THE EFFECTIVENESS OF STRATEGIC INFORMATION SYSTEMS PLANNING FOR TECHNICAL RESOURCES, PERSONNEL RESOURCES, AND DATA SECURITY IN ENVIRONMENTS OF HETEROGENEITY AND HOSTILITY

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ABSTRACT

Environmental uncertainty is believed to influence strategic information systems planning (SISP). Research suggests that more such uncertainty would prompt more SISP, and that more SISP would produce greater planning success. This study tested those expected relationships.

A questionnaire defined SISP in terms of the planning activities for technical resources, personnel resources, and data security. It measured environmental uncertainty as heterogeneity and hostility where hostility consisted of scarcity and competition. It assessed planning success as a second order construct composed of alignment, analysis, cooperation, and improvement in capabilities. A postal survey collected data from 161 IS executives. Constructs were extensively validated.

Heterogeneity predicted personnel resources and data security planning. Scarcity predicted technical and personnel resources planning. Technical and personnel resources planning predicted planning success. The research contributed by highlighting the potential impact of heterogeneity and hostility on SISP, and that of technical resources, personnel resources, and data security planning on SISP success.

Keywords: strategic IS planning, strategic IS planning effectiveness, heterogeneity, hostility, data security

INTRODUCTION

An uncertain environment challenges today's business managers. It forces them to be more careful strategic planners. Because information systems provide a critical resource for reducing uncertainty, they become all the more important [51]. Hence, such uncertainty forces their planning, that is the organization's strategic information systems planning (SISP), to simultaneously be more extensive. In fact, a SISP approach that incorporates exhaustiveness and inclusiveness would be more effective in such an environment [28]. Not surprisingly, both business and information systems executives view SISP as a critical issue [10]. The purpose of the study reported herein was to test the impact of environmental heterogeneity and hostility on SISP, as well as that of SISP on SISP success.

CONSTRUCTS

Strategic Information Systems Planning

SISP can be defined as the process of determining an organization's portfolio of computer-based applications that will help it achieve its business objectives [49, 70]. SISP is a rational process, intended to recommend new information systems linked to an overall corporate strategy rather than to recommend them as an "ad hoc" response to such current crises as shrinking profits, growing lead-times and falling productivity [11, 21]. It has been described in terms of five phases and the specific tasks within them [54]. The phases and tasks represent the components of the planning process, with each having its own objectives, participants, preconditions, products, and techniques.

The first phase, strategic awareness, determines key planning issues, defines planning objectives, organizes planning team(s), and obtains top management commitment. The second, situation analysis, examines the current business systems, organizational systems, information systems, and the external business and IT environments. The third, strategy conception, identifies major IT objectives, opportunities for improvement, and high-level IT strategies. The fourth, strategy formulation, identifies new business processes, new IT architectures, specific new projects, and the priorities for the new projects. Finally, strategy implementation planning defines the change management approach, action plan, and follow-up and control procedure.

Although the planning literature has emphasized the notion of multidimensionality of planning systems, no consensus exists about what these dimensions are. One review of the SISP and strategic planning literatures has suggested five key SISP design dimensions. These dimensions are planning systems capability, link to organizational concerns, internal considerations, organization-specific environmental considerations, and general environmental considerations [66].

Another study described SISP in terms of such process dimensions as comprehensiveness, formulation, focus, flow, participation, and consistency [75]. SISP has been elucidated in terms of such general approaches as business-led, method-driven, administrative, technology, and organizational [24]. Furthermore, SISP has been viewed in terms of the analysis of internal, external, and technology issues [65].

Finally, SISP has been described in terms of IS resources planning activities, that is, in terms of activities associated with the resources that serve as the targets of the planning [35]. IS resources planning activities can be viewed as three constructs. Technical resources planning activities focus on the particular information technologies that are planned such as application software, systems software, hardware, and network communications, whereas personnel resources planning activities focus on more people-oriented concerns such as technical training, end-user

computing, facilities, and the personnel themselves [60]. Data security planning activities focus on protecting the organization from unwanted intrusion and recovering from such intrusion if and when it occurs [1].

Heterogeneity and hostility

Heterogeneity and hostility are external environmental components that threaten organizations [20, 32]. They do so by increasing uncertainty, i.e., the difference between the amount of information required to perform a task and the amount of it already possessed by the organization [29]. That is, they increase the amount required while raising questions about the amount already possessed. Heterogeneity and hostility have also been referred to respectively as complexity and munificence [22].

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 [53, 72, 79]. 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 [41].

A heterogeneous environment has been shown to challenge managers by moderating the effect of strategy on firm performance [53]. Even though a more flexible business planning system is more likely to be used in a heterogeneous environment [47, 48], simplicity in planning is adversely related to performance in such an environment [52]. A heterogeneous environment can demand that managers understand not only a multitude of products, customers, and bases for competition, but also the interconnectedness of these elements [32]. Presumably, this is because environmental heterogeneity increases the difficult managerial activity of acquiring and disseminating information [30, 58].

Hostility: Scarcity and Competition

Hostility refers to both the scarcity of available resources and the degree of competition in the external environment [57]. 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 [57, 72, 79].

Hostility has been treated as having two components, i.e., the scarcity of resources and the degree of competition [79]. These components are consistent with the operationalization of other researchers [59, 76]. 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 [82].

In a hostile environment, procedures tend to be formalized [12, 85] and the locus of decision-making shifts to higher hierarchical levels with fewer people involved in the process [7, 36, 77]. A hostile environment is also positively associated with IS planning that emphasizes negotiations [72].

Persistence with predetermined and intended business plans is more positively related to financial performance among firms in a hostile environment than among firms in a non-hostile one [20]. Performance has also been associated with a long-term orientation in a hostile environment and a short-term orientation in a non-hostile one [19].

SISP Success

The benefits of SISP cannot be reduced to such simple financial measures as return on investment, payback, or internal rate of return [74, 78]. This is because SISP, like strategic business planning, produces many difficult-to-assess benefits [44, 45]. 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 [67]. Segars and Grover [74] 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 [4, 31, 38, 39, 43, 61, 63, 68]. 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. It thus enables the organization's progression to more complex and advanced information systems [46].

Analysis concerns the results of the study of the internal operations of the organization [8, 9, 34]. 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 [37]. 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 [81]. 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, heterogeneity, scarcity, and competition in the current research are environmental characteristics beyond the control of the organization. Planning (i.e., as technical resources, personnel resources, and data security planning) is a process under its control, and effectiveness (composed of alignment, analysis, cooperation, and improvement in capabilities) is an outcome of that planning process. The process-outcome interpretation in the current research coincides with Reich and Benbasat's [69] recognition of the distinction between the organizational process

of planning and the resulting outcome of alignment. It is also consistent with Segars and Grover's [74] view of planning as a process and their four effectiveness constructs as outcomes of that process.

HYPOTHESES

In general, heterogeneity, scarcity, and competition create uncertainty. In an uncertain environment, managers perform planning in order to achieve the goals of the organization [43]. They apply the information provided by the planning to reduce both the uncertainty and the unfavorable effects of the uncertainty as best they can to achieve those goals [30]. This reasoning suggests that more planning will occur in a more uncertain environment, and thus underpins the first nine hypotheses in this study.

Hypotheses about heterogeneity and planning

For example, heterogeneity creates uncertainty. Heterogeneity is composed of diversity in customer buying habits, in product lines, and in the nature of competition. Diversity in customer buying habits creates uncertainty by impeding the organization in its efforts to know precisely which and how many products to produce. A greater number of product lines increases that uncertainty by making the production process more complex. Finally, diversity in the nature of competition creates uncertainty by impeding the organization in its efforts to anticipate how competitors will react to its moves. Such uncertainty, whether resulting from customer buying habits, product lines, or the nature of competition, would not only be present in the marketing and production functions, but would also permeate the organization including the information systems function.

This uncertainty would inspire more technical resources planning. IS managers would be expected to do more planning associated with the selection of application software. They would do so to choose the applications more likely to include the new and enhanced features that may lead to efficiency and effectiveness in business processes. The same would hold true for systems software because it must effectively manage the interface between the new application software and the hardware. Likewise, more planning for hardware and network communications would be done to support the new applications and systems software. Hence we propose:

H1: Greater heterogeneity leads to more technical resources planning

Under such uncertainty, managers would need to more carefully plan new positions and changes to existing ones, the training for occupants of new and changed positions, the role of end-users in the context of the new applications software, and the facilities in which end users and IT specialists would work. Hence we hypothesize:

H2: Greater heterogeneity leads to more personnel resources planning

Under such uncertainty, managers would need to more carefully plan to prevent unauthorized accesses to their databases. They would also need to more carefully plan how they would recover from such possible disasters. Hence we hypothesize:

H3: Greater heterogeneity leads to more data security planning

Hypotheses about scarcity and planning

Scarcity (a component of hostility) creates uncertainty. As comprising the lack of labor and the lack of materials, it can threaten the survival of the organization. Both the scarce supply of labor and of materials creates uncertainty by impeding the organization in its efforts to know the costs of, thus the prices of its products and services as well as the feasibility of making those products and services available. Such uncertainty — whether resulting from scarcity in labor or materials — would spread throughout the organization including the information systems function. Following the reasoning for H1-H3 about how uncertainty is expected to inspire planning, we hypothesize:

H4: Greater scarcity leads to more technical resources planning
H5: Greater scarcity leads to more personnel resources planning
H6: Greater scarcity leads to more data security planning

Hypotheses about competition and planning

Competition (the other component of hostility) creates uncertainty. The construct is comprised of tough competition in price, product/service quality, and product/service differentiation. Tough price competition creates uncertainty about an organization's ability to make a profit if it must offer products and services at similar prices. Tough competition in product/service quality creates uncertainty about an organization's ability to make a profit if it must offer similar quality. Tough competition in product/service differentiation creates uncertainty about an organization's ability to differentiate its own products or services. Such uncertainty — whether resulting from tough competition in prices, quality, or differentiation would spread throughout the organization including the information systems function. Following the reasoning for H1-H3 about how uncertainty is expected to inspire planning, we hypothesize:

H7: Greater competition leads to more technical resources planning
H8: Greater competition leads to more personnel resources planning
H9: Greater competition leads to more data security planning

Hypotheses about planning and SISP success

More technical resources planning is expected to lead to SISP success. For example, more applications software planning would lead to greater alignment of IS strategy with the business strategy, greater analysis of internal operations to discover how the firm can use IT to compete, and greater cooperation among managers about development priorities, implementation schedules, and managerial responsibilities. This is because more technical resources planning would enable an organization to choose and implement software better able to facilitate those outcomes. Moreover, more technical resources planning would produce improvement in capabilities in terms of the enhancement of

the overall planning system through the organizational learning associated with the planning. We thus hypothesize:

H10: Greater technical resources planning leads to greater SISP success
Greater technical resources planning leads to greater SISP in
- **H10a: Alignment**
- **H10b: Analysis**
- **H10c: Cooperation**
- **H10d: Improvement in Capabilities**

More personnel resources planning is expected to lead to greater SISP success. That is, more personnel planning would lead to greater alignment, analysis, and cooperation. This is because more personnel planning would enable the organization to hire and retain employees who would possess the skills for developing information systems to compete successfully. It would also result in choosing employees who would fit better into the culture of the organization and likewise facilitate its success. Planning for technical training, end-user computing, and facilities would complement the selection, hiring, and retention of the employees. Moreover, more personnel resources planning would produce improvement in capabilities in terms of the enhancement of the overall planning system through the organizational learning associated with the planning. We thus hypothesize:

H11: Greater personnel resources planning leads to greater SISP success
Greater personnel resources planning leads to greater SISP success in:
- **H11a: Alignment**
- **H11b: Analysis**
- **H11c: Cooperation**
- **H11d: Improvement in Capabilities**

More data security planning is expected to lead to greater SISP success. More data security planning would lead to greater alignment, analysis, and cooperation because it would enable the organization to protect its resources and thus devote more time and energy to alignment, analysis, and cooperation. Moreover, more data security planning would produce improvement in capabilities in terms of the enhancement of the overall planning system through the organizational learning associated with the planning.

H12: Greater data security planning leads to greater SISP success
Greater data security planning leads to greater SISP success in:
- **H12a: Alignment**
- **H12b: Analysis**
- **H12c: Cooperation**
- **H12d: Improvement in Capabilities**

METHODOLOGY

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.

SISP consisted of three dimensions, namely the extent of technical resources planning activities, the extent of personnel resources planning activities, and the extent of data security planning activities. The survey employed four items for the first two and two for the third based on a study of SISP in the manufacturing industry [35]. The first two had been validated and applied in a study of SISP autonomy in the subsidiaries of multinational firms [60]. Higher values on the Likert scales represented more planning.

Heterogeneity and hostility (in terms of the scarcity and competition components) in the firm's external environment were based on the eight items used in a study of the integration between SISP and business planning [79] as derived from business strategy research [55, 56, 57] and a study of the development of strategic information systems [72]. Higher values on the Likert scales represented more heterogeneity and hostility.

The SISP success construct measured the extent the organization fulfilled its IS objectives of alignment, analysis, cooperation, and improvement in capabilities. It used a 30 item measure from a study whose purpose was to develop an instrument to measure SISP success [74]. Higher values on the scales represented more success.

Appendix A shows the items as they appeared in the survey.

Pilot Test

Five IS executives accepted an invitation to participate in a pilot test. Four had the title of Chief Information Officer, and one was Director of Information Services. They worked in a variety of industries, and their experience ranged from 17 to 38 years.

After completing the survey in the presence of the senior author in about 17 minutes, 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 were applied to the survey before the next pilot subject began filling it out. The fifth interview resulted in no changes.

Data Collection and Demographics

A sample of IS executives was randomly selected from a directory of top computer executives. The survey was sent to 1,200 such executives. A total of 220 returned it for an 18% response rate. 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 worked in a variety of industries, and were well educated and highly 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. Respondents also had an average of 21 years of IS experience and had been employed by their current companies for an average of 14 years.

The scope of the SISP was the entire enterprise for 81% of the subjects and a division for 16%. Twelve percent of the organizations had a two year planning horizon, 47% had a three year horizon, and 21% had a five year horizon.

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

Non-response Bias

A time-trend extrapolation test examined non-response bias [3]. It assumes that non-respondents resemble late respondents more than early ones. With the first 25 percent as early respondents and the last 25 percent as surrogates for non-respondents, a multivariate analysis of variance of the 48 variables indicated no significant differences (Wilks' Lambda = .274; p = .23). This finding is consistent with the absence of non-response bias.

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 [64]. Most SISP research has thus used a single subject to assess them [33, 50, 66, 69]. Nevertheless Harman's single-factor test was used to check for common method variance [73], a problem that can account, at least in part, for a relationship between similar measures [6, 23, 62]. The test assumes 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 twelve factors with an Eigenvalue greater than one, and no single factor explaining most of the variance (i.e., they ranged from 2.1% to 25.0%). These results are consistent with the absence of significant common method variance.

STATISTICAL ANALYSIS

Overview

Partial Least Squares (PLS) Graph version 3.0, a structural equation modeling SEM tool that takes a component-based approach to estimation, was utilized both to validate the measurement model and test the hypotheses [15]. 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 [14, 25, 26, 83]. In contrast, such covariance-based SEM tools as LISREL, EQS, and AMOS 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.

The psychometric properties of the constructs with reflective indicators are assessed using PLS to examine internal consistency reliability (ICR), convergent validity, and discriminant validity [14]. ICR values, also known as composite reliabilities, resemble Cronbach's alpha. Values of .70 or higher are considered adequate [27]. PLS generates the ICR values.

Convergent and discriminant validity are assessed with PLS 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., AVE>.50) and should exceed that construct's correlation with other constructs [5, 14, 27]. Second, standardized item loadings should generally be at least .707, and items should load more highly on their own constructs than on others [2, 13, 18]. 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 [14].

PLS produces the latent variable correlations, AVE values, and factor loadings. Pearson correlations can be computed between a standardized data matrix and a matrix of latent variables scores (known as the Eta matrix in PLS) to calculate cross-loadings [14].

For constructs with formative indicators, PLS provides weights that give information about the make-up and relative importance of each indicator [14]. 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.

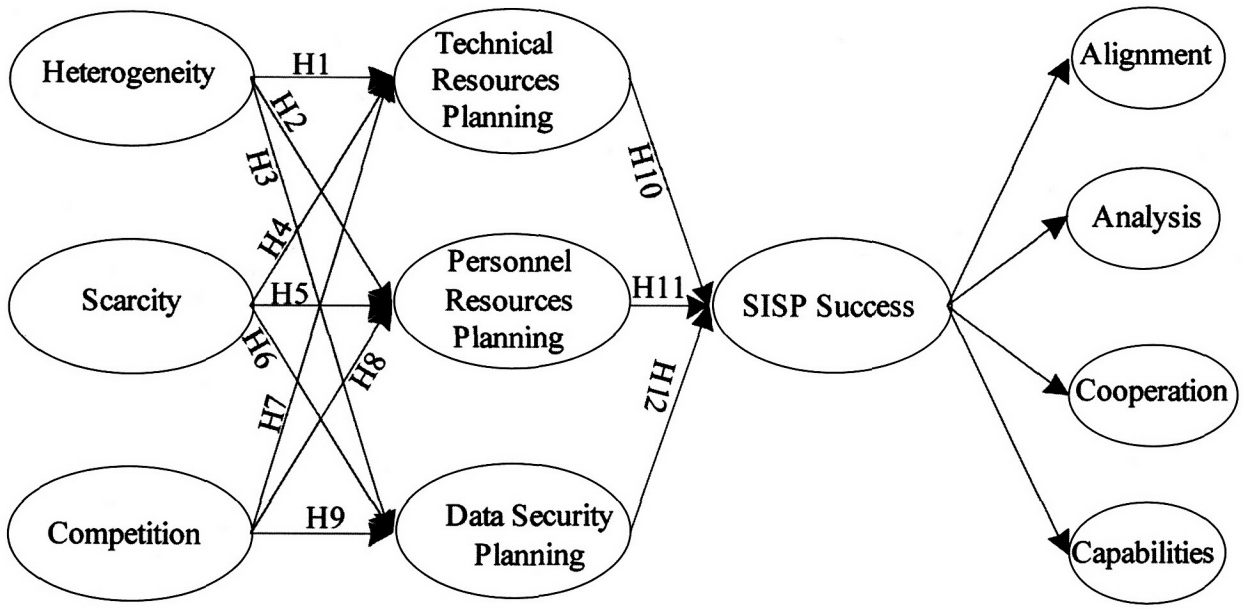

Figure 1. Model for H1-H9, H10, H11 and H12

Finally, PLS provides path coefficients and t-statistics for testing hypotheses in a structural model. It also provides r-square values for dependent, latent variables.

Wold [83] advocated the broader use of PLS. Thompson et al. [80], Igbaria et al. [40], Barclay et al. [5], Agarwal and Karahanna [2], Keil et al. [42], Chwelos et al. [17], Chin et al. [16], Yi and Davis [84], and others have applied it in IS research.

Model Validation

The current study assessed two models. Figure 1 was used to test H1-H12 while Figure 2 was used to test H10a-d, H11a-d, and H12a-d. In Figure 1, SISP success was a second order construct composed of first order factors of alignment, analysis, cooperation, and capabilities specifically for testing H10, H11, and H12. In Figure 2, the first order factors alone were used for testing H10a-d, H11a-d, and H12a-d. Boostraping was done with 500 re-samples. Each model required a separate validation.

Technical resources planning, personnel resources planning, and data security planning as well as alignment, analysis, cooperation, improvement in capabilities, and SISP success itself were the constructs in this study with reflective indicators. After dropping seven indicators due to low factor loadings, the loadings of the resulting items generally exceeded .707 and all exceeded their cross loadings for both models. All ICR values exceeded .70 in both models. All of the square roots of the AVEs exceeded .707, and the correlations between latent constructs were all less than the square root of its AVE for both models. Finally, the weights for the indicators of the formative constructs (i.e., heterogeneity, scarcity, and hostility) were all statistically significant ($p<.001$).

Hypothesis Testing

Tables 1 and 2 show the results of the hypothesis testing. H2, H3, H10, H10a, H10b, H10d, H11, H11b, H11c, H11d, and H12c were supported. Statistically significant results were found for H4 and H5, but in the unexpected direction. In both models, controls of annual IS budget and organization size (in terms of number of IS employees) were applied to the three planning constructs; none of the controls were statistically significant.

DISCUSSION

Support for H2 and H3 (i.e., that heterogeneity leads to personnel resources and data security planning) is consistent with the expectation that managers would respond to environmental uncertainty by seeking the information provided by the planning to reduce both the uncertainty and the unfavorable effects of that uncertainty as best they can [29]. The lack of support for H1 (i.e., that heterogeneity would lead to technical resources planning) might be because diversity in customers' buying habits, in the nature of competition, and in product lines does not easily translate into new application software, systems software, hardware, and network communications.

H4 and H5 (i.e., that scarcity leads to technical and personnel resources planning) were not only unsupported, but also statistically significant in the unexpected direction. The implication is that the scarce supply of labor and materials discourages such planning. Perhaps scarcity does so because managers are concerned that they will not have the resources to implement any proposed plans. Although H6 (i.e., scarcity leads to data security planning) was not significant, its coefficient was likewise in the unexpected direction.

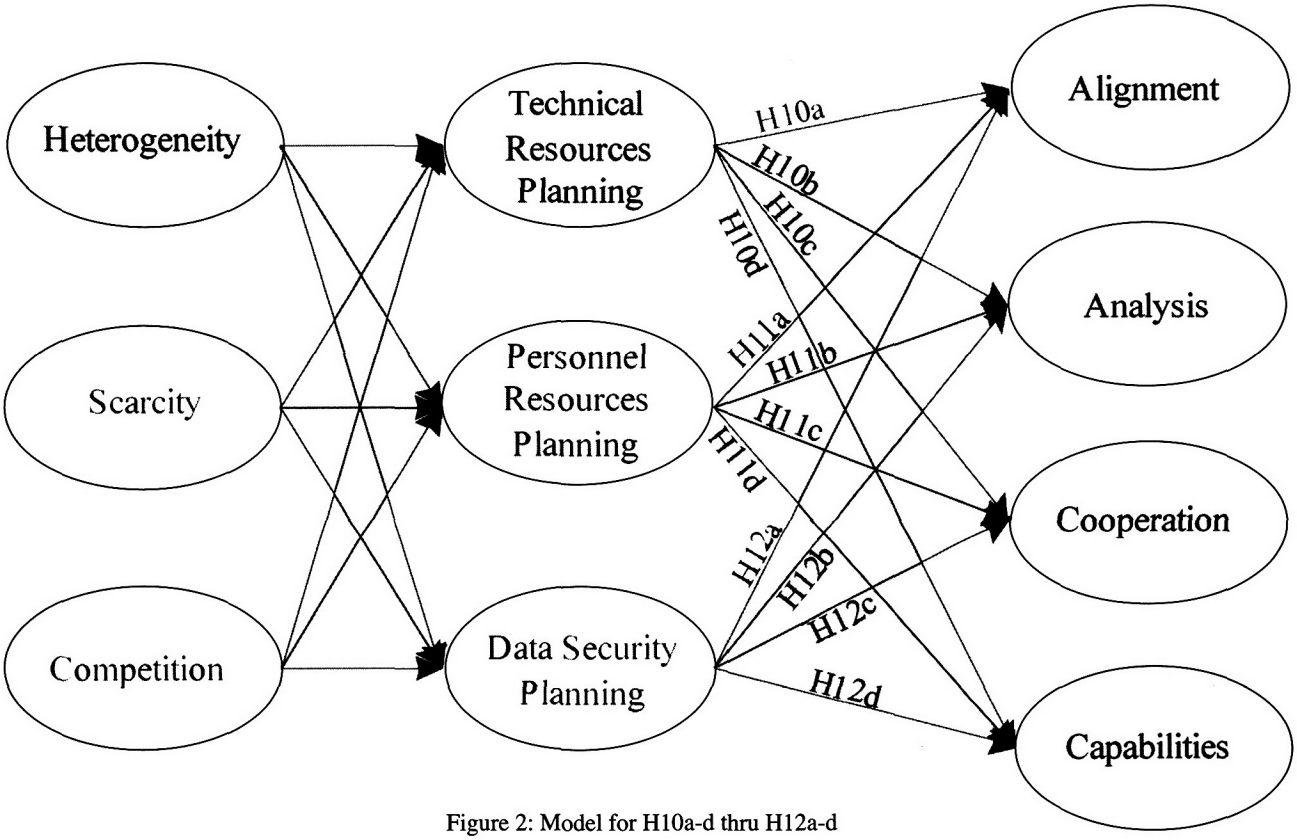

Figure 2: Model for H10a-d thru H12a-d

TABLE 1
Path Coefficients and T-statistics

Construct	Path	T
H1: Heterogeneity -> Technical Resources Planning	0.18	1.82
H2: Heterogeneity -> Personnel Resources Planning	0.18	2.02*
H3: Heterogeneity -> Data Security Planning	0.22	1.96*
H4: Scarcity -> Technical Resources Planning	-0.17	2.14*
H5: Scarcity -> Personnel Resources Planning	-0.19	2.27*
H6: Scarcity -> Data Security Planning	-0.10	1.07
H7: Competition -> Technical Resources Planning	0.13	1.19
H8: Competition -> Personnel Resources Planning	-0.06	0.63
H9: Competition -> Data Security Planning	-0.06	0.52
H10: Technical Resources Planning -> SISP Success	0.31	3.23**
H11: Personnel Resources Planning -> SISP Success	0.28	3.63***
H12: Data Security Planning -> SISP Success	0.10	1.27

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

TABLE 2
Path Coefficients and T-statistics

Construct	Path	T
Heterogeneity -> Technical Resources Planning	0.18	1.91
Heterogeneity -> Personnel Resources Planning	0.18	2.10*
Heterogeneity -> Data Security Planning	0.22	2.02*
Scarcity -> Technical Resources Planning	-0.17	1.97*
Scarcity -> Personnel Resources Planning	-0.19	2.18*
Scarcity -> Data Security Planning	-0.10	1.05
Competition -> Technical Resources Planning	0.13	1.29
Competition -> Personnel Resources Planning	-0.06	0.63
Competition -> Data Security Planning	-0.06	0.53
H10a: Technical Resources Planning -> Alignment	0.30	2.78**
H10b: Technical Resources Planning -> Analysis	0.34	3.44***
H10c: Technical Resources Planning -> Cooperation	0.17	1.52
H10d: Technical Resources Planning -> Improvement in Capabilities	0.33	3.57***
H11a: Personnel Resources Planning -> Alignment	0.11	1.22
H11b: Personnel Resources Planning -> Analysis	0.23	2.57*
H11c: Personnel Resources Planning -> Cooperation	0.30	3.38***
H11d: Personnel Resources Planning -> Improvement in Capabilities	0.18	2.12*
H12a: Data Security Planning -> Alignment	0.10	1.24
H12b: Data Security Planning -> Analysis	-0.05	0.51
H12c: Data Security Planning -> Cooperation	0.19	2.06*
H12d: Data Security Planning -> Improvement in Capabilities	0.04	0.44

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

H7, H8, and H9 (i.e., that competition leads to technical recourses, personnel resources, and data security planning) were not supported. Perhaps tough competition in price, product/service quality, and product/service differentiation does not inspire planning because planners are concerned that they cannot successfully plan new information systems under such uncertainty.

Support for H10 (that technical resources planning leads to planning success) as well as for H10a, b and d (i.e., that such planning leads to alignment, analysis, and improvement in capabilities) is consistent with expectations that SISP success is a function of planning as currently conducted. The lack of support for H10d (i.e., that such planning would lead to cooperation), however, suggests that perhaps technical resources planning may be more a basis for conflict than conflict resolution.

Support for H11 (i.e., that personnel resources planning leads to planning success) as well as for H11b, c and d (i.e., that such planning leads to analysis, cooperation, and improvement in capabilities) confirms the expected impact of planning in the more personnel-related tasks. However, the lack of support for H11a (i.e., that such planning would lead to alignment) suggests that personnel resources planning does not have such impact on the more competitively-oriented and probably even more desirable planning outcome.

Finally, the lack of support for H12 (i.e., that data security planning would lead to planning success) along with the lack

of it for H12a, b, and d (i.e., that such planning would lead to alignment, analysis, and improvement in capabilities) in light of support for only one of the data security planning hypotheses (H12c, that such planning leads to cooperation) suggests that while data security planning may encourage cooperation, more likely the expected outcomes of it are somewhat distant from those sought from creating new, competitive information systems.

IMPLICATIONS FOR RESEARCH

This research found support for four of its twelve main hypotheses (Table 1), and for seven of its twelve planning success sub-hypotheses (Table 2). We suggest reasons that the other hypotheses were not supported, but future research might investigate those reasons and identify others.

The research found statistically significant relationships in the unexpected direction for two of the main hypotheses. We propose an explanation, but future research might likewise test that explanation and identify others.

This research used existing measures for heterogeneity, scarcity, and hostility. However, scarcity had only two items and the others had only three. The measures demonstrated reliability and validity, but still, future research might develop new measures with more items.

Data security planning had only two items, and they did not predict the general planning success construct. Future research might use a measure for data security planning with more items. Moreover, the planning success instrument might be improved with a construct more directly related to expectations for improved data security.

IMPLICATIONS FOR MANAGEMENT

Because heterogeneity and scarcity appear to affect SISP, IS planners might consider more careful planning under those dimensions of environmental uncertainty. They would first need to analyze their environments to assess the extent to which those environments exhibit heterogeneity and scarcity. Given the knowledge that organizations in general plan more carefully under heterogeneity and scarcity, they would then consider if and how they might adjust their planning in response to those conditions.

Because technical resources and personnel resources planning lead to planning success, IS planners might consider increasing their emphasis on them. They would first need to assess how they conduct such planning. They would then need to consider alternatives that might enable them to expand their efforts and enable them to realize the expected effectiveness.

CONCLUSION

Strategic information systems planning is a critical challenge to today's researchers and executives. This study contributed in several ways. First, it re-validated measures of heterogeneity, scarcity, and SISP effectiveness. Future researchers may be more confident in the validity and reliability of the measures and thus in their own use of them. Second, the study validated new measures of personnel resources, technical resources, and data security planning. Researchers may use them in the future or further develop them.

Third, the study contributed by highlighting the potential impact of heterogeneity and hostility on technical resources, personnel resources, and data security planning. Fourth and finally, the study contributed by highlighting the potential impact of such planning on SISP success. These latter two contributions can inspire researchers to future study in the area and executives to more careful and, hopefully, more effective planning in it.

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(Appendix A, next page)

Appendix A

SISP COMPREHENSIVENESS

Please mark the number to indicate the extent to which the organization practiced each of the following activities during its SISP efforts:

	No Extent				Great Extent
Application software planning	1	2	3	4	5
Systems software planning	1	2	3	4	5
Hardware planning	1	2	3	4	5
Network communications planning	1	2	3	4	5
Personnel planning	1	2	3	4	5
Technical training planning	1	2	3	4	5
End-user computing planning	1	2	3	4	5
Facilities planning	1	2	3	4	5
Data security planning	1	2	3	4	5
Disaster recovery planning	1	2	3	4	5

ENVIRONMENTAL UNCERTAINTY

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
In our industry, there is considerable diversity in:					
customer buying habits	1	2	3	4	5
nature of competition	1	2	3	4	5
product lines	1	2	3	4	5
The survival of this organization is currently threatened by:					
scarce supply of labor	1	2	3	4	5
scarce supply of materials	1	2	3	4	5
tough price competition	1	2	3	4	5
tough competition in product/service quality	1	2	3	4	5
tough competition in product/service differentiation	1	2	3	4	5

SISP SUCCESS

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:

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

Cooperation Objectives	Entirely Unfulfilled				Entirely Fulfilled
Avoiding the overlapping development of major systems	1	2	3	4	5
Achieving a general level of agreement regarding the risks/tradeoffs among system projects	1	2	3	4	5
Establishing a uniform basis for prioritizing projects	1	2	3	4	5
Maintaining open lines of communication with other departments	1	2	3	4	5
Coordinating the development efforts of various organizational subunits	1	2	3	4	5
Identifying and resolving potential sources of resistance to IS plans	1	2	3	4	5
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
Ability to identify key problem areas	1	2	3	4	5
Ability to identify new business opportunities	1	2	3	4	5
Ability to align IS strategy with organizational strategy	1	2	3	4	5
Ability to anticipate surprises and crises	1	2	3	4	5
Ability to understand the business and its information needs	1	2	3	4	5
Flexibility to adapt to unanticipated changes	1	2	3	4	5
Ability to gain cooperation among user groups for IS plans	1	2	3	4	5