The Strategic Impact Of Environmental Uncertainty And Information Systems Design

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ABSTRACT

For most of this century, strategic planning has been a three-to-five year organizational ritual of measuring the current position of the firm and determining where the firm should go in the future within the context of perceived environmental uncertainty (PEU). It has long been assumed that PEU impacts the strategic choices that drive organizational structure, including information systems design. However, technology has blurred the delineation between strategy and structure, and how organizations deal with PEU. The convergence of these elements has resulted in these causal relationships being questioned and re-examined. Recent research indicates that information systems play such an important role in today's organizations that they may impact the strategy that an organization pursues. This study surveys and examines 148 firms operating in ninety-two different industries. The results indicate that PEU has a significant impact on both strategy and information systems design while information systems design significantly affects strategy. This is critically important for information systems professionals as it suggests that the design and capabilities of the firm's information system are important considerations in the selection of a firm's strategy.

Introduction

In today's rapidly changing global marketplace the relationships between an organization's information system, strategy, and environmental uncertainty requires revisiting some dearly held assumptions about strategy and structure, including information systems design, that may even be the foundation of a company's success. In fact, management's perceived environmental uncertainty and its strategic intent have long been assumed to be the drivers determining the design of the organization's information system. However, new research

reveals that information systems play such an important role in today's organizations that they can significantly impact the strategy an organization pursues. The increased role of technology will have implications for all facets of organization and especially the need to optimize internal processes that may now be intertwined with the external world in unforeseen ways. In this information age, technology has become the central driver of organizational change causing a deep shift in how executives view their organization's information systems.

Readers with comments or questions are encouraged to contact the authors via e-mail.

Strategic Thinking, Information Systems, And Uncertainty

Perceived Environmental Uncertainty and Information Systems

Since Duncan (1972) first used the term, perceived environmental uncertainty (PEU) has been the subject of much speculation as to its impact on the organization. Milliken (1987) defines PEU as referring to top management's perceived inability to predict the organization's external environment with an acceptable degree of accuracy. Sathe and Watson (1987) define the environment as those factors external to the organization, which impact organization structure. Elements of the environment that have been studied include suppliers, competition, markets, and government/regulatory agencies (Bourgeois, 1985; Miles and Snow, 1978).

Since its conceptualization, PEU has been considered an important factor in the design of information systems. Gordon and Miller (1976) considered the relationships among a number of variables, including the environment, and information systems design. Environmental variables addressed were dynamism, hostility, and heterogeneity. Each of these variables can be considered as components of PEU. They proposed that as environmental dynamism increases, the effective accounting system will: (1) incorporate more non-financial and qualitative information, (2) make greater use of forecast information, and (3) increase the frequency of reporting. As environmental hostility increases, the effective accounting information system will: (1) provide substantial non-financial data to aid in identifying strengths, opportunities, threats and weaknesses, and (2) require continuous reporting. Gordon and Miller (1976) proposed that as environmental heterogeneity increases, the effective accounting information system will compartmentalize information so that management can rapidly measure the performance of separate strategic business units.

In their analysis of the impact of the en-

vironment on information systems design, Banbury and Nahapiet (1979) later proposed that the nature of the environment, especially its illiberality and turbulence, were influential in the design of information systems. They considered the tightness to which a system was operated to be dependent on management's perceptions of the illiberality of the environment in which the organization operates. Likewise, they believed that information systems should be more adaptive and flexible in environments reflecting increasing turbulence.

Ewusi-Mensah (1981) considered the primary responsibilities of an organization's information system to be the selective gathering, memorization, processing, and communication of information for decision-making purposes. He identified three environmental states with which an organization must interact: (1) controllable, (2) partially controllable, and (3) un-controllable. He proposed that organizations operate in different environments and environmental states requiring different decision processes and systems for providing information with different characteristics. The characteristics of the information which must be considered in information systems design are: (1) quality, (2) availability, (3) value, (4) impact on decision making, (5) organizational interaction, (6) organizational search, (7) response time, (8) source, (9) time horizon, and (10) type.

Gordon and Narayanan (1984) found that the driving force behind decisions concerning the characteristics of the information required from information systems was management's perception of uncertainty in the environment. Managers operating in uncertain environments felt a greater need for external, non-financial, and future-oriented information. Those managers operating in less turbulent environments were found to favor internally generated, financially information with a deterministic orientation.

Chenhall and Morris (1986) found a positive relationship between PEU and the perceived usefulness of broad scope information and

the timeliness of information. The level of aggregation of information was not found to be related to PEU.

In a related study, Gul and Chia (1994) determined that under conditions of high PEU, decentralization and a management accounting system providing information with increased levels of the information characteristics of scope and aggregation were associated with higher firm performance.

Chong and Chong (1997), in a recent study utilizing the Chenhall and Morris (1986) scale for the information characteristic of scope, found PEU to be an important antecedent of system design. This is consistent with previous research.

Perceived Environmental Uncertainty and Strategy

Strategy has been defined and described in a multitude of ways. Chandler (1962) defines strategy as the determination of basic long-term goals and the adoption of courses of action and allocation of resources for achieving these goals.

Miles and Snow (1978, 7) view strategy as "... a pattern or stream of major and minor decisions about an organization's future domain." Porter (1985) defines strategy as the search for a favorable competitive position in an industry with the aim of establishing a profitable and sustainable position against the forces that determine competition within that industry.

In defining strategy, the distinction must be made between corporate strategy and business strategy (Robbins, 1990). Corporate strategy defines the businesses or markets in which a company will compete (Andrews, 1980). Business strategy focuses on how to compete in each line of business or market. The issues at this level involve the matching of environmental opportunities and competitive threats with the efficient deployment of the organization's resources (Venkatraman, 1989). Business strategy is that which is addressed in this study.

As with information systems, the link between PEU and strategy has long been recognized. Senior management's perceptions about the external environment affect the strategic choices of the organization (Wheelen and Hunger, 1995). Therefore, PEU is considered to be an important antecedent of an organization's strategy.

Previous studies (Chandler, 1962; Simons, 1987; Govindarajan, 1984) have suggested that firms pursuing a prospector-like strategy perceive PEU as high. These firms locate and exploit product/market opportunities through a continuous monitoring of environmental conditions. To accomplish this, the prospector invests heavily in systems to monitor a wide range of environmental conditions, trends, and events (Miles and Snow, 1978).

At the other end of the continuum, firms pursuing a defender-like strategy are associated with relatively low levels of PEU (Miles and Snow, 1978; Miller, 1988). Defenders direct their products or services to a limited segment of the market. The management of defender-type firms have a tendency to ignore issues outside of the chosen domain. The outside environment is generally viewed as a conglomeration of a relatively few factors whose behavior can be accurately predicted and which are not expected to significantly influence the internal operations of the firm (Miles and Snow, 1978).

Information Systems Design and Strategy

Strategy and its relationship to information systems has been the subject of a considerable amount of research interest (Weill and Olson, 1989). Traditional organization theory emphasizes the concept of strategy influencing organization structure, of which information systems design is one element (Chandler, 1962). Gorry and Scott Morton (1971) proposed that information systems exist only to support decision-making and that systems design should be based on the information required to make various types of organizational decisions.

Tymon, Stout, and Shaw (1998) proposed in their model of the antecedents and consequences of PEU that strategy, which emanates from management's perceptions of environmental uncertainty, impacts organizational design decisions. Included in these decisions are those regarding control mechanisms, including information systems. This model is in consonance with current conceptualizations of the strategic management process (Thompson and Strickland, 1995). While traditional organizational theory emphasizes the causal effect of strategy on information systems design, this has not received universal acceptance. Some suggest that information systems (IS) may impact the strategy that an organization pursues.

Pyburn (1983) addresses the importance of information systems in organizations' strategy. He notes that efficiency concerns have become an important part of many organizations' strategies. This has elevated the role of information systems in addressing these efficiency concerns. This is especially important, as productivity has become a matter of survival in many industries. Also, he argues that since information technology has become such an integral part of the product/service of many firms, information systems strategy has become a critical component of those organizations' overall strategies.

Mason (1984) challenges Chandler's (1962) thesis that strategy influences organizational structure and ultimately, information systems. He states that in some organizations, the converse is true--information systems influence strategy. Mason proposes that a convergence of information systems, structure, and strategy has emerged. He attributes this convergence to several forces: (1) the rapid innovation of new information technologies, (2) the widespread proliferation of new ideas about information itself and its role in the organization, and (3) the development of new information intensive organization structures and business strategies.

The above would seem to suggest that information systems play a much more important

role in the organization than was previously realized. In fact, organizations may be so dependent on information systems that these systems may act to constrain or circumscribe the strategy that an organization is capable of pursuing.

Hypothesis Development

Linkage Between Perceived Environmental Uncertainty and Information Systems Design

The first hypothesis is concerned with the relationship between PEU and information systems design. It has been suggested that PEU has a direct influence on the characteristics of the information which is required from information systems. Gordon and Narayanan (1984) found PEU to be the primary determinant of the characteristics of the information desired by managers from information systems. Recent studies (Gul, 1991; Gul and Chia, 1994; Chong and Chong, 1997) have found PEU to be associated with the information characteristics of scope, timeliness, aggregation, and integration as defined by Chenhall and Morris (1986). Thus, the following hypothesis is suggested:

H₁: Perceived environmental uncertainty has a significant impact on information systems design.

Linkage Between Perceived Environmental Uncertainty and Strategy

The second hypothesis addresses the relationship between PEU and strategy. Previous research suggests a strong relationship between PEU and strategy. Using the Miles and Snow (1978) strategic taxonomy, this research (Miles and Snow, 1978; Govindarajan, 1984; Simons, 1987; Miller, 1988) has shown prospector-like firms to be associated with high PEU and defender-like firms to be associated with low levels of PEU. Therefore, the following hypothesis is proposed:

H₂: Perceived environmental uncertainty has a significant impact on strategy.

Linkage Between Information Systems Design and Strategy

The third hypothesis is concerned with the relationship between information systems design and strategy. Traditional organization theory supports the concept that strategy determines organization structure and, therefore, information systems design (Chandler, 1962; Gordon and Narayanan, 1984; Thompson and Strickland, 1995; Tymon, Stout, and Shaw, 1998). However, it has been suggested that information systems are such an integral part of contemporary organizations and their products/services that information systems design may serve to constrain or circumscribe the strategy that an organization is capable of pursuing (Pyburn, 1983; Mason, 1984). Therefore, the following hypothesis is suggested:

H₃: Information systems design has a significant impact on strategy.

Methodology

Modeling Strategy

The analysis of the data in this study was accomplished through the application of structural equation modeling. This analytical technique provides several advantages in that it has the capability to incorporate the following elements into the analysis: (1) simultaneous esti-

mation of multiple, interdependent relationships, (2) incorporation of latent constructs, and (3) account for measurement error.

A confirmatory modeling strategy, as described by Hair *et al.* (1995), was employed in the study. The first phase of the study involves an analysis of the measurement properties of the model. The second phase continues with modifications to the measurement model to improve fit and examination of the structural parameters.

Measurement of the Variables

All variables were measured using seven point Likert scales that have been used in previous research. A covariance matrix of the variables is shown in Table 1. Descriptive statistics for all variables are provided in Table 2.

Information systems design (INFOSYS) was assessed using the scales, comprised of nineteen items, developed by Chenhall and Morris (1986) to measure the four characteristics of the information provided by management accounting systems. These characteristics are scope (SCOPE), timeliness (TIME), aggregation (AGGRG) and integration (INTG). Defining information systems design in terms of the desired characteristics of the output serves to educate system designers to the information needs of the users (Gordon and Miller, 1976; Larcker, 1981; Chenhall and Morris, 1986). As the manage-

TABLE 1
COVARIANCE MATRIX OF THE VARIABLES

		1	2	3	4	5	6	7	8
1	SCOPE	1.91							
2	TIME	0.89	1.92						
3	AGGRG	0.92	1.01	1.44					
4	INTG	1.36	1.26	1.53	2.57				
5	MKTSTR	0.40	0.25	0.38	0.51	1.31			
6	OPNSTR	0.30	0.40	0.39	0.38	0.74	1.84		
7	ADMSTR	0.25	0.25	0.47	0.51	0.67	0.60	1.29	
8	PEU	0.21	0.41	0.31	0.27	0.29	0.48	0.26	1.53

SCOPE – Scope; TIME – Timeliness; AGGRG – Aggregation; INTG – Integration; MKTSTR – Marketing Strategy; OPNSTR – Operational Strategy; ADMSTR – Administrative Strategy; PEU – Perceived Environmental Uncertainty.

TABLE 2
DESCRIPTIVE STATISTICS OF THE VARIABLES

	Range	Mean	Standard Deviation	Min.	Max.
SCOPE	1 - 7	3.74	1.38	1.00	1.00
TIME	1 - 7	4.63	1.39	1.00	7.00
AGGRG	1 - 7	4.57	1.20	1.57	7.00
INTG	1 - 7	4.02	1.60	1.00	7.00
MKTSTR	1 - 7	4.42	1.15	1.00	7.00
OPNSTR	1 - 7	4.13	1.36	1.00	7.00
ADMSTR	1 - 7	5.32	1.14	1.00	7.00
PEU	1 - 7	4.75	1.23	1.00	6.60

SCOPE - Scope; TIME - Timeliness; AGGRG - Aggregation; INTG - Integration; MKTSTR - Marketing Strategy; OPNSTR - Operational Strategy; ADMSTR - Administrative Strategy; PEU - Perceived Environmental Uncertainty.

(PEU) was measured through a scale comprised of five items developed by Miller and Droge (1986). This scale is based on Khandwalla's (1977) and Miller's (1983) measures which gauge the degree of change and unpredictability in market-related and technological dimensions.

Sampling Frame and Data Collection Procedures

ment accounting system is an integral part of the information and control system of any organization, these characteristics were deemed important in describing the information required from the organization's overall information system.

Strategy (STRATEGY) was assessed through the scales, totaling twelve items, developed by Venkatraman (1990) measuring management's satisfaction with the organization's performance relative to its competition in three strategic domains: marketing (MKTSTR), operations (OPNSTR), and administration (ADMSTR). Like Miles and Snow (1978), Venkatraman views strategy as a pattern of major and minor decisions addressing the utilization of resources for competing in the organization's chosen market. Implicit in Venkatraman's conceptualization of strategy is the belief that organizations allocate resources to the marketing, operations, and administrative functions in such a manner so as to maximize the firm's competitive posture relative to other firms in the industry. Satisfaction with the performance in these functional areas is posited to be indicative of the decisions concerning the allocation of resources, and therefore the strategies, employed in these functional areas.

The *Compact Disclosure* database was chosen as the sampling frame for this study. From this database, firms limiting their operations to only one industry, as identified by four digit Standard Industrial Classification (SIC) code, were selected. This resulted in 1,948 firms being selected for the sample. The sample was limited to firms operating in only one industry due to the difficulties in analyzing the strategic responses of firms operating in multiple product/market domains (Chandler, 1962; Rumelt, 1974). Survey instruments were mailed to the chief executive officers of the 1,948 firms.

Responses were received from 210 of the sampled firms, resulting in a response rate of 10.8 percent. This response rate was deemed acceptable considering the level of the individual to whom the research instrument was sent. Of the 210 responses, 148 were found to be useable for this study. The 148 responding firms represent ninety-two different industries, as measured by four digit SIC code.

Data Analysis

Nonresponse Error

Perceived environmental uncertainty

Nonresponse error in this study was as-

sessed using the techniques suggested by Armstrong and Overton (1977) and Churchill (1991). Univariate and multivariate analyses of variance were conducted comparing the responses from the first and fourth quartiles for each of the eight variables and the eight variables taken in total. Respondents from the fourth quartile are used as proxies for nonrespondents. No significant differences between the first and fourth quartile data were found for any single variable, nor for the group of variables in total. Therefore, nonresponse error was not considered to be a major consideration in this study.

Reliability

The reliability of the measures was analyzed by computing Cronbach's Alpha for each of the variables. Table 3 presents these values. All variables reflect a Cronbach's Alpha above the threshold of .70 deemed acceptable by Nunnally (1978).

Estimation of the Structural Equations

The proposed model shown in Figure 1 was estimated with LISREL 7.20. Hair *et al.*

(1995) suggests a procedure for evaluating structural models which includes the following steps: (1) search for offending estimates, (2) assess the overall goodness of fit of the model, (3) examine the measurement properties of the indicators and constructs, (4) examine the structural properties of the model, and (5) modify the model if required by analyses of the standardized residuals and modification indices.

Following the procedure suggested by Hair *et al.* (1995), the analysis began with a search for offending estimates. The most common offending estimates take the form of negative error variances, standardized coefficients exceeding or very close to 1.0, or very large standard errors. No offending estimates were found.

Next, the goodness of fit of the proposed model was evaluated. The following measures were utilized for assessing the overall goodness of fit of the proposed model: Chi-square (X^2) goodness of fit statistic, goodness of fit index (GFI), adjusted goodness of fit index (AGFI), total coefficient of determination (TCD), and the root mean square residual (RMSR). Incorporating multiple measures allows the acceptability of the model to be evaluated from several perspectives. The goodness of fit statistics for the proposed model are shown in Table 4. The reported p-value associated with the Chi-square statistic indicates an unacceptable fit as it does not exceed the critical value of .05 (An insignificant p-value associated with the Chi-square statistic is an indication of good fit). The GFI measure of .82 falls slightly below the acceptable value of .90 suggested by Bagozzi and Yi (1988). The AGFI measure of .68 is also below the acceptable value of .90. The TCD value of .95 indicates that a significant amount of the variance in the structural equations is explained by the model. The RMSR

TABLE 3
RELIABILITY ASSESSMENT
OF THE CONSTRUCT MEASUREMENT SCALES

Construct	Variable	Reliability (Cronbach's Alpha)
Information Systems	SCOPE	.82
	TIME	.78
Design	AGGRG	.87
	INTG	.83
	MKTSTR	.80
	OPNSTR	.77
Strategy	ADMSTR	.78
	PEU	.83
Perceived Environmental Uncertainty		

SCOPE - Scope; TIME - Timeliness; AGGRG - Aggregation; INTG - Integration; MKTSTR - Marketing Strategy; OPNSTR - Operational Strategy; ADMSTR - Administrative Strategy; PEU - Perceived Environmental Uncertainty.

of .44 is somewhat large. Bagozzi and Yi (1988) indicate that the RMSR value should be small. Considering all of the measures addressed above, the analysis of the goodness of fit of the proposed model indicates that it is marginally acceptable, at best.

The next phase of the analysis involved the analysis of the measurement properties of the proposed model. First, the loadings of the measured variables on the latent constructs were examined. This information is shown in Table 5. As can be seen, all of the loadings are significant as the t-value for each exceeds the critical value of ± 1.96 for a two-tailed test at the .05 level of significance.

Next, the standardized residuals and the modification indices were analyzed. An examination of the standardized residuals indicated that ten exceeded the critical value of ± 2.58 suggested by Bagozzi and Yi (1988) with the largest being 9.82. This is significantly greater than the guideline suggested by Hair et al. (1995) that no more than 5 percent of the residuals, which in this case is two (5 percent of 36), exceed the critical value of ± 2.58 . A review of the modification indices revealed five exceeding the critical value of 3.84 specified by Bagozzi and Yi (1988) and Hair et al. (1995) with the largest being 101.24. The examination of these statistics indicated that modifications to the model were necessary.

Model Modification

As indicated above, examination of the standardized residuals and the modification indices

FIGURE 1
PROPOSED MODEL

Table 4
Goodness of Fit Statistics
of the Proposed Model

Statistic	Value
X ²	218.09
d.f.	20.00
p-value	.00
GFI	.82
AGFI	.68
TCD	.95
RMSR	.44

GFI - Goodness of Fit Index

AGFI - Adjusted Goodness of Fit Index

TCD - Total Coefficient of Determination

RMSR - Root Mean Square Residual.

Table 5
Loading Estimates of the Proposed Model

Variable	Loading Estimate	t-value
SCOPE	-.73	-6.46
TIME	-.67	-6.16
AGGRG	.12	^B
INTG	-.87	-7.03
MKTSTR	.78	5.76
OPNSTR	.61	5.55
ADMSTR	.66	^B
PEU	.18	^B
Largest Standardized Residual	9.82	
Largest Modification Index	101.24	

^A all estimates are standardized

^B item is used for scaling and no t-value is provided

SCOPE - Scope; TIME - Timeliness; AGGRG - Aggregation; INTG - Integration; MKTSTR - Marketing Strategy; OPNSTR - Operational Strategy; ADMSTR - Administrative Strategy; PEU - Perceived Environmental Uncertainty.

provided evidence that the model required modification. The pattern of the standardized residuals revealed that the aggregation (AGGRG) characteristic of information systems design was involved in six of the ten residuals exceeding the critical value of ± 2.58 . This variable was deleted from the model.

Both Bagozzi and Yi (1988) and Hair *et al.* (1995) strongly caution against the indiscriminate freeing of parameters suggested by modification indices to improve goodness of fit. To do so without theoretical justification is capitalizing upon unique aspects of the data set being analyzed. Upon examination of the modification indices, it was determined that no theoretical or methodological justification existed for further modifications to the model. Therefore the modified model shown in Figure 2 was tentatively accepted.

The modified model was then subjected to the same evaluation as was the proposed model. The goodness of fit statistics of the modified model are shown in Table 6. As can be seen, the fit of the model has been significantly improved. The p-value of .14 exceeds the critical value of .05. The GFI and AGFI values of .96 and .93, respectively, exceed the critical value of .90. Also, the TCD and RMSR are both acceptable. In summary, the modified model exhibits excellent fit.

Table 6
Goodness of Fit Statistics
of the Modified Model

Statistic	Value
X ²	19.78
d.f.	14.00
p-value	.14
GFI	.96
AGFI	.93
TCD	.99
RMSR	.10

GFI - Goodness of Fit Index

AGFI - Adjusted Goodness of Fit Index

TCD - Total Coefficient of Determination

RMSR - Root Mean Square Residual

The measurement properties of the modified model were evaluated through examination of the loading estimates shown in Table 7. As indicated, the loadings of the variables on their respective constructs are significant as all p-values exceed the critical value of ± 1.96 .

FIGURE 2
MODIFIED MODEL

An analysis of the standardized residuals revealed only one, with a value of 2.86, exceeding the critical value of ± 2.58 . This is within the guidelines suggested by Hair *et al.* (1995). Examination of the modification indices revealed six exceeding the critical value of 3.84. However, the suggested modifications lacked theoretical support, so no further changes were made and the modified model was accepted.

Examination of the path estimates of the modified model provide tests of the three hypotheses. As indicated in Table 8, all of the hypothesized relationships are significant as evidenced by the t-value for each relationship exceeding the critical value of ± 1.96 for a two-tailed test at the .05 level of significance. Therefore, all three hypotheses are accepted.

Discussion And Suggestions For Future Research

This study examines the relationships among perceived environmental uncertainty, information systems design, and business strategy. It was hypothesized that perceived environmental uncertainty has a significant effect on information systems design and strategy, and that information systems design has a significant effect on strategy.

Consistent with past research, perceived environmental uncertainty was found to have a significant effect on both information systems design and strategy. Information systems design was found to have a negative effect on strategy. This suggests that information systems design, as conceptualized by the characteristics of the information provided and used in decision-making, may serve to circumscribe or constrain an organization's ability to pursue a given strategy. If information of a certain type is not available or not used, the ability of the organization to pursue a planned strategy may be limited or non-existent. An alternative explanation is that the availability and use of

Table 7
LOADING ESTIMATES
OF THE PROPOSED MODEL^A

Variable	Loading Estimate	t-value
SCOPE	.71	7.31
TIME	.66	7.02
INTG	.86	^B
STRTMKT	.78	5.71
STRTOPNS	.60	5.52
STRTADM	.66	^B
PEU	.18	^B
Largest Std Residual	2.86	
Largest Modification Index	5.56	

^A all estimates are standardized

^B item is used for scaling and no t-value is provided

SCOPE - Scope; TIME - Timeliness; AGGRG - Aggregation; INTG - Integration; MKTSTR - Marketing Strategy; OPNSTR - Operational Strategy; ADMSTR - Administrative Strategy; PEU - Perceived Environmental Uncertainty.

Table 8
PATH ESTIMATES OF THE
MODIFIED MODEL RELATIONSHIPS^A

Relationship	Parameter Estimate	t-value
PEU → INFOSYS (H ₁)	.99	10.58
PEU → STRATEGY (H ₂)	7.65	5.74
INFOSYS → STRATEGY (H ₃)	-7.18	-6.63

^A all estimates are standardized

PEU - Perceived Environmental Uncertainty.
INFOSYS - Information Systems Design.
STRATEGY - Strategy.

An analysis of the standardized residuals revealed only one, with a value of 2.86, exceeding the critical value of ± 2.58 . This is within the guidelines suggested by Hair *et al.* (1995). Examination of the modification indices revealed six exceeding the critical value of 3.84. However, the suggested modifications lacked theoretical support, so no further changes were made and the modified model was accepted.

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Consistent with past research, perceived environmental uncertainty was found to have a significant effect on both information systems design and strategy. Information systems design was found to have a negative effect on strategy. This suggests that information systems design, as conceptualized by the characteristics of the information provided and used in decision-making, may serve to circumscribe or constrain an organization's ability to pursue a given strategy. If information of a certain type is not available or not used, the ability of the organization to pursue a planned strategy may be limited or non-existent. An alternative explanation is that the availability and use of information possessing the subject characteristics to a greater degree may allow the organization to "fine tune" its strategy by permitting it to deploy its resources in the functional areas (marketing, operations, administration) in a more efficient, selective manner as opposed to allocating substantial resources to all functional areas in a relatively inefficient fashion.

The results of this study are subject to several limitations. First, the sample was limited to publicly traded firms limiting their operations

to a single industry. Care should be exercised in generalizing the results to organizations that are privately held and/or operate in more than one product/market segment. Second, all data utilized in this study were obtained from the chief executive officers of the responding firms. The possibility of key informant bias exists any time that data from a single respondent is used to represent the characteristics of an entire organization (Huber and Power, 1985). In addition, the respondents can only be expected to be familiar with the characteristics of the information provided to them. Anthony (1965) and Gorry and Scott Morton (1971) address the characteristics of information required for decision-making at different levels in organizations.

Future research should address antecedent and consequent effects of each of these constructs. In addition, there are alternative operationalizations of the subject constructs that should be incorporated into future research.

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