A DISCRIMINANT ANALYSIS OF ORGANIZATIONAL ANTECEDENTS OF IS PERFORMANCE

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ABSTRACT

The competitive advantages offered by new information technologies (IT or IS) have been widely recognized over the past two decades. Initially, firms achieved some of the IT benefits by simply acquiring new and complex hardware equipment to increase efficiency. The unusually high IT investment and proprietary technology served as ideal barriers to new entrants. However, the rapidly decreasing cost of computers and shortening technology life cycle quickly brought this hardware advantage to an end. For most firms today, sustaining IT advantage will not come from whether they have the technology, but how effectively it is being used, which is expressed in terms of IS effectiveness, IS success, or IS performance. It has been a continuing effort among IS researchers to search for organizational antecedents that affect IS performance.

Some of the well-researched antecedent variables include organizational size, structure, maturity, resource availability, etc. The current study expands this set of important organizational variables and demonstrates that factors in the IS environment can play a critical role in influencing IS performance. Discriminant analysis is used to analyze the empirical data from questionnaire survey of IS executives. Results show that the proposed set of organizational variables can be used to successfully distinguish between high and low IS performance. Implications of the results for organizations are discussed.

INTRODUCTION

Today's businesses are increasingly dependent upon information technology (IT) to create competitive advantages (McFarlan, 1984). At the strategic level, IT is expected to change the nature of competition by increasing entry barrier, changing bargaining power of buyers and suppliers, creating new business opportunities (Porter and Miller, 1985), or even altering the existing industry structure (Segars and Grover, 1995). While at the operational level, the anticipated benefits of IT include reduced cost, improved quality, increased productivity, better financial performance (Small and Chen, 1995), enhanced internal and external integration through better communication, improved decision-making processes, and better customer service (Sethi and King, 1994; Doll and Torkzadeh, 1995).

Initially, firms achieved some of the IT benefits by simply acquiring new and complex hardware equipment to increase efficiency. The unusually high IT investment and

proprietary technology served as ideal barriers to new entrants. However, the rapidly decreasing cost of computers and shortening technology life cycle quickly brought this hardware advantage to an end. As Clemons and Row (1991) pointed out, when the same equipment is available to all firms and most applications can be easily duplicated, sustaining IT advantage will come not from having the technology, but from using it effectively. According to Nelson and Cooprider (1996), a major issue facing information systems (IS) managers is the increasing pressure to demonstrate the business value of the firm's investment in IT. Boddy, McCalman and Buchanan (1988) called this a "new management challenge". They argued that, while technical developments offered firms new strategic options, the real management challenge is to perceive these options and to implement IT in a way that demonstrably improves performance. Thus, effective IT management relies heavily upon the successful identification of organizational determinants of information systems (IS) performance.

In the IS literature, IS performance is also termed "IS success" or "IS effectiveness." Saarinen (1996) proposed four dimensions of IS success measurement: 1) Development process success, such as speed and cost effectiveness of system development (White and Leifer, 1986); 2) IS product quality, such as information reliability and timeliness (Saunders and Jones, 1992); 3) Use process success, such as system usage (Torkzadeh and Dwyer, 1994) and user satisfaction (Doll and Torkzadeh, 1988); and 4) Impact of IS on organizational effectiveness, such as improvements in operational efficiency and decision making processes (Grover, Jeong and Segars, 1996). The IS performance measures in the current study will focus on the last two categories.

The search for organizational antecedents of system success has been a continuing effort among IS researchers. Ein-Dor and Segev (1978) were the first to address the relationship between organizational context and IS success. They proposed a series of hypotheses concerning various organizational context variables, including organizational size, structure, maturity, resource availability, and decision time frame. Later, Ein-Dor and Segev (1982) found IS structure to be the most significant determinant of IS performance. The research on antecedent variables of IS performance has been gradually expanded to include other organizational variables like steering committees (Nolan, 1982), user involvement (Franz and Robey, 1986), top management support (Raghunathan and Raghunathan, 1988), IS sophistication (Raymond, 1990), user training and education (Torkzadeh and Dwyer, 1994), and evolution level of IS (Choe, 1996), etc.

Although prior research has attempted to link the impact of some of the organizational variables on IS performance, there is a gap in the literature with respect to testing the empirical validity of the combined effect of these variables on IS performance. The current study is an attempt to address this gap. Empirical data for the study consists of the responses of IS executives to a large-scale questionnaire survey. The statistical technique of discriminant analysis is used to test if the hypothesized variables can successfully distinguish between high and low levels of IS performance.

The next section reviews the antecedent variables addressed in this study and their hypothesized relationship to IS performance. The research methodology is then presented, followed by an analysis and discussion of results and their implications.

DESCRIPTION OF VARIABLES AND HYPOTHESES DEVELOPMENT

The antecedent organizational variables proposed in this research are variables that have been identified in the IS literature as influencing various aspects of the organization's IS. They are:

1) Strategic significance of IS (Cash, McFarlan, McKenney and Applegate, 1992),
2) IS support to users (McKeen, 1994; Nelson and Cooprider, 1996),
3) Top management support to IS (Choe, 1996),
4) Degree of IS control (Raghunathan and Gupta, 1989),
5) Degree of IS stability (McLean, Smits and Tanner, 1991),
6) Degree of IS integration (Teo and King, 1997), and
7) Degree of IS centralization (Von Simson, 1990).

These variables and the nature of their hypothesized relationship to IS performance are described below. Table 1 presents the listing of the variables and the literature basis for the hypotheses.

Strategic Significance of IS

The strategic significance of IS in an organization is defined as the strategic consequences of the portfolio of systems applications in operation (Cash, et. al., 1992). Empirical studies by Raghunathan and Raghunathan (1990) and Neumann, Ahituv, and Zviran (1992) have further developed this notion of IS strategic significance as initially conceptualized by Cash et al. (1992). Campion and Medsker (1993) found that task

significance could greatly improve work group effectiveness. This would lead one to expect that IS performance would be influenced by the significance of IS function within the organization. An important source of higher performance is the motivation of group members to make contributions. IS personnel are expected to be highly motivated in organizations where IS is considered as a strategic resource because their significant organizational roles are more likely to bring them higher levels of self-esteem. It is therefore hypothesized that

H1: the greater the strategic significance of IS, the higher will be the level of IS performance.

IS Support to Users

IS support to users is defined as the extent to which the IS department provide training and develops cordial working relationships to end-users. With the proliferation of hardware and software technology towards easy to use end-user oriented applications, the difference between traditional users of IS and end-users is beginning to blur. While IS-user coordination has always been encouraged in the IS literature and in practice (Cash, et. al., 1992), the emergence of end-users has added a new dimension to the nature of cooperation between IS and users. McKeen (1994) found that communication between the IS and users played a key role in promoting end-user satisfaction. Henderson (1990) argues that effective delivery of IS products and services require an effective partnership between the two major actors concerned with systems, namely, user managers and IS managers. More recently, Nelson and Cooprider (1996) empirically verified that a good working relationship of mutual trust, influence and shared knowledge between the IS department and other organizational groups can have major contribution to increasing IS performance. It is therefore hypothesized that

H2: the higher the level of IS support to users, the higher will be the level of IS performance

Top Management Support to IS

Top management support to IS is defined as the degree to which top management understand the importance of IS function and are personally involved in IS activities. The IS literature has consistently identified top management support as a key positive factor in influencing the success of many IS related activities (King, Grover and Hufnagel, 1989). IS managers perceive such support as an indication of top management's confidence in the ability of IS and its management to help meet organizational goals. Raghunathan and Raghunathan (1988) verified the important impact of top management support on successful IS planning. Several other studies also found top management support to be a critical success factor for IS (Doll, 1985; Slevin, Stieman and Boone, 1991; Choe, 1996). A supportive managerial attitude would provide IS executives with an environment in which they believe that their work will be recognized and appreciated, and therefore, is likely to motivate them to achieve higher performance. It is therefore hypothesized that

H3: the greater the level of top management support to IS, the higher will be the level of IS performance.

Degree of IS Control

IS control is defined as the degree to which IS function has authority over IS related decisions. Donovan (1988) provides an interesting description of the control tactics used by IS executives to maintain control over the IS domain, and notes that, through these tactics, end users are sought to be controlled. However, rapid changes in IS technology can lead to greater dispersion of systems development and operating responsibilities away from IS functional control. Cash, et. al. (1992) note that, as companies becomes more decentralized in structure and geographically diverse, a distributed IS function becomes a better fit to the organizational structure. This may lead to a greater degree of user control. IS executives who feel that they are losing control over IS activities are likely to be subject to feelings of frustration and loss of power. These perceptions of diminished power are likely to promote a sense of alienation negatively affecting the level of IS performance. An empirical study by Raghunathan and Gupta (1989) found IS management control to be a critical success factor of IS organizations. It is therefore hypothesized that

H4: the higher the perceived degree of IS control over IS activities, the higher will be the level of IS performance.

Degree of IS Stability

IS stability, as defined, is a broad measure of stability in the operational environment of IS. It includes the stability of IS group membership and working environment. For example, lower turnover rate, longer member tenure, and

fewer systems fiascos will indicate higher IS stability. An unstable IS environment may have negative psychological impact on IS personnel such as unnecessary tension and stress that decrease performance level. Cash et. Al. (1992) state that factors such as instability contribute to vulnerability to operational problems. Igbaria, Greenhaus and Parasuraman (1991) found job security to be an important career orientation of IS employees. McLean, Smits and Tanner (1991) surveyed 261 MIS majors, and found "Provide security and stability" to be one of the most expected MIS job characteristics. Using simulation-based study, Abdel-Hamid (1992) verified that frequent IS managerial turnover and succession have significant negative influence on system performance. It is therefore hypothesized that

H5: the higher the degree of IS stability, the higher will be the level of IS performance.

Degree of IS Integration

IS integration refers to how well IS activities are integrated with organizational and other functional activities, thus strategic alignment of IS. These activities may include cross-functional problem solving, personnel transfer and joint strategic planning. Henderson and Venkatraman (1991) proposed a model of strategic IS alignment in terms of two dimensions: functional integration and strategic fit. Functional integration reflects the strategic integration between IS function and the business unit, while strategic fit reflects the integration between external strategies and internal IS structures/processes. They claim these two types of integration to be essential to IS success. Teo and King (1997) argue that the integration between IS planning and business planning is key to successful strategic IS planning. Several other studies also confirmed the importance of linking IS objectives and business objectives (Zviran, 1990; Reich and Benbasat, 1996). It is therefore hypothesized that

H6: the higher the degree of IS integration, the higher will be the level of IS performance.

Degree of IS Centralization

IS centralization is defined as the degree to which an organization's computing facilities and activities are centrally organized and controlled. As information technology became less expensive and more powerful, end users gain more control of their computer applications. Thus many firms migrate from centralized mainframe computing to decentralized computing (Fiedler, Grover and Teng, 1996). However, IS decentralization caused many organization-wide problems, such as lack of standardization and control over data hygiene, duplication of technical staff, increased computing cost, and data security problems (Cash, et al., 1992). Thus, after a period of decentralizing their IS organizations, companies are now starting to "consolidating data centers, beefing up the authority of their central IS staff, and establishing company-wide technical standards and work procedures" (Von Simson, 1990). Evidences showed that re-centralization of IS could help cut computing cost, attract first-rate IS professionals, improve system reliability, and facilitate system integration. It is therefore hypothesized that

H7: the higher the degree of IS centralization, the higher will be the level of IS performance.

Table 1: Literature Basis for the Hypothesized Relationships

Relationships studied in this paper	Literature basis	Nature of relationships
IS Strategic Significance and IS Performance	• Task significance - Group effectiveness (Campion and Medsker, 1993) • Strategic consequences of IS (Cash et al., 1992) • IS strategic significance (Raghunathan and Raghunathan, 1990; Neumann, Ahituv, and Zviran, 1992)	Positive
IS Support to Users and IS Performance	• IS-user coordination (Cash et al., 1992) • IS-user communication - User satisfaction (McKeen, 1994) • IS-user partnership - IS effectiveness (Henderson, 1990) • IS-user working relationship - IS performance (Nelson and Coooprider, 1996)	Positive
Top Management Support and IS Performance	• Top management support - IS success (King, Grover and Hufnagel, 1989) • Top management support - IS planning success (Raghunathan and Raghunathan, 1988) • Top management support - IS success (Doll, 1985; Stieman and Boone, 1991; Choe, 1996)	Positive
Degree of IS Control and IS Performance	• IS control tactics (Donovan, 1988) • User control - IS performance (Cash et al., 1992) • IS management control - IS success (Raghunathan and Gupta, 1989)	Positive
Degree of IS Stability and IS Performance	• Vulnerability (Cash, et. Al. 1992) • IS job security and stability (McLean, Smits and Tanner, 1991) • IS managerial Turnover - IS performance (Abdel-Hamid, 1992)	Positive
Degree of IS Integration and IS Performance	• IS strategic alignment (Henderson and Venkatraman, 1991) • Integration of IS and business planning - successful IS planning (Teo and King, 1997) • Linking IS and business objectives (Zviran, 1990; Reich and Benbasat, 1996)	Positive
Degree of IS Centralization and IS Performance	• Decentralized computing (Fiedler, Grover and Teng, 1996) • IS decentralization and IS performance (Cash et al., 1992) • Re-centralization of IS - IS performance (Von Simson, 1990)	Positive

RESEARCH METHOD

Data Collection

A self-administered questionnaire was mailed to 800 information systems executives chosen at random from a list of 3,000 senior IS executives. There were 237 responses of which 231 were complete and hence usable as the sample for this study. The response rate of 29.6% is similar to that in comparable studies; due to lack of information on non-respondents it was not possible to test if the responding group differed from the non-respondents. Table 2 provides an industry classification of the sample companies and Table 3 presents information on company revenues. Companies with revenues of 50 million and above are well represented (85%) in this sample. The results of this study may therefore be more appropriately relevant to companies in these size categories. Manufacturing and finance sectors are represented by 57% of the sample. This information is relevant in generalizing the results of this study.

Table 2: Type of Companies in the Sample

Industry Type	Number	Percentage
Business Services	7	3.0%
Finance/Insurance	52	22.5%
Government	3	1.3%
Manufacturing	86	36.2%
Medicine/Law/Education	10	4.3%
Petroleum	5	2.2%
Public Utility	12	5.2%
Transportation	10	4.3%
Wholesale/Retail	22	9.5%
Others	24	10.4%
Total	231	100.0%

Table 3: Company Sales (Millions of $)

Sales	Number of Respondents	Percentage
LESS THAN 100M	51	22.1%
100 TO < 250 M	33	14.3%
250 TO < 500 M	25	10.8%
500 To < 1000 M	43	18.6%
1000 M AND ABOVE	57	24.7%
OTHERS (Sales not marked)	22	9.5%
TOTAL	231	100.0%

Operationalization of Variables

The IS performance and its antecedent variables were operationalized on five-point interval scales using multiple items developed from the IS literature referred to earlier and summarized in Table 1. The value of each variable is the mean value of the multiple items representing that variable. The appendix presents the multiple items representing each of these variables.

To ensure the content validity of the instrument items, the questionnaires were first sent to two IS researchers who checked the items for appropriateness and relevance. Two IS executives of major organizations were also requested to complete the questionnaire, and then to comment on the clarity and appropriateness of the items. Modifications were made to the final questionnaire based on their comments. Table 4a reports means, standard deviations, intercorrelations, and reliability values for each of the variables. The reliability values based on Cronbach's alpha are all greater than 0.80, well above the recommended minimum value of 0.7 (Nunnally, 1978).

Table 4a: Means, Standard Deviations, and Intercorrelations of the Organizational Variables

Variables	Mean	SD	1	2	3	4	5	6	7	Reliability
(1) Strategic significance of	4.33	0.55	-							0.83
(2) IS support to users	3.55	0.69	0.20	-						0.83
(3) Top management support	3.51	0.87	0.37	0.23	-					0.91
(4) Degree of IS control	3.64	0.79	0.23	0.19	0.34	-				0.83
(5) Degree of IS stability	3.87	0.61	0.34	0.22	0.33	0.45	-			0.80
(6) Degree of IS integration	3.02	0.87	0.18	0.28	0.58	0.18	0.17	-		0.81
(7) Degree of IS	3.87	1.05	0.37	0.03	0.27	0.23	0.19	0.14	-	0.86
IS Performance	3.67	0.65	0.39	0.29	0.42	0.51	0.55	0.28	0.27	0.86

All correlation are significant at p=0.01 level except between the variables 7 and 2 which is not significant and between 7 and 6 which is significant at p=0.05 level.

Validity Assessment of the Measurement Instrument

We have shown that the measurement instrument used in this study meet the reliability criteria. To further ensure the convergent and discriminant validity of the instruments, exploratory factor analysis was performed on the dependent variable and independent variables. Table 4b and Table 4c presents the exploratory factor analysis results.

As can be seen from Table 4b, one single factor emerged for the dependent variable (IS Performance) with all factor loadings above 0.60, indicating very good unidimensionality and convergent validity of the measurement instrument.

Table 4b: Factor Analysis of the Dependent Variable – IS Performance

Item	Description	Factor Loading
IS Performance		
1	IS is perceived as facilitating organizational decision-making	0.69
2	The user community is generally satisfied with IS	0.70
3	The IS function has not achieved its performance goals (Reverse coded)	0.67
4	Use of IS has let to better management of organizational activities	0.74
5	Benefits of IS have outweighed it cost	0.72

In an extra effort to ensure the predictive validity of the IS Performance instrument and minimize respondent bias, the same questionnaire was sent to both IS managers and CEO's, and 63 matched pairs were found. A matched-pair T-test showed no significant difference between IS manager's view and CEO's view on IS performance.

As for the independent variables, an exploratory factor analysis was conducted using all 35 items that measure the seven independent variables. Seven clear factors emerged with most factor loadings above 0.70 as shown in Table 4c, indicating good convergent and discriminant validity of the measurement instrument. There were one factor loading below 0.50 (item 3 if IS Significance) and one significant cross-loading (i.e., loaded

above 0.50 on both factors) (item 4 of IS Integration). A factor analysis was conducted using only the items of those two constructs, top management support and degree of IS integration. Two clear factors emerged with factor loadings of greater than 0.67 and cross loadings of less than 0.46 on two items and less than 0.30 on other items, as shown in Table 4d, further justifying discriminant validity between these two factors. Considering the importance of these two items which cross loaded on the over all factor analysis to the entire construct and their contribution to the reliability of the factors and emergence of clear factors on subfactor analysis it was decided to keep the factors as such.

Table 4c: Exploratory Factor Analysis of Independent Variables

Item	Description	Factor Loading	Cross Loading
I. Strategic Significance of IS:			
1	IS is used to offer significant new features to the existing product line	0.61	
2	IS is not vital to our organization (reverse coded)	0.66	
3	IS is looked at as a competitive resource	0.44	
4	IS breakdown for extended periods will affect organizational activities severely	0.81	
5	Our company relies heavily on IS for efficient operation	0.72	
6	IS breakdown will critically affect one or more of our functional departments	0.81	
7	IS breakdown will affect our database access	0.81	
8	IS breakdown will affect overall coordination within our organization	0.66	
II. IS Support to Users			
1	We educate and train users to develop their own systems	0.87	
2	We have cordial relations with user groups	0.76	
3	We support end user computing	0.83	
III. Top Management Support to IS			
1	Top management involvement with IS function is strong	0.79	
2	Top management is not interested in the IS function(reverse coded)	0.79	
3	Top management understands the importance of IS function	0.73	
4	Top management does not support the IS function(reverse coded)	0.80	
5	Top management considers IS as a strategic resource	0.77	
6	Top management understands IS opportunities	0.70	
7	Top management keeps pressure on operating units to work with IS	0.75	
IV. Degree of IS Control			
1	IS feels it is losing control over IS activities to users	0.58	
2	There is unplanned growth in the number of new systems and supporting staff to meet user demand	0.69	
3	IS support services are delivered to users by multiple suppliers without coordination	0.76	
4	There is lack of standardization and control over data hygiene	0.78	
5	There is lack of standardization and control systems	0.76	
V. Degree of IS Stability			
1	Stability of IS development group	0.72	
2	Quality of IS development group as perceived by others in the organization	0.60	
3	Experience of IS systems development group	0.75	
4	Frequency of major IS fiascoes in the last two years (reverse coded)	0.58	
5	Length of service of IS management team	0.72	
VI. Degree of IS Integration			
1	Senior people are transferred between IS and organizational line functions	0.77	
2	Joint task forces evaluate the strategic potential of IS	0.75	
3	IS planning is integrated with overall organizational business planning	0.62	0.45 with Factor III
4	Specific executives are charged with expanding IS capability to support the organizational strategic effort	0.56	0.55 with Factor III
VII. Degree of IS centralization			
1	Management of the IS function is centralized	0.79	
2	Data processing in our organization is centralized	0.87	
3	Database control in our organization is centralized	0.83	

Table 4d: Exploratory Factor Analysis of Top Management Support and IS Integration

Item	Description	Factor Loading	Cross Loading
I. Top Management Support to IS			
1	Top management involvement with IS function is strong	0.78	
2	Top management is not interested in the IS function(reverse coded)	0.81	
3	Top management understands the importance of IS function	0.80	
4	Top management does not support the IS function(reverse coded)	0.81	
5	Top management considers IS as a strategic resource	0.76	
6	Top management understands IS opportunities	0.67	
7	Top management keeps pressure on operating units to work with IS	0.75	
II. Degree of IS Integration			
1	Senior people are transferred between IS and organizational line functions	0.78	
2	Joint task forces evaluate the strategic potential of IS	0.85	
3	IS planning is integrated with overall organizational business planning	0.69	0.43
4	Specific executives are charged with expanding IS capability to support the organizational strategic effort	0.67	0.46

Choice of Analytic Technique

There is reason to believe that there might be some degree of multicollinearity among the antecedent organizational variables. Given this possibility, the analytical technique of discriminant analysis was considered appropriate for this study because multicolliniarity does not affect the interpretation of the results of discriminant analysis (Eisenbeis, 1977). Using this technique, a weighted linear combination of the organizational variables is used to classify IS performance as high and low. Given the interest in exploring the organizational attributes that contribute to IS performance, the sample was classified into two groups representing high and low levels of IS performance on the basis of high and low values for the IS performance variable compared to the sample mean for the variable.

ANALYSIS AND DISCUSSION OF RESULTS

The discriminant model developed in this study includes the antecedent organizational variables as the discriminating variables and IS performance as the criterion (grouping) variable. Discriminant analysis, in general, yields a number of discriminant functions which are interpreted using information provided by eigenvalues and canonical correlations. The eigenvalues and their associated canonical correlations are used to indicate the relative ability of each discriminant function to separate the groups. A maximum of *n-1* discriminant functions are mathematically possible when there are *n* groups. Since the present study involves a two-group discriminant analysis, only one discriminant function is possible for each criterion variable. The significance of the function is indicated by the statistical significance of the chi-square statistic, which is calculated from the value of the Wilks' Lambda. Table 5a presents the results of the discriminant analysis. The table provides information on (1) standardized discriminant function coefficients and their significance, (2) the size of the groups, and (3) the significance level of the discriminant function. The discriminant function developed in this study has a chi-square value of 89.28 (6 degrees of freedom) which is significant at the $p < 0.0001$ level. This provides strong support for the discriminant function's ability to discriminate group membership on the basis of the variables used. The results further show that all but one of the variables are significant at the $p < 0.0001$ level. The "degree of IS integration" variable did not enter the discriminant function because of the enter criterion of F=1.0. Thus all of our hypotheses except H6 are supported by the discriminant function.

Table 5a: Results of Discriminant Analysis (Standard Coefficients and F-values)

Coefficient Statistics	Standardized Coefficient	F value	Significance
(1) Strategic significance of IS	0.336	7.09	0.00
(2) IS support to users	0.186	2.39	0.00
(3) Top management support to IS	0.260	4.32	0.00
(4) Degree of IS control	0.264	4.38	0.00
(5) Degree of IS stability	0.514	17.63	0.00
(6) Degree of IS integration	-	-	NS
(7) Degree of IS centralization	0.137	1.18	0.00

NS: Not significant
Discriminant function statistics
Group 1 = Low performance (112 cases)
Group 2 = High performance (119 cases)
Wilks' Lambda - 0.671
Chi-square - 89.28 (6 d. f.)
Significance - 0.0000

The standardized discriminant coefficients provide useful information on the relative contribution of their associated variables to the overall discriminant function. The higher the absolute value of the standardized coefficient the greater is its contribution to the function. On this basis, the "degree of IS stability" variable emerges as the most important variable in its contribution to the discriminant function, followed by "strategic significance of IS", "degree of IS control" and "top management support to IS". The "IS support to user" and "degree of IS centralization" variables are relatively less important. Table 5b presents, for each variable, its mean value within each group and its overall mean. The higher mean values of the group 2 (high performance) variables compared to the corresponding group 1 (low performance) variables provide further support for the direction of each of our hypotheses.

Table 5b: Results of Discriminant Analysis (Group Means)

Group Means	Group 1 Low performance	Group 2 High performance	Overall
(1) Strategic significance of IS	4.12	4.54	4.33
(2) IS support to users	3.40	3.72	3.56
(3) Top management support to	3.19	3.82	3.51
(4) Degree of IS control	3.36	3.93	3.64
(5) Degree of IS stability	3.58	4.15	3.87
(6) Degree of IS integration	2.86	3.18	3.02
(7) Degree of IS centralization	3.60	4.12	3.85

To check further the informativeness of the model, the discriminant function's accuracy in classification was assessed. Table 6 presents the percentage classification accuracy of the discriminant model and percentage classification accuracy of two types of chance models. The classification results from the discriminant model indicating a "hit rate" of 76.6 percent. This means that approximately 76.6 percent of the organizations were classified correctly by the discriminant model. Two criteria can be used to judge how good the hit rate is, i.e., to judge the goodness of classification accuracy. They are the maximum chance criterion and the proportional chance criterion (Morrison, 1969). The maximum chance criterion classifies any case chosen at random into the larger group, to maximize the proportion of cases correctly classified. The sample for this study consists of 112 cases in the low performance group 119 cases in the high performance group. Classifying all cases into the larger group yields classification accuracy of 119/231, 51.5%. The discriminant model's classification accuracy of 76.6% is 25 points better than that of the maximum chance model. The proportional chance criterion uses sample group prior probabilities and is the preferred criterion because it is based on an attempt to identify members of both groups. Rather than classify all organizations into the high performance group (as is done in the maximum chance criterion classification), the method classifies organizations into both groups and thereby defies "the a priori odds" (Churchill, 1983). The classification accuracy using the proportional chance criterion equals 50 percent. The discriminant model's classification accuracy is 26.6 percentage points better.

Table 6: Classification Accuracy

		Predicted Group	
Actual Group	No. of Cases	Group 1	Group 2
Group 1	112	82	30
Group 2	119	24	95

Overall percentage of cases correctly classified by discriminant function:	76.6%
Percentage accuracy based on maximum chance criterion:	51.5%
Percentage accuracy based on proportional chance criterion:	50.0%

The results presented above, taken together, suggest that characteristics of the organizational environment that affect IS are able to successfully distinguish between IS organizations that have high levels of performance and those that have low levels of performance. The results indicate that the likelihood of a high level of performance is greater when the degree of IS stability is higher, when information systems have strategic significance for the organization, when IS has higher level of control over IS activities, and when there is a higher level of support from top management. Further, the greater the level of IS support to users and more centralized the IS activities, the greater is the likelihood that IS performance will be higher.

The results of this study may provide some useful directions for top management in understanding and dealing with the performance problems in IS organizations. The ability to rank the organizational variables in terms of their importance in distinguishing between high and low levels of performance should allow management to recognize the relative impact of these variables and respond to their effects. For example, the emergence of "degree of IS stability" as a most significant variable indicates that today's IS professionals expect a secure and stable IS working environment. Given the popular trend of information systems downsizing nowadays, management should pay close attention to the possible negative effects on IS performance from the instability and stress caused by downsizing. Due (1992) discussed the hidden dangers of IS downsizing, including degraded morale that seriously affects performance.

Our results also show that the more strategic an organization's IS portfolios, the greater the level of IS performance. It appears then that when organizations plan to use their IS strategically, such a move not only gives them new competitive capabilities but also motivates the IS personnel to perform better. While top management of organizations with strategic IS portfolios may find these to be positive outcomes, there might be a different implication for other organizations. As Cash, et al. (1992) pointed out, while IS may play a strategically significant future role in some types of organizations, there may be other types of organizations where IS may only play a supportive role. The implication for top management in

these latter types of organizations might be that they need to make an extra effort to motivate their IS personnel. Such efforts may include offers of better compensation packages and career opportunities.

The degree of IS control emerged as the third most significant factor for IS performance. While this result would appear to indicate logical behavior on the part of IS organizations, and is consistent with the notion of IT dominance in Cash et. al (1992, p. 339), a high degree of IS control may not be a realistic expectation for IS environments of the future. Given the realities of the changing computing environment and the evolving trends in end-user computing and distributed processing, IS organizations may no longer expect to enjoy the level of control that they have traditionally had in the past. Top management should understand and anticipate the likely effects of loss of IS control and take appropriate steps to negate these effects.

The results indicate that the notion of support - whether it is in the form of top management support to IS or IS support to users - plays a significant part in influencing IS performance. Recognizing this, top management can effectively improve the performance of IS function by setting in place organizational processes and procedures that create an environment characterized by mutual support and recognition.

IS centralization was found to have significant, but the least, impact on IS performance. It signifies that a certain degree of IS centralization is necessary under today's prevalently distributed end-user computing environment. The non-significant result of IS integration may have two possible implications: either firms are not paying enough attention to the integration of IS into overall business activities, or IS integration is no longer an important issue to firms. We think the first situation applies to most firms.

This study represents a continuing effort in addressing organizational contexts that are more conducive to higher IS performance. The issues involved are both complex and substantive in nature. While the hypotheses developed in the present research represent our perspectives on the issue, there is scope for future research to extend this study in at least two directions. One, the effect on IS performance of other organizational variables can be theorized and then empirically tested. Secondly, relationships such as the ones hypothesized in this study can be analyzed in a more dynamic setting. An example would be the introduction of contingent variables that might moderate the relationships in the present study. Future research can also benefit from the use of multiple respondents to counter the likely effects of single respondent bias.

CONCLUSION

Prior IS studies have looked into the issue of organizational antecedents and IS performance. The current research expanded into an additional set of important organizational variables and demonstrated that factors in the IS environment can play an important part in influencing IS performance. The discriminant model developed in this study was able to discriminate between IS organizations with high levels of performance and those with low levels of performance. These results have significant implications for management efforts directed at improving IS effectiveness.

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APPENDIX: QUESTIONNAIRE ITEMS

Strategic Significance of IS: 1)IS is used to offer significant new features to the existing product line; 2)IS is not vital to our organization (reverse coded); 3)IS is looked at as a competitive resource; 4)IS breakdown for extended periods will affect organizational activities severely; 5)Our company relies heavily on IS for efficient operation; 6)IS breakdown will critically affect one or more of our functional departments; 7)IS breakdown will affect our database access; 8)IS breakdown will affect overall coordination within our organization

IS Support to Users: 1)We educate and train users to develop their own systems; 2)We have cordial relations with user groups; 3)We support end user computing

Top Management Support to IS: 1)Top management involvement with IS function is strong; 2)Top management is not interested in the IS function(reverse coded); 3)Top management understands the importance of IS function; 4)Top management does not support the IS function(reverse coded); 5)Top management considers IS as a strategic resource; 6)Top management understands IS opportunities; 7)Top management keeps pressure on operating units to work with IS

Degree of IS Control: 1)IS feels it is losing control over IS activities to users; 2)There is unplanned growth in the number of new systems and supporting staff to meet user demand; 3)IS support services are delivered to users by multiple suppliers without coordination; 4)There is lack of standardization and control over data hygiene; 5)There is lack of standardization and control systems

Degree of IS Stability: 1) Stability of IS development group; 2) Quality of IS development group as perceived by others in the organization; 3) Experience of IS systems development group; 4) Frequency of major IS fiascoes in the last two years; 5) Length of service of IS management team

Degree of IS Integration: 1) Senior people are transferred between IS and organizational line functions; 2) Joint task forces evaluate the strategic potential of IS; 3) IS planning is integrated with overall organizational business planning; 4) Specific executives are charged with expanding IS capability to support the organizational strategic effort

Degree of IS centralization: 1) Management of the IS function is centralized; 2) Data processing in our

organization is centralized; 3) Database control in our organization is centralized

IS Performance: 1) IS is perceived as facilitating organizational decision-making; 2) The user community is generally satisfied with IS; 3) The IS function has not achieved its performance goals (Reverse coded); 4) Use of IS has let to better management of organizational activities; 5) Benefits of IS have outweighed it cost

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