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Abstract

Strategic information systems planning (SISP) is a great concern to both researchers and managers. Research concerning it is important because improved SISP can help managers plan first for information systems themselves and then secondly for the broader, underlying business needs that motivate the development of those systems. Hypotheses examine the expected relationship between SISP comprehensiveness and SISP effectiveness. They predict a nonlinear, inverted-U relationship between comprehensiveness and effectiveness thus suggesting the existence of an optimal level of comprehensiveness. A postal survey collected data from 161 U.S. information systems executives. An extensive validation of the constructs followed. The statistical analysis supported the hypothesis when SISP comprehensiveness was assessed in terms of a strategy implementation planning phase but not in terms of four other phases. Future researchers should investigate why the hypothesis was supported for that phase but not the others. Managers may benefit from the knowledge that both too much and too little strategy implementation planning may be ineffective.

Keywords: Strategic information systems planning; strategic planning; management of information systems

Introduction

One challenge to effective strategic information systems planning (SISP) is to determine the extent of planning that should be practiced. This research will examine the impact of SISP comprehensiveness on SISP effectiveness. It will do so by investigating the relationship between SISP comprehensiveness and SISP success. A nonlinear, inverted-U relationship between those constructs would suggest the existence of an optimal level of comprehensiveness. This research will test whether such a level exists.

Although the law of diminishing returns is typically associated with physical effort and SISP is typically associated with intellectual effort, SISP might display features of the law. SISP would do so in terms of the extent of success associated with the comprehensiveness in the planning process. For example, as planning effort is increased throughout the process, the extent of success would increase, reach an optimal, and then start to decline. This decline would occur because of the complexity of coordinating the work of too many planners doing too much analysis to produce the plan. The excessive effort could delay the conclusion of the planning process and render the plan out-of-date and thus of less use.

In other words, the amount of formal planning that can contribute to the success of any planning process might be limited. Said differently, too little planning and too much planning might both be detrimental. Some optimal level might exist.

The SISP Process

SISP has been defined as the process of identifying a portfolio of computer-based applications to support an organization's business plans and to help it realize its business goals (Lederer and Sethi 1988). It is an intricate and complex activity. Research has shown that many IS executives have stated that performing SISP successfully is one of their top challenges (Brancheau, et al. 1996).

SISP was defined in one study in terms of phases and tasks (Mentzas 1997). They can and have been used to measure SISP comprehensiveness (Mirchandani 2000). They appear in Table 1. They form one of the bases of the current research.

Table 1. IS Planning Phases and Tasks

Planning the IS planning process (i.e., Strategic Awareness)
Determining key planning issues
Defining planning objectives
Organizing the planning team(s)
Obtaining top management commitment
Analyzing the Current Environment (i.e., Situation Analysis)
Analyzing current business systems
Analyzing current organizational systems
Analyzing current information systems
Analyzing the current external business environment
Analyzing the current external IT environment
Conceiving Strategy Alternatives (i.e., Strategy Conception)
Identifying major IT objectives
Identifying opportunities for improvement
Evaluating opportunities for improvement
Identifying high level IT strategies
Selecting Strategy (i.e., Strategy Formulation)
Identifying new business processes
Identifying new IT architectures
Identifying specific new projects
Identifying priorities for new projects
Planning Strategy Implementation (i.e., Strategy Implementation Planning)
Defining change management approach
Defining action plan
Evaluating action plan
Defining follow-up and control procedure

Success

Two success constructs, namely improvement in the capability of the planning system and extent of fulfillment of key planning objectives (Venkatraman and Ramanujam 1987; Raghunathan and Raghunathan 1994) were used recently to develop an instrument for measuring SISP success. The two were decomposed into four dimensions. Three were alignment, analysis, and cooperation to represent the fulfillment of objectives. The fourth was capabilities to represent the improvement approach (Segars and Grover 1998). The constructs and items in Table 2 form a basis of the current study.

Hypotheses

The major theoretical basis for the hypotheses in this research was the law of diminishing marginal returns. This law states that the assignment of one unit of input to a process results in an increase to the total output. The marginal output is the extra output added by one unit of input, while other factors are being held constant (Samuelson 1976). The marginal output of that unit adds favorably to the process and the total output increases at an increasing rate. However, as additional units are added to the process, the marginal output begins to decline and the total output begins to rise at a declining rate (McGuigan et al. 1996). As still more units are added to the process, the marginal output of each unit becomes zero and the total output levels off. At this point, the total output is at its optimal. The marginal output then becomes negative and the total output starts to decline. As more and more of the variable input is added to the process, the total output declines further (Sichel and Eckstein 1974).

Table 2. Success Measure

Alignment
Understanding the strategic priorities of top management
Aligning IS strategies with the strategic plan of the organization
Adapting the goals/objectives of IS to changing goals/objectives of the organization
Maintaining a mutual understanding with top management on the role of IS in supporting strategy
Identifying IT-related opportunities to support the strategic direction of the firm
Educating top management on the importance of IT
Adapting technology to strategic change
Assessing the strategic importance of emerging technologies
Analysis
Understanding the information needs of organizational subunits
Identifying opportunities for internal improvement in business processes through IT
Improved understanding of how the organization actually operates
Development of a "blueprint" which structures organizational processes
Monitoring of internal business needs and the capability of IS to meet those needs
Maintaining an understanding of changing organizational processes and procedures
Generating new ideas to reengineer business processes through IT
Understanding the dispersion of data, applications, and other technologies throughout the firm
Cooperation
Avoiding the overlapping development of major systems
Achieving a general level of agreement regarding the risks/tradeoffs among system projects
Establishing a uniform basis for prioritizing projects
Maintaining open lines of communication with other departments
Coordinating the development efforts of various organizational subunits
Identifying and resolving potential sources of resistance to IS plans
Developing clear guidelines of managerial responsibility for plan implementation
Capabilities
Ability to identify key problem areas
Ability to identify new business opportunities
Ability to align IS strategy with organizational strategy
Ability to anticipate surprises and crises
Ability to understand the business and its information needs
Flexibility to adapt to unanticipated changes
Ability to gain cooperation among user groups for IS plans

Although diminishing returns is typically associated with physical effort and SISP is typically associated with intellectual effort, SISP might display features of the law of diminishing returns. SISP would do so in terms of the extent of success associated with the comprehensiveness in the planning process. For example, as planning effort is initially increased (i.e., more planners perform more analysis), the extent of success would increase. Then at some point of comprehensiveness (i.e., some number of participants in the planning process performing some amount of analysis), success would reach an optimal. Continued increases in effort (i.e., too many planners doing too much analysis) would cause success to start to decline from its optimal. This decline would occur because coordinating the work of too many planners, too much analysis, and too many planning outputs would be difficult. The excessive effort could delay the conclusion of the planning process and render plans out-of-date and thus of less use. In other words, there is a limited amount of formal planning that can contribute to the success of any planning process. Said differently, too little planning and too much planning can both be detrimental. Some optimal level of planning does exist.

Further support for this relationship between planning comprehensiveness and success comes from a quite different perspective. In the field of psychology, the Yerkes-Dodson law (Yerkes and Dodson 1908) states that moderate, rather than excessively high or low, levels of motivation would produce optimal performance. An inverted-U function has been used to illustrate the law. In light of the organizational pressures to perform SISP, "excessively high or low levels of motivation" might be replaced with "too much or too little SISP." Optimal performance would then refer to various possible measures of successful outcomes of SISP.

Information processing theory is a third basis of support for the expected relationship (Schroder, Driver, and Streufert 1967). In it, information processing is described as reaching a maximum and then decreasing as a function of task complexity. Increases in SISP comprehensiveness would be analogous to increases in complexity, and would eventually result in less success (analogous to less information processing).

This notion of an optimal level of SISP can be examined in the context of its five phases (Mentzas 1997). For example, the strategic awareness phase raises issues concerning creating strategies and providing answers to major questions concerning the overall direction of the organization and its competitors. It does so by identifying the business processes of the organization and the strategic relevance of each. Conceivably planners could do too much or too little of it. Thus, H1 states:

> H1. As comprehensiveness in the strategic awareness phase of SISP increases, SISP success increases until it (success) reaches a maximum; as SISP comprehensiveness continues to increase, SISP success decreases.

With similar reasoning for each phase, the following hypotheses are proposed:

> H2. As comprehensiveness in the situation analysis phase of SISP increases, SISP success increases until it (success) reaches a maximum; as SISP comprehensiveness continues to increase, SISP success decreases.

> H3. As comprehensiveness in the strategy conception phase of SISP increases, SISP success increases until it (success) reaches a maximum; as SISP comprehensiveness continues to increase, SISP success decreases.

> H4. As comprehensiveness in the strategy formulation phase of SISP increases, SISP success increases until it (success) reaches a maximum; as SISP comprehensiveness continues to increase, SISP success decreases.

> H5. As comprehensiveness in the strategy implementation planning phase of SISP increases, SISP success increases until it (success) reaches a maximum; as SISP comprehensiveness continues to increase, SISP success decreases.

Methodology

This research used a field survey of practicing IS planners. The instrument operationalized two constructs. They were strategic IS planning comprehensiveness and strategic IS planning success. Each used five-point Likert-scales.

The comprehensiveness construct measured five planning phases and the tasks of each. The items were derived from Mentzas (1997) and used by Mirchandani (2000).

The success construct measured the extent the organization fulfilled its IS objectives of alignment, analysis, and cooperation and the extent IS capabilities improved over time. It used the success items from Segars and Grover (1998).

Data Collection

After five IS executives successfully pilot tested the instrument, a sample of IS executives was randomly selected from the East and West editions of the Directory of Top Computer Executives (1999). The survey was sent to 1,200 executives. A total of 220 returned it for a response rate of 18%. Fifty-nine sent only demographic data and said they had not participated in SISP. The remaining 161 surveys were used in the analysis.

Data Analysis

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

The scope of the planning was the entire enterprise for 81% and a division for 16%. The planning horizon was three years for 47%, five for 21%, and two for 12%. Their mean number of IS employees was 853 and mean IS budget was $131 million.

Analysis of Potential Response Bias

A time-trend extrapolation test examined non-response bias (Armstrong and Overton 1977). With the first 25% as early respondents and the last 25% as surrogates for non-respondents, a multivariate analysis of variance of the 51 variables indicated no significant differences (Wilks' Lambda = 0.98; $p = .17$).

Validation of SISP Construct

The SISP comprehensiveness activities construct contained five phases: strategic awareness, situation awareness, strategy conception, strategy formulation, and strategy implementation planning. Each had four or five tasks. This study used the phases to represent the different dimensions or factors of this construct.

The internal consistency of the latent factors for the construct was determined using Cronbach's alpha. It ranged from .77 to .88 for the phases. These results exceed the minimally accepted level suggested by Nunnally (1978) of .70.

Confirmatory factor analysis (CFA) was performed on the detailed items of the construct (Hatcher 1994). With the addition of two modifications, namely covariances of error terms, the resulting model met standards for the comparative fit index (CFI), robust comparative fit index (RCFI), non-normed fit index (NNFI), and the Satorra-Bentler chi square divided by degrees of freedom (SB χ^2 / df) ratio.

Convergent validity was assessed by reviewing the t statistic of the factor loadings for each indicator variable measuring a given factor. The standardized factor loadings ranged from .52 to .90 and the t statistics were significant at $p < .001$. These results supported convergent validity for the strategic IS planning comprehensiveness construct.

This study used the chi-square difference test, confidence interval test, and variance extracted test to assess discriminant validity of the construct. The chi square differences between the standard measurement model and the revised measurement models were significant ($p<.001$). These results supported discriminant validity.

None of the intervals calculated for the construct included 1.0. These findings indicated that the confidence interval test supported discriminant validity.

The variance extracted test provided mixed support for discriminant validity. The square of the correlation between F3 and F4 was less than the variance extracted estimate for F4. However, in general the analysis confirmed the validity of the construct.

Validation of SISP Success Construct

Thirty detailed items measured the success construct. Eight measured alignment, eight analysis, seven cooperation, and seven capability. Cronbach's alpha ranged from .79 to .87 for the construct, above the minimally accepted level.

CFA was performed. The NNFI was above the acceptable range. One item was dropped because it loaded on two factors. A second modification created a covariance of error terms associated with one factor. All fit indices then exceeded the acceptable level.

Convergent validity was assessed by reviewing the t statistic of the factor loadings for each indicator variable measuring a given factor. The standardized factor loadings ranged from .35 to .77 and the t statistics were significant at $p < .001$. These results supported convergent validity for the Success construct.

The chi square differences between the standard measurement model and the revised measurement models were significant at $p < .001$. This supported discriminant validity for the construct. Also, the confidence intervals calculated for the construct did not include the value 1.0, thus supporting discriminant validity.

The variance extracted test provided mixed support for discriminant validity. The squares of the correlation between F1 and F2, F1 and F4, and F3 and F4 were greater than both variance extracted estimates for the respective factors. However, in general the analysis confirmed the validity of the construct.

Hypothesis Testing

The SAS software package was used to analyze the relationship of the two variables in each hypothesis. This relationship was expected to assume a concave inverted-U, quadratic function. The regression analysis procedure of the SAS software package estimated the parameters of this quadratic function:

$$ISPS = a + b_1 * ISPC1 + b_2 * ISPC2 + \epsilon$$

Where: ISPS = Information System Planning Success
ISPC1 = Information System Planning Comprehensiveness
ISPC2 = ISPC1 * ISPC1
a = Intercept
b_1 and b_2 = Coefficients
ϵ = Random error term

Based on calculus, a negative b_2 significantly different from zero will confirm the concave curvilinear relationship predicted in the hypothesis.

Plots of the relationships of each phase with success were visually examined. They revealed linear relationships up to a certain point where the data began to exhibit curvilinear behavior. That point was 3.6 and was the cutoff in the regressions.

Five regression analysis runs showed that a concave curvilinear relationship existed for strategy implementation planning. The F test indicated the model was significant. The t statistic showed that b_1 and b_2 significantly differed from zero and b_2 was negative. Therefore H5 was supported. Table 3 shows the results.

Table 3. Hypothesis Testing

Phase	Quadratic Coefficient Estimate (Standard Error)	P value	T value	df	R^2
Strategic Awareness	0.13 (0.21)	.50	0.67	97	.36
Situation Analysis	-0.09 (0.33)	.77	-0.30	70	.15
Strategy Conception	0.41 (0.24)	.08	1.75	114	.19
Strategy Formulation	-0.11 (0.25)	.66	-0.44	92	.22
Strategy Implementation Planning	-0.62 (0.28)	.03*	-2.21	59	.31
*p . 5					

Implications for Researchers

This study hypothesized that as comprehensiveness increased, success increased until it reached a maximum and then decreased as comprehensiveness continued. The study supported only the strategy implementation planning phase (H5). Future researchers should attempt to determine why the data did not support more of them.

Future researchers could examine different combinations of the factors that make up the constructs in this research. For example, they could explore the relationship between each of the four success constructs and each of comprehensiveness constructs. Such more detailed examination may reveal new and interesting relationships that might exist among the constructs. Support or lack of support for combinations might provide insight into why more of the hypotheses were not supported using the current analysis.

This research primarily used medium to large companies to investigate the relationships among the constructs. Future researchers could investigate the relationships among them by gathering data from small companies. Perhaps company size influenced the outcome of the hypothesis testing.

Future researchers could use companies from different industries. They could investigate the relationships among the constructs by using companies from specific industries. For example, companies from the manufacturing or finance industries could be investigated. Perhaps industry influenced the outcome of the hypothesis testing.

In any case, the question remains as to why the planning the strategy implementation phase items supported the hypotheses whereas the others did not. Despite the speculation in this study, future research should attempt to determine the reason for the presence and lack of support depending on the independent variable.

Implications for Practitioners

The practical implication of support for the hypotheses was that planners may do too much or too little SISP. Too little SISP would produce plans with insufficient detail to permit implementation. Too much SISP would take too long and produce plans with so much detail that they might become dated and might never be implemented. The partial support for the strategy implementation planning is consistent with those concerns. Planners should be wary of the potential deleterious effects of too much or too little SISP.

Conclusion

The research made the following contributions. It provided further validation for the Segars and Grover (1998) success measure. The instrument offers considerable potential for future use, and the current research demonstrated its validity and reliability.

It created and validated measures of SISP comprehensiveness – an activities-related measure based on Mentzas (1997). Future research can use these measures with some degree of confidence based on the current research.

It provided partial support for the hypotheses. It thus extended the law of diminishing returns, the Yerkes-Dodson Law, and Schroder, Driver, and Streufert's (1967) information processing theory to IS research. Perhaps more important, it thus provided a rationale for future research to discover why that support was merely partial.

Finally, it provided a basis to encourage strategic IS planners to be wary of too much or too little SISP and evidence to be careful in their implementation planning.

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