STRATEGIC ALIGNMENT: A FRAMEWORK FOR STRATEGIC INFORMATION TECHNOLOGY MANAGEMENT

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Abstract

This paper develops a framework for strategic information technology management, termed the Strategic Alignment Model. This model is defined in terms of four domains -- Business Strategy, Information Technology Strategy, Organizational Infrastructure and Processes, and Information Systems Infrastructure and Processes -- each with their constituent components. This model is developed using two fundamental dimensions -- strategic integration and functional integration -- and the cross-domain alignment across the two dimensions. A theoretical perspective of strategic alignment is developed using four concepts -- (1) *consistency* in cross-domain analysis, (2) *completeness* of the analysis, (3) *validity* of the process, and (4) *comprehensiveness* of the process. These concepts are used to develop a set of research propositions with important implications for the management of strategic I/S planning processes.

1.0 Introduction

The emerging role of Information Technology (I/T)[1] in the strategy of organizations is generally known and widely discussed (Benjamin, Rockart, Scott Morton and Wyman, 1984; Earl, 1988; Keen, 1986; McFarlan, 1984; Rockart and Scott Morton, 1984; Wiseman, 1985). While investments in I/T have accelerated[2], the main challenge is the realization of benefits from them. The impacts of I/T at different levels of economic analysis have been problematic (Strassman, 1985). At a national economy level, researchers have failed to establish a significant relationship between I/T investments and increased productivity (Loveman, 1988). At the firm level, the results are somewhat mixed. While some cases of above-average benefits have been reported, other cases are cited where substantial investments in I/T yield no appreciable value (Kemerer and Sosa, 1989). The apparent gap between the decision to invest in I/T and the realization of benefits highlights the risk facing organizations that are using I/T to initiate new strategies and transform their business processes. Given this risk, it is not surprising that the need for effective strategic I/T management is viewed as critical by executives (Dickson, et al., 1984).

A central tenet of this paper is that strategic management of I/T requires appropriate choices to *position* the firm with respect to a dynamic and uncertain information technology marketplace as well as effective decisions that define the *implementation strategy* for building and operating the information systems infrastructure. In essence, we argue that the challenge of managing the information

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[1] By I/T we mean computer hardware, software, communications and related computer-based applications.

[2] By one estimate, as much as 50% of the *new* capital investments are I/T related.

systems function must parallel that of the strategic management of the enterprise. As such, effective management of I/T will require alignment among a complex set of choices reflecting both a strategic and a functional perspective. This paper develops the concept of alignment and presents a model for I/T management that is consistent with evolving concepts of strategic management and also addresses the functional complexities of I/T management. The *Strategic Alignment Model* is developed using two fundamental dimensions -- (1) *strategic integration*, which builds upon strategic management research relating to the integration of strategy formulation and implementation; and (2) *functional integration*, which builds upon a tradition of information systems research that focuses on the integration of I/T management with the management of other line and functional areas. These two dimensions define four strategic choice domains (Business Strategy, Information Technology Strategy, Organizational Infrastructure and Processes, and Information Systems Infrastructure and Processes) that form the basis for the Strategic Alignment Model. The theory underlying the alignment among these domains is developed using four theoretical concepts -- (1) *consistency* in terms of cross-domain relationships, (2) *completeness* of the process, (3) *validity* of the process, and (4) *comprehensiveness* of the process. In the following sections, we define the general alignment model, define and illustrate each of these four theoretical concepts, and then use them as a basis for developing research proposals relating to the effectiveness of strategic I/T planning processes.

2.0 Strategy-I/T Alignment

2.1 There is widespread acceptance that business and I/T strategies should be *linked* or *interdependent*. Indeed, the operative word, *linkage* is used by many researchers

to characterize an approach to I/T planning that *responds* to, as well as *shapes*, business strategies (Henderson and Sifonis, 1988; King, 1984; McFarlan and McKenney, 1983; Pyburn, 1983). While this has achieved the status of conventional wisdom among practitioners, and is often an unquestioned axiom among researchers, the *nature* of linkage has not been adequately clarified in the literature. That is, the concept of linkage has been historically invoked as a *metaphor* to argue for the integration of business and I/T strategies without adequate articulation or clarification of its characteristics.

This paper seeks to clarify the nature of linkage, or as we will define, "alignment". It argues that the strategy-I/T relationship should be conceptualized in terms of two fundamental dimensions and their alignment:

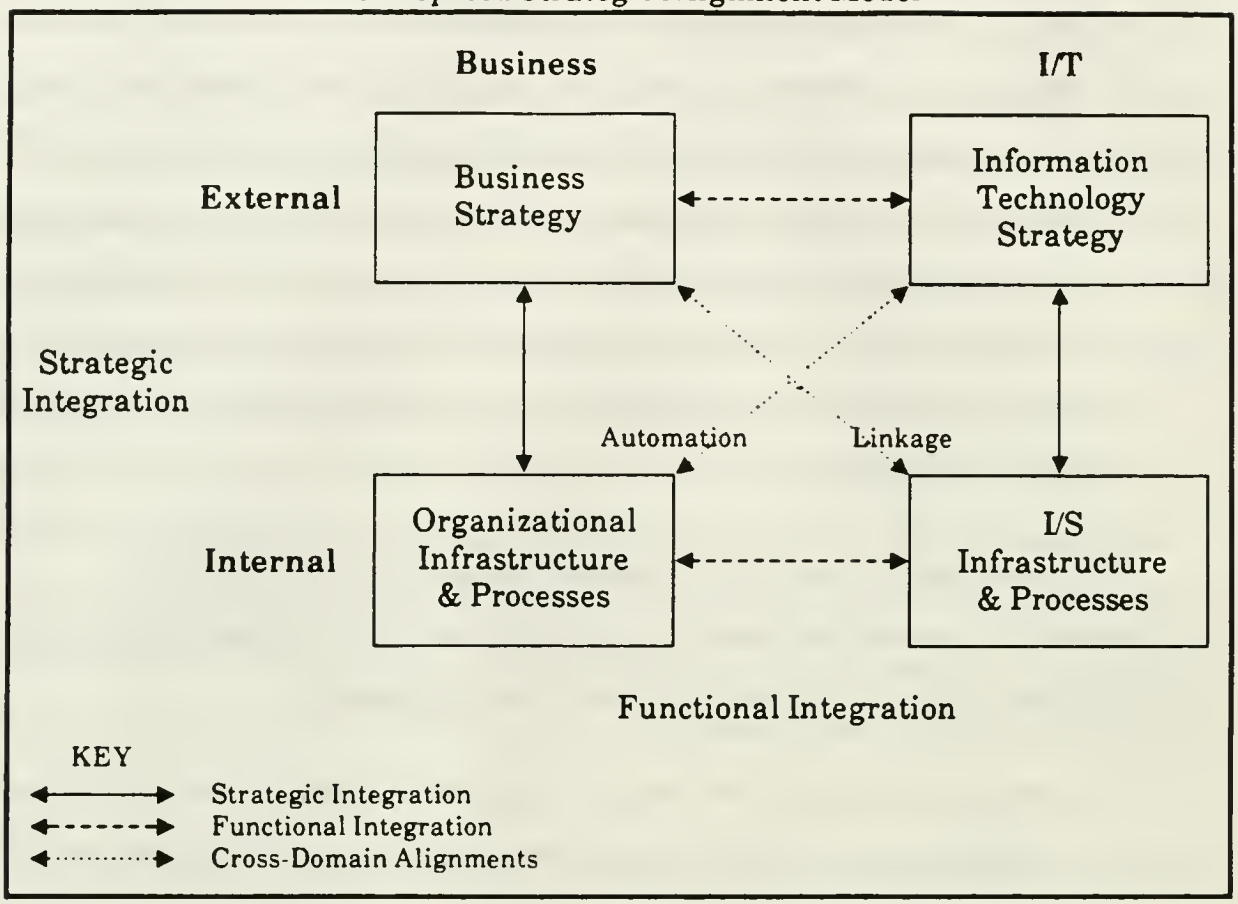
(a) *Strategic Integration* involving the alignment between *external* (marketplace) and *internal* (organizational) domains. This incorporates the classic open-system view of organization and strategy (Andrews, 1980; Lawrence and Lorsch, 1967; Thompson, 1967).

(b) *Functional Integration* involving the integration between the *business* and the *I/T* domains. This is consistent with the recent trend towards the integration of different functions to attain competitive advantage.

(c) *Cross-Domain Alignment* involving the relationships among domains that lie along the two diagonals of a matrix implied by the above two dimensions. As shown in Figure 1, there are two types of cross-domain

Figure 1

The Proposed Strategic Alignment Model



2.2 Strategic Integration

It is perhaps a truism that effective management requires both the positioning of the organization in the external environment (marketplace) and the arrangement of the internal structure and processes necessary to execute the positioning strategy (Andrews, 1980; Thompson, 1967). This form of alignment has been used (Venkatraman and Camillus, 1984) to discuss the role of strategy in a general theory of organizations (Snow and Miles, 1983). Snow and Miles note that strategy is best viewed as the combination of "external alignment and internal arrangement". Neither external alignment (strategy formulation) nor internal arrangement

(strategy implementation) alone ensures organizational effectiveness, thus requiring an *interdependent* (i.e., formulation-implementation) perspective.

Following this general logic, Figure 1 depicts two different types of strategic integration. The left side reflects the classic formulation -- implementation alignment. The right side depicts a corresponding type of alignment from the I/T perspective. While we define each domain of Figure 1 later in Section 2.5, it is important to underscore the correspondence between these two types of strategic integration.

I/T strategy is analogous to business strategy in the sense that it is defined in terms of the *external domain*. Hence, an I/T strategy defines the position of the firm in the I/T marketplace.[3] Similarly, I/S infrastructure and processes is analogous to organizational infrastructure and processes in the sense that it is defined in terms of an internal domain. I/S infrastructure and processes reflect the *internal arrangements* of the I/S function necessary to execute the I/T strategy. We use I/S (information systems) instead of I/T to help differentiate in our terminology the distinction between a focus on the general market of information technology and those particular technologies (i.e., hardware, software, systems, etc.) that form the internal infrastructure.

2.3 Functional Integration

Functional integration reflects a strategic perspective for the management of a function. We see increased recognition of this perspective in functions such as

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[3] One perspective is to view I/T vendors as critical suppliers. Thus, I/T strategy will affect supplier power and, therefore, will have a direct impact on the profitability of the firm. In that sense, the Strategic Alignment Model is an attempt to *explicitly assess and interpret* this supplier-firm relationship and understand the implications of this relationship for managing the I/S infrastructure..

marketing (Wind and Robertson, 1983), finance (Myers, 1984) and information technology (King, 1984; McFarlan, 1984; Parker et al., 1988; Sharpe, 1989; Boynton and Zmud, 1987). In this paper the functional integration involves two types of alignment; one is between business strategy and I/T strategy, the other between organizational infrastructure and processes and I/S infrastructure and processes. Functional integration between business and I/T strategies is concerned with the integration between the *positions* of a firm in the product-market arena and the position in the I/T marketplace. Our argument is that an appropriate alignment between these two *strategies* is a fundamental requirement for realizing values from I/T investments. Further, these strategic choices affect not only the transformation of the organizational processes but also the design of I/S infrastructure and processes (Rockart and Short, 1989; Zmud et al., 1986).

The second type of functional integration is the alignment between organizational infrastructure and processes and I/S infrastructure and processes. That is, the ability to design, implement and operate the I/S infrastructure (i.e., applications, data and technology) is directly related to the organizational infrastructure -- structure, processes, etc. Similarly, the design of organizational infrastructure determines the requirements for the I/S infrastructure and processes. These two types of functional integration highlight the need for integration between the business operations and the technological (especially I/T and I/S) operations.

2.4 Cross-Domain Alignment

As depicted in Figure 1, there are two types of *cross-domain* (i.e., diagonal) alignment defined by these two dimensions. The *cross-domain* alignment between business strategy and I/S infrastructure and processes depicts a classic *linkage* view prevalent today (King, 1984; Pyburn, 1983). The other type of alignment between

I/T strategy and organizational infrastructure and processes reflects a view of *automation* of the work environment (Mumford, 1981; Zuboff, 1988). Specifically, creating a *linkage* between business strategy and I/S infrastructures and processes requires the specification of work processes, roles and authority structures in order to relate how the I/S products and services will impact the business strategy. That is, the business strategy must be decomposed into work processes in order to define the requirements of the I/S infrastructure and processes.

The *automation* type of cross-domain alignment represents the potential for emerging technology to *change* or alter organizational processes. This view emphasizes the potential value of I/T and how the I/S infrastructure and processes provide a service organization to support this potential.

Thus, we define the proposed Strategic Alignment Model in terms of the dimensions of two types of integration and *cross-domain* alignments. Specifically, we argue that neither strategic integration nor functional integration alone is adequate to effectively manage I/T. Stated differently, each is necessary, but not sufficient for deriving value from I/T investments. Further, the cross-domain alignment derives its logic and meaning through the two basic dimensions of integration. We will later argue that the effectiveness of strategic I/T management can be understood in terms of cross-domain alignment.

2.5 Four Domains of the Model

Thus far, we have discussed the rationale of alignment in terms of four basic domains being aligned, namely: *business strategy, organizational infrastructure and processes, I/T strategy* and *I/S architectures and processes*. In the following paragraphs, these basic domains are described in detail.

2.5.1 Business Strategy is defined in terms of the *choices* pertaining to the *positioning of the business in the product-market arena*. It reflects the set of goals (ends), means (actions) and underlying assumptions pertaining to the choices that position the firm in a product-market arena.

The concept of business strategy not only covers a broad terrain but has also been defined using many typologies and classifications (Hofer and Schendel, 1978; Venkatraman and Grant, 1986). However, most discussions of business strategy deal with questions of *business scope* (in terms of product-market choices) and the specific orientation to compete in the chosen market. The specific orientation of a strategy is viewed in terms of two components: *distinctive competences* and *governance structures*. Distinctive competences refers to those attributes of strategy which contribute to a distinctive, comparative advantage over competitors in the product-market arena (Snow and Hrebiniak, 1980). Common attributes include (but are not limited to): pricing, quality, value-added service, delivery channels and image. Governance structure involves the articulation of collaborative mechanisms for obtaining competitive advantage, including value-added partnerships, strategic alliances, etc. This component of business strategy is critical since neither "pure" markets nor classical hierarchies alone define the set of available mechanisms for effective strategy (Harrigan, 1985). Thus, a business may be able to compete more effectively through a carefully designed network of partners and alliances than alone in uncertain complex, turbulent, and dynamic markets. Indeed, these collaborative mechanisms are not only on the increase but also effective in the I/T sector (Koh and Venkatraman, 1989).

2.5.2 Organizational Infrastructure and Processes is defined in terms of the *choices* pertaining to the particular *internal arrangements that support the*

organization's chosen position in the product-market arena. It reflects the goals (ends), means (actions) and underlying assumptions pertaining to the design of management structure and work processes.

While there is a wide range of possible constructs for representing this domain, we focus on those components that are critically intertwined with the I/T and business strategy issues (Galbraith, 1977; Lawrence and Lorsch, 1967; Leavitt, 1965): (a) *administrative infrastructure* that includes the organizational structure, roles and responsibilities necessary to execute the business strategy; (b) work *process* that includes the articulation of the work flow and its associated information flow that are necessary to execute strategies; and (c) *skills* and knowledge indicating the capability of the organization to implement a strategy. As we will argue later, the choices made in this domain both directly affect the ability to execute business strategy and establish critical requirements for the I/S architectures and processes.

2.5.3 Information Technology Strategy is defined in terms of the *choices* pertaining to the *positioning of the business in the information technology marketplace.* It reflects the set of goals (ends), means (actions) and underlying assumptions that relate to these choices. Three components underlie this strategy and have important parallels with business strategy. These are: (a) *technology scope*, (b) *distinctive competences*, and (c) *governance structure.* Technology scope, analogous to business scope, refers to the types and range of I/T functionality that will be made available to the organization. Strategic choices pertaining to scope often center on adoption of an emerging technology. For example, using expert systems to decentralize the underwriting authority to the independent agents enables new business strategies for an insurance carrier. Similarly, the use of an electronic imaging system for paper-intensive operations like credit cards enables new modes of differentiation for a financial service firm. The critical concept is how

these choices position the firm in the I/T market. For example, the choices might increase or decrease the firm's dependency on particular vendors.

Distinctive competencies refers to those choices that affect the ability of the firm to differentiate its I/T infrastructure. As with distinctive characteristics of a business strategy, there are a number of characteristics that may differentiate the technology strategy pursued. For example, the degree of connectivity reflected in the infrastructure can affect characteristics such as availability or access to information, flexibility or cost. Decisions to adopt or provide standards such as operating systems (e.g., UNIX), communication protocols (e.g., OIS), application environments (MAPA, SQL, etc.) or hardware (e.g., common PC architecture), increase the potential for connectivity across vendors and directly affect flexibility and availability within and between organizations. Of course, adoption of such standards also reduces the ability to use specific information systems as a competitive barrier and thus must be assessed in terms of current or emerging business strategy. Other factors that reflect the distinctive competency of the I/S infrastructure include price/performance, reliability or capacity. Each of these characteristics defines parameters within which the infrastructure must operate. For example, emerging technology architectures may well create a new process/performance curve that enable adopters to radically alter the economics of using I/T to support strategy.

The *governance* issue in I/T strategy is parallel to governance in business strategy. Traditionally, I/T governance has focused on issues of privacy and security. However, as the role of information technology in interorganizational strategy increases (Barrett and Konsynski, 1982; Cash and Konsynski, 1985; Malone, Yates, and Benjamin, 1987), the governance of I/T infrastructure emerges as an important element of I/T strategy. Rotemberg and Saloner (1989) discuss the distinction

between cooperative and competitive advantage in the context of relative ownership of information technology networks. More specifically, the networks of ATMs and airline reservations systems illustrate the complexities of the governance structure in terms of ownership/influence relationships and the relative ability of the participating firms to provide proprietary services across the network. The important point is that the use of I/T for an interorganizational competitive strategy has strategic implications for choices relating to governance of the emergent technology infrastructure.

2.5.4 Information Systems Infrastructure and Processes are defined in terms of *choices* pertaining to *internal arrangements and the processes that determine the range and types of I/S products and services delivered to the organization.* It reflects the goals (ends), means (action) and underlying assumptions that relate to these choices. This is parallel to the organizational infrastructure and processes of the business domain. In other words, while organizational structure and management process relate to business strategy implementation, the information systems architectures and processes relate to the implementation of I/T strategy.

The three components of this domain are *infrastructure, processes* and *skills*. I/S infrastructure is similar to organizational infrastructure. It represents the definitions, governing policies and rules, and implied priorities for three key I/S management areas: applications, data and technology configurations. The applications architecture is the interrelation of system products that manipulate, store or retrieve data in order to support the information processing requirements of the firm. The data architecture is a definition and implementation of data entities, relationships and policies that determine the integrity and accessibility of data. Finally, the technology configuration component is the set of hardware, software and communications technologies that determine the specific characteristics of the

embedded technology infrastructure. Increasingly, each of these areas is managed so as to enable coordination across them without requiring tight coupling, e.g., a change to the logic of an application does not require redefining the data base.

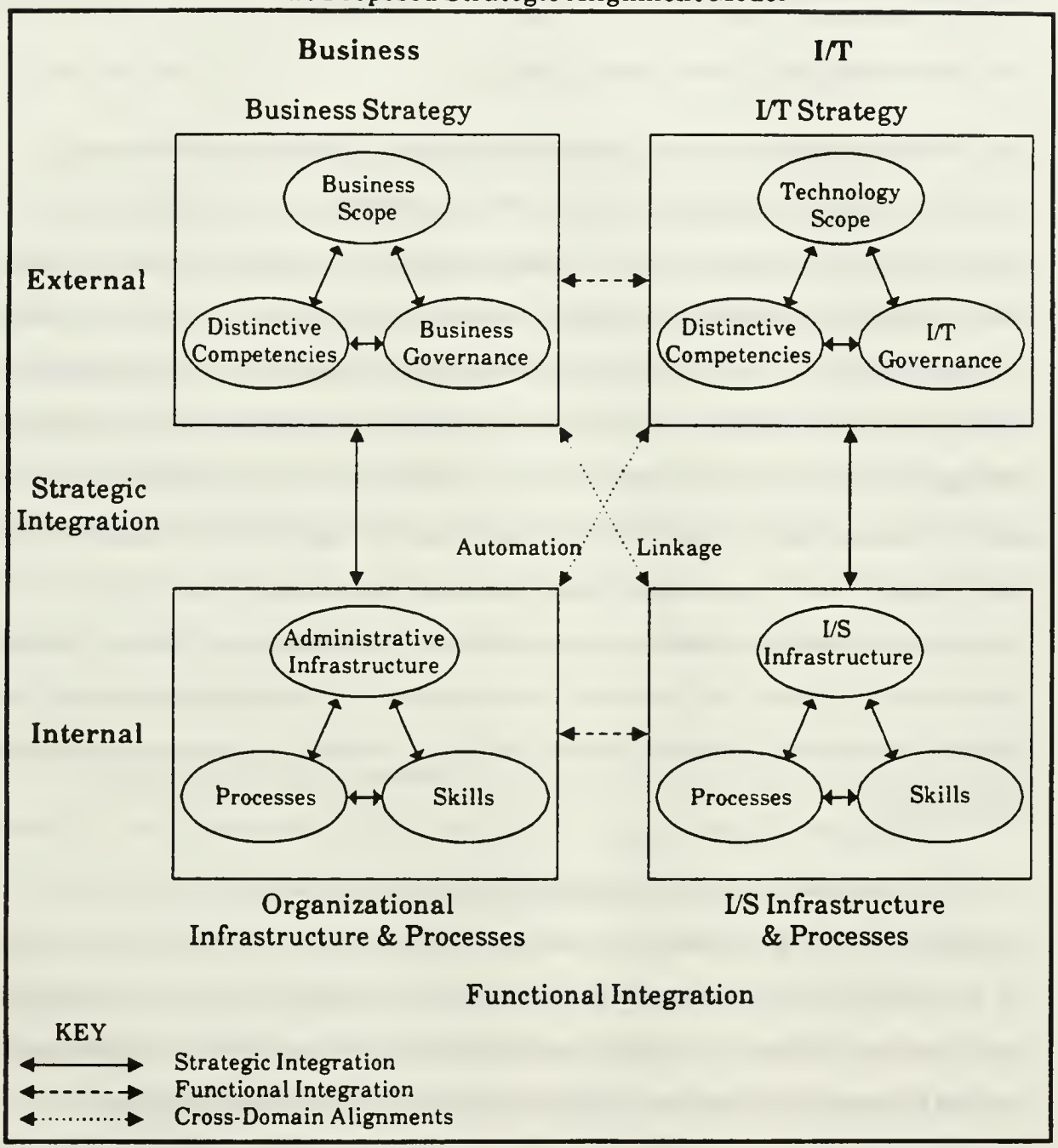
The *processes* component relates to work processes that are critical to the efficient and effective operation of the I/S infrastructure. Such processes would include methodology and procedures for development of systems, security/backup procedures, data center operations, cost/control systems and so on. In essence, these are the underlying production processes for managing and adapting the I/S infrastructure.

Finally, the human resource component, as with line organizations, is a critical component of the I/S architectures and processes. This component reflects needs for new skills, knowledge or values within the I/S function. The criticality of this component should not be overlooked. For example, Martin (1982), Mumford (1981) and others point out that introduction of changes in architectures (i.e., adopting a data resource management strategy) or processes (adopting computer aided software engineering techniques) often implies major changes in the skill sets of the work force.

In summary, 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. Figure 2 is an expanded version of the Strategic Alignment Model with the internal components highlighted.

Figure 2

The Proposed Strategic Alignment Model



3.0 Four Theoretical Concepts of Strategic Alignment

3.1 Consistency in Cross-Domain Analysis

One approach to alignment is to focus on the set of *bivariate fit* between all possible domains identified in Figure 1. As discussed before, the vertical links represent the classical external-internal integration. For example, the fit between business strategy and organizational structure and processes in the business domain reflects the interplay between business strategy formulation and implementation; the fit between I/T strategy and I/S infrastructure reflects the interplay between I/T strategy formulation and its implementation. The horizontal links represent functional integration. The fit between business strategy and I/T strategy reflects the interplay between strategic choices across two domains: positioning of the business in the product-market arena and in the I/T marketplace. Similarly, the fit between organizational infrastructure and processes and I/S architectures and processes reflects the interplay between two sets of internal arrangements across the two domains.

Our argument is that the adoption of bivariate fit is seriously limited. For example, while the fit between business and I/T strategies ensures the formulation of I/T-enabled strategic options, the implications for implementation are provided by the fit between business strategy and organizational infrastructure and processes, and the fit between I/T strategy and I/S architectures and processes. There is considerable support for the thesis that successful exploitation of I/T capabilities requires appropriate changes in internal arrangements (i.e., organizational infrastructure and I/S architectures). Thus any one bivariate fit ignores considerations of other crucial relationships. Further, in the larger body of theory and research rooted in the alignment concept, serious limitations of bivariate

perspective relate to possible inconsistencies among multiple forms of interrelated bivariate fits (Child, 1975; Miller, 1981) and have been termed as errors of logical typing (Bateson, 1979).

A multivariate coalignment perspective attempts to overcome the limitations of bivariate fit. In essence, we propose that effective strategic I/T management process must address both functional integration *and* strategic integration. In fact, many current I/T planning processes adopt this perspective. For example, *enterprise modeling* (Martin, 1982) represents a process that explicitly analyzes linkage through strategic integration (i.e., fit between business strategy and organizational processes) and functional integration (i.e., fit between organizational processes and I/S architectures). Note that this process is framed by the assumptions and decisions of an *a priori* strategic business planning process that generated these goals. That is, *enterprise modeling*, as most often described, does *not* attempt to address external market positioning issues.

An enterprise modeling process is an explicit means-ends analysis that links strategic goals to the three key I/S architectures: Applications, Data and Configurations. While current implementations of this process often advocate one type of architecture, e.g., a data architecture versus a systems/process architecture, the trend in I/S planning appears to be converging to one that recognizes the necessity of each (Zachman, 1986). It is interesting to note that alternatives to Enterprise Modeling often emphasize issues of skills and knowledge within the organization and issues of roles, responsibilities and formal reporting relationships (Mumford, 1981; Bostom and Heinen, 1977). The important point is that these approaches enable the planners to *explicitly* examine the linkage issue. That is, linkage is examined in terms of organizational processes, structure and people

rather than at an abstract level of attempting to relate I/S architectures to strategic goals.

Thus, we propose that attention to both strategic integration and functional integration is a necessary requirement for effective strategic I/T management. We define this perspective as *internal consistency* of the management process. The concept of consistency has been identified as one element of effective strategic I/S planning systems (Henderson and Sifonis, 1988; King, 1983). Henderson and Sifonis (1988), for example, defined consistency in terms of a hierarchical set of means/ends relationships. Consistency is achieved when the means/ends relationships at a strategic level are disaggregated into a set of compatible means/ends relationships at a functional level. In many I/S planning approaches, consistency is often addressed through function decomposition, i.e., function, process and activity. A similar notion of consistency with respect to ends can be found in the use of hierarchical systems such as objectives, goals and targets to help represent the translation of abstract, long-term intention into concrete, short-term behavior.

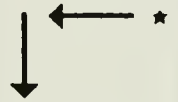
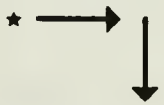
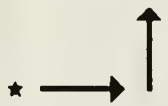
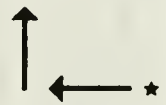
3.2 Eight Perspectives of Cross-Domain Analysis

The Strategic Alignment Model provides for eight perspectives of internally consistent cross-domain analysis (see Table 1). Each perspective, involving *both* functional integration and strategic integration, is briefly discussed in the following sections.

3.2.1 Technology Exploitation. In recent years, several cases have been cited where I/T has challenged, influenced or shaped business strategy (McFarlan, 1984; Rockart and Scott Morton, 1984; Wiseman, 1985). Technology exploitation for strategic thrusts can be viewed in terms of I/T choices enabling or threatening strategies in the product-market arena. Further, I/T strategies have the potential

Table 1

Eight Consistent Strategic I/T Perspectives

Label	Cross-Domain Perspective	Domain Anchor	Planning Orientation	Cross-Domain Alignment
(1) Technology Exploitation		Technology	Top-down	Automation
(2) Technology Leverage		Strategy	Top-down	Linkage
(3) Strategy Implementation		Strategy	Top-down	Linkage
(4) Technology Implementation		Technology	Top-down	Automation
(A) Organization Exploitation		Organization	Bottom-up	Automation
(B) Organization Requirements		Organization	Bottom-up	Automation
(C) I/S Capacity		I/S	Bottom-up	Linkage
(D) I/S Requirements		I/S	Bottom-up	Linkage

★ Domain Anchor

for redefining the nature of business and competition as well as the boundaries of the marketplace (Cash and Konsynski, 1985). Indeed, part of the current excitement about I/T is due to the potential that I/T offers to alter the range of strategic options available to businesses (Johnston and Vitale, 1988). It is important to note that this cross-domain perspective involves the consideration of not only the *impact* of information technology on business strategy but also the *implications* for organization and management processes. An example of an analytical approach often employed as a technology exploitation planning process is the use of value chain analysis both to explore strategic options for interorganizational linkage *and* to assess the implications of these strategies for integration of key business processes (Rockart and Short, 1989).

3.2.2 Technology Leverage. In contrast to technology exploitation, *technology leverage* involves the formation of an I/T strategy that best supports a chosen business strategy in combination with the assessment of how these choices have an impact on existing I/S architectures and processes. For example, USAA embarked on a joint technology development with a key vendor in order to create and adopt a new approach to document handling. This strategy required them to make major changes to the existing I/S infrastructure across all three architectures: applications, data and configuration. This process reflects technology leverage that is a cross-domain perspective that involves the consideration of not only the *impact* of business strategy on the I/T strategy but also the *implications* for I/S infrastructure and processes for successful implementation. This view is often associated with the general issue of technology scanning and management.

3.2.3 Strategy Implementation. Here, the focus is not explicitly on the I/T strategy, but on the traditional conceptualization of business strategy

implementation through organizational structure and processes and the associated I/S infrastructure. *Strategy implementation* is a cross-domain perspective that involves the assessment of the *implications* for organizational and management processes of a business strategy as well as the *impact* of organizational and management processes on the requirements for particular I/S infrastructure and processes. This approach emphasizes detailed analysis of business processes and their relationships to both goals and I/S products and services often associated with methodologies such as Enterprise Modeling (Martin, 1982).

3.2.4 Technology Implementation. This perspective involves not only the implementation of I/T strategy through the design of I/S infrastructure and processes but also the impact of this design on the scope of I/S products and services that will be available to the organization. Note that in the *technology implementation* perspective, business strategy is not explicitly recognized. Thus this cross-domain perspective involves the *implications* of I/T strategy for I/S infrastructure and processes and the *impact* of those choices on the organizational infrastructure and processes. This perspective is often viewed as a necessary process for ensuring effective uses of the I/S resources. In many cases its use emerges from the belief that the I/S function has insufficient technical leadership.

The above four perspectives share one common theme -- namely, a top-down orientation where either the business strategy or the I/T strategy direct the other strategy and subsequent implementation considerations. In contrast, the other four perspectives reflect a bottom-up orientation. Here, either the current organizational infrastructure and processes or the current I/S infrastructure and processes *signal* the implications for strategic choices at the level of business and I/T strategies. Thus, while a top-down orientation may reflect the preference of professional planners, the Strategic Alignment Model (as shown in Table 1) reflects a range of

perspectives that could also support the notion of internally consistent, bottom-up analysis of a cross-domain relationship. The four bottom-up perspectives are discussed below.

3.2.5 Organizational Exploitation. This perspective recognizes an internally consistent process that emerges from organization action. In perspective, the local knowledge and innovation of the individual or work unit are communicated and interpreted in terms of the implications for effective business strategies. Given this interpretation, appropriate choices for positioning the firm in the I/T marketplace are made. Thus, *Organizational Exploitation* is a cross-domain perspective that identifies the *implications* of organization action for business strategy and articulates the *impact* of these consequences on the I/T strategy. This bottom-up process has become quite common for user-based technologies such as personal computers or Decision Support Systems. It is interesting to note that these processes operated outside of the more traditional top-down view of strategic I/T management. And yet, many of the strategic uses of technology can be traced back to emergent strategies, i.e., strategic uses of technology that evolved from organization innovation driving the adoption of I/T strategies (see for example, Copeland and McKenney, 1988).

3.2.6 Organizational Requirements. In this view, the organization is treated as a market. This I/S management process involves market analysis, the design of appropriate products and services and adoption of an I/T strategy that will support the demands for development and sustained delivery of these products and services. Thus, *Organizational Requirements* is a cross-domain perspective that identifies the *impact* of the organization on the I/S infrastructure and processes and the *implications* of these demands for strategic I/T positioning. This bottom-up I/S

product and service perspective is also advocated for an end user environment that views the I/S function as a major supplier/distributor.

3.2.7 I/S Capacity. This perspective is seldom advocated by professional planners, and yet may have relevance for some organizations. In this view, the I/S infrastructure and processes are taken as the anchor. The strategic I/S management process is one that seeks to maximize the use of this resource in the pursuit of a business strategy. Thus, *I/S Capacity* is a cross-domain perspective that identifies the *impact* of I/S products and services on the organization and then evaluates the *implications* of the I/S product/service use on business strategy. Current I/S planning techniques that seek to understand and optimally size I/T capacity reflect this management perspective.

3.2.8 I/S Requirements. In this perspective, the requirements of the I/S infrastructure and processes provide the basis for strategic I/T choices. These choices, i.e., decisions that position the firm in an I/T marketplace, are evaluated in terms of their ability to enable or threaten business strategy. Thus, *I/S Requirements* is a cross-domain perspective that evaluates the *implications* of I/S infrastructure and processes on I/T strategic choices and the *impact* of these choices on business strategy. Such processes yield an emergent I/T-business strategy relationship evolving from an I/S functional perspective.

Note also that each perspective reflects a domain anchor (indicated by ★ in Table 1). This anchor is the potential source of decision bias. The assumptions, language and orientation of the process will be heavily influenced by this initiating frame. Of course, bias is not inherently bad. Rather it is the existence of unknown bias that can be the source of significant confusion and distortion.

In summary, each of the perspectives has the potential to support an internally consistent cross-domain analysis. However, it is also clear from Table 1 that each perspective is limited. That is, in each case one *domain* is not directly incorporated in the analysis. To redress this limitation, we discuss the need for *completeness* of analysis next. Propositions concerning the *relative* effectiveness of internally consistent processes will be discussed in Section 4.0.

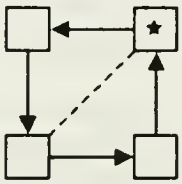
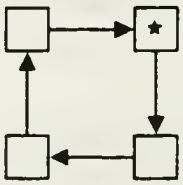
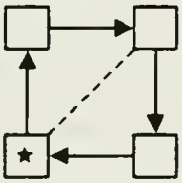
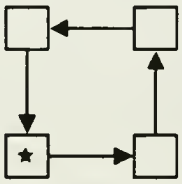
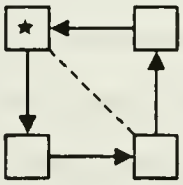
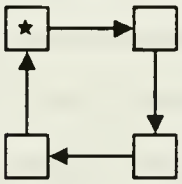
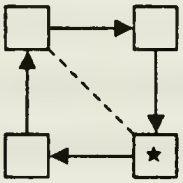
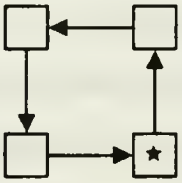
3.3 Completeness of Analysis

It is clear that considerations of any one of the eight forms of cross-domain analysis will leave unchallenged one domain and its associated relationships. For example, technology exploitation (1) does not address (i.e., it takes as given) issues relating to the I/S infrastructure and processes, and is therefore *incomplete*. Our definition of completeness involves the following: (a) a *closed loop* addressing all the four domains, and (b) it examines a particular cross-domain relationship from both a top-down and a bottom-up orientation.

This definition of *completeness* is analogous to the concept of organizational learning. Argyris (1977, 1982) and others argued that the concept of single-loop learning involves the adjustment of behavior with respect to a given assumption set (frame). This adaptation process acts to minimize deviation from this desired state. In this context, a *complete* I/S process not only examines a cross-domain (hence hierarchical) relationship, but also examines this relationship from both a top-down and a bottom-up perspective. Note that by restricting the combination of internally consistent analyses, a given domain anchor is maintained. Figure 3 shows four *common* forms of *complete* processes, highlighting the cross-domain relationship that is explicitly examined.

Figure 3

Complete Processes (Single Loops)

	Preferred Process			Alternate Process		
Domain Anchor	Label	Diagram	Table 1 Reference	Label	Diagram	Table 1 Reference
I/T Strategy	Competitive I/T impact		1, B	I/T implementation		4,A
Organization	Organization-led I/T exploitation		A, 4	Organization demand		B,1
Business Strategy	Strategy execution		3, D	I/T infrastructure		2,C
I/S	I/S resource maximization		C, 2	I/S operations		D,3

Key: Numbers represent top-down perspectives,
while letters represent bottom-up perspectives; and
★ = Domain Anchor

Three observations are appropriate. First, note that the interpretation of each consistent process assumes a start point (indicated by ★). A closed-loop process requires a domain anchor, and for each anchor, there are fundamentally two choices. A current practice set is shown on the left side of Figure 3, while the competing model is shown to the right. While these alternatives are possible, there is little support for them. In fact, they have often been identified as dysfunctional (Kling,

1980; Marcus and Robey, 1988). For example, *I/T implementation* is a classic "technology imperative" decision process and has been described as less effective relative to a *competitive I/T* perspective (Marcus and Robey, 1988). Figure 3 illustrates a range of common approaches to I/S decision making, but a more careful empirical assessment of the superiority of the current practice set is warranted before generalization concerning the relative effectiveness of these approaches can be drawn.

A second observation may be less apparent. The selection of a domain anchor (creation of a bias) and the execution of a consistent decision process are both a strength and a weakness. This is reflected by the cross-domain relationship that is examined. That is, the given process will promote a particular type of organizational learning. For example, *strategy execution* (3,D) is often proposed as a preferred approach (Martin, 1982). This process has the strength of tightly linking the I/S architecture to the strategy of the firm. Further, the adoption of technology enables the I/S resource to be optimized with respect to this strategy. However, the process is based on a strategic I/S decision-making process that does not explicitly examine how emerging technology could best be exploited.[4] Thus, alternative I/S decision-making processes could be initiated by exploring how technology could have an impact on strategy and its implications for changing business processes and organization structures. These strategic opportunities are then defined in terms of potential I/T products and services with appropriate changes to the I/S function. This alternative, reflected by *Competitive I/T Impact*, may well increase the likelihood that new technology is effectively exploited. While it has this strength, such an approach may be less effective as a means to explore how these strategic

[4] Note that advocates argue that by creating both application and data architectures, the I/S resource is less sensitive to changes in business processes and hence can support changes in organization that are required to execute strategy.

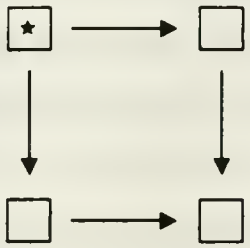
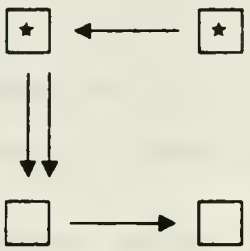
initiatives propagate across multiple business processes and affect a complex, embedded technology.

Another way to compare *Strategy Execution* and *Competitive I/T Impact* is to note that they address different cross-domain alignments. *Strategy Execution* focuses the consistent alignment with business strategy. This approach leads to *linkage* between business strategy and I/S architectures and processes. *Competitive I/T Impact* addresses the *automation* alignment by exploring how technology could transform organization structure and processes. Value from I/T investment evolves from enabling new strategy-structure alignments combined with the ability to provide appropriate service levels. We will argue in Section 4 that organizational contingencies determine when a given form of a complete process is most effective.

Finally, we should note that many variations of incomplete processes exist. Consider two (illustrative) forms of incompleteness shown in Figure 4. The first is created by combining two forms of top-down decision making. Both are strategy driven, hence, has the strength of increasing the likelihood that the business strategy is driving both the definition of I/S products and services and the choices that position the firm in an I/T marketplace. Unfortunately, the two paths meet at I/S infrastructure and processes, and there may well be inconsistent results. One perspective is business strategy interpreted through the organization, the other is business strategy interpreted through the positions in the I/T marketplace. At best, this process reflects a type of dialectic strategic management process requiring a resolution component, i.e., resolving conflicting demands on the I/S infrastructure and processes. At worst, it reflects two competing top-down views (i.e., business and technical) without recognition of the inherent inconsistency (Mason and Mitroff, 1981).

Figure 4

Two Illustrative Cases of Incomplete Analysis

	Form	Underlying Perspectives*	Scenario
I		2,3	Given a particular strategic choice, (1) What are the critical business processes and I/S architectures? (2) What are the key technologies and how should I implement them?
II		1,3	(1) Given a particular technology choice, how would it have an impact on my strategy and what are the implications for changing the organization? (2) Given the new strategies for (1), what are the key processes and I/S products required to support them?

* See Table 1 for details

The second case is easier to criticize, and yet may well be a more common occurrence. In this scenario, a top-down *technology exploitation* perspective is used to identify new I/T-enabled opportunities. This is followed by a *strategy implementation* process that decomposes the new strategy into processes and activities and then defines the I/S infrastructure and processes. Such a case might occur when a two-step strategic management process (i.e., strategic and functional) is employed without reflecting on the characteristics of the management process. Apart from the argument that this scenario is inefficient, i.e., redundant examination of the strategy-organization relationship, this form of incompleteness introduces a major risk. That is, the risk that the defined architectures can not be

implemented given the embedded technology and the implied I/T strategy decisions (e.g., pertaining to scope, distinctive competencies, or governance structures). Such a technology risk is essentially the risk that the envisioned infrastructure will fail or at least far exceed expected costs. In essence this potential risk and those analogous risks created by other forms of incomplete planning processes form the basis for our propositions that complete decision-making processes are effective. These propositions will be discussed in Section 4.

3.4 Validity of the Process

A concern raised by Churchman (1971), Henderson and Sifonis (1988), Mason and Mitroff (1981), Weick (1979) and others relates to the potential threat to validity of a decision-making process introduced by the domain anchor. One possible solution to this threat is to surface and examine the assumptions underlying a given anchor. This alternative can also involve implementing a process that challenges the assumptions of a planning frame (Mason and Mitroff, 1981). This process of surfacing and challenging assumptions is analogous to the concept of double-loop learning. Double-loop learning, Argyris (1977), can be thought of as a process that challenges the existing frame of reference or paradigm used by the organization for problem solving and control. In contrast to single-loop learning, a double-loop learning process does not seek to restore or resolve deviation from an existing set of concepts or standards but attempts to challenge and perhaps reformulate these concepts or standards. The Strategic Alignment Model highlights two forms of valid process: weak and strong. Each is discussed below.

3.4.1 Forms of Validity: Weak and Strong

Weak Validity. We define a planning process as having weak validity if it enacts a double and opposite closed-loop planning process for a single cross-domain

relationship. Note that a closed-loop process implies both internal consistency and completeness. For example, one form of a valid process begins with a complete process from a strategy frame using *Strategy Execution*, i.e., *strategy implementation* and *I/S requirements*. (See Table 1 for these basic perspectives.) The former process links strategy to I/S through organization while the latter links I/S to business strategy through I/T strategy. This approach is depicted as a complete process labeled *Strategy Execution* in Figure 3. In order to challenge the assumptions underlying this process, a second, perhaps concurrent, process is initiated from business strategy to I/S infrastructure and processes through I/T strategy (i.e., *Technology Leverage*). This is followed by a process of *I/S capacity* maximization. The combination of these two basic processes is shown as *I/T infrastructure* in Figure 3 and emphasizes the technology positioning decisions in order to balance the *Strategy Execution* process. The result is a double-loop process that examines the *linkage* relationship through two perspectives (i.e., internal organization and external technology positioning). In practice, such a process often reflects a two-cycle strategic planning process that involves line planning (*Strategy Execution*) and technology planning (*I/T Infrastructure*). As noted earlier, each perspective represents a complete planning process that provides a means to explore the issue of linkage, both top-down and bottom-up. This is a weak form of validity, however, in that it concentrates only on this single cross-domain alignment, i.e., *linkage*.

Strong Validity is defined as a double-loop decision-making process that explores both cross-domain alignment relationships: *linkage* and *automation*. For example, a *strategy execution* (3,D) could be augmented by an *I/T exploitation* (A,4). This process not only provides a mechanism to challenge the assumptions of a given planning frame but will also address both types of cross-domain relationships. We argue that the strong form of validity process offers a means to achieve strategic

alignment. That is, the outcome of the decision-making processes is the attainment of strong bidirectional linkage between each domain anchor and the explicit exploration of both cross-domain alignments. Propositions concerning the relative effectiveness of this process are discussed in Section 4.

It is interesting to consider the use of socio-technical processes (Mumford, 1981; Bostom and Heinen, 1977) as a means to generate a valid I/T management process. This approach explicitly separates the design of a social system solution from the design of a technology solution. The separation offers the potential to challenge the bias of the technologist as well as the social system designer. However, if the socio-tech process is initiated from a strategic business frame (i.e., both processes take as given the business strategy), the decision-making process is modeled as combining 3,D and 2,C. As such it results in a weak form of validity that emphasizes linkage. A strong form of validity could be created if the social system design reflected a bottom-up process that challenged the business strategy. Such an approach (2,C and A,4) would examine both cross-domain relationships.

The concept of bidirectional linkage between two domain anchors, e.g., business strategy and organization, is often advocated (King, 1978; Pyburn, 1983). For example, iterative or adaptive planning is used to emphasize the desired state of exploring *both* strategy from an organization perspective *and* organization from a strategy perspective. However, it is much easier to draw arrows on paper that point in opposite directions than it is to actually enact an iterative management process that views issues from opposite perspectives. We argue that a valid process must achieve the ideal of adaptive processes while also examining both forms of cross-domain alignment. While it may be possible to construct a single planning event that would achieve such ends, we believe it is more likely to require multiple planning processes. Of course, executing multiple planning processes carries

additional cost, and hence the need is to demonstrate that such efforts in fact result in measurably improved effectiveness of the strategic I/T management process. To this end, we propose in Section 4 a set of propositions concerning the effectiveness of I/S planning processes and indicate how the propositions could be formulated and tested as alternative structural models.

An issue that is separable from completeness and validity is the degree of comprehensiveness found in a given planning method. For example, an alternative approach to Enterprise Modeling is found in Critical Success Factors (CSF). These two approaches both reflect a strategy implementation (3) perspective but differ significantly with respect to the level of detail involved in the means/ends analysis. Rockart (1979), for example, referred to the CSF concept as a "quick and dirty" BSP (an early form of Enterprise Modeling). The level of comprehensiveness introduces a fourth characteristic that is discussed in Section 3.5.

3.5 Comprehensiveness of the Decision-Making Process

A final characteristic of the decision-making process focuses on the level of detail required to complete the analysis. Historically, the I/S field has been influenced by a desire to minimize the risk of omitting a key element or detail in a means/ends analysis. Thus, we have the concept of Enterprise Modeling (Martin, 1982) that attempts to define all goals and all processes so as to ensure the resulting architectures are complete and consistent. Some advocates of a data-oriented approach to strategic I/S planning, for example, argue for an ideal outcome that defines the total set of all data entities and their relationships (Martin, 1982). The implementation process for the approach then segments this total data model in order to allow subset-by-subset implementation.

This view of planning is in stark contrast to planning processes that advocate a high degree of focus. Critical Success Factors (Rockart, 1979), for example, do not attempt to model all processes, only those that "are critical to the ongoing success of the firm". In this view, the risk of omission is increased in return for a focus on high return opportunities. Further, the costs, time and complexity of the planning process are greatly reduced. Such approaches are often recommended when the competitive environment is unstable and a long, detailed "engineering" of a strategy appears infeasible. And yet, these approaches have been criticized for their sensitivity to a range of potential method biases (Davis, 1979).

We note that a consistent and valid decision-making process can be carried out at various levels of *comprehensiveness*. The degree of comprehensiveness is, therefore, a fourth parameter of decision-making process may account for process effectiveness. That is, two processes may be valid but differ in terms of their level of comprehensiveness. As we will discuss in Section 4.0, organizational context issues such as the stability of the competitive environment may help to determine when a given level of comprehensiveness is warranted.

4.0 Research Propositions

In this section, we briefly discuss three research propositions relating to strategic I/T or I/S planning methods that evolve from the Strategic Alignment Model. Due to space limitations, the discussion of these propositions is general. Specific hypotheses and the measurement models used to explore them are available from the authors.

The first proposition is stated as follows:

P1: Effective I/T or I/S strategic planning processes will exhibit internal consistency.

This is the basic proposition of the Strategic Alignment Model. This proposition argues that any single bivariate analysis fails to effectively explore a cross-domain relationship. As a result, these planning processes will *not* support either linkage or automation and will prove ineffective.

While the first proposition is viewed as a necessary condition, our experience and review of the strategic I/S planning literature suggest that this is a "strawman". That is, bivariate planning processes are not advocated by I/S researchers or planners. The second proposition, however, does begin to address a wide range of planning processes currently advocated in the I/S field. Propositions 2A, 2B, 2C and 2D are illustrated by Figure 5. Formally, these propositions can be represented as:

$$\Pi_1 < \Pi_2 = \Pi_3 < \Pi_4 < \Pi_5$$

where Π is planning effectiveness.[5]

P2A: On *average*, a unidirectional, cross-domain analysis is the least effective form of consistent I/S planning.

The rationale for this proposition lies in both the risk associated with incompleteness (i.e., exclusion of one domain of the Strategic Alignment Model) *and* also the failure to challenge the domain anchor.

[5] A discussion of planning effectiveness is beyond the scope of this paper. The reader should see King, 1983 and Venkatraman and Ramanujam, 1987 for more information.

P2B: On average, single-loop planning (complete but invalid) and focused planning (incomplete but valid) will be equally effective and superior to unidirectional planning.

This proposition proposes increased planning effectiveness by addressing either the completeness or validity dimension. Both forms of planning are currently used (Rockart, 1979; Boynton and Zmud, 1987). Due to lack of a priori theory on the relative importance of completeness versus validity, the proposition does not further delineate the relative effectiveness of these two approaches.

P2C: On average, double-loop planning will be the most effective form of strategic I/S planning.

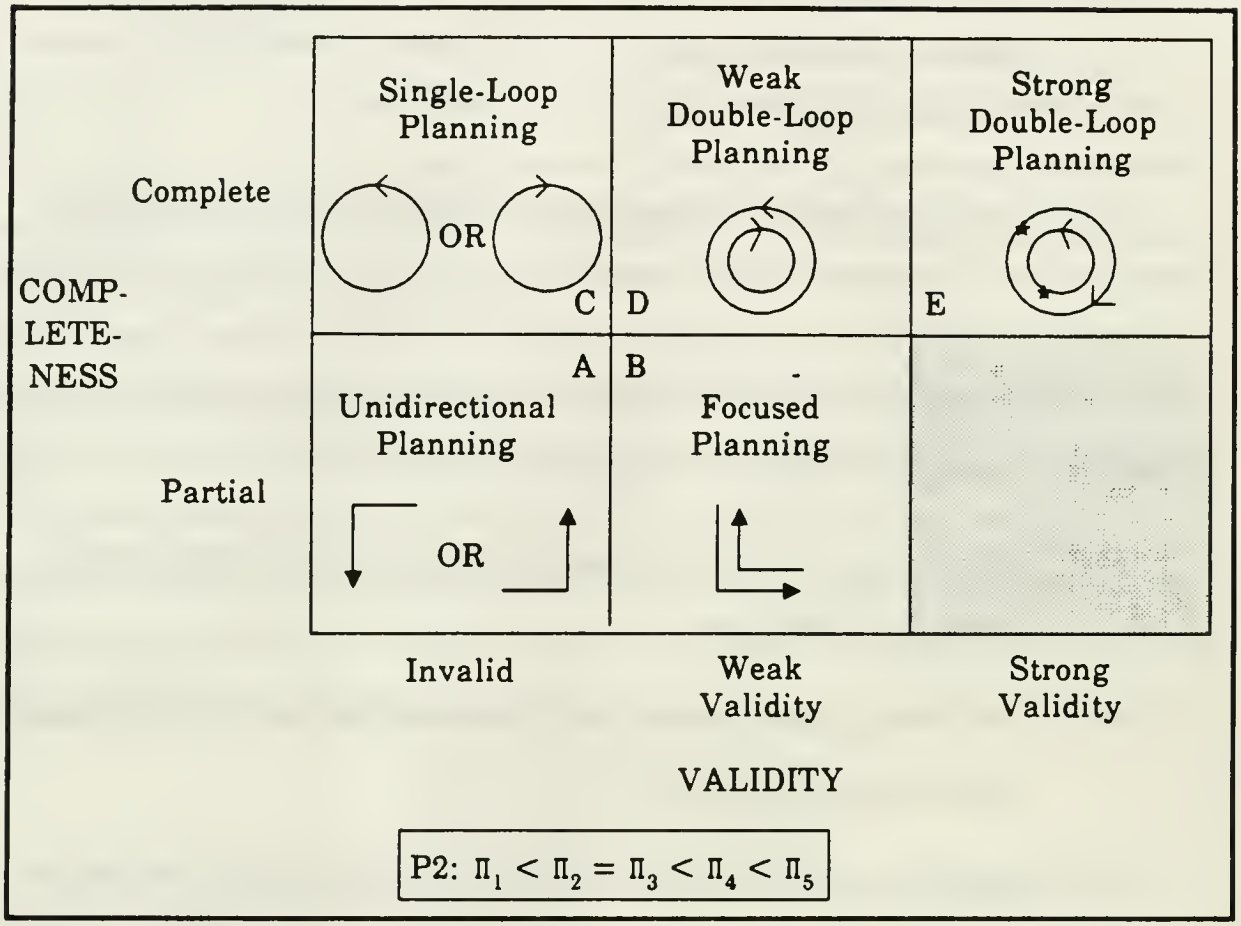
P2D: On average, strong double-loop planning will be more effective than weak double-loop planning.

These propositions argue that a complete and valid planning process will be most effective. This approach not only addresses all planning domains but seeks to challenge the assumptions of a domain anchor. Proposition 2D argues that strong validity is, on average, more effective than weak validity.

Each of these propositions is stated as holding *on average*. One could easily imagine a set of organizational context factors (contingencies) that would result in working to improve the effectiveness of a given planning process. For example, one major contingency relates to the level of uncertainty. Galbraith (1977), Thompson (1967) and others have argued that increased environmental uncertainty requires increased information processing in order to sustain or improve organizational performance. In effect, efforts to enact a complete and/or valid planning process

Figure 5

I/S Planning Effectiveness



reflect increased information processing for the strategic I/S planning. This contingency leads to the third proposition.

P3A: Under conditions of low or moderate uncertainty, focused or single-loop planning will be equally as effective as double-loop planning.

In essence, this proposition argues that conditions of low or moderate uncertainty enable the organization to appropriately *select* a domain anchor or to appropriately *relax* the condition of strategic alignment. For example, low uncertainty concerning critical trends in information technology will increase the effectiveness of a focused planning process using *Strategy Execution*.

P3B: Under conditions of high uncertainty, comprehensive planning processes (of any form) will be less effective.

P3C: Under conditions of high uncertainty, double-loop planning will be more effective than single-loop or focused planning.

These propositions argue that the level of comprehensiveness and validity of the planning process should reflect the level of knowledge held by the firm. To the extent that uncertainty is high, the stability of any given planning assumption is problematic (Fredrickson, 1984). As such, attempts to minimize the risk of omission during the planning process will be ineffective. Similarly, the planning process should attempt to surface and explicitly explore critical assumptions.

While each of these propositions could be expanded, they serve to highlight how the Strategic Alignment Model can be used to systematically explore the characteristics of various strategic I/S planning methodologies. Ultimately, introducing the notion of contingencies, i.e., organizational context, suggests that effectiveness of a planning process requires a selection of a process that fits the organizational environment. The Strategic Alignment Model provides a model to differentiate among planning processes and, hence, provides the foundation for building a *perspective* theory for strategic I/S planning.

5.0 Conclusion

The Strategic Alignment Model (SAM) argues that strategic I/T management must address both strategic integration (internal and external) and functional integration (business and I/S). The SAM provides the framework to define four

concepts of strategic I/T management: consistency, completeness, validity and comprehensiveness.

The set of propositions illustrate how the effectiveness of any given I/S planning process relates to these four concepts. Further, major contingencies such as environmental uncertainty may moderate the effect of these concepts on planning process effectiveness. As a result, maximizing the effectiveness of a given strategic I/S planning process will require an appropriate *selection* of planning method. Further, a sequence of planning processes can be made more effective through selection of methods in a manner that maximizes the effectiveness of the overall planning system.

Ultimately, the Strategic Alignment Model reflects the impact of various types of risk on decision effectiveness. Incompleteness introduces risk associated with *relaxing* or taken as given the state of any one domain anchor. Invalid decision-making processes incur the risk of method bias (i.e., effect of an unchallenged domain anchor). Low comprehensiveness reflects the risk of omitting critical elements or details during analysis. To the extent that these risks are understood, selection of a planning method becomes a fundamental issue of risk/return and, hence, an *important* and ongoing responsibility of strategic management. This research seeks to build a prescribed model that will aid managers in making this choice.

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