Incremental and Comprehensive Strategic Information Systems Planning in an Uncertain Environment

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***Abstract*—Strategic information systems planning (SISP) is a critical challenge for organizations. Some researchers have suggested that more incremental SISP in an uncertain environment produces greater planning success, while others have suggested that more comprehensive SISP does so in that environment. The purpose of this study was to test the effect of incremental versus comprehensive SISP on SISP success in environments of varying uncertainty. A questionnaire defined SISP in terms of characteristics of incremental and comprehensive planning. It measured environmental uncertainty in terms of 1) the changeability and unpredictability components of dynamism, 2) heterogeneity, and 3) the scarcity and competition components of hostility. It assessed planning success as a second-order construct composed of alignment, analysis, cooperation, and capabilities. A postal survey collected data from 161 IS executives. The constructs were extensively validated. In general, greater SISP comprehensiveness predicted greater SISP success. Greater changeability and unpredictability, however, weakened the impact of such SISP on success. On the other hand, as the environment became more competitive, more comprehensive SISP led to greater SISP success. These findings contribute by suggesting that planners should expect comprehensive SISP to be less effective as changeability and unpredictability increase, but more effective as competition increases.**

***Index Terms*—Environmental uncertainty, strategic information systems planning, strategic information systems planning success.**

I. Introduction

THE RATE and unpredictability of environmental change, the diversity of the environment, the scarcity of resources, and the degree of competition are thought to moderate the impact of strategic information systems planning (SISP) on SISP success [70], [88], [97]. They would do so by limiting planners' knowledge, diminishing their planning horizons, reducing the precision of their plans, making senior managers reluctant to implement those plans, and thus possibly even dooming the plans to failure [89], [90]. Nevertheless, the high cost of large-scale information systems and the lengthy duration necessary to construct them do require planning. Without planning, such information systems themselves would also likely fail. Not surprisingly, both business and information systems executives view SISP as a major challenge [13].

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Some researchers have suggested that an IS planner should respond to the moderating effects of the environment by choosing an appropriate planning approach. Some have thus suggested that an incremental approach—one that incorporates alacrity, flexibility, and agility—will be more effective in an uncertain environment [21], [29], [80], [91], [100] whereas others have suggested that a comprehensive approach—one that incorporates exhaustiveness and inclusiveness—will be more effective in such an environment [66], [67], [78], [83]. The appropriate choice of the approach might enable the organization to successfully plan its new systems, whereas the inappropriate approach might prevent it from doing so. The purpose of this study was to answer questions about the impact of such approaches under different levels of environmental uncertainty.

This research thus tested a model with an independent variable of comprehensive vs. incremental SISP and a dependent variable of SISP success as a second-order construct composed of alignment, analysis, cooperation, and capabilities. The changeability and unpredictability components of dynamism; heterogeneity; and the scarcity and competition components of hostility served as moderators. Fig. 1 shows the research model.

The next three sections define the constructs in this study. The research questions are then put forth. Subsequent sections describe the methodology, provide an overview of the statistical analysis, discuss the psychometric properties of the measures, and analyze the structural models used to answer the research questions. The paper then discusses the findings, implications for future research, implications for practice, and conclusions.

II. Constructs: SISP, Environmental Uncertainty, and SISP Success

The main constructs in this study are SISP, environmental uncertainty, and SISP success. The following subsections elucidate these constructs and their components.

A. SISP

SISP is the process whereby an organization determines a portfolio of computer-based applications to help it achieve its business objectives [60], [85]. It has been described on a continuum from incremental to comprehensive in terms of five characteristics [89]. Table I summarizes them.

For example, the analysis done within the planning process can be either formal or informal. Incremental planning is more informal, and comprehensive planning is more formal. That is, incremental planning relies on personal experiences and judgment to derive IS plans [91], [100], whereas comprehensive planning uses better-defined, multiple analyses [9], [29], [83].

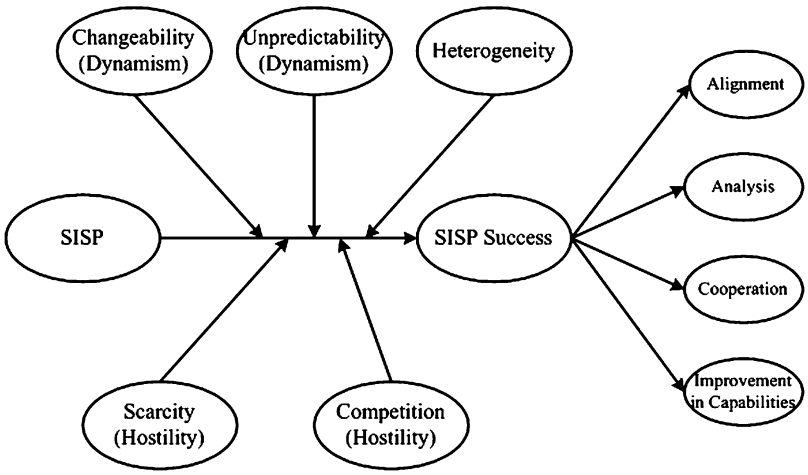

Fig. 1. The research model.

TABLE I
CONTRASTED CHARACTERISTICS OF INCREMENTAL AND COMPREHENSIVE SISP

Characteristic	Incremental SISP	Comprehensive SISP
1 Analysis	Informal analysis	Formal analysis
2 Integration with business strategy	IS plans loosely integrated with business strategy	IS plans tightly integrated with business strategy
3 Review of SISP plans	SISP plans continuously reviewed to adapt to changed circumstances	SISP plans periodically reviewed to adapt to changed circumstances
4 Representation basis	SISP based on representation from a few individuals	SISP based on representation from many organizational groups
5 Simplicity vs. complexity	Simple SISP plans	Complicated SISP plans

Second, incremental planning creates plans that are loosely integrated with the overall strategy of the organization [21], [91]. That is, the content of the IS plan only approximately reflects the business plan. On the other hand, comprehensive planning creates IS plans that are tightly integrated with overall strategic plans and thus more precisely represent them [55], [79], [82].

Third, in incremental planning, IS plans are continuously reviewed to adapt to changed circumstances [29], [91], [100]. In comprehensive planning, IS plans are periodically reviewed to adapt to such circumstances [38], [66]. In the former, the review might take place monthly, whereas in the latter it might take place every few years.

Fourth, incremental planning is based on an informal network of a few key individuals [29], [80], [100]. Comprehensive planning is based on formal representation from a large number of diverse organizational groups [28], [38]. Consensus is thus more readily arrived upon for incremental than for comprehensive planning.

Finally, plans can be simple or complicated. Incremental planning, the simpler approach, involves the shared group understanding of a few key individuals as the basis for its decisions [21], [91]. Comprehensive planning, on the other hand, involves well-defined methods and criteria as its basis [30].

Despite not using the above five characteristics, Mintzberg and Waters [75] described emergent and deliberate planning, two approaches that correspond respectively to incremental and comprehensive planning in the current study. Emergent incorporates the notion of strategic learning, whereas deliberate emphasizes direction and control, i.e., accomplishing required objectives at appropriate times. Emergent augments deliberate with the notion of learning that enables the organization to review and adjust SISP plans to adapt to environmental changes.

Both case studies and survey research have provided evidence of the existence of incremental and comprehensive SISP, the independent variable in the current study, and have thus lent some credibility to this study of the effect of comprehensive versus incremental SISP on SISP success in environments of varying uncertainty. The business-led approach/design school and administrative approach/political school of Earl [29] in his case studies and of Segars and Grover [94] in their survey research, with emphasis on informality and negotiation, illustrate incremental SISP. Comprehensive SISP is represented in those same researchers' technological approach/planning school and method approach/positioning school which emphasize structure and method.

B. Environmental Uncertainty

Uncertainty is the difference between the amount of information required to perform a task and the amount of it already possessed by the organization [37]. In the context of SISP, it thus represents the lack of information on which to create IS plans [91].

Environmental uncertainty has been described as being composed of three dimensions: dynamism, heterogeneity, and hostility [20], [68]–[70], [97]. The dimensions have also been referred to respectively as dynamism, complexity, and munificence [26]. While all three present major problems for contemporary managers, dynamism has been especially challenging [44]. The next three subsections describe dynamism (as composed of changeability and unpredictability), heterogeneity, and hostility (as composed of scarcity and competition) as shown in Fig. 1, and the fourth subsection overviews their impact on SISP.

Dynamism: Changeability and Unpredictability: Dynamism, according to a Webster's dictionary definition, refers to a theory that explains the universe in terms of forces, and their interplay.

Miller and Friesen [70] used the term in their organizational research and characterized it as the rate and unpredictability of environmental change such that the environment represented the forces, and its rate and unpredictability of change illustrated the interplay. As such, dynamism represents uncertainty to the extent that managers lack knowledge about environmental change. Miller and Friesen, as well as other researchers, have generally operationalized dynamism as a single construct of the rate of product/services obsolescence, the rate of product/services technology change, the unpredictability of competitors' moves, and the unpredictability of product/services demand changes [70], [88], [97].

Teo and King [97] factor analyzed dynamism, and found it to have two dimensions. The dimensions are referred to here as changeability (i.e., concerned with the rate of obsolescence and of technology change) and unpredictability (i.e., concerned with competitors' moves and demand changes). The rigor of that study and relative recency of the findings motivated the use of those two dimensions in the current research.

Heterogeneity: Heterogeneity is the diversity of external factors. Researchers have described it in terms of diversity in customers' buying habits, in the nature of competition, and in product lines [70], [88], [97]. As such, it represents uncertainty to the extent that managers lack knowledge due to the large and varied number of such factors, and it thus provides a serious external threat to the organization [53].

Hostility: Scarcity and Competition: Hostility refers to both the scarcity of available resources and the degree of competition in the external environment [70]. As such, it represents uncertainty to the extent that managers lack knowledge about the availability of resources and about their competitors. Researchers have generally defined hostility in terms of the threats posed by labor scarcity, materials scarcity, price competition, product quality competition, and product differentiation [70], [88], [97].

Hostility has also been treated as having two components, i.e., the scarcity of resources and the degree of competition [97]. These components are consistent with the operationalization of other researchers [72], [95].

Impact of the Dimensions: All the dimensions potentially affect how well managers use SISP to achieve its objectives. The changeability and unpredictability of dynamism can make it difficult for managers to achieve the objectives when they plan new, large-scale information systems because requirements and technologies may have unexpectedly changed by the time the systems are implemented. The customer, competitor, and product line diversity (of heterogeneity) can make it difficult for managers to achieve SISP objectives because SISP can demand such great information about and understanding of customers, competitors, and product lines. The scarcity and competition of hostility can make it difficult for managers to use SISP to achieve its objectives because scarcity and competition entail lack of information about labor, materials, and competition, and thus make allocation decisions for the new systems more complex.

Despite the potential impact of the environment, Teo and King [97] failed to find any environmental dimensions associated with IS and business planning. Choe [20] found that information systems provide a greater contribution in a more uncertain environment than in a less uncertain one, and Sabherwal and King [88] did find some associations concerning dynamism, heterogeneity, and hostility. However, most of the theoretical interest and empirical research have focused on dynamism rather than heterogeneity and hostility [42]. The current study considers 1) changeability and unpredictability as the components of dynamism, 2) heterogeneity, and 3) competition and scarcity as the components of hostility. It also considers, in particular, how those environmental dimensions moderate SISP to influence SISP success.

C. SISP Success

The benefits of SISP cannot be reduced to such simple financial measures as return on investment, payback, or internal rate of return [93]. This is because SISP, like strategic business planning, produces many difficult-to-assess benefits [56], [57]. Therefore, measuring SISP success is complex and considers these intangibles.

In that context, SISP success can be viewed as the degree of attainment of the objectives of SISP [84], [93]. Segars and Grover [93] have shown SISP success to be comprised of four dimensions of objectives which they referred to as alignment, analysis, cooperation, and improvement in capabilities.

Alignment refers to the results of the linkage of the IS strategy and business strategy [8], [47], [48], [55]. It facilitates top management's understanding of the importance of information systems, and improves IS management's understanding of business objectives. It, thereby, encourages senior business executives to provide managerial leadership and financial backing for the implementation of new systems that support the firm's objectives rather than for new ones that only extend current organizational patterns of usage.

Analysis concerns the results of the study of the internal operations of the organization [11], [12], [45]. It is used to help planners better understand the firm's current business processes and procedures, information technologies, and power structure for the purpose of discovering how the firm can use information technology to compete via an architecture of integrated applications and databases.

Cooperation refers to the results of the general agreement about development priorities, implementation schedules, and managerial responsibilities [105]. Through it, planners ensure that key managers and users support the process and content of SISP. Cooperation can create a partnership between managers, other users, and systems developers and, thereby, reduce the possible conflicts that may put SISP implementation at risk.

The fourth dimension, improvement in capabilities, represents the enhancement of the potential of the planning system [99]. The adapting of the planning process over time represents a key component of planning effectiveness. Thus, the organizational learning experienced through SISP should result in improved ability to align IS and business strategies; to analyze internal operations; to promote cooperation among managers, other users, and systems developers; to anticipate organizational and environmental changes; and to adapt to unanticipated changes.

In summary, this research applied three constructs. It uses them to test the effects of comprehensive vs. incremental SISP on SISP success in environments of varying uncertainty.

III. Research Questions

The next three subsections describe the research questions. Each subsection contrasts the conflicting points of view of the effects of comprehensive and incremental planning under the particular dimensions of environmental uncertainty in Fig. 1. Each ends with a restatement of the questions in terms of corollary hypotheses to the following main, countervailing hypotheses.

H-C As the environment increases in uncertainty, more comprehensive SISP leads to greater SISP success.

H-I As the environment increases in uncertainty, more incremental SISP leads to greater SISP success.

A. The Dynamic Environment

The first research question is: As the environment becomes more dynamic—in terms of its changeability or unpredictability components—does either more comprehensive or more incremental SISP predict greater SISP success? The following two subsections explain the reasoning underpinning the countervailing yet cogent expectations that motivate this question.

Comprehensive: Researchers have suggested that environmental dynamism makes it more difficult for managers to use SISP to achieve its objectives [89], [90]. Unpredictability about competitors and customers can make the establishment of business objectives and priorities difficult. Substantial changes (i.e., changeability) over short periods of time in an industry's products, services, and technologies can force businesses to modify objectives and priorities as managers learn more about those changes. The lack of business objectives and priorities (due to changeability) and the modifications to business objectives and priorities (due to unpredictability) can produce unexpected changes in IS objectives and priorities. All of these changes can make managers uncertain about the organizational value of IS projects [22], and reduce their commitment to them. Projects lacking managerial commitment may be started and stopped with such frequency that few are completed, and little value is realized.

Traditional strategic business planning theory predicts that organizations using comprehensive planning would be more successful in coping with such a dynamic environment [2]–[5], [49], [52], [86]. The same would be true in SISP [66], [67], [78], [83]. This would be because meticulous analysis would produce greater knowledge about the environment and thus greater ability to respond to the impact of its changes and to reduce its unpredictability. Meticulous analysis would permit the organization to develop plans that are less vulnerable to the detrimental consequences of that uncertainty. Such knowledge and ability would result in greater top management commitment and thus a better plan with greater likelihood of implementation, and therefore greater SISP success. Management research has provided some support for this position [41], [42], [77]. Moreover, action research found that an organization practicing comprehensive SISP was more successful than one that followed incremental SISP in the same, extremely dynamic environment [89].

Incremental: On the other hand, some general management and IS researchers have suggested that organizations using an informal, incremental approach will be more successful in a dynamic environment [29], [62], [72]–[74], [80], [81], [91], [100]. Their rationale is that planning quickly in smaller steps with continuous reviews by small groups of planners would permit flexibility in adjusting the plan while still facilitating satisfactory choices. Simplicity in plans and loose integration with business strategy would also facilitate such flexibility in adapting to the unpredictability of the environment and in responding to its changeability.

More meticulous and formal analysis, in contrast, would require so much time that the unexpected changes taking place in a changeable and unpredictable environment would render a plan obsolete. Any planning other than incremental in such an environment would be doomed to failure because data are unavailable, relationships obscure, and the future unpredictable; any other planning would simply not be flexible enough to be effective [21].

Strategic planning research has provided some support for the expectation that incremental planning would be more successful in a dynamic environment. Fredrickson and Mitchell [36] and Fredrickson [34] empirically demonstrated that rational comprehensiveness in the strategic business planning process is negatively related to performance in such an environment. In a subsequent study of the same firms in the same industries, Fredrickson and Iaquinto [35] found this relationship to be stable over time. More recently, consistent findings emerged from Hough and White's [50] study of the decision making of executive teams.

Information systems research has similarly provided some support for the expectation that incremental planning will be more effective in a dynamic environment. In one study, two organizations that practiced an informal approach considered their planning successful [80]. In another, a trial-and-error approach was credited with identifying applications that were highly praised by industry watchers [29].

The first research question can be summarized as the following two pairs of countervailing hypotheses:

H1-C As the environment increases in changeability, more comprehensive SISP leads to greater SISP success.

H1-I As the environment increases in changeability, more incremental SISP leads to greater SISP success.

H2-C As the environment increases in unpredictability, more comprehensive SISP leads to greater SISP success.

H2-I As the environment increases in unpredictability, more incremental SISP leads to greater SISP success.

B. The heterogeneous environment

The second research question is: As the environment becomes more heterogeneous, does either more comprehensive or more incremental SISP predict greater SISP success? The following

two subsections explain the reasoning underpinning the expectations that motivate this question.

Comprehensive: A heterogeneous environment (i.e., one with diversity in products, customers, and the nature of competition) has been the objective of considerably less research than has a dynamic one. Nevertheless, it can challenge managers by moderating the effect of strategy on firm performance [65]. Such an environment can demand that they understand not only a multitude of products, customers, and bases for competition, but also the interconnectedness of these elements [42]. The study and assimilation of considerable information may be required in order to create, design, and implement strategy under such diversity. Comprehensive planning would be better suited to such study and assimilation because it could interpret a larger amount of information, and thus result in more accurate and, thereby, more successful planning.

Research has supported this contention by showing that simplicity in planning (as found in the incremental approach) is adversely related to performance in a heterogeneous environment [64]. Presumably, this is because environmental heterogeneity increases the difficult managerial activity of acquiring and disseminating information [40], [71].

Incremental: On the other hand, managers might be so overwhelmed with the breadth and variety of information about products, customers, and the nature of competition that they cannot study and assimilate it sufficiently well to develop their strategy under the comprehensive approach. They would instead, need to develop the strategy as they learn about products, customers, and competitors. The more informal approach of incremental planning might enable them to develop more flexible plans that facilitate more successful SISP.

A study of 115 firms found that a more flexible business planning system is more likely to be used in a heterogeneous environment [58], [59]. The researcher concluded that more frequent reviews and shorter time horizons (as in the incremental approach) would produce better firm performance in such an environment.

The second research question can be summarized as the following pair of countervailing hypotheses.

H3-C As the environment increases in heterogeneity, more comprehensive SISP leads to greater SISP success.

H3-I As the environment increases in heterogeneity, more incremental SISP leads to greater SISP success.

C. The hostile environment

The third research question is: As the environment becomes more hostile—in terms of its scarcity or competition components—does either more comprehensive or more incremental SISP predict greater SISP success? The following two subsections explain the reasoning underpinning the expectations that motivate this question.

Comprehensive: The scarcity of and tough competition for labor and materials in a hostile environment creates difficulties for management, and can even threaten the firm's survival [101]. Such scarcity and competition can moderate the effect of planning by making the obtaining and allocating of labor and materials more difficult (for example, via the required searches for labor and materials or via the need to plan to operate without them). Comprehensive planning would enable the organization to gather and analyze more information about the availability and location of resources, and thus presumably enable managers to further forecast shortages and make better decisions about obtaining and using them. Comprehensive SISP, in particular, would also enable the organization to gather and analyze more information, thus improving allocation decisions for new information systems and resulting in greater SISP success.

The formalization of procedures, as in comprehensive planning, has been found in case studies in a hostile environment [14], [104]. Persistence with predetermined and intended business plans (versus regular and extensive adjustment to them in unanticipated ways as in incremental planning) is more positively related to financial performance among firms in a hostile environment than among firms in a nonhostile one [25]. Performance has also been associated with a long-term orientation (as in comprehensive planning) in a hostile environment and a short-term orientation (as in incremental) in a nonhostile one [24].

Incremental: Managers might be more effective if they develop their business strategy as they learn about the availability of labor and materials. Simpler planning in smaller steps by fewer executives (as found in the incremental approach) might enable them to work more effectively with the scarcity of and tough competition for labor and materials in the hostile environment.

In parallel in the IS area, under tighter competition for scarce labor, the more informal approach of incremental planning with its smaller required number of planners might enable managers to develop more flexible IS plans that facilitate more successful SISP. Moreover, due to its flexibility, incremental planning might produce more successful SISP under the scarcity and tight competition for the qualified specialists who would be the end users of the planned information systems. Comprehensive SISP in such an environment, with its requirement for more planners, might bog down under tighter competition for scarce labor.

Research has identified characteristics of a hostile environment that, at least, suggest incremental is more common in it. For example, in a hostile environment, the locus of decision-making shifts to higher hierarchical levels with fewer people involved in the process (a characteristic of incremental planning) [10], [46], [96]. A hostile environment is also positively associated with IS planning that emphasizes negotiations, another element of the incremental approach [88].

The third research question can be summarized as the following two pairs of countervailing hypotheses.

H4-C As the environment increases in scarcity, more comprehensive SISP leads to greater SISP success.

H4-I As the environment increases in scarcity, more incremental SISP leads to greater SISP success.

H5-C As the environment increases in competition, more comprehensive SISP leads to greater SISP success.

H5-I As the environment increases in competition, more incremental SISP leads to greater SISP success.

TABLE II
SISP CONSTRUCT ITEMS

	Item	Mean	SD
SISP Construct		2.74	.75
SISP analysis can be formal vs. informal	CI1	2.59	1.24
IS plans can be tightly vs. loosely integrated with business strategy	CI2	2.66	1.13
SISP plans can be reviewed to adapt to changed circumstances periodically vs. continuously	CI3	2.77	1.18
SISP can be based on representation from many organizational groups vs. a few individuals	CI4	2.49	1.36
SISP plans can be complicated vs. simple	CI5	3.23	1.10
SISP was comprehensive vs. incremental	CI6	2.71	1.15

IV. METHODOLOGY

This section describes the methodology used in the study. Its individual subsections elucidate the survey construction, pilot test, data collection and demographics, nonresponse bias testing, and common method variance testing.

A. Survey Construction

This research used a field survey of IS executives. The instrument operationalized three constructs, namely SISP, environmental uncertainty, and SISP success. Each used items of five-point Likert scales.

The SISP construct measured planning using the five characteristics derived from Salmela *et al.* [89] and discussed above. One item represented each characteristic. Because the construct was new and had only five items, a summary item was added. Low values on the Likert scales represented comprehensive planning and high values represented incremental. Appendix A shows the items as they appeared in the survey.

Environmental uncertainty was measured in terms of the extent of 1) the changeability and unpredictability components of dynamism, 2) heterogeneity, and 3) the scarcity and competition components of hostility in the firm's external environment based on the twelve items used by Teo and King [97] as derived from Miller and Friesen [68]–[70] and Sabherwal and King [88]. Higher values on the Likert scales represented more uncertainty. Appendix B shows the items.

The SISP success construct measured the extent the organization fulfilled its IS objectives of alignment, analysis, cooperation, and improvement in capabilities using Segars and Grover's [93] 30 items. Higher values on the scales represented more success. Appendix C shows the items.

B. Pilot Test

Five IS executives were invited to participate in a pilot test, and all agreed to do so. Four had the title of Chief Information Officer, and one was Director of Information Services. Their experience ranged from 17 to 38 years, and they worked in a variety of industries.

They completed the survey in the presence of the senior author in about 17 min. After doing so, they were asked to identify anything unclear or confusing. They commented on the content, length, and overall appearance of the instrument. Changes from each of the first four executives were integrated into the survey before the subsequent executive began filling it out. The interview with the fifth resulted in no changes.

C. Data Collection and Demographics

A sample of IS executives was randomly selected from the East and West editions of the Directory of Top Computer Executives [27]. The survey was sent to 1,200 executives. A total of 220 returned the survey for a response rate of 18%. Fifty-nine sent only demographic data and stated that they had not participated in an organization's SISP. Thus, the data analysis used the remaining 161 surveys.

Respondents were employed in a variety of industries, well educated, and experienced. Fifteen percent of them worked in manufacturing, 12% in finance, 11% in insurance, and the remainder in other industries. Ninety-three percent held a four-year college degree while 68% had some postgraduate school and 50% had completed an advanced degree. They also had an average of 21 years of IS experience. They had been employed by their current companies an average of 14 years.

The scope of the SISP was the entire enterprise for 81% of the subjects and a division for 16%. The planning horizon was two years for 12%, three for 47% and five for 21%.

Organizations in this study used substantial IS resources. The average number of IS employees was 853 and the average IS budget was $131 million.

Table II shows the means and standard deviations for the SISP construct and items. Tables III and IV show them for the environmental uncertainty and SISP success constructs and items.

D. Nonresponse Bias

A time-trend extrapolation test examined nonresponse bias [6]. It assumes that nonrespondents resemble late respondents more than early ones. With the first 25 percent as early respondents and the last 25 percent as surrogates for nonrespondents, a multivariate analysis of variance of the 48 variables indicated no significant differences (Wilks' $\mathrm{Lambda} = .55$; $\mathrm{p} = .34$). This finding is consistent with the absence of nonresponse bias.

E. Common Method Variance

The CIO is typically seen as the most knowledgeable person in the organization to assess SISP activities and success as defined in this study [106]. Most SISP research has thus used a single subject to assess them [43], [61], [83], [87]. Nevertheless Harman's single-factor test was used to check for common method variance [92], a problem that can account, at least in part, for a relationship between similar measures [76]. Underlying the test is the assumption that if a substantial amount of such variance exists in the data, a single factor will emerge from an exploratory factor analysis of all the variables that account for most of the variance. However, the analysis revealed fourteen factors with an Eigenvalue greater than one, and no single

TABLE III
ENVIRONMENTAL UNCERTAINTY DIMENSIONS AND THEIR ITEMS

	Item	Mean	SD
Changeability (Dynamism)		3.27	1.11
Products and services in our industry become obsolete very quickly	DYCH1	2.98	1.26
The product/services technologies in our industry change very quickly	DYCH2	3.57	1.13
Unpredictability (Dynamism) (reverse-coded items)		2.82	.82
We can predict what our competitors are going to do next	DYUNP1	2.84	.89
We can predict when our products/services demand changes	DYUNP2	2.79	.92
Heterogeneity		3.04	.98
In our industry, there is considerable diversity in customer buying habits	HE1	3.07	1.15
In our industry, there is considerable diversity in nature of competition	HE2	3.15	1.11
In our industry, there is considerable diversity in product lines	HE3	2.89	1.08
Scarcity (Hostility)		2.26	.84
The survival of this organization is currently threatened by scarce supply of labor	HOSC1	2.74	1.28
The survival of this organization is currently threatened by scarce supply of materials	HOSC2	1.74	.83
Competition (Hostility)		3.61	.87
The survival of this organization is currently threatened by tough price competition	HOCO1	3.68	1.10
The survival of this organization is currently threatened by tough competition in product/service quality	HOCO2	3.56	1.03
The survival of this organization is currently threatened by tough competition in product/service differentiation	HOCO3	3.62	1.13

factor explained most of the variance (i.e., they ranged from 2% to 24%). These results are consistent with the absence of significant systematic variance common to the measures.

V. OVERVIEW OF STATISTICAL ANALYSIS

Partial Least Squares (PLS) Graph version 3.0, a structural equation modeling tool that takes a component-based approach to estimation, was utilized for both measurement model validation and answering the research questions [17]. PLS uses a least squares estimation procedure that permits the flexibility to represent both formative and reflective latent constructs. It places minimal demands on measurement scales, sample size, and distributional assumptions [29], [31], [32], [102]. In contrast, such covariance-based SEM tools as LISREL and EQS use a maximum likelihood function to obtain parameter estimates and, in doing so, make much greater demands on the scales, sample, and distribution assumptions. Moreover, with PLS, statistical significance can be assessed using a bootstrap re-sampling procedure; in the current study this was done with 500 re-samples.

The next section explains the assessment of the psychometric properties of the measures, and the following one explains the analysis of the structural model used to answer the research questions. In summary, that analysis tested the effects of the interaction of SISP with changeability, unpredictability, heterogeneity, scarcity, and competition on SISP success. Wold [102] had advocated the broader use of PLS, and [1], [7], [16], [18], [51], [54], [98], [103] and others have applied it in IS research.

VI. PSYCHOMETRIC PROPERTIES OF THE MEASURES

The psychometric properties of the constructs with reflective indicators were assessed using PLS to examine internal consistency reliability (ICR), convergent validity, and discriminant validity [19]. ICR values, also known as composite reliabilities, resemble Cronbach's alpha. Values of .70 or higher are considered adequate [33]. PLS generated them from the data in this study.

Convergent and discriminant validity were assessed via two criteria. First, the square root of the average variance extracted (AVE) by a construct from its indicators should be at least .707 (i.e., $\mathrm{AVE} > .50$) and should exceed that construct's correlation with other constructs [7], [19], [33]. Second, standardized item loadings should generally be at least .707, and items should load more highly on their own constructs than on others [1], [15], [23].

PLS produced the latent variable correlations, AVE values, and factor loadings. From the output of the PLS run, a rescaled data matrix and a matrix of latent variables scores (known as the Eta matrix) were copied into an Excel spreadsheet. Pearson correlations were then computed between them to simultaneously recalculate the loadings and, more importantly, to calculate the cross-loadings [19].

SISP success was the only construct in this study with reflective indicators. [93] had similarly treated the indicators as reflective.) Because it was a second-order construct, PLS required including all of the items from the four first-order constructs (i.e., alignment, analysis, cooperation, and improvement in capabilities), loading those items on their respective first-order constructs, and then linking the first-order constructs to the second-order construct (i.e., SISP success). After dropping six indicators in the current study due to low factor loadings, the loadings of the resulting items generally exceeded .707[1] and all exceeded their cross loadings. Table V shows the final factor loadings and

[1]The reliability score for each item should generally be at least .707. However, reliability scores as low as .5 or .6 can be acceptable if some other items measuring the same construct have high reliability scores [19]. Thus for example, [1], [7], [19], and [54] all used items with reliabilities below .60 with some using those well below .50. In the current study, .67 was the lowest accepted reliability.

TABLE IV
SISP SUCCESS DIMENSIONS AND THEIR ITEMS

	Item	Mean	SD
Alignment		3.73	.54
Understanding the strategic priorities of top management	AL1	3.97	.79
Aligning IS strategies with the strategic plan of the organization	AL2	3.85	.77
Adapting the goals/objectives of IS to changing goals/objectives of the organization	AL3	3.84	.81
Maintaining a mutual understanding with top management on the role of IS in supporting strategy	AL4	3.70	.81
Identifying IT-related opportunities to support the strategic direction of the firm	AL5	3.80	.79
Educating top management on the importance of IT	AL6	3.59	.85
Adapting technology to strategic change	AL7	3.64	.75
Assessing the strategic importance of emerging technologies	AL8	3.47	.83
Analysis		3.46	.59
Understanding the information needs of organizational subunits	AN1	3.61	.85
Identifying opportunities for internal improvement in business processes through IT	AN2	3.61	.84
Improved understanding of how the organization actually operates	AN3	3.63	.76
Development of a "blueprint" which structures organizational processes	AN4	3.13	.96
Monitoring of internal business needs and the capability of IS to meet those needs	AN5	3.30	.76
Maintaining an understanding of changing organizational processes and procedures	AN6	3.30	.88
Generating new ideas to reengineer business processes through IT	AN7	3.53	.84
Understanding the dispersion of data, applications, and other technologies throughout the firm	AN8	3.56	.90
Cooperation		3.56	.66
Avoiding the overlapping development of major systems	CO1	3.94	.95
Achieving a general level of agreement regarding the risks/tradeoffs among system projects	CO2	3.55	.86
Establishing a uniform basis for prioritizing projects	CO3	3.35	.95
Maintaining open lines of communication with other departments	CO4	3.73	.83
Coordinating the development efforts of various organizational subunits	CO5	3.43	.88
Identifying and resolving potential sources of resistance to IS plans	CO6	3.39	.88
Developing clear guidelines of managerial responsibility for plan implementation	CO7	3.56	.90
Improvement in Capabilities		3.71	.50
Ability to identify key problem areas	CA1	3.84	.62
Ability to identify new business opportunities	CA2	3.70	.72
Ability to align IS strategy with organizational strategy	CA3	3.93	.84
Ability to anticipate surprises and crises	CA4	3.38	.77
Ability to understand the business and its information needs	CA5	3.90	.68
Flexibility to adapt to unanticipated changes	CA6	3.53	.81
Ability to gain cooperation among user groups for IS plans	CA7	3.68	.78

cross loadings, and thus provides support for convergent and discriminant validity.

Table VI further describes the reliability, and the convergent and discriminant validity of SISP success. All ICR values exceed .70. The diagonal elements (in bold) are the square roots of the AVEs; all of them exceed .707. The off-diagonal elements are the correlations between latent constructs; each is less than the square root of its AVE. Thus, the table further supports the reliability, and the convergent and discriminant validity of SISP success.

These criteria of reliability, convergent validity, and discriminant validity should be applied only for latent constructs with reflective indicators. They are not appropriate for constructs with formative indicators, that is, constructs that emerge from their indicators and are not necessarily expected to correlate with each other [19], [39]. In the current study, for example, the unpredictability construct contains one item for unpredictability about competitors and another for unpredictability about customers; it is easily conceivable that unpredictability for either competitors or customers might be present without unpredictability for the other.

For constructs with formative indicators, PLS provides weights that give information about the make-up and relative importance of each indicator [19]. The weights can be interpreted as beta coefficients in a standard regression. They normally have smaller absolute values than item loadings, and must be statistically significant.

Table VII shows the weights for the indicators of the formative constructs (i.e., SISP and the environmental dimensions) after dropping CI3 due to its nonsignificant t-statistic $(p > .05)$ for its weight of .03 in an earlier run. All of the weights for the final items in the table were statistically significant $(p < .001)$.

VII. ANSWERING THE RESEARCH QUESTIONS

PLS Graph 3.0 was used to test relationships among the constructs. SISP was the independent variable and SISP success, a second-order factor comprised of alignment, analysis, cooperation, and capabilities, was the dependent variable. Before

TABLE V
FACTOR LOADINGS

Items	Factors			
	Align-ment	Analy-sis	Cooper-ation	Capa-bilities
AL1	**.71**	.44	.37	.46
AL2	**.75**	.36	.39	.43
AL3	**.80**	.52	.46	.47
AL4	**.76**	.51	.39	.50
AL5	**.70**	.38	.26	.33
AL6	**.67**	.36	.28	.38
AN1	.50	**.72**	.43	.30
AN2	.42	**.78**	.40	.36
AN3	.38	**.69**	.40	.43
AN4	.39	**.70**	.33	.36
AN5	.47	**.69**	.55	.43
AN6	.47	**.81**	.47	.46
AN7	.36	**.68**	.35	.41
CO1	.43	.41	**.72**	.46
CO2	.37	.36	**.76**	.38
CO3	.29	.30	**.68**	.33
CO4	.39	.52	**.79**	.58
CO5	.39	.47	**.76**	.47
CO6	.31	.43	**.75**	.40
CO7	.39	.49	**.76**	.50
CA2	.42	.36	.26	**.69**
CA3	.55	.50	.52	**.81**
CA5	.42	.44	.52	**.80**
CA7	.36	.32	.50	**.70**

TABLE VI
RELIABILITIES, CONVERGENT VALIDITIES, AND DISCRIMINANT VALIDITIES FOR CONSTRUCTS WITH REFLECTIVE INDICATORS

Factors	ICR	Correlations and AVE Square Roots			
		Align-ment	Analy-sis	Cooper-ation	Capa-bilities
Alignment	.87	**.73**			
Analysis	.89	.60	**.73**		
Cooperation	.90	.50	.59	**.75**	
Capabilities	.84	.59	.54	.61	**.75**

testing the hypotheses, PLS was used to examine the impact of comprehensive vs. incremental SISP alone on SISP success in order to gain a broader view of the relationship between those two constructs. The test showed that greater SISP comprehensiveness predicted greater SISP success at a significant level ($\mathrm{path} = -.520, \mathrm{t} = 6.84, \mathrm{p} < .0001$).

For the actually answering the research questions, five variables (one for each of the interactions of SISP with changeability, unpredictability, heterogeneity, scarcity, and competition) moderated the effect of SISP on SISP success. Each moderator was calculated by multiplying each of the standardized indicators in the SISP construct times each of the standardized indicators in the respective environmental construct using the SPSS transform/compute function.

Table VIII shows the results of the PLS analysis used to answer the research questions. Changeability ($\mathrm{p} < .01$) and unpredictability ($\mathrm{p} < .05$; a reverse-coded construct) moderated the effect of SISP on SISP success. That is, the increasingly changeable and unpredictable environment weakened the impact of SISP comprehensiveness on SISP success. On the other hand, competition moderated the effect of SISP comprehensiveness on SISP success in that as the environment became more competitive, greater SISP comprehensiveness predicted even more SISP success ($\mathrm{p} < .05$). (Thus, in terms of hypotheses, H5-C for competition was fully supported, whereas H1-C for changeability and H2-C for unpredictability were supported with the qualification of the weakened impact.)

Table IX summarizes the findings in terms of the hypotheses.

Table X provides a closer look at the moderating effects of changeability, unpredictability and competition by showing the results of one PLS run for each dimension of SISP success.

TABLE VII
WEIGHTS FOR ITEMS IN FACTORS WITH FORMATIVE INDICATORS

Factor/Item	**Weight**
SISP	
CI1	.31
CI2	.26
CI4	.26
CI5	.23
CI6	.31
Dynamism – Changeability	
DYCH1	.54
DYCH2	.54
Dynamism – Unpredictability	
DYUNP1	.56
DYUNP2	.56
Heterogeneity	
HE1	.38
HE2	.38
HE3	.38
Hostility – Scarcity	
HOSC1	.65
HOSC2	.65
Hostility – Competition	
HOCO1	.41
HOCO2	.44
HOCO3	.41

TABLE VIII
PATH COEFFICIENTS AND T-STATISTICS OF ANTECEDENT, MODERATING, AND INTERACTION CONSTRUCTS

Construct/Interaction Term	Path	t
SISP	-.151	1.61
Changeability	.068	1.18
Changeability x SISP	.195	2.70**
Unpredictability	-.182	3.131
Unpredictability x SISP	-.250	2.55*
Heterogeneity	.051	0.85
Heterogeneity x SISP	.098	1.29
Scarcity	-.155	2.50
Scarcity x SISP	-.172	1.75
Competition	.099	1.69
Competition x SISP	-.153	1.97*

*p<.05, **p<.01

TABLE IX
SUMMARY OF FINDINGS FOR COUNTERVAILING HYPOTHESES

	Independent variable	**Moderating variable**	**Dependent variable**	**Support**
H1-C H1-I	Comprehensive SISP Incremental SISP	Changeability	SISP Success	Qualified
H2-C H2-I	Comprehensive SISP Incremental SISP	Unpredictability	SISP Success	Qualified
H3-C H3-I	Comprehensive SISP Incremental SISP	Heterogeneity	SISP Success	No
H4-C H4-I	Comprehensive SISP Incremental SISP	Scarcity	SISP Success	No
H5-C H5-I	Comprehensive SISP Incremental SISP	Competition	SISP Success	Yes

TABLE X
PATH COEFFICIENTS AND T-STATISTICS OF ANTECEDENT, MODERATING, AND INTERACTION CONSTRUCTS FOR COMPONENTS OF SISP SUCCESS

Construct/ Interaction Term	Alignment		Analysis		Cooperation		Capabilities	
	Path	t-value	Path	t-value	Path	t-value	Path	t-value
SISP	-.141	1.53	-.266	2.96	-.167	2.12	-.150	2.01
Changeability	.019	0.25	.145	2.30	.063	0.99	.097	1.56
Changeability x SISP	.254	3.77***	.336	4.21***	.165	2.38*	.292	4.03***
Un-predictability	-.083	1.45	-.135	1.97	-.178	3.04	-.228	3.99
Un-predictability x SISP	-.330	3.39***	-.068	.79	-.132	1.44	-.263	3.02**
Competition	.128	1.48	.133	1.96	.028	0.42	.114	1.76
Competition x SISP	-.220	3.04**	-.183	2.34*	.258	3.48***	.169	2.54*

p<.05, **p<.01, ***p<.001

Changeability moderated the effect of SISP on alignment ($p < .001$), analysis ($p < .001$), cooperation ($p < .05$), and capabilities ($p < .001$), whereas unpredictability moderated it on alignment ($p < .001$) and capabilities ($p < .01$); again, environmental changeability and unpredictability weakened the impact of comprehensive SISP on the SISP success measure. Competition moderated the effect of SISP such that as the environment became more competitive, increased comprehensiveness led to greater alignment ($p < .01$) and analysis ($p < .05$) success. Finally however, competition moderated the effect of SISP such that greater competition weakened the impact of comprehensive SISP on cooperation ($p < .001$) and capabilities ($p < .05$) success.

VIII. DISCUSSION

In general, more comprehensive planning predicted more SISP success ($p < .0001$). In other words, more formal SISP, with its complicated plans created by many organizational groups and tightly integrated with business strategy, predicted greater SISP success than did less formal SISP with its simpler plans created by a few individuals and less integrated with business strategy.

However as Table VIII shows, the increasingly changeable and unpredictable environment weakened the impact of comprehensive SISP on SISP success ($p < .01$ for changeability and $p < .05$ for unpredictability). That is, the shift toward more comprehensive planning in an environment of greater changes in products and services and their technologies as well as in an environment of less ability to predict what competitors will do next and when products/services demand will change, led to a decrease in that impact. Although comprehensive was more effective than incremental, this moderating environmental effect suggests that comprehensive planning loses some effectiveness when the environment becomes more dynamic. This loss of effectiveness would presumably be due to the time requirements and thus reduced flexibility of comprehensive planning.

The moderating effect of changeability was most evident in all four dimensions of SISP success (see Table X), whereas the effect of unpredictability was evident only for alignment and capabilities. Interestingly, unpredictability does not appear to moderate the effect of SISP on success at analysis (i.e., understanding the internal operations of the organization) and cooperation (i.e., creating agreement on development priorities). We speculate that perhaps this is true because the tasks for conducting analysis and producing cooperation are simpler and better defined than those for creating alignment (i.e., linkage of the IS strategy and business strategy) and improvement in capabilities (i.e., the enhancement of the potential of the planning system), and thus are less subject to the effects of unpredictability.

As Table VIII shows, when the environment became increasingly competitive, more comprehensive SISP led to greater SISP success ($p < .05$). That is, the shift toward even more comprehensive planning in an environment where the survival of the organization was threatened by tough competition in prices, product/service quality, and product/service differentiation led to greater achievement of SISP objectives. In other words, it appears at first glance that more comprehensive planning may help organizations deal with such competition. Comprehensive planning would do so by enabling the organization to gather and analyze more information, and thus would lead to better decision making. Unlike changeability and unpredictability, the time requirements and reduced flexibility of comprehensive planning are thus seemingly not unfavorably affected by tough competition.

On the other hand, the closer look at the SISP success construct for the moderating effect of competition in Table X revealed another perspective. Competition did moderate the effect of SISP such that as the environment became more competitive, increased comprehensiveness led to greater alignment ($p < .01$) and analysis ($p < .05$) success, but it also moderated the effect of SISP such that in the more competitive environment, increased comprehensiveness led to less cooperation ($p < .001$) and improvement in capabilities ($p < .05$) success. We speculate that perhaps comprehensiveness enhances alignment and analysis success because those types of success depend on more detailed facts about business strategy, information systems strategy, and internal operations in a more competitive environment, whereas it impedes cooperation and capabilities success because less formality facilitates the achievement of agreement on priorities and enhancement of the planning system.

The effect of any shift toward more or less comprehensive planning was not present in an environment of heterogeneity or scarcity (Table VIII). Heterogeneity does not moderate the effects of SISP because, perhaps, the diversity of customers' buying habits and product lines is sufficiently insulated from SISP. Likewise, scarcity might not moderate the effects of SISP

because, perhaps, the scarce supply of labor and of materials is similarly insulated from SISP. Possibly heterogeneity and scarcity do not threaten the organizational value of IS projects and top management's commitment to them.

IX. Implications for Future Research

The current study found that changeability, unpredictability, and competition moderated the effect of SISP on SISP success whereas heterogeneity and scarcity did not do so. The decomposition of SISP success into its four dimensions revealed that changeability, unpredictability, and competition moderated the effect of SISP somewhat differently for those individual dimensions. These findings have several potential implications for future research.

They suggest that researchers investigate SISP comprehensiveness and incrementalism in greater detail. The independent variable of SISP relied on a continuum of a few relevant, scaled, perceptual items. Such items are both customary and deemed valid in both SISP and business planning research. However, future research might treat each of those items as a construct itself, and thus use multiple indicators for each. Such a decomposition of incremental and comprehensive SISP might provide a more detailed understanding of the effects of each under environmental uncertainty.

More tangible measures might do so too. Researchers might count the number of formulas, diagrams, and tables appearing in the IS plan to represent formal versus informal SISP analysis. They might tally the references to specific business strategies appearing in the IS plan to correspond to IS plans tightly versus loosely integrated with business strategy. The number of times SISP plans were changed during the planning horizon (for SISP plans reviewed to adapt to changed circumstances periodically versus continuously), the number of organizational groups and key individuals on the planning team (for SISP based on representation from many organizational groups versus a few individuals), and the number of words or pages in the IS plan (for complicated vs. simple SISP plans) might also serve as measures the could result in findings that provide more specific guidance to practicing planners in their attempt to choose the extent of comprehensiveness or incrementalism.

The current study opens the question about potential contextual factors. For example, does comprehensiveness or incrementalism in SISP have a greater impact when an organization's existing or planned information systems are more or less extensive? What roles do organization size, type of industry, sophistication of IS management, and sophistication of business management play in the impact of SISP comprehensiveness or incrementalism on SISP success in an uncertain environment?

A fundamental assumption underlying the current research is that SISP success leads to information systems success and thus organizational success. That assumption is of paramount importance, and future research could examine it more thoroughly than has been done in the past.

The findings about SISP under changeability and unpredictability raise the question as to how organizations might move toward reducing their expectations for comprehensiveness in such an environment. The findings about SISP under competition raise the question as to how organizations might move toward implementing more comprehensiveness in that environment. Combined, those findings raise the even more difficult question about planning in an environment that is high in changeability, unpredictability, and competition.

The current study failed to find that heterogeneity, and scarcity moderated the effect of SISP on SISP success. Future research might investigate why. In terms of heterogeneity and scarcity, speculation here suggests that the diversity of customers' buying habits and of product lines, and the threat of the scarce supply of labor and materials are sufficiently insulated from SISP so that they do not moderate its effects. Heterogeneity and scarcity do not, perhaps, threaten the organizational value of IS projects and top management's commitment to them. Future research might investigate this speculation. It might also seek and test alternative explanations for the lack of moderating effects of heterogeneity and scarcity.

The current study found the moderating effect of changeability to be on all four dimensions of SISP success, but the moderating effect of unpredictability to be only on alignment and capabilities. In light of the speculation offered here, future research might investigate why unpredictability did not moderate the effect of SISP on analysis and cooperation success.

The current study found the moderating effect of competition to be favorable on alignment and analysis, but unfavorable on cooperation and capabilities. In light of the speculation offered here, future research might investigate why those differences appeared.

Future research might also attempt to compensate for the limitations of the current study. One limitation of this study was its use of a strictly survey-based method. Although such an approach is common in SISP research, future study might include measures of the variables drawn from other sources.

Another limitation of this study was its use of a single key informant. Although such an approach is common in SISP research and a test for common source variance was conducted, future study might draw responses from multiple informants in each organization.

X. Implications for Practice

Strategic information systems planning is a critical challenge to managers in today's rapidly changing and highly competitive world. Although correlation is not causation, the findings of this research suggest that more comprehensive SISP, in general, leads to greater SISP success. Greater changeability and unpredictability in this study, however, weakened the impact of such SISP on success. On the other hand, as the environment became more competitive, more comprehensive SISP led to greater SISP success.

The former finding (about changeability and unpredictability) suggests that as the environment becomes more dynamic, IS planners might adjust their expectations about the advantages of comprehensive SISP. That is, they should expect less from more complicated IS plans based on representation from more organizational groups with plans more tightly integrated with business strategy.

The latter finding suggests that as environmental competition increases, IS planners might consider a shift toward those more complicated IS plans based on representation from more organizational groups with plans more tightly integrated with business strategy. In this manner, they may be able to achieve greater success from comprehensive SISP in that environment.

The lack of findings for heterogeneity and scarcity suggest that the choice of comprehensiveness or incrementalism is not important under those environments. In other words, planners might neither benefit nor suffer from one choice versus the other.

Changeability, unpredictability, and competition may be quite prevalent today in various organizations and industries. The findings in this research better prepare planners for further increases and even for decreases in them as the environment evolves.

However, the greatest challenge to planners may be the environment high in changeability, unpredictability, and competition. Although the findings here show that comprehensive SISP outperforms incremental SISP, they also suggests that managers' expectations for the advantages of increased comprehensiveness should be lower in the increasingly dynamic rather than the increasingly competitive environment.

XI. Conclusion

Some researchers have suggested that an incremental planning approach—one that incorporates alacrity, flexibility, and thus agility—wwill be more effective in an uncertain environment, whereas others have suggested that a comprehensive approach—one that emphasizes exhaustiveness and inclusiveness—will perform better. The current study found that greater environmental changeability and unpredictability weaken the impact of comprehensive SISP on SISP success, but that as environmental competition grows, the increasingly comprehensive approach does result in greater SISP success. The study also found no moderating effects at all under heterogeneity or scarcity.

The study has thus contributed by providing empirical evidence in the debate about comprehensiveness versus incrementalism in uncertain environments by illuminating the potential of each in them. It has suggested that planners should expect more comprehensive SISP to be less effective under greater changeability and predictability, but more effective under greater competition.

It also contributed by validating a new measure of SISP and a relatively new one of SISP success. Both instruments can be used in future investigations with greater confidence.

Finally, whereas most research had considered only dynamism [42], the current study has contributed by considering (1) dynamism as composed of unpredictability and changeability, (2) heterogeneity, and (3) hostility as composed of scarcity and competition. In today's highly uncertain world, the study therefore offers new directions for IS researchers in their efforts to understand all of those environmental factors, and it provides encouragement for IS managers who attempt to deal with them.

Appendix A
Relevant Comprehensive-Incremental SISP Items From the Instrument

Please mark the number to indicate the extent to which one of the opposite items better describes your organization's most recent SISP.

CI1	SISP analysis was		
	formal	1 2 3 4 5	informal
CI2	IS plans were integrated with business strategy		
	tightly	1 2 3 4 5	loosely
CI3	SISP plans were reviewed to adapt to changed circumstances		
	periodically	1 2 3 4 5	continuously
CI4	SISP was based on representation from		
	many organizational groups	1 2 3 4 5	a few individuals
CI5	SISP plans were		
	complicated	1 2 3 4 5	simple
CI6	SISP was		
	comprehensive	1 2 3 4 5	incremental

Appendix B
Relevant Environmental Uncertainty Items From the Instrument

Please mark the number to indicate the extent to which you agree or disagree with the following statements about environmental uncertainty in the organization's industry.

		Disagree Agree
DYCH1	Products and services in our industry become obsolete very quickly	1 2 3 4 5
DYCH2	The product/services technologies in our industry change very quickly	1 2 3 4 5
DYUNP1	We can predict what our competitors are going to do next	1 2 3 4 5
DYUNP2	We can predict when our products/services demand changes	1 2 3 4 5
	In our industry, there is considerable diversity in:	
HE1	customer buying habits	1 2 3 4 5
HE2	nature of competition	1 2 3 4 5
HE3	product lines	1 2 3 4 5
	The survival of this organization is currently threatened by:	
HOSC1	scarce supply of labor	1 2 3 4 5
HOSC2	scarce supply of materials	1 2 3 4 5
HOCO1	tough price competition	1 2 3 4 5
HOCO2	tough competition in product/service quality	1 2 3 4 5
HOCO3	tough competition in product/service differentiation	1 2 3 4 5

APPENDIX C
RELEVANT SISP SUCCESS ITEMS FROM THE INSTRUMENT

Please mark the number to indicate the extent to which the organization fulfilled each of the following objectives of alignment, analysis, and cooperation from its SISP efforts.

		Entirely Unfulfilled				Entirely Fulfilled
	Alignment Objectives	1	2	3	4	5
AL1	Understanding the strategic priorities of top management	1	2	3	4	5
AL2	Aligning IS strategies with the strategic plan of the organization	1	2	3	4	5
AL3	Adapting the goals/objectives of IS to changing goals/objectives of the organization	1	2	3	4	5
AL4	Maintaining a mutual understanding with top management on the role of IS in supporting strategy	1	2	3	4	5
AL5	Identifying IT-related opportunities to support the strategic direction of the firm	1	2	3	4	5
AL6	Educating top management on the importance of IT	1	2	3	4	5
AL7	Adapting technology to strategic change	1	2	3	4	5
AL8	Assessing the strategic importance of emerging technologies	1	2	3	4	5
	Analysis Objectives					
AN1	Understanding the information needs of organizational subunits	1	2	3	4	5
AN2	Identifying opportunities for internal improvement in business processes through IT	1	2	3	4	5
AN3	Improved understanding of how the organization actually operates	1	2	3	4	5
AN4	Development of a "blueprint" which structures organizational processes	1	2	3	4	5
AN5	Monitoring of internal business needs and the capability of IS to meet those needs	1	2	3	4	5
AN6	Maintaining an understanding of changing organizational processes and procedures	1	2	3	4	5
AN7	Generating new ideas to reengineer business processes through IT	1	2	3	4	5
AN8	Understanding the dispersion of data, applications, and other technologies throughout the firm	1	2	3	4	5

		Entirely Unfulfilled				Entirely Fulfilled
	Cooperation Objectives					
CO1	Avoiding the overlapping development of major systems	1	2	3	4	5
CO2	Achieving a general level of agreement regarding the risks/tradeoffs among system projects	1	2	3	4	5
CO3	Establishing a uniform basis for prioritizing projects	1	2	3	4	5
CO4	Maintaining open lines of communication with other departments	1	2	3	4	5
CO5	Coordinating the development efforts of various organizational subunits	1	2	3	4	5
CO6	Identifying and resolving potential sources of resistance to IS plans	1	2	3	4	5
CO7	Developing clear guidelines of managerial responsibility for plan implementation	1	2	3	4	5

Please indicate the extent to which the following SISP capabilities improved over time within the firm:

		Much Deterioration				Much Improvement
CA1	Ability to identify key problem areas	1	2	3	4	5
CA2	Ability to identify new business opportunities	1	2	3	4	5
CA3	Ability to align IS strategy with organizational strategy	1	2	3	4	5
CA4	Ability to anticipate surprises and crises	1	2	3	4	5
CA5	Ability to understand the business and its information needs	1	2	3	4	5
CA6	Flexibility to adapt to unanticipated changes	1	2	3	4	5
CA7	Ability to gain cooperation among user groups for IS plans	1	2	3	4	5

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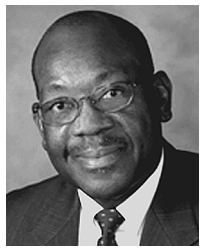

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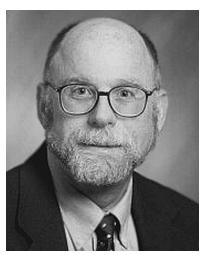

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