator

Wiseman's (1985) model —the Strategic Option Generator— is an instrument that

defines five competitive weapons, or strategic thrusts, that organizations use to gain

competitive advantage, such as differentiation, cost, innovation, growth, and alliance.

"Strategic thrusts" are major offensive or defensive moves made by an organization that

seek to gain a competitive advantage (Rackoff, Wiseman, & Ullrich, 1985). According

to Wiseman (1985), information systems support or shape the five strategic thrusts. The

author also points out that strategic thrusts are combined with information technology to

attack suppliers, customers, or competitors.

Customer Resource Life Cycle

Ives and Learmonth (1984) suggest a model for categorizing competitive

information systems and generating new applications. According to the authors, there are

13 stages in the Customer Resource Life Cycle. Each stage provides opportunities for the

strategic use of information systems by differentiating a product through enhanced

customer service.

The Strategic Grid

McFarlan and McKenney (1983) position the information systems of an

organization on a two-by-two Strategic Grid. An organization occupies a support,

turnaround, factory, or strategic position on the grid as illustrated by Figure 1. The

authors indicate that the position of the organization on any of the four given quadrants

varies over time and is determined by the level of strategic impact of the current

applications development portfolio and of existing operating systems.

High

Strategic impact of
existing operating
systems

	Factory	Strategic
	Support	Turnaround

Low

Low   High

Strategic impact of application
development portfolio
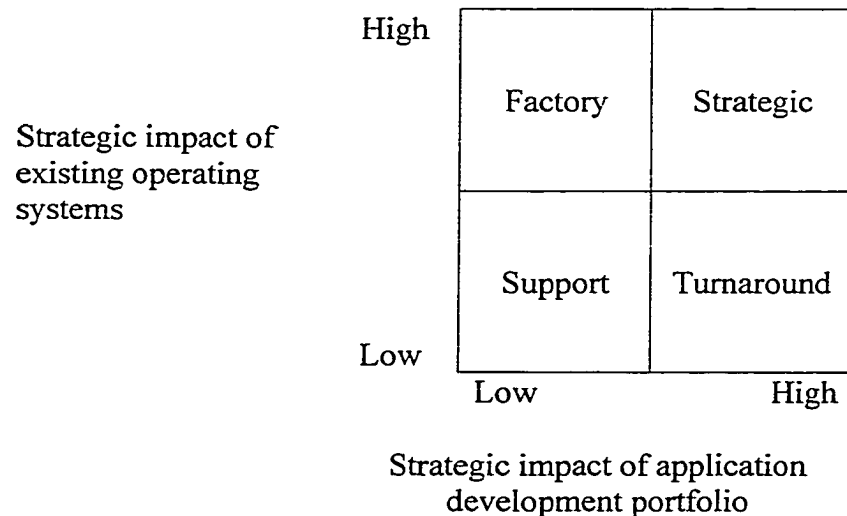
Figure 1. The Strategic Grid (Cash, McFarlan, & McKenney, 1992, p. 255).

According to Cash, McFarlan, and McKenney (1992), strategic organizations are highly dependent on information technology and:

> IT planning is closely integrated with corporate planning in a two-way dialogue because IT can open new operations capabilities for the firms. Not only does IT need the guidance of corporate goals, but the achievement of corporate goals can be severely impacted by IT performance and capabilities or lack thereof. (p. 254)

The authors point out that while turnaround companies are not absolutely dependent on information technology for operational support, the "successful implementation of the applications under development, however, are absolutely vital for the firm's reaching its strategic objectives" (p. 255). They also state that, for organizations in the factory and support quadrants, strategic goal setting for information technology and linkages to corporate strategies in information technology planning are not as critical.

Strategic Opportunity Matrix

Benjamin, Rockart, Scott Morton, and Wyman (1984) suggest an analytical framework —Strategic Opportunity Matrix— which considers the strategic use of information technology for the internal and external operations of a firm. The authors recommend management to consider the implications of the following two questions:

1. Can I use the technology to make a significant change in the way we now doing business so my company can gain a competitive advantage?

2. Should we, as a company, concentrate on using I/T to improve our approach to the marketplace? Or, should we center our efforts on internal improvements in the way we currently carry out our activities? (Benjamin et al., 1984, p. 7)

Based on the responses to these questions, the authors derive the Strategic Opportunity Matrix.

Planning for the Strategic Use of Information Technology

These explanatory models are useful in depicting how information technology is used as a strategic tool. However, they do not address the necessary question of how information technology becomes a strategic tool. To answer this interrogation, it is necessary to review past literature on management information systems planning.

In the late 1960s, two papers (McKinsey & Co., 1968; Kriebel, 1968) established the strategy-technology connection. Kriebel was the first to link information technology strategies to business strategies at the stage of strategy formulation. According to the author, the formulation of a computer strategy includes the establishment of "computer planning objectives on the basis of corporate goals" (p. 12). He ascribed to senior management the responsibility for linking information technology to business strategy. Kriebel also suggested that managers must define the role of computers in relation to the strategic objectives of the corporation.

In the late 1970s, strategic planning was incorporated into planning for information systems in McLean and Soden's (1977) review of the literature and King 's (1978) conceptualization of the strategic planning process for management information systems. It is important to note that King stressed the integration of the process of management information systems planning as a way to prevent it from becoming an appendage of the organization.

By the early 1980s, traditional management information systems literature recognized five frameworks for information systems planning. Sprague and McNurlin (1986) identified them as Nolan and Gibson's and McFarlan and McKenney's Stages of

Growth; Rockart's Critical Success Factors; IBM's Business Systems Planning; Norton's

Investment Strategy Analysis; and the scenario approach (for a description of other

planning methodologies see Sullivan, 1985; Synnott, 1987). The first four frameworks

implicitly link information systems planning to business planning, although not as a

premise for management information systems planning.

By the middle of the 1980s, linking information technology to business strategy

became a running theme in the literature of information systems management. McFarlan

(1984b, p. 274) called it "an old, powerful, and enduring" notion. This progressive

realization about the potential of utilizing information technology for a competitive

advantage characterized the end of the decade and the beginning of the 1990s. Among the

authors who emphasized the coupling of information and business strategies were

Jahangir (1988); Parker, Benson, and Trainor (1988); QED Information Sciences (1989);

Sprague and McNurlin (1986); Sutherland and Moriex (1988); Synnott (1987); and

Wassenaar (1991). There is a common thread to the work of these researchers: the

integration or linkage between business strategy and information technology domains and

its view as central to an organization's potential use of information technology as a

competitive weapon.

In the 1990s, the literature on information technology strategies in business

decreased and two dimensions in research emerged: synthesis and introspection. The

synthesis of research started at the "Management in the 1990s" program of the

Massachusetts Institute of Technology's Sloan School of Management. This research

program first conceptualized a framework for the process of aligning information and

technology strategies for a competitive advantage and then initiated investigations into this subject. This framework is known as the Strategic Alignment Model. The introspection of research resulted from the visibility gained when managers began to measure the effects of investments in technology. Recent research is comparative. Bensaou and Earl (1998) concluded that information technology is framed differently by Japanese and Western managers. The authors depicted strategic alignment as a Western model for information technology management that contrasted with a Japanese model in which operational goals, instead of strategy, drive information technology investments.

The Strategic Alignment Model

The Strategic Alignment Model, created by N. Venkatraman and J. C. Henderson at the Massachusetts Institute of Technology, is a framework for strategic information management (Henderson & Venkatraman, 1989). Henderson and Venkatraman (1993) argue that the "inability to realize value from I/T investments is, in part, due to the lack of *alignment* between the business and I/T strategies of organizations" (p. 4). The alignment of business and information technology becomes a requisite for the use of information as a competitive weapon. The process of alignment is described by the authors (1990) as a descriptive, prescriptive, and dynamic model of organizational transformation. For Macdonald (1991), the Strategic Alignment Process is a practical interpretation of the Strategic Alignment Model.

Henderson and Venkatraman identify and define four domains of strategic choice: business strategy, information technology strategy, organizational infrastructure and processes, and information systems infrastructure and processes (Henderson &

Venkatraman, 1989, 1990, 1993, 1999). According to Henderson and Venkatraman (1989), "each domain requires consistency among a set of interrelated components. Further, these domains serve to define the major elements that must be effectively aligned to derive the maximum benefits from I/T investments" (p. 12).

An organization's capacity to use information for competitive advantage is related to the alignment of these four domains. The model "is based on the need to achieve alignment across internal and external domains as well as functional integration across business and I/T" (Henderson & Venkatraman, 1990, p. 24). There must be a strategic fit between both the business strategy and organizational infrastructure and between the process information technology strategy and information systems infrastructure. "Strategic fit" refers to the interrelationship between the formulation and implementation of a strategy (Henderson & Venkatraman, 1989). In addition, there must be integration between both the domains of business and information technology and those of the organizational infrastructure and processes. Functional integration is the integration between the business and information technology domains (Henderson & Venkatraman, 1989).

The result of the alignment fits into one of four perspectives. In the first two, which consist of strategy execution and technology, business strategy is the driver. In the last two, which are comprised of competitive potential and service level, information technology is the enabler (for an overview of these alignment perspectives see Henderson & Venkatraman, 1993, 1999). The authors view the four alignment perspectives as equally important.

Empirical research on the <u>Strategic Alignment Model</u> is not extensive.

Venkatraman (1991) indicated that research by the "Management in the 1990s" program

showed that organizations "have been successful in achieving one (or two) of these

patterns of alignment, but not necessarily blending these four into a coherent and

consistent framework to guide decisions and actions" (p. 157).

Henderson, Thomas, and Venkatraman (1992) conducted a survey of 393 health-

care executives to examine the relationship of their "understanding of the strategic

alignment between the business and information technology domains and the

organizational context in which that understanding is manifested" (p. ii). The survey

concluded that both information technology planning efforts and the partnership between

top managers and information systems management are directly related to top managers'

understanding of information technology fit, strategic linkage, and business fit. A survey

of the manufacturing and financial services sectors found a strong relationship between

strategic alignment and a firm's effectiveness and performance (Chan & Huff, 1993).

A case study of the Australian banking industry by Broadbent and Weill (1993)

collected quantitative and qualitative information. The alignment of business and

information technology strategy "was facilitated" (p. 169) by the nature of the strategy-

formation process, strategic orientation characteristics, management experience with

reviewing information technology, organizational structure and accountabilities,

information systems responsibilities and policies, and technology strategy.

Norden (1993) proposes the application of modeling and quantitative techniques

for the study of strategic alignment. The author limits his discussion to a description of

these techniques and does not elaborate on how they might apply to understanding the

Strategic Alignment Model. The explanatory use of modeling and quantitative techniques

for the study of strategic alignment is limited. There are two reasons for this. The first

reason for this limitation is that strategic alignment has not been studied extensively. The

second reason can be ascribed to the notion that management's information systems

strategic planning process "cannot be delineated in algorithmic form because the relevant

aspects of the organizational strategy will be vastly different in various organizations"

(King, 1978, p. 36).

Research on the Strategic Use of Information Technology in Higher Education

The strategic potential of information technology in higher education literature

was recognized initially by experts in the business arena in the mid- and late 1980s. In

1984, Emery published a white paper entitled *Developing a Strategy for Information*

Technology in Colleges and Universities that addressed strategic information planning

and management. Four years later, McFarlan (1988) authored the first article in which the

concept of information technology for a competitive advantage is applied to the academic

world. He discussed the movement of information systems in academic institutions from

a supportive to a strategic position on the Strategic Grid and its corresponding managerial

implications. One year later, a survey by Holmes and Stahl (1989) that measured the

strategic uses of information technology across industries found that the issue was not as

critical to senior executives in education as it was to their counterparts in other industries.

The results of this survey revealed that the education/research industry scored the lowest

on the extent of information systems technology usage (Holmes & Stahl, 1989). This

finding suggests that educational institutions were not as successful as other industries in

the creation of competitive advantage through information technology. It also confirmed

the conclusions of several articles that stated that, initially in the world of ivory towers,

the application of the concept of competition in higher education seems to be

contradictory (Ryland, 1990), not readily apparent (Gleason, 1991), or at least a

misconception (Temares, De Torres, & Cook, 1992).

Although information technology was not being widely recognized as a strategic

tool, the concept began gaining early adopters as evidenced by EDUTECH's (1988)

categorization of academic institutions based on the strategic, operational, or tactical role

of technology. One year later, Nolan (1989) addressed the CAUSE National Conference

and stressed the need to add information technology to the strategic equations of colleges

and universities.

Although explanatory models for strategic information did not emerge in

academic and administrative computing literature, as was the case with business,

descriptions of the manner in which information technology becomes a tool for

competition emerged. For example, Gleason (1991) stated that a competitive edge "most

likely will be the cumulative results derived from a collection of innovative and

integrated systems" (p. 8) that serves users. On the other hand, research conducted by the

Institutional Management in Higher Education Project of the Organization for Economic

Co-Operation and Development specified five areas that have the potential for providing

a competitive advantage in higher education: research, administration, management,

teaching and learning, and libraries and information services (Frackmann, 1994).

In the 1990s, the strategic potential of information technology gained extensive acknowledgment in higher education information technology literature (Cyganski, 1990; Daniels, 1998; Ernest & Segall, 1995; Frackmann, 1996; Fleit, 1990; Gates, 1996; Gleason, 1990; Graves, 1998; Hafner & Oblinger, 1998; Hawkins, 1991; HEIRAlliance, 1994; Heterick, 1988; Tuller & Oblinger, 1997; Ringle & Updegrove, 1998; Rocheleau, 1996; Ryland, 1990; Temares et al., 1992). Beyond these acknowledgments, the strategic potential of information technology became the central focus of three books: *The Future Compatible Campus: Planning Designing, and Implementing Information Technology in the Academy* (Oblinger & Rush, 1998); *Dancing with the Devil: Information Technology and the New Competition in Higher Education* (Katz & Associates, 1999); and *Information Technology in Higher Education: Assessing its Impact and Planning for the Future* (Katz & Rudy, 1999). These publications, which are all collections of essays, recognize the essential strategic role of information technology in teaching, research, and administration. It is only in Oblinger and Rush's (1998) book that a framework for strategic alignment is presented.

Although the strategic role of information technology in higher education has gained wide recognition, researchers have not studied the topic empirically. This has been a reality for almost a decade. As indicated by Levy (1988), by the late 1980s there was a lack of empirical research on the relationship of higher education and information technologies. Around that time Graham (1989) recognized information technology as a significant strategic issue in her investigation of higher education, but did not explore this issue fully. By the mid-1990s, a posterior study of information technology planning in a

research university environment investigated institutional transformation but failed to

make a connection to the concept of competitive strategy (Julia, 1996).

<p style="text-align:center;">Strategic Alignment in Higher Education</p>

Strategic alignment in higher education requires recognizing the role of

information technology in relation to institutional missions. As Duderstadt (1999)

suggests, although the fundamental roles of universities do not change over time, "the

particular realization of those roles does change," (p. 6) with technology as the driver.

The recognition of technology as a driver in teaching, research, and management requires

establishing the link to an institutional mission. This notion is articulated here by Duke

University (1999):

> Fuqua [School of Business] has long realized the importance of technology as it
> enhances and differentiates its educational programs, provides computing power
> for faculty research and enables the staff to realize objectives in support of the
> School's mission. (p. 19)

Therefore, planning for information technology should be strategic and have a

vision of the learner at the center of the process (Norris & Dolence, 1996). Hawkins

(1991) indicates that the development of planning paradigms will facilitate this strategic

integration of information technology with the research and instructional mission of the

university. However, even though strategic alignment of academic strategy and

information technology has been prescribed, it has become only a partial reality. By

1996, *The Seventh National Survey of Desktop Computing and Information Technology*

in Higher Education reported that less than half of American colleges and universities

(43%), had a strategic plan for the use of information technology (Green, 1996). When

comparing institutions by type of control, the survey revealed that the percentage of

private institutions with information technology plans was higher than for public institutions: 61% for private institutions and 54% for public. The same trend was observed in terms of the existence of a financial, curriculum, or instructional plan for information technology, an instructional plan for the Internet, and an information technology plan for distance education.

Although the awareness of the need for strategic alignment in higher education is extensive (Bleed & McClure, 1995; CAUSE Current Issues Committee, 1995, 1996; Ernest & Segall, 1995; Frackmann, 1994, 1996; Rocheleau, 1996), the proposition of explanatory models is limited. Others who echo the benefits of linking information technology to academic strategy include Berge and Schrum (1998); Dillman and Hicks 1990; EDUTECH 1991, 1992; Ehrlich, Neal, and McClure (1992); Gregorian, Hawkins, and Taylor (1992); Hawkins (1991); HEIRAlliance (1992, 1994, 1995); Madron (1991); Merck and Fleit (1988); Miselis (1989); Ringle and Updegrove (1998); Roselle (1989); Rosser, Kunselman, and Penrod (1992); Ryland and Smallen (1989); and Vogel and Wetherbe (1991).

It was not until 1998 that Moran proposed the <u>Strategic Alignment Model</u> as a framework for information technology planning. His article presented Henderson and Venkatraman's model and provided generic examples of the approach to information technology planning. Moran focused on the examination of an institution's strategy and its organizational infrastructure and processes. He recommended using technology planning as a tool for alignment and stressed the fundamental need for "a high degree of integration and consistency between the institutional mission and the technology plan" (p.

44). Moran also stated that the technology must support the fundamental mission of the organization.

<div align="center">Strategic Alignment in Web Sites</div>

The strategic use of Web sites exemplifies the alignment of information technology with business strategy. Keen et al. (1998) presented three types of relationships or dimensions that can be forged through a presence on the World Wide Web: transaction, information, and interaction. A transaction relationship refers to the electronic ordering and payment for goods and services (Keen et al., 1998). The authors described the information relationship as electronic data "ranging from static displays of text to the full range of dynamic multimedia" (p. 3). Interaction is defined as electronic links ranging from passive one-way communication by electronic mail to a two-way flow of messages involving participation or collaboration. The presence of universities on the World Wide Web can be described in the same terms. The Web has become a mechanism through which relationships are built between an institution and its multiple constituencies (i.e., parents, prospective students, faculty, donors, and students). If these relationships are of strategic value, the alignment of Web-based technologies to the institutional mission becomes central.

This research project empirically investigated the degree of integration and consistency between universities' mission statements and information technology strategies. Our intention was to determine to what extent technology supports the institution's mission. The next chapter describes how the study was conducted. It

describes methodological considerations for the content analysis of Web sites,

institutional mission statements, and technology plans.

Chapter 3: Design of the Study

Introduction

This chapter describes the methodological approach used to study the alignment

of academic and information technology strategies and the strategic use of information

technology by research universities. The chapter begins with a description of content

analysis. This is followed by a discussion of previous research that analyzed the content

of mission statements and Web sites. Next, the design of the study is presented. This

chapter concludes by addressing issues of data collection, reduction, and analysis and by

discussing the limitations of the study.

Content Analysis

Content analysis is defined as a "systematic research method for analyzing textual

information in a standardized way that allows evaluators to make inferences about the

information" (General Accounting Office, 1996, p. 6). According to Weber (1990),

inferences about the message, the sender of the message, or the audience of the message

can be made through this research methodology. As a method of inquiry into the symbolic

meaning of messages, content analysis is concerned with the relationship between data

and their environment at different levels of abstractions (Krippendorff, 1980). As an

archival naturalist research strategy (Wolcott, 1982, 1992), content analysis allows the

researcher to gain a holistic overview of the context under study and to isolate themes and

expressions for examination (Miles & Huberman, 1994).

The General Accounting Office's (1996) report on content analysis summarizes

the advantages and disadvantages of this research methodology. Content analysis is

described as an unobtrusive and systematic methodology that can deal with large volumes

of material, can be used to corroborate other findings, and can allow for the evaluation of

objectives. In terms of disadvantages, content analysis is described as labor intensive and, in some instances, costly.

<div align="center">Justification</div>

The focuses of the investigation were on both the alignment of academic and information technology strategies and the strategic uses of information technology in public and private research universities. The alignment of academic and information technology strategies was studied by examining and comparing (a) the content of institutional and information technology mission statements, and (b) the content of information technology plans. The research also examined the strategic uses of information technology by investigating how universities use the Web for teaching, research, and administration.

Content analysis was an appropriate research strategy for reasons pertaining to data collection, analysis, and interpretation. In terms of data collection, content analysis provided a systematic and unobtrusive strategy for gathering the research data from university Web sites. Because the research studied the symbolic representation of academic and information strategies through the evaluation of mission statements and technology plans, content analysis provided the means to isolate the major themes of these statements of purpose in order to construct a holistic picture of this area of inquiry. On the other hand, since the research also investigated concrete manifestations of the use of technology in teaching, research, and administration, content analysis allowed both identifying those instances in Web sites and gaining a holistic overview of research universities in regard to this matter. In the end, content analysis provided the means to compare the symbolic representations of the statements of purpose with the concrete representations of technology.

Content Analysis of Web Sites

Content analysis of Web sites is an emergent research area that is exploratory in nature. Even though content can be considered the essential fact (Engle, 1997) in the evaluation of Web sites, most of the literature on the topic focuses on design issues. As Alexander and Tate (1999) indicated, the existing literature focuses on the graphic or technical design of Web pages. Among the evaluation criteria suggested for the evaluation of Web sites are relevance, scope, and validity (Wilkinson, Bennett, & Oliver, 1997), as well as comprehensiveness and bias (Westera, 1996). Alexander and Tate (1999) recommended the application of five traditional criteria to the evaluation of Web resources: authority, accuracy, objectivity, currency, coverage, and intended audience.

Empirical research on the content of Web sites belonging to academic institutions is limited and recent. These investigations illustrate the use of two different methodologies for studying Web content: survey research and content analysis. A description of them follows.

Survey Research

The Tenth National Survey of Information Technology in American Higher Education (Green, 1999a) gathered information on the use of Web sites by 530 institutions. The results of the study, based on self-reporting by chief information officers, provide information on the uses of Web sites for teaching, research, and administration. The questionnaire identified 24 services or resources available in academic Web sites[2]. The results demonstrate that Web-based services vary across institutional types. The percentage of research universities offering academic resources/services in their

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[2] Undergraduate admissions applications, financial aid applications, current course catalogs, program/major degree requirements, course registration, course add/drop options, E-commerce, online courses, library/card catalogs, interlibrary loan services, journal and reference services, course reserves, student transcripts, IT support resources, IT training/tutorials, instructional software, faculty/staff directory, student newspaper, student handbooks, athletic event schedules, alumni information/services, press releases/media services, campus bookstores, and customizable student home pages.

Web sites was greater than the percentages of four-year or two-year colleges. Two-year

colleges reported the lowest levels of availability of Web-based resources. For four-year

and two-year colleges, the percentage of public institutions offering Web-based resources

was greater than the percentage of private institutions. For research universities, the

percentage differences between public and private institutions were lower. Table 1

compares public and private research across categories related to teaching, research, and

administration.

Table 1

Web-based Services in Research Universities by Institutional Control (Green. 1999a)

	Web-based service		
	Online courses	Reference resources	Undergraduate applications
Control			
Public	75	90	85
Private	41	93	82

Green (1999b) underscored gains for some services between 1997 and 1998 by

stating that alumni services grew by 20% while student transcripts, as well as online

course reserves, grew by 50%. The survey also revealed a longitudinal growth in the

number of institutions providing Web-based services and variations across time between

private and public institutions with regards to the types of services provided. According

to the author, between 1995 and 1998, research universities experienced the largest gain in

the use of information technology for instruction, as evidenced by a 300% growth rate for

public research universities and 500% growth for private research universities.

The results of *The Tenth National Survey of Desktop Computing and Information Technology in Higher Education* provided an important basis for comparing the findings of the intended investigation on the strategic uses of Web sites for teaching, research, and management. Both studies share a common focus: the functionality of the Web sites. In addition, findings were based on recent data that relate to similar populations.

Content Analysis

Web sites have been studied through content analysis in both higher education and business literature. Three studies of academic Web sites illustrate the use of different approaches to content analysis. They were conducted by Aikat (1995), Rada, Rimpau, Bowman, Gordon, Henderson, and Sanson (1996), and the Institute for Learning Technologies (1997) at Columbia University.

Aikat (1995) explored the content of 380 academic, 387 government, and 373 commercial Web sites. The author analyzed the pages through manual coding and classified them under ten categories of information: news, commentary, public relations, advertising, bulletin board, services/product support information, entertainment, exhibits/picture archive, data bank/general information, and miscellaneous/other. This research found that the majority of the academic Web pages were devoted to public relations (22%), advertising (16%), news (13%), or bulletin boards (12%). This finding suggests that the initial content of academic Web sites was neither operational nor strategic and that five years ago Web sites were not being used for research or administration. The author also concluded that the content of public and private institutions' Web sites had a significantly high correlation. When academic, commercial, and government sites were compared, the research concluded that academic and commercial sites had the highest correlation. A limitation of the study was drawing a representative sample based on listings of active Web sites. Consequently, the results are

only representative of a set of active sites at that particular time. A preferred strategy would have been drawing the sample from the listings of academic institutions, government agencies or businesses based on comparative attributes such as enrollment, location or sales. For example, an appropriate listing of academic sites would have been The Carnegie Foundation's *Classification of institutions of higher education.*

Rada et al. (1996) conducted a longitudinal study of the Web sites of 12 land-grant universities. The researchers examined the educational content of the Web sites by conducting random and heuristic searches during a five-month period. The study concluded that the sites were not consistently organized and contained limited educational content, but that the amount of significant educational information increased over time.

Research conducted by the Institute for Learning Technologies (1997) at Columbia University included a survey of both the design and content of 489 Web sites belonging to academic institutions. The researchers drew comparisons by institutional type utilizing the Carnegie typology. The researchers discovered that 89% of research universities had a Web site. In terms of the content of the site, 80% had a general information section, 79% provided library access, and 18% included admissions information. The authors pointed out that the presence of admissions information was lower for research universities than for other institutional types even though a substantial majority of research universities had Web sites. They concluded that these findings suggest that Web sites belonging to research universities differ from those belonging to other types of universities in terms of purpose. Like the survey conducted by Green (1999a), the findings of Columbia's Institute of Learning Technologies provided a basis for comparing the results of this research because in both studies the samples were drawn from the population of research universities and the library and admissions pages were examined.

Empirical research on the content of business Web sites suggests other useful conceptualizations of Web functionality from a strategic perspective. An analysis of the Web sites of 95 Fortune 500 consumer-marketing companies by Kierzkowski, McQuade, Waitman, and Zeisser (1996a) provided a framework for Web site classification based on content. The authors classified the Web sites as information-delivery, relationship building, or intermediation. Information-delivery Web sites provide information about a product or service, relationship-building Web sites identify users or prospects, and intermediation Web sites create new distribution channels (Kierzkowski, McQuade, Waitman, & Zeisser, 1996b). This classification is similar to Keen et al.'s (1998) description of Web activity as information, interaction, and transaction-based relationships.

On the other hand, Leovic (1997) analyzed 42 Web sites of North American commercial banks through content analysis. He examined the demographics, message content, and Web technologies that were used. In the case of the message content, he examined and quantified the mission statements. Eighty percent of these sites contained mission statements. His research recognized the strategic potential of Web sites but concluded that the quality and organization of the information were not related to the use of advanced Web technologies such as custom data delivery or secure transactions over the Internet.

Finally, an empirical investigation of the relationship between the strategy and performance of corporate Web sites conducted by Auger (1997) included a survey of 176 marketing managers, presidents/owners, and Web site managers of the computer, telecommunications, and food industries. An inherent limitation of the study was its drawing of the sample from a directory of Web sites. The researcher found a positive association between multi-objective Web sites and performance, a positive association

between advertising the Web site and performance, a strong association between Web site activity and performance, and a lack of association between Web site design and performance.

<div align="center">Content Analysis of Mission Statements</div>

The content of mission statements is a fundamental tool for management. As Drucker stated in 1974:

> Only a clear definition of the mission and purpose of the business makes possible clear and realistic business objectives. It is the foundation of priorities, strategies, plans, and work assignments. It is the starting point for the design of managerial jobs and, above all, for the design of managerial structures. Structure follows structure. Strategy determines what the key activities are in a given business. And strategy requires knowing "what our business is and what it should be." (p. 75)

This view of the mission statement as a planning strategy is contemplated in the business literature by Pearce (1982), Staples and Black (1984), McGinnis (1981) and Cochran, David, and Gibson (1985). Pearce (1982), specifically, viewed the mission statement as an invaluable tool in strategy formulation and implementation. Pearce and David (1987) authored the landmark study of the corporate mission statement that identified eight components of mission statements: philosophy, self-concept, public image, customer/market, product/service, geographic domain, technology, and concern for survival. The research conducted by the author examined the relationship between the eight components and the financial performance of the Fortune 500 firms. Three independent raters used content analysis to evaluate 61 corporate mission statements and determine the degree to which they contained the eight desired components. The authors' findings empirically supported "the notion that higher performing firms have comparatively more comprehensive mission statements" (p. 112). An interesting finding

was that technology was the component that was least frequently included in the 61 mission statements that were evaluated.

In higher education, Lang and Lopers-Sweetman's (1991) examination of 32 university institutional statements led the authors to the creation of a content-based taxonomy. They classify institutional mission statements as expressions of the following six types: historical-philosophical, action plans, interrogative or optional, scale and capacity, messianic tablets, or anthologies of missions. The authors concluded that each type of mission statement serves a different purpose and can either complement institutional planning processes, operate outside those processes, or never function as plans. Lang and Lopers-Sweetman's work underscores that institutional use of mission statements is contingent on their purpose and is not necessarily linked to the strategic planning process.

Lang and Lopers-Sweetman cited the seminal work of Peterson (1980), Cope (1981), and Keller (1983) to support the assertion of the utility of mission statements in planning. In Peterson's (1980) work, mission statements are part of the value assessment element of strategic planning. The author states that "Educational institutions in their mission, purposes and strategies either reflect implicitly or have made explicitly decisions about certain value choices" (p. 149). Cope (1981) describes the review of missions as a technique of the strategic planning process that focuses on the institution. For the author, a mission is the "primary institutional driving force and the element reviewed first in nearly every process of strategic planning" (p. 41). Keller (1983) considers missions as a feature of the strategic planning process "that looks outward and is focused on keeping the institution in step with the changing environment" (p. 145).

Empirical research on the content of academic mission statements has also been conducted by Newson and Hayes (1991), Mathieu (1993), Stober (1997), and Stemler

and Bebell (1999). Newson and Hayes (1991) reviewed the mission statements of 114 institutions in 11 southeastern states. Mission statements were provided by the presidents of the institutions in the sample. The researchers assessed the presence of seven of the eight components identified by Pearce and David (1987). Technology as a component of the content of a mission statement was not included. The authors did not provide reasons for this exclusion. The research found that more than half of the mission statements contained references to public image and geography. It also concluded that the presence of the seven dimensions vary by institutional control. However, differences between public, private, and sectarian institutions were not statistically tested.

Mathieu (1993) assessed the presence of references to setting or environment in a sample of 84 small private liberal colleges. Mission statements were obtained from college catalogs and evaluated by independent raters. The author tested for differences between urban and rural colleges in the degree to which the setting or environment of the institution was reflected in the mission statement. He concluded that only 19% of the colleges in the sample included references to setting or environment in their mission statements and that no significant differences existed between urban and rural institutions.

A content analysis of 120 mission statements conducted by Stober (1997) used three independent human raters to identify if mission statements differ in terms of content and text clarity according to the Carnegie classification and type of control. The author used four content categories: philosophy, target group, service areas, and principals served, and three sources of control: public, independent non-sectarian, and independent sectarian. The author concluded that colleges and universities categorized by type of control described themselves differently than the manner in which they were described by their corresponding Carnegie classification. Technology was cited in the mission statements more frequently by doctoral and non-sectarian institutions.

A recent investigation on the content of mission statements was conducted by Stemler and Bebell (1999). In this research, the mission statements of a stratified random sample of 267 schools and colleges were gathered from Web sites. Specifically, 187 academic Web sites were examined. Fifty-three percent of them had mission statements. The authors observed that mission statements were more easily available and apparent in academic Web sites than in those for elementary, middle, or high schools. Stemler and Bebell also examined the content of these 100 academic mission statements to test if significant variations existed between institutions in respect to the type and number of factors emphasized in their mission statements. Ten dimensions of content were identified: (a) cognitive/academic; (b) social; (c) citizenship; (d) physical development; (e) attitude/value/emotional development; (f) school environment; (g) spiritual community; (h) local community; (i) global community; and (j) faculty/staff. Stemler and Bebell concluded that the distribution of these dimensions in college mission statements approximated a normal distribution with few institutions emphasizing one or nine dimensions and most emphasizing four or five. The authors also found that variations existed between institutions in terms of the types and number of factors emphasized in their mission statements and that the major themes of the mission statements are related to institutional level.

<div align="center">The Population</div>

In this study, the population is finite and defined as all the doctorate-granting institutions listed by The Carnegie Foundation for the Advancement of Teaching in their *1994 Classification of institutions of higher education*. This segment is divided into four groups: Research Universities I, Research Universities II, Doctoral Universities I, and Doctoral Universities II (1994). Table 2 presents the number of institutions by institutional control.

Table 2

Doctoral Granting Institutions

	Public	Private	Total
Doctoral I	28	23	51
Doctoral II	38	22	60
Research I	59	29	88
Research II	26	11	37
Total	151	85	236

The Target Population

This research focused on the 125 Research Universities as the target population. Both Research I and II institutions offer a full range of baccalaureate programs, are committed to graduate education through the doctorate, give high priority to research, and award 50 or more doctoral degrees each year[3]. Research universities, as Brooks (1980) points out, are a vital component of American higher education that "provide cultural and intellectual leadership, research potential, and the professional and technical human resources to translate research into social, industrial, and economic action" (p. 2).

Research universities were the target population because the exploratory nature of conducting investigations on the emergent area of Web site research demands the initial study of intra-relationships vis-à-vis interrelationships. Therefore, at this moment it is more valuable to compare private and public research universities than to compare

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[3] The differentiation made by The Carnegie Foundation by the Advancement of Teaching (1994) between types I and II is based on the amount of federal support received annually. The amount of federal support received by Research Universities I surpasses the amount of $40 million. Research Universities II received annually between $15.5 and $40 million in federal support.

research universities with comprehensive colleges. As Leovic (1997) indicated, to allow for potentially meaningful results, the content analysis of Web sites should be conducted within the same sector as opposed to content analysis across different sectors. This is also suggested by Keen et al. (1998), who recommended avoiding generalizations from one space, such as education, to another, such as business. Doctoral universities were not considered, since these institutions do not give high priority to research and one of the focuses of this investigation is the strategic use of information technology for research.

Size was also a practical consideration that played a minor role in the selection of Research Universities as the target population. One hundred twenty-five institutions were deemed of manageable size to conduct the required data collection, reduction, and analysis. The elements of the sampling frame are listed in Appendix A.

<u>Sample</u>

In contingency tests, Cohen (1977) suggests establishing the significance criterion, degrees of freedom, and the power and effect size prior to the determination of sample size. This study set the significance criterion at .10, the degrees of freedom at 1, the desired power at .80, and effect size at .40. Through the use of a sample size table[4], a sample size of 39 was calculated. This study sampled 39 private institutions and 39 public institutions for a total sample size of 78. The institutions were selected through simple random sampling. They are listed in Appendices B and C.

<u>Research Design</u>

Content analysis was the research methodology of this investigation. The process has five phases: development of conceptual framework, operationalization of variables, data collection, data condensation, and data analysis.

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[4] Table 7.4.11 in Cohen (1977).

The Pilot Study

A pilot study was conducted to refine the method for the collection, reduction, and analysis of data prior to conducting the full-scale study. The purposes of the pilot study were to: (a) estimate the length of data collection; (b) develop a fixed-coding scheme; (c) create a spreadsheet template for data analysis; (d) choose the appropriate statistical test; and (e) elaborate a preliminary scheme for the presentation of findings. The following sections describe how the pilot study was carried out. It describes aspects of the research design pertaining to the phases of data collection, reduction, and analysis.

Phase 1: Development of Conceptual Framework

As suggested by Miles and Huberman (1994), a conceptual framework based on the Strategic Alignment Model was built prior to data reduction to explain graphically the main constructs and variables being studied and the relationship between these attributes. Interviews with three information technology managers at Boston College were conducted in June 1999 to help develop the conceptual framework. The individuals interviewed were Kathleen Warner, Vice President for Information Technology, Bernard W. Gleason, Associate Vice President for Information Technology, and Paul R. DuPuis, former Director of Strategic Planning and Business Operations.

In the Strategic Alignment Model, Henderson and Venkatraman identify and define four domains of strategic choice: business strategy, information technology strategy, organizational infrastructure and processes, and information systems infrastructure and processes (Henderson & Venkatraman, 1989, 1990, 1993, 1999). Because an organization's capacity to use information for competitive advantage is related to the alignment of these four domains, the model "is based on the need to achieve alignment across" them (Henderson & Venkatraman, 1990, p. 24). Therefore, there must be a fit between the business strategy and organizational infrastructure and the

information technology strategy and information systems infrastructure. An interpretation of this model for academic institutions required only the redefinition of one of the four domains of strategic choice. Hence, business strategy is redefined as academic strategy. Therefore, strategic alignment, the main construct of this conceptual framework, is represented as the alignment of academic strategy, information technology strategy, academic infrastructure and processes, and information technology infrastructure and processes.

This conceptualization views the alignment of information technology with academic strategy at two levels: strategy formulation and implementation. The process is described in terms of two variables: integration and fit. Figure 2 presents a graphic representation of the conceptual framework developed for this research project. Figure 3 presents a graphic representation of the model after the variables were defined operationally.
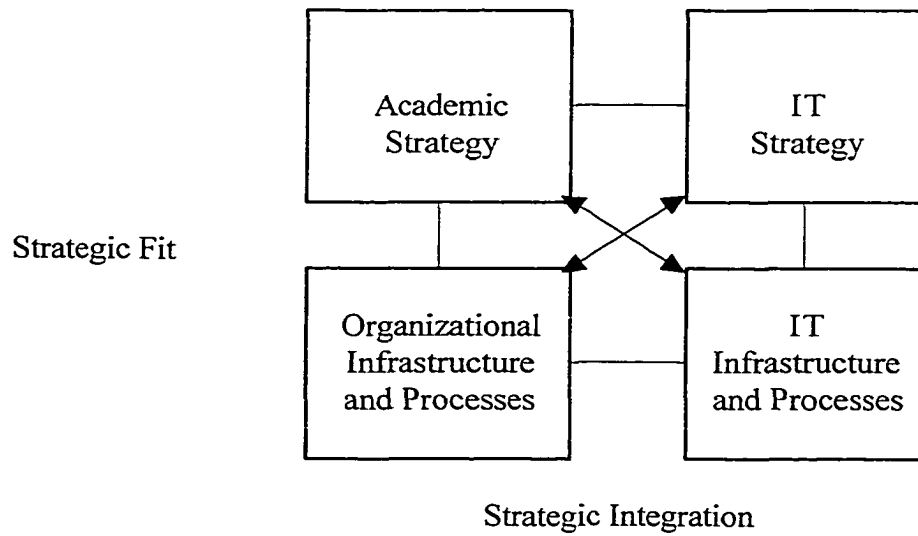
Figure 2. Conceptual Framework of the Strategic Alignment Model.
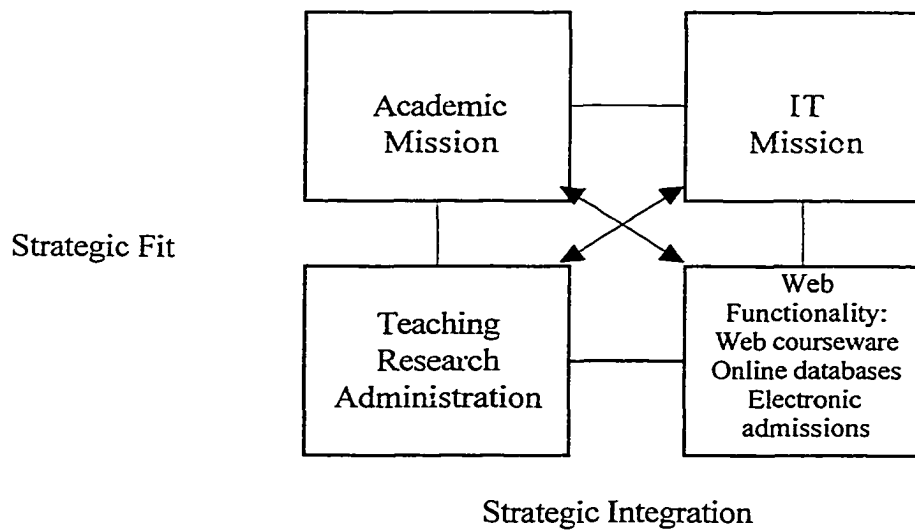
Figure 3. Operational Framework of the Strategic Alignment Model.

<u>Phase 2: Operational Constructs and Variables.</u>

The following definitions were created for the constructs and variables in the operational framework of the Strategic Alignment Model:

1. <u>Strategy formulation</u>: the institutional mission statement or information technology mission statement;

2. <u>Strategy implementation</u>: the functionality of Web pages for teaching, research, and administration;

3. <u>Strategic integration</u>: the cross-references between the content of the academic and information technology mission statements;

4. <u>Strategic fit</u>: the strategic use of information technology in teaching, research, and management;

5. <u>Strategic use of information technology in teaching</u>: the presence of Web-based courseware (i.e., WebCT, Blackboard, Web Course in a Box, etc.) in the Web site;

6. <u>Strategic use of information technology in research</u>: the restricted or unrestricted online access to research databases via the Web site;

7. <u>Strategic use of information technology in administration</u>: the functionality of electronic inquiries, downloadable applications or online applications for undergraduate or graduate admissions;

8. <u>Strategic alignment</u>: the state in which (a) academic mission statements are aligned with information technology, (b) information technology missions are aligned with institutional missions, or (c) technology plans are aligned with institutional missions or strategic plans. This synchronization leads to strategic uses of technology for teaching, research, or administration.

Phase 3: Data Collection

Data were collected from the Web sites of the 78 research institutions in the sample. A pilot study was conducted to ascertain the data collection process prior to conducting the full study. The pilot study sampled 10% of the target population of research universities through proportional stratified sampling. The sample contained nine public and four private institutions. The institutions in the sample were not selected in the same manner as the institutions in the full study because the purpose of the sample was to refine the method, not to produce statistically significant findings that could be generalized.

The data for the pilot study were collected between May 14 and May 18 of 1999. A determination was made to download the data within a limited frame of time. Since the information on Web sites evolves continuously, this allowed the researcher to compare sites as they existed during a specific time and prevented drawing possibly misleading inferences that might result when one site was downloaded four weeks later than another.

The data collection process was systematic. Alphabetical lists of the uniform resource locators of the private and public institutions in the sample were created. The URLs of the sites of the 13 institutions in the pilot study were identified by accessing Yahoo!'s *Complete Listing of Colleges and Universities*. Each site was opened employing the Web browser Netscape Navigator 4.05 on a Macintosh with the operating system software 8.1.5 via a T1 connection. Data from the sites of private institutions were downloaded first. Each Web site was examined once.

The institution's home page was accessed and saved in a text only format. The same process was repeated for the admissions, library, and information technology unit pages. Only pages with information relevant to the research questions were saved. Pages

from the undergraduate or graduate admissions[5] sites that were saved contained references to electronic inquiries and downloadable or online applications. The library pages that were saved had references to electronic access to research databases. Pages from the information technology units were saved if they contained the unit's mission statement and the technology plan. Using the site's search engine, the researcher conducted Boolean searches for the phrase "mission statement." Links were made to the corresponding pages. Pages that contained the institution's mission statement were saved. If the search did not yield positive results, Boolean searches were conducted for the words "catalog" or "bulletin." The institution's catalog or bulletin was examined to locate the institution's mission statement. Finally, the academic, computing, and library pages were examined to locate and save pages for Web courseware. If the search did not yield positive results, Boolean searches were conducted for the phrases "Web courseware," "Web CT," "CourseInfo," or "Web Course in a Box."

As data were collected, the researcher kept a chronological journal. The journal recorded impressions about data collection and the content of the Web pages. At the end of the downloading process for the four private institutions in the sample, a data collection sheet, illustrated in Appendix D, was developed and used. Notes on the impressions about data collection and the content of the Web pages were from that time annotated at the bottom of the data collection sheet. In addition, a set of instructions for the data collection process, included in Appendix E, was created. The data collection sheet was used to guide the downloading of pages for the remaining nine public institutions in the sample. The time spent per site downloading information ranged from 15 to 40 minutes. A total of 894 kilobytes of text was downloaded.

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[5] For Graduate Arts and Sciences only.

Phase 4: Data Reduction

Data reduction, or data condensation (Tesch, 1990), is the process of "selecting,

focusing, simplifying, abstracting, and transforming the data" (Miles & Huberman, 1994,

p. 10). Data reduction was done using HyperResearch 1.65[6]. This content analysis

software allows for the use of multiple data sources for each case. In this research, each

university constituted a case or the unit of analysis. Each page downloaded from the Web

site became a source for the case. This research utilized one type of source material: Web

pages. In the pilot study, there were 13 cases and 195 sources.

The first step in the data coding process required verifying whether the data were

in the proper format for manipulation by HyperResearch 1.65. Since this qualitative

analysis software cannot access more than 16,000 characters at a time (Researchware,

1997), it became necessary to insert page breaks recognized by the software into those

files with more than 16,000 characters. All files larger than 9 Kilobytes were opened with

MS Word 6.01. A word count was done to verify that the source did not contain more

than 16,000 characters. If the numbers of characters exceeded that quantity, the file was

divided into pages by inserting a tilde (~) at the end of each page. Upon completion of

this step, all files were renamed and locked.

Weitzman and Miles (1995) differentiated between fixed and evolving coding

schemes. In the pilot study, an evolving coding scheme was used to develop the fixed

coding scheme used in the full study. The textual data were condensed into recording units

using the coding engine of HyperResearch 1.65. This research design used the six types of

recording units identified by Weber (1990): word, word sense, sentence, paragraph,

theme, and whole text. A preliminary list of ten content categories was created.

Additional codes for categorical variables were created as the text of the collected Web

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[6] This software is a code-and-retrieve program that contains a theory building module (Weitzman & Miles, 1995).

pages were being condensed. Table 3 compares the preliminary list of content categories and the listing that emerged after coding the private institutions.

The coding scheme that evolved from data-condensation was adopted in the full-scale study. In that instance, the coding was fixed at the start. Upon completion of the code-building process, and as suggested by Stone, Dunphy, Smith, and Ogilvie (1966), a dictionary of categorical variables classified by type of recording unit was created for the 36 content variables that emerged. Through the construction of a dictionary, each one was defined. A category was assigned to each recording in concordance with the dictionary. As Namenwirth (1969) suggested, the choice of categories and their definitions is a theoretical enterprise based on the concerns of the researcher as well as semantic considerations. This dictionary is presented in Table 4. It summarizes the coding rules.

Table 3

Content Categories of Preliminary and Emergent Coding Schemes

Preliminary coding scheme	Emergent coding scheme
1. Mission statement	1. Traditional mission 2. Technological mission 3. Link to mission statement in home page 4. Mission statement in stand alone Web page 5. Mission statement in fact book 6. Mission statement in college catalog 7. Mission statement in strategic plan 8. Mission statement in accreditation site 9. Mission statement in faculty or staff handbook 10. Mission statement in institutional bylaws
2. IT mission statement	11. Strategic IT mission 12. Supportive IT mission 13. Teaching content in IT mission 14. Research content in IT mission 15. Administrative content in IT mission 16. IT mission in stand alone Web page 17. IT mission in strategic plan 18. IT mission in annual report 19. IT mission in planning document
3. Technology plan	20. Technology plan 21. Alignment in technology plan
4. IT organization chart	Deleted
5. Strategic plan	Deleted
6. Web courseware	22. Own Web courseware 23. WebCT 24. CourseInfo 25. Web Course in a Box 26. Link to Web coursware in home page 27. Link to Web courseware in library Web site
7. Electronic admissions inquires	28. Undergraduate electronic admissions inquires 29. Graduate electronic admissions inquiries
8. Downloadable application	30. Undergraduate downloadable application 31. Graduate downloadable application
9. Online application	32. Undergraduate online application 33. Graduate online application 34. Own online application 35. College Edge
10. Online research databases	36. Online research databases

Table 4

Dictionary of Categorical Variables

Emergent coding scheme	Recording unit	Definition[7]
1. Link to mission statement in home page	Word or sentence	Direct link to mission statement in the home page.
2. Link to Web courseware in home page	Word or sentence	Direct link to mission statement in home page.
3. Traditional mission	Theme	Statement of purpose alluding to teaching, research, scholarship or service.
4. Technological mission	Theme	Statement of purpose alluding to technology or computing resources.
5. Mission statement in stand alone Web page	Word or word sense	Statement of purpose appearing as a Web page.
6. Mission statement in fact book	Word or word sense	Statement of purpose located in a fact Web page or a page belonging to the fact book.
7. Mission statement in college catalog	Word or word sense	Statement of purpose located in a Web page belonging to the college catalog or bulletin.
8. Mission statement in strategic plan	Word or word sense	Statement of purpose located in a strategic plan.
9. Mission statement in accreditation site	Word or word sense	Statement of purpose located in a Web page belonging to the accreditation Web site.
10. Mission statement in faculty or staff handbook	Word or word sense	Statement of purpose located in a Web page belonging to the faculty or staff handbook.
11. Mission statement in institutional bylaws	Word or word sense	Statement of purpose located in Web page containing the bylaws of the institution.

[7] As suggested by Weber (1990), words, phrases, units of text classified in the same category are presumed to have similar meanings.

12. Strategic IT mission	Theme	Information technology mission statement that bestows a strategic role to technology.
13. Supportive IT mission	Theme	Information technology mission statement that bestows a supportive role to technology.
14. Teaching content in IT mission	Theme	Information technology mission statement alluding to teaching.
15. Research content in IT mission	Theme	Information technology mission statement alluding to research.
16. Administrative content in IT mission	Theme	Information technology mission statement alluding to administration.
17. IT mission in stand alone Web page	Word or word sense	Information technology mission statement appearing as a Web page.
18. IT mission in strategic plan	Word or word sense	Information technology mission appearing in a Web page belonging to a strategic plan.
19. IT mission in annual report	Word or word sense	Information technology mission appearing in a Web site belonging to an annual report.
20. IT mission in planning document	Word or word sense	Information technology mission appearing in a Web page belonging to a planning document.
21. Technology plan	Whole text	Presence of technology plan in Web site.
22. Alignment in technology plan	Theme	Technology plan that references the institution's mission or strategic plan.
23. Own Web courseware	Word, sentence or paragraph	Use of a customized interface developed in-house for online course.
24. WebCT	Word	Presence of the commercial courseware known as Web site.

25. CourseInfo	Word	Presence of the commercial courseware known as CourseInfo in Web site.
26. Web Course in a Box	Word	Presence of the commercial courseware known as Web Course in a Box courseware in Web site.
27. Undergraduate electronic admissions inquiries	Word or sentence	Web site that allows electronic admissions inquiries at the undergraduate level.
28. Undergraduate downloadable application	Word	Web site that allows prospective students to download the undergraduate application in a portable document format (PDF) or as a text file.
29. Undergraduate online application	Word	Web sites that allow prospective students to complete and transmit the undergraduate applications electronically.
30. Graduate admissions inquiries	Word or sentence	Web site that allows electronic admissions inquiries at the graduate level.
31. Graduate downloadable application	Word	Web site that allows downloading the graduate application in a portable document format (PDF) or as a text file.
32. Graduate online application	Word or sentence	Web sites that allow prospective students to complete and transmit the graduate applications electronically.
33. Own online application	Word or sentence	Online application submitted directly to the institution.
34. Embark	Word	Online application submitted to Embark.

35. College Net/Apply Web	Word	Online application submitted to College/Apply Web.
36. College Link	Word	Online application submitted to College Link.
37. Apply Yourself	Word	Online application submitted to Apply Yourself.
38. UXAP	Word	Online application submitted to UXAP
39. Online research databases	Word sense or paragraph	Availability of restricted or unrestricted research databases in the library Web site.
40. Link to Web courseware in library Web site	Word or sentence	Direct link to Web courseware in library Web site.

Note. College Edge was renamed Embark after the pilot was conducted. College Net/Apply, College Link and UXAP were codes for type of online applications that emerged when the full study was conducted.

Phase 5: Data Analysis

Once textual data were coded, they were transformed into categorical variables. All variables, as suggested by the General Accounting Office (1996), were nominal, exclusive, and exhaustive. Upon completion of data condensation, frequency distributions were calculated for the categorical variables. Through the use of frequency distributions, the categorical variables were compared. Comparisons were made between private and public institutions. Through inferential statistics, conclusions were drawn about the target population. Because all variables were nominally scaled, the Chi-square[8] test of independence, a nonparametric statistic, was the appropriate measure to test the null hypotheses of no difference between private and public institutions. Through the use of

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[8] Denoted by χ^2.

this test, this research assessed the degree of correspondence between observed and expected frequencies.

Siegel and Castellan (1988) recommended the use of the Fisher exact test to test for significance in a 2 x 2 contingency table since, in the pilot study N = 13, this was the appropriate test when private and public institutions were compared. In the full study, depending on the sample size, either the Fisher exact, Chi-square or Chi-square corrected for continuity tests were employed instead. In the pilot study, for some research questions, there were not enough cases to find significant differences. However, the pilot study revealed the need to have variables with at least two different levels and to condense variables in order to create 2 x 2 contingency tables for the test of independence.

The findings of the pilot are not included in this section because the sample did not meet the minimum size required to be able to draw valid inferences. It is important to point out that this was due to the fact that the purpose of the pilot was to refine the method prior to carrying out the full study.

<div align="center">Limitations</div>

The limitations of the study pertain to issues of reliability and validity inherent to the research design. They, along with the measures that were taken to minimize the effects of the threats to reliability and validity, are discussed in depth in the following section.

Reliability

According to Krippendorff (1980), the types of reliability relevant to content analysis are stability, reproducibility, and accuracy. Stability is the weakest form of reliability and results from inconsistencies in coding by the same coder that stem from recording the wrong code for a category or from ambiguities in the coding rules or the text (Weber, 1990). To minimize threats to stability arising from recording errors, a report for

each code was generated through HyperResearch (see sample in Appendix F). It was used

to verify the correspondence between the text and the categorical variable that was

assigned prior to data analysis. The report was also compared with the notes from the

data collection sheet (see Appendix D) and the Dictionary of Category Variables (see

Table 4).

On the other hand, threats to stability posed by ambiguities in the coding rule

were minimized through the construction of a precise and clear dictionary of categorical

variables classified by type of recording unit for the emergent coding-scheme (see Table

4). Threats to stability related to ambiguities in the text were minimized by paying

attention to the text coding using the recording units of word sense or theme, since the

content analysis of these recording units is, by nature, interpretative.

The second form of reliability is reproducibility, or intercoder reliability.

Intercoder reliability measures the "degree of consistency between two or more coders"

(General Accounting Office, 1996, p. 74). Weber (1990) identified three threats to

intercoder reliability: cognitive differences among coders, ambiguous coding instructions,

and random recording errors. The General Accounting Office (1996) discussed three

methods to measure intercoder reliability: observed agreement, chance agreement rate, and

Cohen's kappa[7]. The General Accounting Office (1996) recommended the use of Cohen's

kappa as an appropriate measure of intercoder reliability for nominal level variables. All

the variables in this research are nominal. Consequently, the decision to measure

intercoder reliability through the estimation of Cohen's kappa emerges. Riffe, Lacy, and

Fico (1998) stated that, while Wimmer and Dominick (1997) suggested measuring the

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[9] Kappa is calculated by subtracting the change agreement rate from the observed agreement rate and dividing the result of the subtraction of the chance agreement rate to 1 ($K = (Po - Pc)/1 - Pc$). It equals 1 when there is a perfect agreement between coders. See Cohen (1960), GAO (1996) and Riffe et al. (1998) for a discussion of the calculation of observed and chance agreement measures of reliability.

reliability on a sample of between 10% to 20% of the total content, Kaid and Wadsworth (1989) recommended between 5% and 7%. Riffe et al. (1998) recommended a random selection of content samples for reliability testing.

The study of information content of Web pages conducted by Aikat (1995) estimated intercoder reliability between the author and a second coder by comparing the observed agreement at coding a random sample equal to 16% of the sites in the study. The second coder was instructed on the categorical definitions, the purpose of the research, and the methodology. Although the author describes the coding by the second coder as independent analysis, the author in a contradictory manner states that "the two coders deliberated on differences to arrive at the 'best judgement' in every case of disagreement" (p. 85). It is not clear if the deliberation was conducted posteriori to the calculation of intercoder reliability. A similar methodology was employed in this research to assess the degree of intercoder reliability. However, deliberations of disagreement did not take place. The independent coders were given a set of instructions that included the coding rules developed in the pilot study (see Appendix G) and were asked to code in a sheet (see Appendix H) a random sample of the data consisting of 4 public[10] and 4 private[11] research universities. A sample size for the reliability check of eight institutions equals 10% of the 78 research universities in the sample.

The coding results of the principal investigator were compared with those of two independent coders[12] to calculate the observed agreement, chance agreement and Cohen's kappa. Table 5 summarizes the results for each categorical variable and the overall study. Tables 6, 7 and 8 compare the reliability results between: (a) the principal investigator

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[10] Arizona State University, University of California at Los Angeles, University of South Florida and University of Tennessee at Knoxville.
[11] George Washington University, Harvard University, Rockefeller University and University of Miami.
[12] Coder A was Dr. Jorge Ríos, a clinical pathologist. Coder B was Bridget Sullivan, a sophomore majoring in English at Boston College.

and coder A, (b) the principal investigator and coder B, and (c) coders A and B. As Table 8 shows, the average and median agreement rates were in excess of the "reasonably good over-all agreement" of .61, suggested by Kvaselth (1989, p. 226). The reliability of coding with theme as the recording unit had low levels of observed agreement, chance agreement, and Cohen's kappa than those condensed from words, word sentences, paragraphs, or whole texts. For example, coding the content of mission statements as traditional or technological was by nature interpretative. In contrast, coding Web courseware required identifying the words WebCT, CourseInfo, or Web Course in a Box in the text of Web pages.

The third type of reliability is accuracy. It is defined by Weber (1990) as "the extent to which the classification of text corresponds to a standard or norm" (p. 17). The author points out that, since standard codes for text are not established frequently, accuracy is seldom used in reliability assessment. Since no standard for coding of the text in this research has been developed, accuracy was not assessed in this investigation.

Table 5

Reliability Results for Categorical Variables

Categorical Variable	Observed agreement	Chance agreement	Cohen's kappa
1. Link to mission statement in home page	.92	.92	.00
2. Link to Web courseware in home page	1	1	--
3. Traditional mission	.92	.51	.83
4. Technological mission	.92	.92	.00
5. Mission statement in stand alone Web page	.92	.50	.83
6. Mission statement in fact book	1.00	.78	1.00
7. Mission statement in college catalog	1.00	1.00	--
8. Mission statement in strategic plan	1.00	1.00	--
9. Mission statement in accreditation site	1.00	1.00	--
10. Mission statement in faculty or staff handbook	1.00	1.00	--
11. Mission statement in institutional bylaws	1.00	1.00	--
12. Strategic IT mission	.67	.58	.20
13. Supportive IT mission	.75	.67	.24
14. Teaching content in IT mission	.83	.63	.56
15. Research content in IT mission	.75	.67	.25
16. Administrative content in IT mission	.83	.58	.60
17. IT mission in stand alone Web page	.83	.53	.65
18. IT mission in strategic plan	.92	.85	.45
19. IT mission in annual report	1.00	1.00	--
20. IT mission in planning document	1.00	1.00	--
21. Technology plan	1.00	.63	1.00
22. Alignment in technology plan	.92	.67	.75

23. Own Web courseware	1.00	.78	1.00
24. WebCT	1.00	.63	1.00
25. CourseInfo	.92	.56	.81
26. Web Course in a Box	1.00	1.00	--
27. Undergraduate electronic admissions inquiries	.83	.63	.56
28. Undergraduate downloadable application	.83	.56	.62
29. Undergraduate online application	.92	.50	.83
30. Own online application	.83	.53	.64
31. Embark	1.00	.78	1.00
32. College Net/Apply Web	.92	.92	.00
33. College Link	1.00	1.00	--
34. Apply Yourself	.92	.92	.00
35. UXAP	1.00	1.00	--
36. Graduate admissions inquiries	.83	.50	.63
37. Graduate downloadable application	.83	.63	.56
38. Graduate online application	.92	.51	.83
39. Own online graduate application	.83	.52	.65
40. Graduate Embark	1.00	.78	1.00
41. Graduate College Net/Apply Web	1.00	1.00	--
42. Graduate College Link	1.00	1.00	--
43. Graduate Apply Yourself	1.00	.78	1.00
44. Graduate UXAP	1.00	1.00	--
45. Online research databases	1.00	1.00	--
46. Link to Web courseware in library Web site	.96	.92	.49
47. Overall	.93	.65	.79
48. Median	.94	.78	.63

<u>Note</u>. Dashes indicate that Cohen's kappa was not calculated because there was no variability. Upper limit for observed and chance agreement is 1. Lower limit is 0. For Cohen's kappa, 1 equals complete agreement and 0 indicates there is no agreement. Cohen (1960) indicates that values for kappa that are less than 0 do not have practical interest. Kvalseth (1989) indicates that .61 represents a reasonably good value for overall agreement between two coders.

Table 6

Observed Agreement Results for Categorical Variables

Categorical Variable	Principal Investigator & Rater A	Principal Investigator & Rater B	Raters A & B	Overall
1. Link to mission statement in home page	.88	1.00	.88	.92
2. Link to Web courseware in home page	1.00	1.00	1.00	1.00
3. Traditional mission	.88	.88	1.00	.92
4. Technological mission	.88	.88	1.00	.92
5. Mission statement in stand alone Web page	.88	1.00	.88	.92
6. Mission statement in fact book	1.00	1.00	1.00	1.00
7. Mission statement in college catalog	1.00	1.00	1.00	1.00
8. Mission statement in strategic plan	1.00	1.00	1.00	1.00
9. Mission statement in accreditation site	1.00	1.00	1.00	1.00
10. Mission statement in faculty or staff handbook	1.00	1.00	1.00	1.00
11. Mission statement in institutional bylaws	1.00	1.00	1.00	1.00
12. Strategic IT mission	.63	.63	.75	.67
13. Supportive IT mission	.88	.75	.63	.75

14. Teaching content in IT mission	.75	.75	1.00	.83
15. Research content in IT mission	.63	.63	1.00	.75
16. Administrative content in IT mission	.75	.88	.88	.83
17. IT mission in stand alone Web page	.75	.88	.88	.83
18. IT mission in strategic plan	.88	1.00	.88	.92
19. IT mission in annual report	1.00	1.00	1.00	1.00
20. IT mission in planning document	1.00	1.00	1.00	1.00
21. Technology plan	1.00	1.00	1.00	1.00
22. Alignment in technology plan	.88	.88	1.00	.92
23. Own Web courseware	1.00	1.00	1.00	1.00
24. WebCT	1.00	1.00	1.00	1.00
25. CourseInfo	.88	1.00	.88	.92
26. Web Course in a Box	1.00	1.00	1.00	1.00
27. Undergraduate electronic admissions inquiries	.88	.88	.75	.83
28. Undergraduate downloadable application	.75	.75	1.00	.83
29. Undergraduate online application	.88	.88	1.00	.92
30. Own online application	.75	.75	1.00	.83
31. Embark	1.00	1.00	1.00	1.00

32. College Net/Apply Web	.88	.88	1.00	.92
33. College Link	1.00	1.00	1.00	1.00
34. Apply Yourself	.88	1.00	.88	.92
35. UXAP	1.00	1.00	1.00	1.00
36. Graduate admissions inquiries	.88	.88	.75	.83
37. Graduate downloadable application	.75	.75	1.00	.83
38. Graduate online application	.88	.88	1.00	.92
39. Own online graduate application	.88	.75	.88	.83
40. Graduate Embark	1.00	1.00	1.00	1.00
41. Graduate College Net/Apply Web	1.00	1.00	1.00	1.00
42. Graduate College Link	1.00	1.00	1.00	1.00
43. Graduate Apply Yourself	1.00	1.00	1.00	1.00
44. Graduate UXAP	1.00	1.00	1.00	1.00
45. Online research databases	1.00	1.00	1.00	1.00
46. Link to Web courseware in library Web site	1.00	1.00	.88	.96
47. Mean	.91	.92	.95	.93
48. Median	.94	.94	1.00	1.00

Note. Upper limit for observed agreement is 1. Lower limit is 0.

Table 7

Chance Agreement Results for Categorical Variables

Categorical Variable	Principal Investigator & Rater A	Principal Investigator & Rater B	Raters A & B	Overall
1. Link to mission statement in home page	.88	1.00	.88	.92
2. Link to Web courseware in home page	1.00	1.00	1.00	1.00
3. Traditional mission	.50	.50	.50	.51
4. Technological mission	.88	.88	1.00	.92
5. Mission statement in stand alone Web page	.50	.50	.50	.50
6. Mission statement in fact book	.78	.78	.78	.78
7. Mission statement in college catalog	1.00	1.00	1.00	1.00
8. Mission statement in strategic plan	1.00	1.00	1.00	1.00
9. Mission statement in accreditation site	1.00	1.00	1.00	1.00
10. Mission statement in faculty or staff handbook	1.00	1.00	1.00	1.00
11. Mission statement in institutional bylaws	1.00	1.00	1.00	1.00
12. Strategic IT mission	.50	.69	.50	.58
13. Supportive IT mission	.69	.63	.69	.67

14. Teaching content in IT mission	.63	.63	.63	.63
15. Research content in IT mission	.69	.69	.63	.67
16. Administrative content in IT mission	.63	.56	.56	.58
17. IT mission in stand alone Web page	.50	.56	.50	.53
18. IT mission in strategic plan	.88	.78	.88	.85
19. IT mission in annual report	1.00	1.00	1.00	1.00
20. IT mission in planning document	1.00	1.00	1.00	1.00
21. Technology plan	.63	.63	.63	.63
22. Alignment in technology plan	.69	.69	.63	.67
23. Own Web courseware	.78	.78	.78	.78
24. WebCT	.63	.63	.63	.63
25. CourseInfo	.56	.53	.50	.56
26. Web Course in a Box	1.00	1.00	1.00	1.00
27. Undergraduate electronic admissions inquiries	.56	.69	.50	.62
28. Undergraduate downloadable application	.63	.63	.53	.63
29. Undergraduate online application	.50	.50	.53	.50
30. Own online application	.53	.53	.63	.53
31. Embark	.78	.78	.78	.78

32. College Net/Apply Web	.88	.88	1.00	.92
33. College Link	1.00	1.00	1.00	1.00
34. Apply Yourself	.88	1.00	.88	.92
35. UXAP	1.00	1.00	1.00	1.00
36. Graduate admissions inquiries	.50	.50	.61	.50
37. Graduate downloadable application	.63	.63	.53	.63
38. Graduate online application	.50	.50	.53	.51
39. Own online graduate application	.56	.50	.50	.52
40. Graduate Embark	.78	.78	.78	.78
41. Graduate College Net/Apply Web	1.00	1.00	1.00	1.00
42. Graduate College Link	1.00	1.00	1.00	1.00
43. Graduate Apply Yourself	.78	.78	.78	.78
44. Graduate UXAP	1.00	1.00	1.00	1.00
45. Online research databases	1.00	1.00	.78	1.00
46. Link to Web courseware in library Web site	1.00	1.00	.77	.92
47. Mean	.66	.65	.64	.65
48. Median	.78	.78	.78	.78

Note. Upper limit for chance agreement is 1. Lower limit is 0.

Table 8

Cohen's Kappa Results for Categorical Variables

Categorical Variable	Principal Investigator & Rater A	Principal Investigator & Rater B	Raters A & B	Overall
1. Link to mission statement in home page	.00	--	.00	.00
2. Link to Web courseware in home page	--	--	--	--
3. Traditional mission	.75	.75	1.00	.83
4. Technological mission	.00	.00	--	.00
5. Mission statement in stand alone Web page	.75	1.00	.75	.83
6. Mission statement in fact book	1.00	1.00	1.00	1.00
7. Mission statement in college catalog	--	--	--	--
8. Mission statement in strategic plan	--	--	--	--
9. Mission statement in accreditation site	--	--	--	--
10. Mission statement in faculty or staff handbook	--	--	--	--
11. Mission statement in institutional bylaws	--	--	--	--
12. Strategic IT mission	.25	.00	.50	.20
13. Supportive IT mission	.60	.33	.69	.24

14. Teaching content in IT mission	.33	.33	.63	.56
15. Research content in IT mission	.00	.00	.63	.25
16. Administrative content in IT mission	.33	.71	.56	.60
17. IT mission in stand alone Web page	.50	.71	.75	.65
18. IT mission in strategic plan	.00	1.00	0.00	.45
19. IT mission in annual report	--	--	--	--
20. IT mission in planning document	--	--	--	--
21. Technology plan	1.00	1.00	1.00	1.00
22. Alignment in technology plan	.60	.60	1.00	.75
23. Own Web courseware	1.00	1.00	1.00	1.00
24. WebCT	1.00	1.00	1.00	1.00
25. CourseInfo	.71	1.00	.75	.81
26. Web Course in a Box	--	--	--	--
27. Undergraduate electronic admissions inquiries	.71	.60	.50	.56
28. Undergraduate downloadable application	.33	.33	1.00	.56
29. Undergraduate online application	.75	.75	1.00	.83
30. Own online application	.47	.47	1.00	.64
31. Embark	1.00	1.00	1.00	1.00

32. College Net/Apply Web	.00	.00	—	.00
33. College Link	—	—	—	—
34. Apply Yourself	00.	—	.00	.00
35. UXAP	—	—	—	—
36. Graduate admissions inquiries	.75	.75	.36	.67
37. Graduate downloadable application	.33	.33	1.00	.56
38. Graduate online application	.75	.75	1.00	.83
39. Own online graduate application	.71	.50	.75	.65
40. Graduate Embark	1.00	1.00	1.00	1.00
41. Graduate College Net/Apply Web	—	—	—	—
42. Graduate College Link	—	—	—	—
43. Graduate Apply Yourself	1.00	1.00	1.00	1.00
44. Graduate UXAP	—	—	—	—
45. Online research databases	—	—	1.00	—
46. Link to Web courseware in library Web site	—	—	.41	.49
47. Mean	.74	.78	.86	.79
48. Median	.66	.73	1.00	.65

Note. Dashes indicate that Cohen's kappa was not calculated because there was no variability. For Cohen's kappa, 1 equals complete agreement and 0 indicates there is no agreement. Cohen (1960) indicates that values for kappa that are less than 0 do not have practical interest. Kvalseth (1989) indicates that .61 represents a reasonably good value for overall agreement between two coders.

Validity

According to Weber (1990), validity refers to the correspondence between the category and the abstract concept it represents as well as to the generalization of results. Lack of correspondence between the investigator's definition of a concept and the category that it measures present threats to the validity of a content analysis (Weber, 1985). Threats to validity were minimized by positioning the constructs and variables with definitions consistent to terms widely accepted in the literature as illustrated by Table 4.

The generalization of results is affected by issues related to data collection. Web sites provide examples of concrete manifestations of the use of technology. However, it is recognized that there are other manifestations of the strategic uses of information technology in higher education that are not Web-based and others —like intranets— that are Web-based but that limit access to users within an organization. Yet, the profound and rapid impact the World Wide Web is having on education merits beginning the isolation of themes and the construction of a holistic overview of the strategic alignment of information technology in higher education. The findings, therefore, are valid for the specific manifestations that were studied.

Chapter 4: Summary of Findings

Introduction

This chapter presents the results of the investigation conducted to examine the alignment of academic and information technology strategies and the strategic use of information technology by research universities. The chapter begins with a description of the quantitative and qualitative analysis applied to the data collected from institutional Web sites that pertain to mission statements, technology plans, and the use of the Web for teaching, research, and administration. This is followed by the presentation of findings. This section is organized in terms of the nine research questions outlined in Chapter 1.

Description of Data Analysis

The Web sites of a random sample of 78 research universities were examined between December 10 and December 20 of 1999. The names and uniform resource locators (URLs) of the institutions in the sample are listed in Appendices B and C. Web pages relevant to nine research questions were downloaded following the data collection procedure described in Chapter 3. Web pages cited in text appeared under a separate section entitled URLs References because the *Publication Manual of the American Psychological Association* (1994) states that a standard for referencing online sources had not yet emerged. Also, using a URLs reference list section avoids the use of citations in text that span several lines.

The time spent downloading information ranged from 15 to 45 minutes per site, with an average of 25 minutes per site spent downloading information. Twenty-two megabytes of text were downloaded. There were 78 cases and 1627 sources.

Text gathered from Web pages was condensed using the emergent coding scheme developed for the pilot study and summarized in Chapter 3. Next, the frequencies of the emergent codes were calculated through a spreadsheet. Through frequency distributions, the categorical variables were compared. Through inferential statistics, conclusions were drawn about the target population. Because all variables were nominally scaled, the Chi-square test of independence, a nonparametric statistic, was used to test the null hypotheses of no difference between public and private institutions or of no relation between two variables. An alpha level of .10 was used for all statistical tests.

Three tests were used, as suggested by Siegel and Castellan (1988): (a) the Fisher exact, (b) the Chi-square, or (c) the Chi-square corrected for continuity. The Fisher exact probability test for 2 x 2 contingency tables was used when the sample size[13] was less than or equal to 20. When the sample size was between 21 and 40, the Chi-square test was used if all expected frequencies were more than five. The Fisher exact test was used if the smallest expected frequency was less than five. When the sample size was greater than 40, the Chi-square corrected for continuity was used.

Web Presence

Each of the institutions in the study had an operational Web site. No sites were under construction.

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[13] Denoted by N.

Research Question #1: What is the content of the academic mission statements?

Seventy-three percent of the institutions sampled in the study included their

mission statements in their Web sites. This group was composed of 51% public

institutions and 49% private institutions. Table 9 shows the data by institutional control.

Differences between public and private institutions in respect to the inclusion of mission

statements in their Web sites were not statistically significant, as shown by using the Chi-

square corrected for continuity $(1, \underline{N} = 78) = 0, \underline{p} > .10$.

Through the location of mission statements in Web sites, universities send an

implicit message about the relevance of these statements. Mission statements appeared as

separate Web pages or as secondary information of a Web page associated with another

content area. Furthermore, direct links to mission statements appeared in home pages.

There was a plurality of mission statements (46%) that appeared as separate Web pages.

Only two institutions, Cornell University (HP 9)[14] and North Carolina State University

(HP 60), had a link to the mission statement in their home pages. Both mission statements

appeared as stand-alone Web pages. Table 10 presents the location of mission statements

in Web sites by institutional control.

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[14] URLs for home pages appear in Appendices B and C.

Table 9

Percentages for Presence of Academic Missions in Web Sites by Institutional Control

(N = 78)

Control	With		Without	
	%	n	%	n
Public	74	29	26	10
Private	72	28	28	11
Combined	73	57	27	21

Siegel and Castellan (1988) indicated that the Chi-square test can be used in contingency tables with degrees of freedom greater than one if "fewer than 20 percent of the cells have an expected frequency of less than 5 and if no cell has an expected frequency of less than 1" (p. 123). If these requirements are not met, the authors recommended combining adjacent categories to increase the expected frequencies in the problematic cells and then using the appropriate Chi-square test to test for differences. None of these requirements are met here since the data were organized in a 7 x 2 contingency table with six degrees of freedom, 79% of the cells have expected frequency of less than five, and two cells have expected frequencies of less than one. Therefore, the categorical data for the location of the mission statement variable was collapsed into two categories: stand-alone and other. After the collapse, the differences between public and private institutions in the location of mission statements in Web sites as stand-alone Web

pages or as secondary information of other content areas were not statistically significant,

as shown by using the Chi-square corrected for continuity (1, $\underline{N} = 57$) = .85, $\underline{p}$ > .10.

Table 10

Percentages for Location of Academic Missions in Web Sites by Institutional Control

($\underline{N} = 57$)

	Public		Private		Combined	
Location	%	n	%	n	%	n
Stand alone	38	11	54	15	46	26
Fact book	28	8	7	2	18	10
College catalog	14	4	14	4	14	8
Strategic plan	17	5	7	2	12	7
Accreditation	0	0	11	3	5	3
Faculty/staff handbook	4	1	4	1	4	2
Bylaws	0	0	4	1	2	1

Note. Percentages may not add to 100 because of rounding.

The mission statements of Brown University (MS 2)[15], Northeastern University

(MS 20), and Yale University (MS 38) appeared as secondary information of an

accreditation Web page. These pages contained the institutions' response to Standard I of

the New England Association of Schools and Colleges. The content of these pages was

organized uniformly under three major sections: mission statement description, appraisal,

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[15] URLs for mission statements, technology plans, and other Web pages appear in the URLs References section.

and projection. These three institutions presented the evolution of their mission statements in the description section. However, Brown University was the only institution to acknowledge that a mission statement should address technology. During their 1996-1997 strategic planning process, Brown recognized the need to incorporate in the mission statement changes brought about by technology because "The partnership of students and professors is now formed in an environment in which electronic data retrieval and global communications play an increasingly large role" (MS 2, 1999). Their appraisal section concluded that their revised mission statement "captures the essence of Brown's tradition —those moral and intellectual standards kept in view by the language of the 1764 Charter— while setting contemporary challenges before the Brown community" (MS 2, 1999).

The mission statements of five institutions were accompanied by explanations. The mission statement of the University of Tennessee at Knoxville had the chancellor's articulation of the statement of purpose (MS 67). The University of Houston included a discussion of shared values within the mission (MS 50). The University of Notre Dame included a context for the educational mission statement as a Catholic university (MS 22). Saint Louis University defined a mission statement and specified how the institution supports the mission (MS 30). Syracuse University included a statement of commitment to the mission by the students, faculty, staff, and administrators (MS 32).

Two institutions clarified their lack of mission statements. Boston University explained that it does not have a formal mission statement or an explicit set of goals because they, "when not merely empty form, can imprudently narrow an institution's

identity and emphases" (MS 3, 1999). Harvard University, in a Web page entitled *What is*

Harvard mission statement? (M 14), stated that it does not have a formal mission and

included a statement of purpose for Harvard College as a reference.

Content of Mission Statements

The content of mission statements was coded as traditional or technological.

Traditional mission statements made references to teaching, research, and service as

illustrated by the mission statement of the University of Hawaii at Manoa:

> The University of Hawaii at Manoa is a research university – the only one of its kind in the state. It is the premier institution of higher learning in the Pacific Basin and belongs to an international community of research universities. It serves society by creating, refining, disseminating, and storing human knowledge, wisdom, and values through exemplary teaching, research, and community service programs.
>
> As a research university, UH Manoa offers a comprehensive array of undergraduate, graduate, and professional degrees through the doctoral level, including law and medicine. It carries out advanced research programs through its colleges, schools, and organized research units and fulfills its land-grant mission by preparing a highly educated citizenry, bringing University expertise to bear on societal problems, and extending its unique educational opportunities and service programs through outreach.
>
> UH Manoa has selective admissions. It facilitates the growth and development of students as responsible citizens who can pursue and achieve their individual goals. The special attribute afforded by its research environment is the integration of teaching with the creation of knowledge, thus providing all students the opportunity for progressive involvement in scholarship and the research enterprise. Service learning and a vigorous co-curricular educational environment are also important components of a UH Manoa education.
>
> The University of Hawaii at Manoa provides Asian, Pacific, and Hawaiian perspectives to the higher education experience. Its location, diverse student body, rich Asian, Pacific, and Hawaiian cultural setting, and biological and physical environment afford many advantages that permeate instructional, research, and service programs and all aspects of campus life. (MS 49, 1999)

Technological mission statements contained references to technology or computer resources, as illustrated by the mission statement of Brown University:

> The mission of Brown University is to seek, create, communicate, and preserve knowledge and understanding through a partnership of students and teachers who are devoted to improving society and to meeting intellectual challenges in a spirit of free inquiry.
> Faculty, undergraduate, graduate and medical students carry out this mission in a unified community known as a university/college with the following goals:
> * critical thinking
> * individual responsibility and respect for the rights of others
> * cultural and intellectual diversity within a global context
> * study of the past in order better to meet the future
> * excellence in research and teaching in all areas of the University
> * leadership in the development and application of technologies
> * preparation for a lifetime of learning (MS 2, 1999)

Mission statements with a technological content referred to technology as an outcome, resource, area of study, or context. Three references were made to technology as a resource. The mission statement of the University of Tennessee (MS 67) identified the development of strong computer resources as one of the institution's major emphases. Case Western Reserve University (MS 6) and Iowa State University (MS 54) had mission statements that alluded to technology as an instructional resource. In the mission statement of Iowa State University, the institution aimed to support the development of both traditional and nontraditional students with advanced instructional resources. In contrast, Case Western Reserve University sought to offer an "undergraduate education that preserves the strengths of traditional disciplinary majors while integrating content and methods from technology" (MS 6, 1999).

The mission statements of three institutions alluded to technology as an outcome of the university. The statement of purpose of North Carolina State University noted that

the institution aspires to provide leadership for the "technological development within the state, the nation and the world" (MS 60,1999). The University of Southern California (MS 29) aimed to provide a stream of new knowledge, art, and technology to the nation, while Brown University sought to offer "leadership in the development and application of technologies" (MS 2, 1999).

Technology was described as a context in two mission statements. Rensselaer Polytechnic Institute stated that it "educates the leaders of tomorrow for technologically based careers" (MS 28, 1999), whereas the University of Iowa (MS 53) sought to enhance education in a technologically advanced environment. Finally, technology was referred to as an area of study when Iowa State University (MS 54) stated that it emphasizes areas related to science and technology and that a common goal of undergraduate education is the acquisition of literacy in technology.

A substantial majority of mission statements (86%) had a traditional content. This group was composed of 51% public institutions and 49% private institutions. Only 14% of the mission statements included technological content. This group included an equal number of private and public institutions. Table 11 shows the content of mission statements by institutional control.

Table 11

Percentages for Content of Mission Statements by Institutional Control (N = 57)

	Traditional		Technological	
Control	%	n	%	n
Public	86	25	14	4
Private	86	24	14	4
Combined	86	49	14	8
χ^2	0		0	

The first research hypotheses examined whether the content of institutional

mission statements is related to type of institutional control. More specifically, the null

hypothesis and alternative hypotheses stated the following:

Null hypothesis #1: Traditional or technological content in a mission statement is
not related to institutional control.
Alternative hypothesis #1: Traditional or technological content in a mission
statement is related to institutional control.

As Table 11 illustrates, null hypothesis #1 was rejected. In addition, the research findings

indicated that there were no statistically significant differences between public and

private institutions in the inclusion of mission statements in their Web sites, as shown by

using the Chi-square corrected for continuity $(1, \underline{N} = 78) = 0, \underline{p} > .10$.

Research Question #2: What is the content of the information technology mission

statements?

While most Web sites (73%) included academic missions, only 42% contained

information technology mission statements. This group was composed of 55% public and

45% private institutions. Table 12 shows the data by institutional control. It illustrates

that the percentage of Web sites belonging to public institutions with information

technology mission statements was only 8% higher than for private institutions.

These mission statements appeared in the information technology Web sites as

stand-alone pages or as part of the technology plan, annual report, or planning document.

Similar to the academic mission statements, a substantial majority of the information

technology missions (70%) appeared as stand-alone Web pages. Table 13 shows the data

by institutional control.

Categorical data for the location of information technology missions was

collapsed in order to test for differences. Differences between public and private

institutions in the location of mission statements in Web sites as stand-alone Web pages

or as secondary information of another content area were not statistically significant, as

shown by using the Chi-square (1, $\underline{N}$ = 33) = .17, Fisher exact $\underline{p}$ > .10.

Table 12

Percentages for Presence of Information Technology Missions in Web Sites by

Institutional Control (N = 78)

Control	With		Without	
	%	n	%	n
Public	46	18	54	21
Private	38	15	62	24
Combined	42	33	58	45

Table 13

Percentages for Location of Information Technology Mission in Web Sites by

Institutional Control (N = 33)

Location	Public		Private		Combined	
	%	n	%	n	%	n
Stand alone	67	12	73	11	70	23
Strategic plan	33	6	13	2	24	8
Annual report	0	0	7	1	3	1
Planning document	0	0	7	1	3	1

Content of Information Technology Missions

In terms of content, information technology mission statements were categorized

as supportive or strategic. Strategic mission statements bestowed a strategic role to

technology, as illustrated by the statement of purpose of the Georgia Institute of

Technology:

> All employees of the Office of Information Technology are committed to using the power of information technology:
> - to foster and advance the Georgia Tech mission of education, research, and public service
> - to constantly improve services to our associates in the Georgia Tech community
> - to empower faculty, staff, researchers, and students to take full advantage of information technology
> - to transform and benefit Georgia Tech administrative processes
> - to celebrate our successes, which is the key to persuading our peers and customers to partner with us in the implementation of emerging technologies, and
> - to serve as leaders in our chosen profession, constantly striving for professional development through education, retraining, and the passionate application of skills in the workplace (IT MS 48, 1999)

In contrast, the statement of purpose for information technology at the Arizona State

University typified a supportive mission statement. It bestowed a supportive role to

information technology: "Information Technology efforts at ASU Main Campus support

efforts to plan, implement, and maintain the technology services and resources required

to support the academic, administrative, and service needs of the campus community"

(IT MS 42, 1999).

Most information technology mission statements (61%) included supportive

content. Half of these institutions were public. In contrast, 39% of the information

technology missions had a strategic content. The majority of these institutions (62%)

were public. Table 14 presents the data for the content of information technology

missions statements by institutional control.

Table 14

Percentages for Content of Information Mission Statements by Institutional Control

(N = 33)

Control	Supportive		Strategic	
	%	n	%	n
Public	56	10	44	8
Private	67	10	33	5
Combined	61	20	39	13

Thirteen information technology mission statements had a strategic content. They made references to leadership, competition, and alignment. Eight referred to leadership. These mission statements referred to leadership in three manners: (a) in the application of information technology, (b) as an aspiration for the staff, and (c) in positioning the university as a leader. References to leadership as an application of information technology were made in the mission statements of the University of Georgia (IT MS 47), the University of Iowa (IT MS 53), the University of Missouri (IT MS 59), North Carolina State University (IT MS 60), the University of Pennsylvania (IT MS 35), and Washington State University (IT MS 76). The information technology statement of the Georgia Institute of Technology expressed an aspiration "to serve as leaders in our chosen profession " (IT MS 48, 1999). The mission statement of Emory University (IT MS 11) was the only one that expressed that in relation to information technology it sought to position the university as a leader in teaching, research, and public service.

Four information technology mission statements were explicitly aligned to the academic mission. They corresponded to the Georgia Institute of Technology (IT MS 48), the University of Idaho (IT MS 51), the University of Missouri (IT MS 55), and the Massachusetts Institute of Technology (IT MS 19). Only two institutions, George Washington University (IT MS 13) and Northwestern University (IT MS 21), possessed mission statements that recognized the role of information technology as a source of a competitive advantage. George Washington University stated that information technology would enable the institution to "fully embrace and compete in the educational, research, and administration challenges of the 21st century" (IT MS 13, 1999). Information technology at Northwestern University is dedicated to "advancing the stature, influence, and competitiveness of the University" (IT MS 21, 1999).

The second research hypotheses examined whether the content of information technology mission statements was related to institutional control. More specifically, the null hypothesis and alternative hypotheses stated:

> Null hypothesis #2: Strategic or supportive content in an information technology mission statement is not related to institutional control.
> Alternative hypothesis #2: Strategic or supportive content in an information technology mission statement is related to institutional control.

As Table 14 illustrates, the content of information technology mission statements was not related to institutional control because differences between public and private institutions were not statistically significant, as shown by using the Chi-square $(1, N = 33) = .42$, $p > .10$. Thus, null hypothesis #2 was not rejected. In addition, the research findings indicated that there was no statistically significant difference between public and private institutions in the inclusion of information technology mission statements in their Web

sites, as shown by using the Chi-square corrected for continuity $(1, \underline{N} = 78) = .21, \underline{p} > .10.$

Besides categorizing the content of information technology mission statements as strategic or supportive, it was also coded in terms of references to the traditional functions of teaching, research, and administration. Out of 33 information technology mission statements that appeared in the Web sites, 85% addressed teaching, 79% addressed research, 67% addressed administration, and 9% did not address any of these traditional university functions whatsoever. Table 15 breaks down the content of information technology mission statements by institutional control. It also illustrates that references to teaching, research, or administration in the content of information technology missions did not vary by institutional control because differences between public and private institutions were not statistically significant.

Table 15

Percentages for References to Teaching, Research, or Administration in Information

Technology Missions by Institutional Control (N = 33)

Control	Teaching		Research		Administration		None	
	%	n	%	n	%	n	%	n
Public	89	16	83	15	72	13	11	2
Private	80	12	73	11	60	9	9	1
Combined	85	28	79	26	67	22	7	3
χ^2	.63		.67		.46		>.99	

Note. Categories are not mutually exclusive. For "Teaching," "Research," and "None,"

the Fisher exact test was used.

Research Question #3: Do cross-references exist between the content of academic

and information technology mission statements?

The content of academic mission statements was rated as traditional or

technological. On the other hand, the content of information technology mission

statements was either supportive or strategic. Cross-references between the content of

academic and information technology mission statements yielded four possible

combinations, as Table 16 illustrates. These four outcomes can be placed in McFarlan

and McKenney's Strategic Grid (1983) as Figure 4 shows. Institutions with the traditional

mission-supportive information technology combination occupy the support position and

those with the technological mission-strategic information technology correspond to the

strategic quadrant. The position of the institution in this continuum indicates the level of

alignment.

Technological

	Factory ($n = 9$)	Strategic ($n = 2$)
	Support ($n = 15$)	Turnaround ($n = 1$)

Academic mission

Traditional   Supportive   Strategic

IT mission

Figure 4. Strategic Grid of Academic and Information Technology Mission Alignment.

Table 16

Position in the Strategic Grid of Content Cross-references Between Institutional and

Information Technology Missions (N = 27)

Combination	Position	n	%	χ^2
Traditional mission/ supportive IT mission	Support	15	56	.55
Technological mission/ supportive IT mission	Factory	9	33	.55
Traditional mission/ strategic IT mission	Turnaround	1	4	.55
Technological mission/ strategic IT mission	Strategic	2	7	.55

Note. The Fisher exact test was used.

Only two institutions, North Carolina State University and University of Iowa, had a

technological mission/strategic IT mission combination. Their positions in the Strategic

Grid suggest a high level of strategic alignment. It is illustrated by these academic and

information technology missions:

1.) The University of Iowa seeks to advance scholarly and creative endeavor through leading-edge research and artistic production; to use this research and creativity to enhance undergraduate, graduate and professional education, health care, and other services provided to the people of Iowa, the nation, and the world; and to conduct these activities in a culturally diverse, humane, technologically advanced, and increasingly global environment. (MS 53, 1999)

2.) Information Technology Services (ITS) is a unit reporting to the Vice President for Research. ITS has principal responsibility for:

- leadership in the development and deployment of modern information technologies,
- provision and support of the University's technology-based information infrastructure, and
- stewardship of technology-based information resources the institution produces and/or uses.

Our goal is to continuously improve our services so the University will have the information technology resources necessary to provide teaching, research, and services of the highest quality. (IT MS 53, 1999)

On the other hand, 15 institutions[16] occupy a support position in the Strategic Grid. This low level of strategic alignment, which is related to a traditional mission/supportive IT mission combination, is depicted by the statement of purpose of the University of Houston (1.) and the supportive role bestowed to information technology in their mission statement:

1.) Provide a range of educational programs that foster an intellectually and culturally diverse environment that enhances individual growth and development. To prepare a broad community of students (undergraduate, graduate, professional and non-degree seeking) to make lifelong learning commitments that result in personal, social, economic and community contributions to an increasingly globally interdependent world.

Create, discover, disseminate and preserve knowledge and understanding by engaging in basic and applied research, scholarly and artistic activities that benefit students, scholars and external constituencies.

Serve as a major resource for local, state, national and global communities by applying scholarly analysis and experience to community problems.

Recognize its special responsibility to the Houston metropolitan area by making the knowledge base and other resources of the institution readily accessible to its citizens. (MS 50, 1999)

2.) The mission of Information Technology is to provide high quality and easy to use computing, telephone, data network and video communication service to the students, faculty and staff in support of instructional, research, service and academic support goals of the University of Houston. (IT MS 50, 1999)

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[16] Arizona State University, California Institute of Technology, University of Colorado, Duke University, Harvard University, University of Houston, Lehigh University, University of Notre Dame, Oklahoma State University, University of South Carolina, Saint Louis University, Texas A&M University, University of Connecticut, Vanderbilt University, and West Virginia University.

Rensselaer Institute of Technology, which has a traditional mission/strategic IT

combination, was the only institution in a turnaround position. Nine institutions[17] occupy

a factory position. They had a technological mission/supportive IT mission combination.

The third research hypotheses examined the statistical significance of cross-

references between the content of academic and information technology mission

statements. More specifically, the null hypothesis and alternative hypotheses stated:

> Null hypothesis #3: The content of information technology mission statements is not related to the content of academic mission statements.
> Alternative hypothesis #3: The content of information technology mission statements is related to the content of academic mission statements.

For this analysis, the integration of academic and information technology strategies was

positioned as a cross-reference between the content of academic and information

technology mission statements. Table 16 summarizes the results of the statistical tests

conducted to examine the relation between both variables. As the table shows, the content

of information technology missions was unrelated to the content of academic mission

statements, as shown by using the Chi-square $(1, \underline{N} = 27) = .55$, Fisher exact $\underline{p} > .10$ for

each of the possible outcomes. Thus, null hypothesis #3 was not rejected.

Research Question #4: Are Web sites used as strategic resources in teaching?

The strategic use of Web sites in teaching was studied by examining the use of

Web courseware. Nearly three-fourths of the institutions sampled (74%) used Web

courseware. This group was composed of 55% public and 45% private institutions. As

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[17] Emory University, University of Georgia, George Washington University, University of Idaho, University of Michigan, University of Missouri, Northwestern University, University of Pennsylvania, and Washington State University.

Table 17 illustrates, more than four-fifths of the public institutions in the sample (82%) used Web courseware. They outnumbered private institutions by 15%.

Table 17

Percentages for Use of Web Courseware by Institutional Control (N = 78)

	With		Without	
Control	%	n	%	n
Public	82	32	18	7
Private	67	26	33	13
Combined	74	58	26	20

The fourth research hypotheses examined whether the use of Web sites as strategic resources in teaching was related to institutional control. More specifically, the null hypothesis and alternative hypotheses stated:

> Null hypothesis #4: The use of Web courseware is not related to institutional control.
> Alternative hypothesis #4: The use of Web courseware is related to institutional control.

Null hypothesis #4 was not rejected because differences between public and private institutions in the use of Web courseware were not statistically significant, as shown by using the Chi-square corrected for continuity (1, $\underline{N}$ = 78) = 1.68, $\underline{p}$ > .10.

Institutions used commercial or customized interfaces for Web courseware. WebCT, CourseInfo, and Web Course in a Box are examples of commercial software. A

majority of the institutions sampled (54%) used commercial interfaces. Forty-three

percent of the institutions used custom-made interfaces and only 3% used both.

A plurality of institutions (47%) used their own Web courseware tool. WebCT

was used by 36% of the institutions in the sample. On the other hand, 16% of the

institutions used Blackboard CourseInfo and only 5% used Web Course in a Box. Table

18 shows the use of Web courseware by institutional control.

Table 18

Percentages for Web Courseware Software by Institutional Control (N = 58)

Control	Own		WebCT		CourseInfo		WCB	
	%	n	%	n	%	n	%	n
Public	44	14	46	15	6	2	6	2
Private	50	13	23	6	27	7	4	1
Combined	46	27	36	21	16	9	5	3
Difference	5		24		21		2	
χ^2	.04		2.56		3.23*		0	

Note. *p < .10. Categories are not mutually exclusive. Chi-square is corrected for

continuity.

While public and private institutions used customized interfaces and Web Course

in a Box in similar proportions, a different pattern emerged for the use of WebCT and

CourseInfo. For WebCT, public institutions outnumbered private institutions by 23%. For

CourseInfo, the pattern is reversed: private institutions outnumbered public institutions

by 21%. As Table 18 illustrates, the use of CourseInfo was related to institutional control because the differences between public and private institutions were statistically significant. While the differences were not statistically significant between public and private institutions that used a customized interface or Web Course in a Box, for WebCT ($p = .11$) they were close to statistical significance.

Most institutions (97%) used one type of Web courseware. Two types of Web courseware were used by the remaining 3% of the institutions sampled. The only institutions that supported two types of Web courseware were Iowa State University and Boston University. Iowa State University supported WebCT through their Instructional Technology Center and ClassNet, an in-house customized interface, through their Computation Center. Boston University supported both WebCT and CourseInfo through Web Central, also known as the Networked Information Services (NIS). As a unit of the Office of Information Technology, NIS guides, coordinates, and supports the University's Web initiatives (WP 3a). Their Web site provides faculty with a detailed functional comparison of both Web courseware interfaces (WP 3b). The site also offers a qualitative assessment by faculty of the courseware's effects on teaching and learning (WP 3c) as well as the guidelines sanctioned by their General Counsel's Office on the use of copyrighted material in course Web sites (WP 3d).

Research Question #5: Are Web sites used as strategic resources in research?

The use of Web sites as strategic resources in research was examined by accessing the library Web page and searching for the availability of online databases. All of the academic Web sites that were sampled provided online access to research

databases. In addition, all of these Web sites provided access to an extensive number of

commercial and public products such as bibliographic and full-text databases, indexes to

periodicals and scholarly journals, full-text encyclopedias, government publications and

electronic journals, and newspapers. In the case of the University of Connecticut, their

library subscribed to more than 240 commercially produced research and citation

databases (WP 73).

The University of South Florida Virtual Library Web page (WP 66) indexed

research databases by title, subject area, vendor, text retrieval, or table of contents. All of

the Web sites limited access to databases due to licensing agreements. As illustrated by

the library Web page of the University of Chicago (WP 7), only members of the

institution's community can access these databases through the campus network or proxy

server. Yale University included a link to trial subscriptions of online resources in its

library page (WP 38).

The role of the virtual library in research is not limited to providing access

gateways to electronic resources. Besides online databases, all these pages provided

access to electronic services. Among such featured were online forms for renewal and

interlibrary loans and electronic inquiries to the reference desk, as featured in the library

Web page of the University of Delaware (WP 45). Only one institution, the University of

California at Riverside (WP 79), had a link to Web courseware —Web Course in a

Box— in their library Web page. In addition to providing Web-based services, libraries

play a strategic role in promoting the use of information technology in the traditional

functions of teaching and research. For example, the Digital Knowledge Center at the

Milton S. Eisenhower Library of Johns Hopkins University "conducts research and

provides expertise to facilitate the development and creation of digital curricular,

instructional and informational resources which further instruction, research and

scholarship" (WP16. 1999).

The fifth research hypotheses examined whether the use of Web sites as strategic

resources in research is related to institutional control. More specifically, the null

hypothesis and alternative hypotheses stated:

> Null hypothesis #5: The availability of online research databases in Web sites is
> not related to institutional control.
> Alternative hypothesis #5: The availability of online research databases in Web
> sites is related to institutional control.

Since all of the public and private institutions that were sampled provided online access

to research databases, the use of information technology in teaching was not related to

institutional control. Therefore, null hypothesis #5 was not rejected.

Research Question #6: Are Web sites used as strategic resources in

administration?

The use of the Web as a strategic resource in administration was examined by

looking at the functions of the admissions page of the Web site. Web pages for

undergraduate and graduate admissions were examined and categorized according to

three functionalities: (a) electronic inquiries, (b) downloadable applications, and (c)

online applications. Two null hypotheses were tested for each functionality. The first one

examined the statistical significance of the observed differences between public and

private institutions. The second one tested the relation between the use of electronic

inquiries, downloadable, and online applications for both undergraduate and graduate admissions.

Electronic Inquiries

Seventy-two percent of the Web sites permitted prospective students to make inquiries about undergraduate admissions online. This group was composed of 48% public and 52% private institutions. The percentage of Web sites with the functionality of electronic inquiries for graduate admissions was 12% lower than for undergraduate admissions. This group was comprised of 47% public and 53% private institutions. Table 19 shows the data by institutional control. Thirty-nine Web sites, or 50% of the institutions sampled, had the functionality for both graduate and undergraduate admissions. This group was composed of 46% public and 54% private institutions.

Table 19

Percentages for Web Sites with Electronic Inquiries by Institutional Control (N = 78)

Control	Undergraduate		Graduate		Both	
	%	n	%	n	%	n
Public	69	27	56	22	55	18
Private	74	29	64	25	83	21
Combined	72	56	60	47	72	39
χ^2	.06		.21		.21	

Note. Chi-square is corrected for continuity.

Research hypotheses #6a, #6b and #6c examined whether the use of Web sites as strategic resources in administration was related to institutional control. More specifically, the null and alternative hypotheses stated:

Null hypothesis #6a: The use of electronic inquiries for undergraduate admissions is not related to institutional control.
Alternative hypothesis #6a: The use of electronic admissions inquiries for undergraduate admissions is related to institutional control.

Null hypothesis #6b: The use of electronic inquiries for graduate admissions is not related to institutional control.
Alternative hypothesis #6b: The use of electronic inquiries for graduate admissions is related to institutional control.

Null hypothesis #6c: The concurrent use of electronic inquiries for both undergraduate and graduate admissions is not related to institutional control.
Alternative hypothesis #6c: The concurrent use of electronic inquiries for both undergraduate and graduate admissions is related to institutional control.

Differences between public and private institutions in the use of electronic admissions inquiries for undergraduate, graduate or concurrently for both levels were not statistically significant, as shown by using the Chi-square corrected for continuity, $(1, \underline{N} = 78) = .06$, .21, and .21, $\underline{p} > .10$, respectively. Thus, null hypotheses #6a, #6b, and #6c were not rejected.

Research hypotheses #6d examined the relationship between the concurrent use of electronic inquiries for both undergraduate and graduate admissions.

Null hypothesis #6d: The use of electronic admission inquiries for graduate admissions is not related to its use for undergraduate admissions.
Alternative hypothesis #6d: The use of electronic admission inquiries for graduate admissions is related to its use for undergraduate admissions.

Null hypothesis #6d was rejected because the use of electronic inquiries for graduate admissions is related to its use for undergraduate admissions, as shown by using the Chi-square corrected for continuity, $(1, \underline{N}= 78) = 5.98, \underline{p} < .10$.

Downloadable Applications

Seventy-three percent of the Web sites that were sampled allowed prospective students to download, complete and mail the undergraduate application. This group was composed of 56% public and 44% private institutions. The percentage of Web sites that allow the download of the application for graduate admissions was 11% lower than for undergraduate admissions. This group was comprised of an equal number of public and private institutions. Table 20 shows the data by institutional control.

Research hypotheses #6e, #6f, and #6g examined whether the use of Web sites as strategic resources in administration was related to institutional control. More specifically, the null and alternative hypotheses stated:

Null hypothesis #6e: The use of downloadable applications for undergraduate admissions is not related to institutional control.
Alternative hypothesis #6e: The use of downloadable applications for undergraduate admissions is related to institutional control.

Null hypothesis #6f: The use of downloadable applications for graduate admissions is not related to institutional control.
Alternative hypothesis #6f: The use of downloadable applications for graduate admissions is related to institutional control.

Null hypothesis #6g: The concurrent use of downloadable applications for both undergraduate and graduate admissions is not related to institutional control.
Alternative hypothesis #6g: The concurrent use of downloadable and graduate applications for both undergraduate and graduate admissions is related to institutional control.

Differences between public and private institutions in the use of downloadable applications for undergraduate, graduate or concurrently for both levels were not statistically significant, as shown by using the Chi-square corrected for continuity, (1, $\underline{N}$= 78) = .13, >. 99, and .11, $\underline{p}$ > .10, respectively. Thus, null hypotheses #6e, #6f, and #6g were not rejected. However, differences between public and private institutions in the use of downloadable applications for undergraduate admissions and concurrently for both levels were close to statistical significance.

Table 20

Percentages for Web Sites with Downloadable Applications by Institutional Control (N = 78)

Control	Undergraduate		Graduate		Both	
	%	$\underline{n}$	%	$\underline{n}$	%	$\underline{n}$
Public	82	32	62	24	59	23
Private	64	25	62	24	39	15
Combined	73	57	62	48	49	38
χ^2	2.35		0		2.51	

Thirty-eight Web sites, or 49% of the institutions sampled, had the functionality for both undergraduate and graduate applications. This group was composed of 60% public and 40% private institutions.

Research hypotheses #6h examined the relationship between the concurrent use of downloadable applications for both undergraduate and graduate admissions. The corresponding null and alternative hypotheses stated:

> Null hypothesis #6h: The use of downloadable applications for graduate admissions is not related to its use for undergraduate admissions.
> Alternative hypothesis #6h: The use of downloadable applications for graduate admissions is related to its use for undergraduate admissions.

Null hypothesis 6h was not rejected because the use of downloadable applications for graduate admissions was not related to its use for undergraduate admissions, as shown by using the Chi-square corrected for continuity, $(1, \underline{N} = 78) = 1.62$, $\underline{p} > .10$.

Online Applications

Seventy-seven percent of the Web sites permit students to complete and transmit the undergraduate application electronically. This group was composed of 53% public and 47% private institutions. The percentage of Web sites with electronic applications for graduate admissions was 31% lower than for undergraduate admissions. This group was comprised of 67% public and 33% private institutions. Nearly half of the Web sites sampled feature online applications for both undergraduate and graduate admissions. Research hypotheses #6I, #6j, and #6k examined whether the functionality of online applications was related to institutional control. The corresponding null and alternative hypotheses stated:

> Null hypothesis #6i: The use of online applications for undergraduate admissions is not related to institutional control.
> Alternative hypothesis #6i: The use of online applications for undergraduate admissions is related to institutional control.

Null hypothesis #6j: The use of online applications for graduate admissions is not related to institutional control.
Alternative hypothesis #6j: The use of online applications for graduate admissions is related to institutional control.

Null hypothesis #6k: The use of online applications for undergraduate and graduate admissions is not related to institutional control.
Alternative hypothesis #6k: The use of online applications for undergraduate and graduate admissions is related to institutional control.

As shown in Table 21, null hypotheses #6j and #6k were rejected because differences

between public and private institutions in the use of online applications for graduate

admissions and concurrently for both levels were statistically significant.

Table 21

Percentages for Web Sites with Online Applications by Institutional Control (N=78)

Control	Undergraduate		Graduate		Both	
	%	n	%	n	%	n
Public	82	32	62	24	49	19
Private	72	28	31	12	23	10
Combined	77	60	46	36	36	29
χ^2	.65		6.24*		4.51*	

Note. The Chi-square is corrected for continuity. *p < .10.

Research hypotheses #6l examined the relationship between the concurrent use of

online applications for both undergraduate and graduate admissions. The corresponding

null and alternative hypotheses stated:

Null hypothesis #6l: The use of online applications for graduate admissions is not related to its use for undergraduate admissions.
Alternative hypothesis #6l: The use of online applications for graduate admissions is related to its use for undergraduate admissions.

Null hypothesis #6l was not rejected because the concurrent use of online applications for graduate admissions was not related to its use for undergraduate admissions, as shown by using the Chi-square corrected for continuity, $(1, \underline{N} = 78) = 0, \underline{p} > .10$.

The Web sites that were sampled offered two ways for applying online: through the institution or via a third party. There were five third-party providers of online admissions: Embark, UXAP, College Link, College Net/Apply Web, and Apply Yourself. At the undergraduate level, most institutions (89%) provided one method. Five percent of the institutions sampled provided two methods. Four percent of the institutions used three methods, and the remaining 2% of the universities provided four ways for online applications

A substantial majority of institutions (77%) use electronic applications for undergraduate admissions. A plurality of the institutions (46%) uses them for graduate admissions. As Table 21 demonstrates, for both levels, the percentage of public institutions with their own online applications was greater than for private institutions. The pattern was reversed for the use of third party online applications. Private institutions outnumbered public ones in the use of proprietary online applications for undergraduate and graduate admissions. The only exception was the use of College Net as an application method for undergraduate admissions via the Web.

Research hypotheses #6m examined whether the type of online application used is related to institutional control. The corresponding null and alternative hypotheses stated:

Null hypothesis #6m: The use of in-house or proprietary online applications is not related to institutional control.
Alternative hypothesis #6m: The use of in-house or proprietary online applications is related to institutional control.

As Table 22 shows, null hypothesis #6m was rejected because the use of in-house online applications for undergraduate and graduate admissions was related to institutional control. Also, the use of Embark for undergraduate online admissions was related to institutional control.

Table 22

Percentages for Web Sites with Online Applications by Institutional Control

Online applications	Public		Private		Combined		χ^2
	%	n	%	n	%	n	
Undergraduate (N = 60)							
Own	72	23	32	9	53	32	7.94*
Embark	3	2	28	17	32	19	18.03*
College Net	2	19	17	11	19	15	.26
College Link	6	2	11	3	8	5	.02
Apply Yourself	0	0	4	1	2	1	.01
UXAP	0	0	4	2	2	1	.01
Graduate (N = 36)							
Own	83	20	50	6	72	26	4.43*
Embark	4	1	17	2	8	3	1.63
College Net	8	2	17	2	11	4	.56
College Link	--	--	--	--	--	--	--
Apply Yourself	4	1	17	2	18	3	1.63
UXAP	--	--	--	--	--	--	--

Note. Categories are not mutually exclusive. *p < .10. Fisher exact test was used for online graduate applications. Dashes indicate the percentage or Chi-square was not estimated.

<u>Research Question #7: Do institutions that aligned information technology to</u>

<u>academic strategy use Web sites as strategic resources in teaching?</u>

Institutions that aligned information technology to academic strategy use Web

sites as strategic resources in teaching. This was evidenced by (a) the use of Web

courseware in institutions that aligned academic and information technology missions,

and (b) the relationship between references to teaching in the content of information

technology missions and the use of Web courseware.

North Carolina State University and the University of Iowa, which are both

public, were the only institutions occupying a strategic position in the <u>Strategic Grid</u>.

However, only the University of Iowa uses Web courseware. Research hypotheses #7a

examined whether the alignment of mission is related to the use of information

technology in teaching. Specifically, the null and alternate hypotheses stated:

> Null hypothesis #7a: The use of Web courseware is not related to the alignment of
> academic and information technology missions.
> Alternative hypothesis #7a: The use of Web courseware is related to the
> alignment of academic and information technology missions.

Null hypothesis #7a was not rejected because differences in the relation between the use

of Web courseware and the level of the alignment of their academic and information

missions were not statistically significant, as shown by using the Chi-square corrected for

continuity $(1, \underline{N} = 78) = .0$, $\underline{p} > .10$.

Eighty-nine percent of the information technology mission statements contained

references to teaching. However, almost three-fourths (73%) of the information

technology missions corresponded to institutions that use Web courseware. A majority of

these mission statements (58%) were from public institutions.

Research hypotheses #7b examined whether the alignment of information

missions with instruction is related to the use of information technology in teaching.

Specifically, the null and alternate hypotheses stated:

Null hypothesis #7b: The use of Web courseware is not related to the alignment of information technology missions with instruction.
Alternative hypothesis #7b: The use of Web courseware is related to the alignment of information technology missions with instruction.

Null hypothesis #7b was not rejected because the relation between the use of Web

courseware and the alignment of information technology missions with instruction were

not statistically significant, as shown by using the Chi-square $(1, \underline{N} = 33) = 1.89$, Fisher

exact $\underline{p} > .10$.

Research Question #8: Do institutions that aligned information technology with

academic strategy use Web sites as strategic resources in research?

Institutions that aligned information technology with academic strategy use Web

sites as strategic resources in research. This was evidenced by (a) the use of online

research databases in institutions that aligned academic and information technology

missions, and (b) the relationship between references to research in the content of

information technology missions and the use of online research databases. North Carolina

State University and the University of Iowa, the two public institutions with both a

technological mission and a strategic information technology mission, used online

research databases. On the other hand, 83% of the information technology mission

statements contained references to research. However, a totality of the information

technology missions corresponded to institutions that use online research databases. Half

of these mission statements were from public institutions.

The eighth research question examined whether the use of Web sites as strategic resources in research is related to (a) the alignment of academic and information technology missions, or (b) the alignment of information missions to scholarship. More specifically, the null hypothesis and its corresponding alternative hypotheses stated:

> Null hypothesis #8a: The availability of online research databases in Web sites is not related to the alignment of academic and information missions.
> Alternative hypothesis #8a: The availability of online research databases in Web sites is related to the alignment of academic and information missions.
>
> Null hypothesis #8b: The availability of online research databases in Web sites is not related to the alignment of information missions to scholarship.
> Alternative hypothesis #8b: The availability of online research databases in Web sites is related to the alignment of information missions to scholarship.

Since all institutions that were sampled provided online access to research databases via the Web, availability of online research databases is not related to the alignment of academic and information missions or the alignment of information missions to scholarship. Therefore, null hypothesis #8a and #8b were not rejected.

Research Question #9: Do institutions that aligned information technology to academic strategy use Web sites as strategic resources in administration?

Institutions that aligned information technology to academic strategy use Web sites as strategic resources in administration. This was evidenced by (a) the use of electronic inquiries, downloadable applications, and online databases in institutions that aligned academic and information technology missions, and (b) the relationship between references to administration in the content of information technology missions and the use of electronic inquiries, downloadable applications, and online applications. North Carolina State University and the University of Iowa, which are both public, were the

only institutions in the strategic quadrant of the <u>Strategic Grid</u>. The Web sites of both universities have electronic inquiries and downloadable applications for undergraduate and graduate admissions. While both Web sites featured electronic applications for undergraduate admissions, only North Carolina State University has a graduate electronic application.

Research hypotheses #9a examined whether the use of Web sites as a strategic resource in management was related to the alignment of academic and information missions. More specifically, the null hypothesis and its corresponding alternative hypotheses stated:

> Null hypothesis #9a: The use of electronic inquiries, downloadable applications, or online applications is not related to the alignment of academic and information missions.
> Alternative hypothesis #9a: The use of electronic inquiries, downloadable applications, or online applications is related to the alignment of academic and information missions.

Null hypothesis #9a was not rejected, as shown in Table 23.

Table 23

Relationship between Alignment of Academic and Information Technology Missions
and Administrative Uses of the Web for Admissions (N = 78)

	Administrative use		
	Electronic inquiries	Downloadable applications	Online applications
	Undergraduate		
%	3	3	3
n	2	2	2
χ^2	.01	.01	.00
	Graduate		
%	3	3	1
n	2	2	1
χ^2	.18	.16	.00
	Both		
%	2	2	1
n	3	3	1
χ^2	.51	.56	.00

Note. Categories are not mutually exclusive. Chi-square corrected
for continuity was used for all categories.

Seventy-two percent of the information technology mission statements contained references to administration. Table 24 shows by institutional control the percentage of institutions with information missions that make references to administrations that use electronic inquiries, downloadable applications, or online applications. The majority of these mission statements were from public institutions: 52 % for undergraduate electronic inquiries; 64% for graduate electronic inquiries; 69% for undergraduate downloadable applications; 78% for graduate downloadable applications; 58% for undergraduate online applications; and 78% for graduate online applications.

Research hypotheses #9b, #9c, and #9d examined whether the use of Web sites as a strategic resource in management was related to the alignment of information missions to administration. More specifically, the null hypothesis and its corresponding alternative hypotheses stated:

> Null hypothesis #9b: The use of electronic inquiries is not related to the alignment of information missions to administration.
> Alternative hypothesis #9b: The use of electronic inquiries is related to the alignment of information missions to administration.
>
> Null hypothesis #9c: The use of downloadable applications is not related to the alignment of information missions to administration.
> Alternative hypothesis #9c: The use of downloadable applications is related to the alignment of information missions to administration.
>
> Null hypothesis #9d: The use of online applications is not related to the alignment of information missions to administration.
> Alternative hypothesis #9d: The use of online applications is related to the alignment of information missions to administration.

As Table 24 shows, the use of electronic inquiries or online applications was not related to the alignment of academic and information missions. However, only the use of

downloadable applications for graduate admissions was related to the alignment of

information missions to administration. Thus, null hypothesis #9c was rejected. The

concurrent use of downloadable applications for both undergraduate and graduate

admissions was close to significant ($p = .14$).

Table 24

Relationship between References to Administration in the Content of Information

Technology Missions and the Use of Web Sites for Admissions (N = 33)

	Administrative use		
	Electronic inquiries	Downloadable applications	Online applications
	Undergraduate		
%	52	49	58
$\underline{n}$	17	16	19
χ^2	1.8	1.5	.14
	Graduate		
%	42	27	27
$\underline{n}$	14	9	9
χ^2	0	7.51*	.06
	Both		
%	36	24	24
$\underline{n}$	12	8	8
χ^2	.97	6.07	0

Note. Categories are not mutually exclusive. *$\underline{p}$ < .10. Fisher exact

test was used for all categories except for "Downloadable

applications for both undergraduate and graduate admissions."

Alignment in Technology Plans

Twenty-seven percent of the Web sites contained technology plans. Sixty-two

percent of these technology plans were from public institutions. Table 25 presents the

data by institutional control. The majority of these plans (71%) aligned information

technology to the institutional mission or strategic planning process. Almost three-fourths

of the aligned plans (73%) were from public institutions. Table 26 presents the results by

institutional control. Alignment in technology plans was not related to institutional

control, as shown by using the Chi-square (1, $\underline{N}$ = 21) = 2.9, Fisher exact $\underline{p}$ > .10). Also,

the inclusion of technology plans in Web sites did not vary as a function of institutional

control, as shown by using the Chi-square corrected by continuity (1, $\underline{N}$ = 78) = 1.04,

continuity corrected $\underline{p}$ > .10.

Table 25

Percentages for Presence of Technology Plans by Institutional Control (N=78)

	With		Without	
Control	%	$\underline{n}$	%	$\underline{n}$
Public	33	13	67	26
Private	21	8	79	31
Combined	27	21	73	57

Table 26

Percentage for Alignment in Technology Plans by Institutional Control (N=21)

Control	With		Without	
	%	n	%	n
Public	85	11	15	2
Private	50	4	50	4
Combined	71	15	29	6

A majority of technology plans (71%) were aligned to institutional missions. One-fifth of

the plans made alignments to strategic plans and one-third to both. The information

technology strategic plan of the University of California illustrates this type of alignment:

> The Information Technology Strategic Plan (ITSP) is an institution-wide effort to
> develop a vision and set of objectives for information technology (IT) at UCLA
> and identify the mechanisms and processes required to achieve that vision. The
> IT Strategic Plan is intended to align UCLA's services and support with the
> University's instruction, research and public service mission and administrative
> processes. It should promote the cost-effective deployment and management of
> appropriate IT in support of faculty, student and staff. (TP 72, 1999)

One-fifth of the plans made alignments to strategic plans and one-third to both. The

technology plan of the University of Missouri represents alignment to an institution's

strategic plan:

> Every planning effort contains three elements: a vision of the targeted endpoint,
> strategies for getting there, and proposed actions or objectives to make it happen.
> It bears repeating that the goals of the planning activities outlined in this master
> plan are synchronized with MU *Mission, Goals, and Objectives: Implementation
> Strategies*. Every IAT [Information and Access Technology] Services Strategic
> theme and project is linked directly to these goals. (TP 59, 1999)

Sixty percent of the plans recognized the role of information technology as a source of

competitive advantage. Coopers and Lybrand Consulting developed the Information

Technology Strategic Plan of the University of California at Los Angeles. This plan's

environmental scan stresses the strategic role of information technology in a competitive

environment:

> Successful planning, implementation and innovation of IT has become a
> competitive necessity for higher education. Faculty, students and staff are
> expecting and demanding a level of unprecedented access to IT capabilities and
> support. To remain competitive and maintain academic quality, UCLA must make
> necessary investments in IT and ensure effective management and delivery of IT
> services and resources. (TP 72, 1999)

Alignment as a Strategic Goal

Alignment in a technology plan is substantially evident by Brown University's *IT*

2000: Information Technology Plan for Computing and Information Services. This was

the only institution that had technology alignment as a goal along with distributed

computing, network infrastructure, campus wide services, support and services, and

information access. The institution defines technology alignment as "link[ing]

Information Technology with the University's strategic planning process to support the

President's strategic priorities" (TP 2, 1999). Their plan identifies 23 potential and

existing areas of linkages between information technology and the institution's five

strategic goals, as illustrated by Table 27.

Table 27

Potential and Existing Relationships of IT to Brown Strategic Goals (TP 2, 1999)

Strategic Goal	Possible IT Linkages
1. Revitalize the undergraduate experience	• Provide IT support for faculty • Establish more comprehensive/coherent program for encouraging/facilitating Web-based course materials • Restructure program for supporting multi-media classrooms • Facilitate student Web pages • Establish stronger academic IT advisory/governance structure • Support (via new Registrar's system) student advisement • Simplify administrative procedures for students (registration, student accounts, address changes, calendaring, admission, financial aid, room scheduling) • Enhance electronic access to information and library resources • Enhance network services and remote or wireless access
2. Reinvent graduate education	• Same as Goal 1 plus: • Create broader infrastructure and staff support for research computing • Implement a better system for recruiting top-notch graduate students • Provide training on role and use of IT in instruction
3. Enhance and integrate School of Medicine education and research	• Consider IAIMS project to support enhancement of relationships with affiliated hospitals and clinics • Evaluate Medical School computing department; reduce duplication of central computing services; strengthen computing unique to Medical School • Investigate IT components of other programmatic goals
4. Restructure economic models	• Assess potential of certain IT innovations as capital fund raising opportunities • Investigate potential for IT to enable some productivity increases and/or consolidation of services • Establish multi-year capital budgeting process for major IT projects and initiatives • Perform goal-based budgeting, tying resource allocation to overarching IT goals • Adopt project-costing discipline that requires project proposals to include realistic projections of implementation, operation, and renewal costs
5. Reinvigorate commitment to community and public purpose	• Consider roles for IT in supporting or enabling community and outreach programs • Support K-12 network services

These linkage areas targeted the traditional functions of teaching, research, and service.

They also aligned information to technology in teaching, research, and administration

through the strategic use of the Web. The information technology planners at Brown

recognize two important conditions for maintaining alignment:

> Computing and Information Services should be engaged as part of the
> planning efforts for each of the strategic planning teams. This would help to
> assure adequate linkage between broad university goals and IT plans as well as
> inform the university planning process on how IT might be used to as a tool to
> achieve those goals.
> As part of the strategic planning process, the University should articulate
> guiding principles for information technology for 2000 and beyond. The faculty
> Advisory Committee on Computing established in 1988 six principles for
> computing (Appendix C). These principles have, in fact, guided computing
> directions on an ongoing basis since then. A new or updated set of guiding
> principles would give the University a framework for thinking about and
> evaluating individual projects, budgets, staffing, and all aspects of managing and
> operating Brown's IT enterprise. (TP 2, 1999)

The Guiding Principles for Computing at Brown were developed by the Faculty Advising

Committee on Computing and adopted by the Computing and Information Services

unit/division. Two of the guiding principles related to alignment. They stated that their

computing strategy "must be consistent with the institution's role as a research university

and as a liberal arts college" and that "the role of computing in instruction, research, and

administration must be continually assessed" (TP 2, 1999).

The following chapter summarizes the findings and discusses their implications.

The relationship of the study to previous research is presented. The chapter concludes by

identifying areas of further research.

Chapter 5: Summary and Discussion

Introduction

This final chapter of the dissertation synthesizes the investigation conducted to examine the alignment of academic and information technology strategies and the strategic uses of information technology by research universities. The first section of the chapter restates the research problem and design. This is followed by the discussion of the major findings. Next, the relationship of the current study to previous research, a discussion of statistical tests conducted, and suggestions for additional research are presented.

Overview of the Study

The study of the strategy-technology connection dominated business literature in the early 1980s by focusing on explanatory models that conceptualized the use of information for a competitive advantage. Two of these models—the Strategic Grid and the Strategic Alignment Model—have been applied to the academic world. McFarlan (1988) offered an interpretation of his Strategic Grid for higher education. The author proposed that the strategic impact of information technology applications determines, over time, the positioning of a university as a support, turnaround, factory, or strategic organization. On the other hand, Moran (1999) used the Strategic Alignment Model developed by Henderson and Venkatraman (1993,1999) to call for integration and consistency between the institutional mission and the technology plan.

The theoretical application of these models revealed the need for an empirical investigation of the alignment of academic and information technology strategies and the strategic uses of information technology in teaching, research, and administration. These areas of inquiry were studied through the content analysis of a random sample of Web sites belonging to 78 research universities. This research method allowed for the study of the symbolic representation of academic and information technology through the evaluation of mission statements and technology plans. It also permitted an examination of the concrete manifestation of the use of technology in teaching, research, and administration by focusing on the use of Web courseware, online databases, electronic inquiries, downloadable applications, and online applications for undergraduate and graduate admissions.

A pilot study was conducted with a random sample of 13 institutions to ascertain the data collection, reduction, and analysis prior to conducting the full study. An evolving coding scheme was used to develop the fixed coding scheme employed in the full study. This entailed creating a preliminary list of ten content variables and downloading Web pages relevant to them as text. Using HyperResearch, a content analysis software application, the text was condensed using emergent coding. At the end of the pilot study, 40 content variables were created. They were used to code the 1627 Web pages downloaded from the Web sites of a random sample of 78 research universities for the full study. Next, the frequencies of the emergent codes were calculated. The Chi-square test of independence, a non-parametric statistic, was used to test the null hypothesis of no

difference between public and private institutions or of no relation between variables. An overview of the results is presented in the following sections.

The Alignment of Academic and Information Technology Strategies

This investigation examined two forms of alignments: (a) the alignment of information technology missions with institutional missions, and (b) the alignment of technology plans with institutional missions or strategic plans. The findings suggest that the integration of academic and information strategies was higher in technology plans than in mission statements.

Alignment in mission statements

Although seventy-three percent of the institutions sampled in the study included their mission statements in their Web sites, only 14% of the mission statements contained references to technology or computer resources. These mission statements referred to technology as an outcome, resource, area of study, or context. On the other hand, less than half of the Web sites (42%) examined contained information technology mission statements. While the majority of these mission statements made references to teaching, research, and administration, only 39% had a strategic content.

Cross-references between the content of academic and information mission statements yielded four possible combinations. Each combination corresponded to a quadrant in the Strategic Grid. This analysis revealed that most institutions (56%) had a traditional mission and a supportive mission and, therefore, occupied a support position. In contrast, a minority of the institutions (7%) had a technological mission and strategic information technology mission. These institutions occupied a strategic position,

suggesting a high level of strategic integration. They were North Carolina State University and the University of Iowa. An interesting finding of this research was that these two institutions also had high levels of use of the Web for teaching, research, and administration.

<u>Alignment in technology plans</u>

Twenty-seven percent of the Web sites contained technology plans. Almost three-fourths of the technology plans that appeared in Web sites was aligned to institutional missions or strategic plans. This finding confirms the results of the Seventh National Survey of Desktop Computing and Information Technology in Higher Education that ranked clarifying technology goals and plans as a top strategic issue by 1999 because:

> External groups will push campuses to develop a strategic plan for technology: trustees, regional accrediting associations, and professional associations will require campus officials to explain their vision for information technology in the context of institutional mission and clientele. (Green, 1996, p. 4)

Although the inclusion of technology plans in Web sites was low (27%), the content of these plans suggests that research universities are planning strategically for technology and have a vision of technology as a strategic tool vis-à-vis an operational one.

Most technology plans (71%) were aligned with institutional missions or strategic planning. This finding suggests that information technology units are harmonizing their operations with institutional priorities and that technology is becoming a driver for strategy formulation and implementation. Technology alignment as a strategic goal appeared only in the technology plan of one institution – Brown University. It is important to point out that this institution's interpretation of alignment was congruent to the <u>Strategic Alignment Model</u>. The findings of the research suggest that technology

alignment will increasingly emerge as a strategic priority for research universities. They also indicate that technology alignment will be related to the use of the Web.

<p style="text-align:center"><u>The Strategic Uses of Information Technology</u></p>

This investigation examined the use of Web sites by research universities as a concrete manifestation of an information strategy. The findings overwhelmingly suggest that universities are using the Web strategically. A plurality of research universities used Web sites for teaching, research, and administration. The percentages ranged from 100% for online databases to 46% for online graduate applications. Table 28 summarizes the results.

In teaching, a remarkable proportion of institutions (74%) used Web courseware. The majority of these institutions offered their faculty one method and used a commercial interface. The most common commercial interface used was WebCT. In administration, the strategic use of Web sites for admissions ranged from 77% for undergraduate online applications to 46% for graduate online applications. In terms of the use of electronic inquiries, downloadable applications, and online admissions, the findings of this investigation suggest that the use of these functionalities is more common for undergraduate admissions than for graduate admissions.

The research also revealed variations of institutional control in the use of proprietary Web courseware and online applications. As Table 29 shows, public institutions outnumbered private ones in the use of commercial interfaces for Web courseware. The pattern was reversed for the use of proprietary applications for both undergraduate and graduate admissions.

Table 28

Summary of Percentages for Use of Web Sites for Research, Teaching, and
Administration by Institutional Control (N = 78)

	Public		Private		Combined	
	%	n	%	n	%	n
Online databases	100	78	100	78	100	78
Web courseware	82	32	67	26	74	58
Electronic inquiries						
Undergraduate	69	27	74	29	72	56
Graduate	56	22	64	25	60	47
Downloadable applications						
Undergraduate	82	32	64	25	73	57
Graduate	62	24	62	24	62	48
Online applications						
Undergraduate	82	32	72	28	77	60
Graduate	62	24	31	12	46	36

Table 29

Use of Proprietary Web Courseware and Online Applications by Institutional Control

Proprietary software	Public		Private		Combined	
	%	n	%	n	%	n
Web courseware	59	19	41	13	55	32
Undergraduate online application	28	17	68	41	47	58
Graduate online application	17	6	47	17	28	23

Relationship of the current study to previous research

The Claremont Graduate University and Columbia University have conducted

research related to the content of the Web sites of the target population of this

investigation. Columbia's Institute of Learning Technologies (1997) found that 89% of

research universities had Web sites. In terms of the content, 79% provided library access

and 18% included admissions information. Within our research, all institutions had

operational Web sites. Also, each of the Web sites sampled provided access to library

services and included admissions information. The two-year gap in the collection of data

between both studies is a plausible explanation for the increases in percentages across all

categories of our research.

Since 1990, the Campus Computing Project at the Claremont Graduate School has

conducted the most comprehensive study of information technology in higher education.

The results of their *Tenth National Survey of Computing and Information Technology in*

Higher Education (Green, 1999a) provided a basis for comparing the findings of our

investigation on the strategic uses of information technology for teaching, research, and management. Data for this study were collected in June 1999 and focused on the use of Web sites for undergraduate admissions applications, online courses, and reference resources.

As Table 30 shows, in both studies a majority institutions use Web sites for research, teaching, and administration. The percentages for use of Web sites were comparable across categories and levels. Our research shows increases in use for research and teaching. A plausible explanation for this growth is the six-month gap between studies. Differences between both studies were greater in the area of teaching. For most categories, public institutions outnumbered private ones.

Table 30

Comparison with Previous Research

	Control		
	Public	Private	Combined
Data collection	Research		
12/1999	100	100	100
6/1999	90	93	92
	Teaching		
12/1999	82	67	74
6/1999	75	41	58
	Administration		
12/1999	82	72	77
6/1999	85	82	84

Note. Data for this study was collected on 12/1999. The

Campus Computing Project collected their data on 6/1999.

"Research" refers to online research databases in this study and

to journals and reference resources in the Campus Computing

Project. "Teaching" refers to Web courseware in this study and

to online courses in the Campus Computing Project.

"Administration" refers to undergraduate online applications in

both studies. N = 78 for this study. N = 530 for the Campus

Computing Project.

The Chi-square Tests of Independence

The Chi-square test of independence was used to test the null hypotheses of no difference between public and private institutions or of no relation between two variables.

Differences by institutional control

This research found that (a) the content of academic and information technology; (b) cross-references between the content of academic and information technology missions; (c) use of Web courseware; and (d) availability of online research databases in Web sites were not related to institutional control. However, differences between public and private institutions were statistically significant in the use of CourseInfo as Web courseware software and the use of Web sites for (a) graduate online applications; (b) in-house online undergraduate applications; (c) in-house graduate online applications; and (d) Embark online undergraduate applications. Table 31 shows that public institutions outnumbered private ones across categories. The only exception was the use of Embark online applications for undergraduate admissions, where private institutions outnumbered public institutions in use. The same pattern was observed for another proprietary application – CourseInfo.

Table 31

Summary for Statistical Significance in Chi-square Tests of Independence (N = 78)

	Online applications			
	Graduate	In-house undergraduate	In-house graduate	Embark undergraduate
Control				
Public	62	72	83	3
Private	31	32	50	28
Combined	46	53	72	32
$\chi2$	6.24*	7.94*	4.43*	18.03*

Note. *$p < .10$.

Relationship between variables

The Chi-square test of independence was also used to test the null hypothesis of no relation between variables. Specifically, two relationships were examined: (a) the relationship between the use of electronic inquiries, downloadable applications, and online applications for undergraduate admissions and their use for graduate admissions, and (b) the relationship between alignment and the strategic uses of Web sites. The results of this investigation confirmed that the use of electronic inquiries and online inquires for graduate admissions is related to its use for undergraduate admissions. On the other hand, the relationships between alignment and the strategic uses of Web sites in teaching and research were not statistically significant. However, alignment was related to the use of downloadable applications for graduate admissions.

Implications of the Results

The findings of this research are significant for theory and practice. For theory, the results have three major implications. First, the empirical applicability of the <u>Strategic Alignment Model</u> and the <u>Strategic Grid</u> validates the interpretations for higher education made of these models by McFarlan (1988) and Moran (1999). It is important to underscore that, although the presence of strategic alignment as a goal in the technology plans reviewed was minimal, the interpretation was consonant with its theoretical conceptualization.

The second major theoretical implication of the study is that the examination of Web-based information strategies represents a fundamental shift in focus from previous research on strategic alignment. The context of the World Wide Web is a new, information-rich, and dynamic environment for the investigation of information strategy formulation and implementation. The Web, as a new archive of information, uncovers new objects through which one can examine the behavior of organizations through content analysis. By examining the use of the Internet by institutions of higher learning, this investigation also opened the door for the examination of information strategies developed for two other domains – intranets and extranets.

In practice, the results have implications for higher education administrators, information technology professionals, and managers in the public and non-profit sectors. The findings illustrate the importance of articulating strategically aligned missions and technology plans. This challenge will increase and become more critical as Web-based applications in teaching, research, and administration are diffused by push or pull

strategies. This research also demonstrated the usefulness of the <u>Strategic Grid</u> as a tool for conducting periodic institutional self-assessments of the integration of academic and technology missions. Finally, the findings of this investigation have implications for professionals in the public sector because, in 1996, strategic alignment became a federal mandate for federal agencies with the passing of the Government Performance and Results Act of 1993 and the Clinger-Cohen Act of 1996 (General Accounting Office, 1997). The interpretations of the <u>Strategic Grid</u> and <u>Strategic Alignment Model</u> that were applied to institutions of higher education can be adopted by both the public and non-profit sectors.

<u>Areas of Further Research</u>

Three major areas of further research emerged from this work. This investigation focused on the alignment of technology plans to institutional missions and strategic plans. One research area that remained uninvestigated was the alignment of institutional strategic plans with information technology. This type of alignment is equally important to the strategic management of information technology in higher education. Future research involving institutional strategic plans should identify how information is linked to institutional goals and objectives pertaining to teaching, research, and administration, as well as the integration between strategic and technology plans.

Our research examined the statistical significance of differences between public and private institutions in (a) the integration of academic and information strategies; (b) the strategic uses of information technology in teaching, research, and administration; and (c) the relationship between both areas. An extension of this research would be to

examine how alignment in research universities is related to other variables, such as the amount of capital or operational expenditures in information technology or Roger's (1983) categorization of organizations as innovators, early adopters, early majority, late majority, or laggards in the diffusion of technology. Such research could be conducted longitudinally.

A final area of further research is the formulation of Web or Internet strategies in higher education. Remarkably, none of the plans examined featured the development of a Web strategy as a goal. As the use of the Internet by universities matures and institutions venture into the strategic uses of intranets and extranets in teaching, research, and administration, this research area will become increasingly important. Focusing on the development of Web strategies in teaching and research will also gain greater importance for Internet2 institutions, which were a substantial majority of the institutions sampled.

Conclusions

Aligning information technology with academic strategy is a determining factor in the strategic positioning of institutions of higher learning. The process involves two deliberate critical processes: (a) formulating academic and information technology missions that bestow a strategic role to information technology; and (b) linking academic and technology planning. For the majority of research universities this implies reassessing mission statements and integrating institutional planning and technology planning. This challenge is greater because advances in technology require shorter planning spans.

Equally essential to remaining competitive is the creation of a Web strategy for teaching, research, and administration. The first step for strategic positioning on the Web, as Cronin (1996) pointed out, is conducting an Internet strategy audit. Our research provides a framework for such an audit. Its use will lead universities to formulate an aligned mission for the Web as illustrated by Georgetown University:

> Georgetown is a Catholic and Jesuit University committed to a tradition of liberal and professional education, research, and patient care, dedicated to the service of others, extending the limits of knowledge, building a sense of community and responsibility, preparing citizens and leaders to serve Washington, the Nation, and the International Community. The University fosters and supports Internet development as it contributes to these goals and facilitates the functioning of the institution.
>
> Georgetown University recognizes the Internet and Web as powerful tools for advancing teaching, learning, and research in today's networked, global society. The underlying interactive technology of the Web can promote greater student participation in learning and open up new possibilities for teaching and scholarly communications. Georgetown also encourages the use of Internet and Web technology for creating a more efficient and effective environment for the University's administrative, business, and clinical operations and alumni communications. As Internet and Web technology grows and matures, Georgetown will continue to encourage the implementation of the best available technology for supporting all of its distinctive missions throughout our campuses, schools, and individual disciplines. (WP 12, 1999)

In the end, the essence of the Research University—advancing pedagogy and research—will be increasingly related to an institution's capacity for Web-based alignment.

Appendix A: Institutions in Sampling Frame

Research Universities

Public Universities

Arizona State University
Auburn University
Clemson University
Colorado State University
Florida State University
Georgia Institute of Technology
Indiana University at Bloomington
Iowa State University
Kansas State University
Kent State University, Main Campus
Louisiana State University and Agricultural and Mechanical College
Michigan State University
Mississippi State University
New Mexico State University, Main Campus
North Carolina State University
Ohio State University, Main Campus
Ohio University, Main Campus
Oklahoma State University, Main Campus
Oregon State University
Pennsylvania State University, Main Campus
Purdue University, Main Campus
Rutgers, The State University of New Jersey at New Brunswick Campus
Southern Illinois University at Carbondale
State University of New York at Albany
State University of New York at Buffalo
State University of New York at Stony Brook
Temple University
Texas A&M University
Texas Tech University
University of California at Santa Cruz
University of Connecticut
University of Alabama at Birmingham
University of Arizona
University of Arkansas, Main Campus
University of California at Berkeley
University of California at Davis
University of California at Irvine
University of California at Los Angeles
University of California at Riverside

University of California at San Diego
University of California at San Francisco
University of California at Santa Barbara
University of Cincinnati, Main Campus
University of Colorado at Boulder
University of Delaware
University of Florida
University of Georgia
University of Hawaii at Manoa
University of Houston
University of Idaho
University of Illinois at Chicago
University of Illinois at Urbana - Champaign
University of Iowa
University of Kansas, Main Campus
University of Kentucky
University of Maryland College Park
University of Massachusetts at Amherst
University of Michigan at Ann Arbor
University of Minnesota at Twin Cities
University of Mississippi
University of Missouri at Columbia
University Nebraska at Lincoln
University of New Mexico, Main Campus
University of North Carolina at Chapel Hill
University of Oklahoma, Norman Campus
University of Oregon
University of Pittsburgh, Pittsburgh Campus
University of Rhode Island
University of South Carolina at Columbia
University of South Florida
University of Tennessee at Knoxville
University of Texas at Austin
University of Utah
University of Vermont
University of Virginia
University of Washington
University of Wisconsin at Madison
University of Wisconsin at Milwaukee
University of Wyoming
Utah State University
Virginia Commonwealth University
Virginia Polytechnic Institute and State University
Washington State University
Wayne State University
West Virginia University

Private Universities

Brandeis University
Brown University
Boston University
Brigham Young University
California Institute of Technology
Carnegie Mellon University
Case Western Reserve University
University of Chicago
Columbia University in the City of New York
Cornell University
Duke University
Emory University
Georgetown University
George Washington University
Harvard University
Howard University
Johns Hopkins University
Lehigh University
University of Miami
Massachusetts Institute of Technology
Northeastern University
Northwestern University
University of Notre Dame
New York University
Princeton University
Rice University
University of Rochester
Rockefeller University
Rensselaer Polytechnic Institute
University of Southern California
Saint Louis University
Stanford University
Syracuse University, Main Campus
Tufts University
Tulane University
University of Pennsylvania
Vanderbilt University
Washington University
Yale University
Yeshiva University

Appendix B: Private Institutions in Sample

Reference		Institution	URL
HP	1	Brandeis University	http:/www. brandeis.edu
HP	2	Brown University	http:/www.brown.edu
HP	3	Boston University	http:/www.bu.edu
HP	4	Brigham Young University	http:/www.byu.edu
HP	5	California Institute of Technology	http:/www.caltech.edu
HP	6	Case Western Reserve University	http:/www.cwru.edu
HP	7	University of Chicago	http:/www.uchicago.edu
HP	8	Columbia University	http:/www.columbia.edu
HP	9	Cornell University	http:/www.cornell.edu
HP	10	Duke University	http:/www.duke.edu
HP	11	Emory University	http:/www.emory.edu
HP	12	Georgetown University	http:/www.georgetown.edu
HP	13	George Washington University	http:/www.gwu.edu
HP	14	Harvard University	http:/www.harvard.edu
HP	15	Howard University	http:/www.howard.edu
HP	16	Johns Hopkins University	http:/www.jhu.edu
HP	17	Lehigh University	http:/www.lehigh.edu
HP	18	University of Miami	http:/www.miami.edu
HP	19	Massachusetts Institute of Technology	http:/www.mit.edu
HP	20	Northeastern University	http:/www.northeastern.edu
HP	21	Northwestern University	http:/www.nwu.edu
HP	22	University of Notre Dame	http:/www.nd.edu
HP	23	New York University	http:/www.nyu.edu
HP	24	Princeton University	http:/www.princeton.edu
HP	25	Rice University	http:/www.rice.edu
HP	26	University of Rochester	http:/www.rochester.edu
HP	27	Rockefeller University	http:/www.rockefeller.edu
HP	28	Rensselaer Polytechnic Institute	http:/www.rpi.edu
HP	29	University of Southern California	http:/www.usc.edu
HP	30	Saint Louis University	http:/www.slu.edu
HP	31	Stanford University	http:/www.stanford.edu
HP	32	Syracuse University	http:/www.syracuse.edu
HP	33	Tufts University	http:/www.tufts.edu
HP	34	Tulane University	http:/www.tulane.edu
HP	35	University of Pennsylvania	http:/www.upenn.edu
HP	36	Vanderbilt University	http:/www.vanderbilt.edu
HP	37	Washington University	http:/www.wustl.edu
HP	38	Yale University	http:/www.yale.edu
HP	39	Yeshiva University	http:/www.yu.edu

Appendix C: Public Institutions in Sample

Reference		Institution	URL
HP	40	University of Alabama at Birmingham	http:/www.uab.edu
HP	41	State University of New York at Albany	http:/www.albany.edu
HP	42	Arizona State University	http:/www.azu.edu
HP	43	State University of New York at Buffalo	http:/www.buffalo.edu
HP	44	University of Colorado at Boulder	http:/www.colorado.edu
HP	45	University of Delaware	http:/www.udel.edu
HP	46	Florida State University	http:/www.fsu.edu
HP	47	University of Georgia	http:/www.uga.edu
HP	48	Georgia Institute of Technology	http:/www.gatech.edu
HP	49	University of Hawaii	http:/www.uhm.hawaii.edu
HP	50	University of Houston	http:/www.uh.edu
HP	51	University of Idaho	http:/www.uidaho.edu
HP	52	University of Illinois at Chicago	http:/www.uic.edu/index.html
HP	53	University of Iowa	http:/www.uiwa.edu
HP	54	Iowa State University	http:/www.iastate.edu
HP	55	University of Kentucky	http:/www.uky.edu
HP	56	Louisiana State University	http:/www.lsu.edu
HP	57	University of Michigan at Ann Arbor	http:/www.umichigan.edu
HP	58	Mississippi State University	http:/www.mstate.edu
HP	59	University of Missouri at Columbia	http:/www.missouri.edu
HP	60	North Carolina State University	http:/www.ncsu.edu
HP	61	University of New Mexico, Main Campus	http:/www.newmexico.com
HP	62	Oklahoma State University, Main Campus	http:/www.pio.okstate.edu
HP	63	Purdue University, Main Campus	http:/www.purdue.edu
HP	64	Rutgers University, The State University of New Jersey at New Brunswick	http:/www.rutgers.edu
HP	65	University of South Carolina at Columbia	http:/www.sc.edu
HP	66	University of South Florida	http:/www.usfweb.edu
HP	67	University of Tennessee at Knoxville	http:/www.utk.edu
HP	68	Texas A&M University	http:/www.tamu.edu
HP	69	University of California at Irvine	http:/www.uci.edu
HP	70	University of California at Riverside	http:/www.ucr.edu
HP	71	University of California at San Diego	http:/www.ucsd.edu
HP	72	University of California at Los Angeles	http:/www.ucla.edu
HP	73	University of Connecticut	http:/www.uconn.edu
HP	74	University of Utah	http:/www.utah.edu
HP	75	University of Virginia	http:/www.virginia.edu
HP	76	Washington State University	http:/www.wsu.edu
HP	77	West Virginia University	http:/www.wvu.edu
HP	78	University of Wyoming	http:/www.uwyo.edu

Appendix D: Data Collection Sheet

URL: _____ . __

Date: _____ **Start:** _____ **End:** _____

Home Page		
Mission		
Admissions		
Undergraduate		
electronic inquiries		
downloadable application		
online application		
Graduate		
electronic inquiries		
downloadable application		
online application		
Library		
IT Mission		
Technology Plan		
Web Courseware		

Appendix E: Data Collection Instructions

1) As data is collected you will keep a chronological journal to record your impressions about the process of data collection and the content of the Web pages.

2) Create a folder for each institution in the disk. All the pages will be saved on this folder.

3) Locate the institution's URL by accessing Yahoo's Complete Listing of Colleges and Universities[1].

4) **Go to the institution's home page.**

    a) Search for the institutional mission statement.
    b) Save the page containing the institutional mission statement. If not found easily, find out if an electronic version of the college catalog is available. Save the page containing the institution's mission statement.

5) **Go to the admissions page.**

6) Link to the undergraduate admissions page. Link to the page containing application information.

    a) Save a page containing references to electronic inquiries.
    b) Save a page containing references to downloadable applications.
    c) Save a page containing references to online applications.

7) Link to the graduate admissions page. Link to the page containing application information.

    a) Save a page containing references to electronic inquiries.
    b) Save a page containing references to downloadable applications.
    c) Save a page containing references to online applications.

8) **Go to the Library home page.**

9) Save a page containing references to online access to research databases.

---

[1] http://dir.yahoo.com/Education/Higher_Education/Colleges_ and_Universities/United_States/ Complete_Listing/

10) Go to the information technology unit home page.

a) Save the page containing its mission statement.
b) Save the technology plan.
c) Browse the information technology pages for evidence of Web courseware (such as WebCT, CourseInfo, or Web Course in a Box).
d) Save a page containing a reference to Web courseware.
e) If you don't find evidence of Web courseware, conduct a search for CourseInfo, WebCT, or Web Course in a Box.
f) If the search is successful, save a page containing reference to that Web courseware.
g) If the search is unsuccessful, browse the academics home page for evidence of Web courseware and save that page.

STEPS AFTER COMPLETING THE DATA COLLECTION FOR AN INSTITUTION:

1. Open folder.
2. Sort files by date.
3. Print window in landscape direction.
4. Rename files.
5. Print window in landscape direction.
6. Verify size of files.
7. Place ~ between pages of those files with more than 16,000 characters.
8. Select all files.
9. Choose get info.
10. Lock all files

Appendix F: Coding Report

_____ REPORT HEADER _____
This Report is on the following codes:
    Strategic IT Mission
_____ (End list of codes)
_____ END OF HEADER _____

The actual report follows:
Case, Code, Frequency, Reference,
NCSU, Strategic IT Mission, 1, char 338 to 2554 of page 1 of Information Technology at NC St,
Source Material:
[*] Office of the Provost
   [*] Information Technology

  * Services   IT MISSION
  * Staff directory
  * Service updates   * Provide leadership to NC State, the UNC system, and the
  * IT Year 2000   state of North Carolina in the design and deployment of
    Project   current and emerging information technologies for
                  learning, teaching, and productivity.
            * Advance the pursuit of excellence in instruction,
             research and service through leadership in the
             application of information technologies and supporting
             expertise.
            * Work in concert with campus units to develop and
             communicate a vision for the broad computing environment
             and provide leadership for charting the direction of this
             vision.
            * Develop and maintain state-of-the-art infrastructure and
             services that empower faculty, students, and staff with
             the technological tools and resources for achieving
             excellence.

GOALS

   * Provide the capability for a diverse student body to
    fully participate in a technologically augmented online
    teaching and learning environment regardless of time or
    location.
   * Appropriately apply new technologies and couple them with
    a strong underlying campus support structure to empower

faculty in the pursuit of opportunities in learning, research and services.

* Elevate service to the campus community by providing campus technical support personnel with opportunities to develop professionally.

[Search] [Help Database] [Provost Home] [NC State Home] [Image

Appendix G: Coding Instructions

This study examined the relationship between academic and information technology strategies and the use of Web sites in administration, research, and teaching. Web pages saved as text contained references to: (a) institutional mission statements; (b) information technology missions statements, (c) technology plans, and (d) the use of Web sites for admissions, online databases, and Web courseware.

Please follow the instructions below to code the content of these Web pages.

Step 1:

1. Read the Dictionary of Categorical Variables.

2. Read the Coding Sheet.

3. Contact the researchers if any definition or item is unclear.

4. Proceed to Step 2.

Step 2:

1. Read each Web page. Please note that the title of each Web page appears in bold on the second line of each page.

2. Use a blue ink pen to underline the words, phrases or paragraphs that correspond to the codes in the Dictionary of Categorical Variables. Write down all the codes that apply next to the word **Code:**

3. If none of the codes apply, write down the word NONE next to the word **Code:**

4. Fill out a coding sheet for each university

Appendix H: Coding Sheet

Coder's Last Name _____ **Date** _____

Institution _____

Circle the number that applies.

A. Content of Mission Statement

    1. Traditional mission

    2. Technological mission

B. Links in home page

    3. To mission statement

    4. To Web courseware

C. Location of mission statement

    5. Stand alone Web page

    6. Fact book

    7. College catalog

    8. Strategic plan

    9. Accreditation site

    10. Faculty or staff handbook

    11. Institutional bylaws

D. Type of information technology mission

    5. Strategic IT mission

    6. Supportive IT mission

E. Content of IT mission

    7. Teaching content in IT mission

    8. Research content in IT mission

    9. Administrative content in IT mission

F. Location of IT mission

    10. Stand alone Web page

    11. Strategic plan

    12. Annual report

    13. Planning document

G. Technology plan

    21. Technology plan

    22. Alignment in technology plan

H. Teaching

23. Own Web courseware

24. WebCT

25. CourseInfo

26. Web Course in a Box

I. Admissions
27. Undergraduate electronic admissions inquiries
28. Undergraduate downloadable application
29. Undergraduate online application
    33. Own online application
    34. Embark
    35. College Net/Apply Web
    36. College Link
    37. Apply Yourself
    38. UXAP
30. Graduate electronic admissions inquiries
31. Graduate downloadable application
32. Graduate online application
    33. Own online application
    34. Embark
    35. College Net/Apply Web
    36. College Link
    37. Apply Yourself
    38. UXAP

J. Research

39. Online research databases

40. Link to Web courseware in library Web site

Appendix I: Dictionary of Category Variables

Emergent coding scheme	Recording unit	Definition
1. Link to mission statement in home page	Word or sentence	Direct link to mission statement in the home page.
2. Link to Web courseware in home page	Word or sentence	Direct link to mission statement in home page.
3. Traditional mission	Theme	Statement of purpose alluding to teaching, research, scholarship or service.
4. Technological mission	Theme	Statement of purpose alluding to technology or computing resources.
5. Mission statement in stand alone Web page	Word or word sense	Statement of purpose appearing as a Web page.
6. Mission statement in fact book	Word or word sense	Statement of purpose located in a fact Web page or a page belonging to the fact book.
7. Mission statement in college catalog	Word or word sense	Statement of purpose located in a Web page belonging to the college catalog or bulletin.
8. Mission statement in strategic plan	Word or word sense	Statement of purpose located in a strategic plan.
9. Mission statement in accreditation site	Word or word sense	Statement of purpose located in a Web page belonging to the accreditation Web site.
10. Mission statement in faculty or staff handbook	Word or word sense	Statement of purpose located in a Web page belonging to the faculty or staff handbook.
11. Mission statement in institutional bylaws	Word or word sense	Statement of purpose located in Web page containing the bylaws of the institution.
12. Strategic IT mission	Theme	Information technology mission statement that bestows a strategic role to technology.
13. Supportive IT mission	Theme	Information technology mission statement that bestows a supportive role to technology.

14. Teaching content in IT mission	Theme	Information technology mission statement alluding to teaching.
15. Research content in IT mission	Theme	Information technology mission statement alluding to research.
16. Administrative content in IT mission	Theme	Information technology mission statement alluding to administration.
17. IT mission in stand alone Web page	Word or word sense	Information technology mission statement appearing as a Web page.
18. IT mission in strategic plan	Word or word sense	Information technology mission appearing in a Web page belonging to a strategic plan.
19. IT mission in annual report	Word or word sense	Information technology mission appearing in a Web site belonging to an annual report.
20. IT mission in planning document	Word or word sense	Information technology mission appearing in a Web page belonging to a planning document.
21. Technology plan	Whole text	Presence of technology plan in Web site.
22. Alignment in technology plan	Theme	Technology plan that references the institution's mission or strategic plan.
23. Own Web courseware	Word, sentence or paragraph	Use of a customized interface developed in-house for online course.
24. WebCT	Word	Presence of the commercial courseware known as Web site.
25. CourseInfo	Word	Presence of the commercial courseware known as CourseInfo in Web site.
26. Web Course in a Box	Word	Presence of the commercial courseware known as Web Course in a Box courseware in Web site.

27. Undergraduate electronic admissions inquiries	Word or sentence	Web site that allows electronic admissions inquiries at the undergraduate level.
28. Undergraduate downloadable application	Word	Web site that allows prospective students to download the undergraduate application in a portable document format (PDF) or as a text file.
29. Undergraduate online application	Word	Web sites that allow prospective students to complete and transmit the undergraduate applications electronically.
30. Graduate admissions inquiries	Word or sentence	Web site that allows electronic admissions inquiries at the graduate level.
31. Graduate downloadable application	Word	Web site that allows downloading the graduate application in a portable document format (PDF) or as a text file.
32. Graduate online application	Word or sentence	Web sites that allow prospective students to complete and transmit the graduate applications electronically.
33. Own online application	Word or sentence	Online application submitted directly to the institution.
34. Embark	Word	Online application submitted to Embark.
35. College Net/Apply Web	Word	Online application submitted to College/Apply Web.
36. College Link	Word	Online application submitted to College Link.
37. Apply Yourself	Word	Online application submitted to Apply Yourself.
38. UXAP	Word	Online application submitted to UXAP

| 39. Online research databases | Word sense or paragraph | Availability of restricted or unrestricted research databases in the library Web site. |
| 40. Link to Web courseware in library Web site | Word or sentence | Direct link to Web courseware in library Web site. |

URL's References

MS 2   Brown University
              Mission and Purpose
              http://www.brown.edu/Administration/Accreditation/standards/standard1.ht
              ml
              1999, December 13

MS 3   Boston University
              accreditation
              http://www.bu.edu/accreditation/standard1.html
              1999, December 13

MS 6   Case Western Reserve University
              University Mission and Accreditation
              http://www.cwru.edu/bulletin/accreditation.html
              1999, December 13

MS 14   Harvard University
              Frequently – Asked Questions about Harvard University
              http://www.harvard.edu/help/faq_index.html
              1999, December 13

MS 20   Northeastern University
              Standard 1
              http://www.neu.edu/accreditation/final/mission.html
              1999, December 12

MS 22   University of Notre Dame
              Mission Statement: Context
              http://www.nd.edu/aboutnd/about/mission/index.shtml
              1999, December 11

MS 28   Rensselaer Polytechnic University
              Welcome to Rensselaer – Our Mission
              http://www.rpi.edu/About/Welcome/mission.html
              1999, December 12

MS 29   University of Southern Carolina
              The Strategic Plan of the University of Southern Carolina
              http://www.usc.edu/admin/provost/strategicplan/94plan.html
              1999, December 10

MS 30   Saint Louis University
Saint Louis University Mission Statement
http://www.slu.edu/mission.shtml
1999, December 12

MS 32   Syracuse University
New Mission and Vision
http://syracuse.edu:80/selfstudy/report1/newmission.html
1999, December 12

MS 38   Yale University
Yale Reaccredidation Web Site: Welcome
http://www.yale.edu/accred/standards/s1.html
1999, December 10

MS 49   University of Hawaii at Manoa
Manoa at 100
http://www.hawaii.edu/svpevc/manoa100.html
1999, December 19

MS 50   University of Houston
UH mission statement
http://www.uh.edu/admin/mission.html
1999, December 19

MS 53   University of Iowa
Strategic Plan 2000 - 2005
http://www.uiowa.edu/president/strat_plan.html#mission
1999, December 19

MS 54   Iowa State University
Mission Statement
http://www.iastate.edu/%7Ecatalog/catalog/geninfo/mission.htm
1999, December 19

MS 60   North Carolina State University
NC State Mission Statement
http://www2.acs.ncsu.edu/UPA/missio96.htm
1999, December 17

MS 67   University of Tennessee at Knoxville
University of Tennessee General Info
http://www.utk.edu/general/default.html
1999, December 20

IT MS 11   Emory University
            http://www.emory.edu/ITD/itd.html
            ITD/Internal Organization
            1999, December 13

IT MS 13   George Washington University
            The ISS Mission
            http://www.gwu.edu/~cio/ISSmission.html
            1999, December 13

IT MS 19   Massachusetts Institute of Technology
            MIT Information Systems: Mission Statement
            http://web.mit.edu/IS/org/mission.html
            1999, December 12

IT MS 21   Northwestern University
            Northwestern University Information Technology/Annual Report...
            http://www.nwu.edu/it/AR98/mission.html
            1999, December 12

IT MS 35   University of Pennsylvania
            ISC Strategic Plan 1996: Mission
            http://www.upenn.edu/computing/isc/plan/fiveyear/mission.html
            1999, December 11

IT MS 42   Arizona State University
            IT: Strategic Plan 1999
            http://www.asu.edu/it/fyi/strategic/plans/stratplan99.html#asumission
            1999, December 15

IT MS 47   University of Georgia
            UCNS Mission and Vision Statements
            http://www.uga.edu/ucns/tti/ucns-mission.html
            1999, December 18

IT MS 48   Georgia Institute of Technology
            Office of Information Technology (OIT) Strategic Plan
            http://www.oit.gatech.edu/Whatshot/stratplanpub/oitstratplanpub.html
            1999, December 15

IT MS 50   University of Houston
            VC/VPIT
            http://www.uh.edu/infotech/ivpit.html
            1999, December 19

IT MS 51   University of Idaho
            Computer Services -- Mission
            http://www.uidaho.edu/csrv/objectives/mission.html
            1999, December 19

IT MS 53   University of Iowa
            Strategic Plan 2000-2005
            http://www.its.uiowa.edu/its/dir/plans/strategicplan2000.htm
            1999, December 19

IT MS 59   University of Missouri
            IAT Services: Strategic Plan
            http://iatservices.missouri.edu/strategic-plan/
            1999, December 20

IT MS 60   North Carolina State University
            Information Technology at NC State
            http://www.ncsu.edu/it/IT/mission.html
            1999, December 17

IT MS 76   Washington State University
            WSU Information Technology
            http://www.wsu.edu/IT/
            1999, December 21

TP 2   Brown University
            Brown University - Computing and Information Services - IT2000
            http://www.brown.edu/Facilities/CIS/IT2000/2.html#_Toc466166086
            1999, December 13

TP 59   University of Missouri University of Missouri
            IAT Services: Strategic Plan
            http://iatservices.missouri.edu/strategic-plan/
            1999, December 20

TP 72   University of California at Los Angeles
            I. Introduction
            http://www.aitb.ucla.edu/itplan/Intro.htm
            1999, December 18

WP 3a   Boston University
            BU Web Central – About NIS
            http://www.bu.edu/webcentral/about/
            1999, December 13

WP 3b   Boston University
BU WebCentral Research: Courseware Comparison
http://www.bu.edu/webcentral/research/courseware/
2000, January 7

WP 3c   Boston University
BU WebCentral: Courseware Effects
http://www.bu.edu/webcentral/output/courseware/effects.html
2000, January 28

WP 3d   Boston University
BU WebCentral: Learning Copyright
http://www.bu.edu/webcentral/learning/copyright/
2000, January 28

WP 7   University of Chicago
Connecting to Electronic Resources
http://www.lib.uchicago.edu/e/db/connect.html
1999, December 11

WP 12   Georgetown University
Georgetown University Mission and Principles for Inte...
http://www.georgetown.edu/technology/use/mission.html
1999, December 14

WP 16   Johns Hopkins University
Digital Knowledge Center at the Eisenhower Library on the Johns...
http://dkc.mse.jhu.edu/
1999, December 13

WP 38   Yale University
YUL Research Workstation – Databases and Electronic Journals
http://www.library.yale.edu/pubstation/alphalist.html
1999, December 10

WP 45   University of Delaware
The University of Delaware Library
http://www.lib.udel.edu/
2000, December 18

WP 66   University of South Florida
USF Virtual Library Databases by Title -- A
http://www.lib.usf.edu/virtual/databases/db-a.html
1999, December 20

WP 70   University of California at Riverside
Welcome to the UCR Library!
http://library.ucr.edu/
1999, December 18

WP 73   University of Connecticut
UCL: dCompass: The Research Database Locator
http://norman.lib.uconn.edu/NewSpirit/Databases/
1999, December 18

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