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ABSTRACT

Top management support has long been conceivable as an important factor for the success of IS projects. Due to the hierarchical nature of an organization, a cross-level interaction can occur among nested levels. Thus, using inappropriate statistical analysis can cause misleading results and lost of information. This study provides two contributions to the IS research. First, Hierarchical Linear Modeling (HLM) was used to explain the cross-level interaction between organizational level and industry level. Second, unlike other studies focusing on an organizational level, this study considers top management support at the industry level and examines the mediating role of top management support between the two levels.

INTRODUCTION

Over the last decade, the industrial society has reached its pinnacle and an information society – dubbed the information age, in which the economy is strengthened by technology innovation and deployment of information, has advanced rapidly. In this information age, the strategic resource is information that drives the creation of wealth and creativity (McGee & Prusak, 1993). Information systems (IS) have been used to create many strategic advantages for organizations including reduced cost, improved quality, increased productivity, sustained financial performance, realized new business opportunities, improved decision making processes, and enhanced internal and external integration through better communication (Small et al., 1995; Thompson, 1967; Doll & Torkzadeh, 1998). To sustain strategic IS advantages, top management (e.g., manager, CIO and CEO) is the leading position in determining the business value of IS investment (Nelson and Cooprider, 1996). Wu et al. (2003) studied a coherent model for positioning the various virtual organizing strategies toward market negotiation, co-operation, co-operation, co-ordination and collaboration and claimed that the top management of an enterprise is a key role to achieve a competitive advantage in an intense information environment. Top management support can be defined as the degree to which top management understands the importance of the IS function and is personally involved in IS activities (Thompson, 1967). The success of IS implementation rests upon top management's readiness to provide full support for a project team once the project has been committed. In IS literature, top management support has been identified as a key positive factor, influencing the success of many IS projects (e.g., IS performance, successful IS planning, and increased IS effectiveness) (King et al., 1989; Thompson, 1967; Raghunathan & Raghunathan, 1988; Seliem et al., 2003).

Although previous studies regarding the impact of top management support on IS performance have been well grounded in IS literature, the focus was on single organizational level effects (Froster, 1978; Raghunathan & Raghunathan, 1988; Cash et al., 1992; Tu, Raghunathan, and Raghunathan, 1999). The application of multilevel analysis or cross-level interactions within IS studies is sparse. The main reason for this omission is that traditional statistical methods and tools have had limited capability to analyze cross-level interactions. Therefore, the current study adds two significant contributions to the IS research stream. First, it studies the effect of top management support on IS performance at both industry and organizational level rather than at only organizational level. Second, it examines the cross-level interaction between organizational factors (*user support, IS budget*) and industry factors (*industrial sectors, top management support*) using *Hierarchical linear modeling* (HLM).

In this study, IS organizations were considered to be the first level (lower) units and industrial sectors were considered to be the second level (higher) units. Empirical data were taken from a large-scale survey of IS executives. The next section reviews statistical methods of HLM. The following sections describe variables, their related hypotheses and model development. The final section discusses results and implications.

HLM Rational

HLM is a statistical approach, which conveys an important structural feature of data that promises a wide variety of applications including studies of growth, organizational effects and research synthesis (Raudenbush & Bryk, 2002). In HLM, organizations are inherently hierarchical in nature. For example, individuals are nested in work groups, work groups are nested in departments, departments are nested in organizations, and organizations are nested in environments (Hofmann and Gavin, 1998). Basically, at least two levels of units exist in HLM methodology. Lower level units (level-1) (e.g., workers or students) are nested within higher- level units (level-2) (e.g., industries or organizations or schools). Within HLM models, different set of predictors are used to model at different levels (Kreft et al., 1995). There are two primary advantages of HLM over regular statistical approaches such as ANOVA, MANOVA, and linear regressions. First, HLM explicitly recognizes that individuals within the same group or organization may be more similar to one another than individuals in different groups or organizations. Since people within the same group or organization possess unique shared characteristics or traits compared to other groups, they might react similarly to specific actions or parameters. Therefore, they are not independent of each other. If we analyze data coming from multiple groups of people using traditional statistical methods, the result might be misleading because the data do not meet the assumption of independence of observations.

Second, HLM allows one to partition the outcome's total variance into lower-level and higher-level variances simultaneously, while maintaining appropriate level of analysis for the independent variables. Therefore, one can model both individual and group level variance in individual outcomes while utilizing individual predictors at the individual level and group predictors at the group level. With HLM, one can simultaneously investigate relationships within a particular hierarchical level as well as relationships between or across hierarchical levels. Therefore, HLM preserves lower-level unit variance, higher-level unit variance, and cross-level unit variance of which largely cannot be accomplished by regular statistics.

HLM in an IS context

Multilevel or HLM models are becoming increasingly popular in medicine, health, psychology, education, and social and behavioral sciences disciplines to analyze hierarchically nested data. In organizational studies, researchers might investigate how workplace characteristics (e.g., centralization of decision making) influence worker productivity (Raudenbush and Bryk, 2002). However, HLM applications and cross-level interactions are very limited in IS research. This study uses two-level HLM to study the interaction effects between organizational factors (level-1) and industrial factors (level-2). Thus, in this study, IS organizations are considered level-1 units, which are modeled by level-1 variables (e.g., IS performances, user support, and IS budget). Industrial sectors are considered level-2 units, which can be modeled by level-2 variables (e.g., industrial sectors, top management support). IS performance (dependent variable) was used to represent the organizational performance. HLM presented in this study can be conceptualized as being two levels. Each HLM level can be formally represented by its own sub-model. These sub-models express relationships among variables within a given level, and specify how variables at one level influence relationship occurring at another (cross-level interaction).

VARIABLES AND HYPOTHESES

The data used in this study were taken from "Information Systems and Organizational Strategy: Linkages and Key Issues" survey conducted by Raghunathan & Raghunathan (1999). Interested readers can review further details of this survey in Tu, Raghunathan, & Raghunathan (1999) and Raghunathan & Raghunathan (1999).

Organizational Variables

IS Performance represents an organizational performance relating to IS activities, IS implementation and IS investment. In any IS organization. An *annual sale* can be used as one of the IS performance indicators (Byrd & Marshall, 1997).

User support is the extent to which the IS department provides training and develops cordial working relationships with end-users. While IS-user coordination has always been encouraged in the IS literature (Cash et al., 1992), the coordination between IS and users can play a key role in enhancing organizational performance. Venkatraman (2004) purported that web-services are a set of new technologies that promise a computing user support to a whole new level. Web-services let organizations bridge communication gaps among users' information systems and enable organizations to seamlessly connect their partners and suppliers. Nelson and Cooprider (1996) empirically verified that a good working relationship between IS department and other organizational groups can have major contribution to increasing IS performance. It is therefore hypothesized that

H1: the higher the level of user support, the higher the level of IS organizational performance.

IS Budget is defined as all capital set-aside by the organization for any IS activity. IS activities are considered capital-intensive in nature. In order to implement information systems effectively, an allocation of adequate organizational resources is required, whether in the form of personnel, managerial time, or physical facilities. Empirical evidence shows that the percentage of the IS budget spent on IS staff training and the percentage of the IS budget spent on IS staff are significantly related to the total sales in IS organizations (Bryk & Raudenbush, 1992). It is therefore hypothesized that

H2: the higher the level of the IS Budget, the higher the level of IS organizational performance.

Industrial Variables

Industrial sector is a nominal scale variable with 0 and 1 value. One represents manufacturing organizations and zero represents the other types of organizations such as service, government, and etc.

Top management support is defined as the degree to which top management understands the importance of the IS function and are personally involved in IS activities. The IS planning literature has consistently emphasized the importance of top management support for the success of any organizational activity (Froster, 1978; Raghunathan & Raghunathan, 1988). Cash et al. (1992) pointed out that the distance between top management and IS should be short in order for a company to successfully implement IS projects. A supportive managerial attitude would provide IS executives with an environment in which their work will be recognized and appreciated, and therefore, is likely to motivate them to achieve higher performance (Tu, Raghunathan, and Raghunathan, 1999). The following are the hypotheses related to industrial variable (level-2) indicators.

H3: The average of organizational performance is significantly different across industries.

H4: The effect of user support on organizational performance is significantly different across industrial sectors.

H5: The effect of IS budget on organizational performance is significantly different across industrial sectors.

H6: Top management support has a positive impact on the relationship between user support and organizational performance.

H7: Top management support has a positive impact on the relationship between the IS budget and organizational performance.

METHODOLOGY

Methods used to develop valid and reliable measures of the variables are described initially. Next, survey methods and sample characteristics are specified. Finally, methods for testing hypotheses using Hierarchical Linear Modeling (HLM) are introduced.

An Operational Definition of Constructs

After a theoretical domain of constructs was identified, formal conversion of the construct definitions into measurable scales was undertaken. This task ensured that both researchers and targeted respondents perceived the same meaning of each item. In addition to defining content domain, a panel of experts and potential respondents can offer much insight into potential problems and means to alleviate those problems resulting from ambiguous or poorly defined scale operationalizations (Churchill, 1979). This process was performed repeatedly until agreement among participants in the panel had been reached.

Item Generation and Pilot Test

The scales were developed based on existing theory and an extensive literature review. Content validity is enhanced when steps are taken to ensure that the domain of the construct is covered (Churchill, 1979). A literature review provided a definition for the construct and helped to identify an initial list of items.

Large-Scale Study

Success in a large-scale empirical study depends on the quality of respondents. For this study, respondents should have detailed knowledge in more than one functional area plus in-depth understanding of IS activities. To achieve these goals and to obtain an acceptable response rate, a self-administered questionnaire was mailed to 800 information systems executives who were chosen at random from a list of 3,000 senior IS executives. IS executives were chosen because they were considered to be the most appropriate individuals within an organization to respond to the questions. There were 237 responses of which 231 were completed and usable for the data analysis. The response rate of 29.6% was considered acceptable. Tables 1 and 2 provide an overview of the general characteristic of the sample. The respondents were asked to mark the range of their answer applicable for their organization. The unmarked questions are reflected in OTHERS category. Table 1 shows the number of responses based on business category (Tu, Raghunathan, and Raghunathan, 1999). The data is skewed in favor of manufacturing and finance/insurance firms. A majority of the respondents are in manufacturing (37%) and finance/insurance (23%); however, the number of respondents is balanced between manufacturing sectors (40%) (e.g., manufacturing, mining/construction/agriculture, and petroleum) and service sectors (50%) (e.g., business services, finance/insurance, government, medicine/law/education, public utility, transportation, and wholesale/retail) and 10% did not provide the information. Table 2 shows the sample distribution of company annual sales. The results show that the distribution is well spread out to both upper and lower bound. The results from both tables show no sign of response bias.

Table 1: Number of Companies in Sample by Type.

Business Category	**Number**
Business Services	7
Finance/Insurance	52
Government	3
Manufacturing	86
Medicine/Law/Education	10
Mining/Construction/Agriculture	3
Petroleum	5
Public Utility	12
Transportation	10
Wholesale/Retail	22
Others	21
Total	231

Table 2: Respondents by Average Annual Sales.

Sales	**Number of Respondents**	**Percentage of Respondents**
Less than 100 M	51	22
100 to <250 M	33	14
250 to <500 M	25	11
500 to <1000 M	43	19
1000 M and Above	57	25
Others	22	10
Total	**231**	**100**

Measures

The concept of IS performance was measured using a composite scale of operational and financial performances. Operational performance was measured using multiple items on a 5-point Likert scale. Financial performance was measured by annual sales. The concept of top management support was operationally measured by 7 items. The concept of IS user support was operationally measured by 3 items. The IS budget variable was operationally measured by 1 categorical item ranging from 1-9 based on the corresponding amount of IS budget in million dollars. The industrial sector variable was operationally measured using major business categories. The score was rated 0 or 1, where 1 represents a manufacturing category and 0 represents a service category.

DATA ANALYSIS

Missing Data

Missing data can have a profound effect on the quality of the data analysis. The impact of missing data is detrimental not only through its potential "hidden" biases of the results but also in its practical impact on the sample size available for analysis. In this study, after randomly checking the pattern of missing data from one observed variable against the others, no pattern of relationship was found among missing values of observed variables and therefore, the data can be used for further statistical analysis with no specific remedial action.

Checks for Statistical Assumptions

The two most important statistical methods exercised in this study deal with multilevel structured data. Since these methods deal with multivariate data, before the data are analyzed, multivariate normality assumption should be tested and specific remedial actions should be performed if the assumption is not met. Because multivariate normality is difficult to test, it is recommended that univariate normality among variables be initially tested. In this study, normal probability plot, skewness, and kurtosis were utilized to assess univariate normality. No nonnormality pattern was found in this data. Therefore, the results suggest no serious departure from multivariate normality, and excessive kurtosis and skewness.

Empirical Assessment of Validity And Reliability Of Measurement

The validity of a measurement concerns the "truth" of the measurement. The validity of a measurement procedure is the degree to which the measurement process measures the variable it claims to measure. The reliability of a measurement procedure is the stability or consistency of the measurement. If the same individuals are measured under the same conditions, a reliable measurement procedure will produce identical measurements. As per the guidelines of Bagozzi (1980) and Bagozzi and Phillips (1982), the important properties for measurement to be reliable and valid include content validity, internal consistency of operationalization (unidimensionality and reliability), and construct validity (discriminant and convergent).

Content Validity

The content validity of measurement refers to the representativeness of item content domain. If the measures adequately cover the topics that have been defined as the relevant dimensions, then it can be concluded that an instrument has good content validity (Kerlinger, 1978). The evaluation of content validity is a rational judgmental process not open to numerical justification. Nunnally (1978) stated "*content validity rests mainly on appeals to reason regarding the adequacy with which important content has been sampled and on the adequacy with which the content has been cast in the form of test items*." An instrument has content validity if there is a general agreement among the subjects and researchers that the measurement items that cover all-important aspects of the variable being measured.

In this study, content validity can be assessed by two important processes. First, a comprehensive review of the literature was conducted to make sure that measurement items were well covered the domain of the variable being measured (Nunnally, 1978). Second, to make sure whether the identified constructs and the items measuring them adequately covered factors under the domain, an operational example of instrument was given to a panel from the employment setting. Then a panel independently assessed the items for a performance test. The recommendation and suggestion from the panel were used to improve or "fine tune" the content validity of the measurement. Then the measurement was used in the large scale survey.

Construct Validity

Construct validity is defined as the extent to which the test measures a theoretical construct. The construct validity of a measure is demonstrated by validating the theory behind the instrument. The construct validity can be assessed using item-total correlations and factor analysis.

Item-total correlations have been used extensively for the development of unidimensional scales. Item-total correlation refers to a correlation of an item or indicator with the composite score of all the items or indicator with the composite score of all the items forming the same set. Item-total correlations less than 0.5 are usually candidates for elimination in further analysis. If all the items in a measure are drawn from the domain of a single construct, responses to those items should be highly intercorrelated (Churchill, 1979). Table 3 shows the results of item-total correlations for IS performance, top management support, and IS user support. The item-total correlations range from 0.5100 to 0.7448 for IS performance, from 0.6685 to 0.8378 for top management support, and from 0.8705 to 0.8865 for IS user support. Thus, relatively high item-total correlations could be obtained from the analysis of a scale defined by the items for each construct. There was no candidate for elimination for all constructs and therefore all items were included and used for further analysis.

Table 3: Corrected Item-Total Correlations (CITC).

Item	Item-total correlation	Item	Item-total correlation	Item	Item-total correlation
	IS Performance		Top Management Support		IS User Support
I1	0.6551	II1	.8309	III1	.8865
I2	0.6992	II2	.6909	III2	.8365
I3	0.7448	II3	.8261	III3	.8705
I4	0.6674	II4	.6685		
I5	0.7337	II5	.8378		
I6	0.5100	II6	.7481		
		II7	.7241		

Factor analysis can be used to extract the confounding structure of hypothesized constructs, which subsequently can be used to test the relationships. In this study, factor analysis with varimax rotation was conducted including all 15 items that measured the three constructs. Table 4 shows the results from factor analysis with varimax rotation for the three constructs. All items show factor loading more than 0.6. Thus, three factors can be extracted. These three factors explained 61.7% of the total variances. The results show high factor loadings on each construct and no cross loading was found, thus confirming statistical significance of construct validity.

Table 4: Confirmatory Factor Analysis.

Item	IS Performance	Top Management Support	IS User Support
I1	.727		
I2	.795		
I3	.801		
I4	.758		
I5	.809		
II1		.833	
II2		.661	
II3		.801	
II4		.649	
II5		.826	
II6		.743	
II7		.689	

III1 III2 III3			.864 .778 .822

Reliability Of Construct Measurement

Using Cronbach's alpha to assess the reliability only proves that the items under the scale have equal reliabilities (Nunnally, 1978). Table 5 reports the reliability values for each of the variables. The reliability values based on Cronbach's alpha were all above the recommended minimum value of 0.7 (Nunnally, 1978).

Table 5: Statistical Attributes of Scales.

Variables	**Number of Items**	**Reliability**
IS Performance	5	0.8603
Top Management Support	7	0.8790
IS User Support	3	0.8311

HLM MODELS

One of the primary advantages of hierarchical linear models is that they allow one to simultaneously investigate relationships within a particular hierarchical level as well as relationships between or across hierarchical levels. In HLM with two levels, each level is represented by its own regression equations. Two HLM models derive the results and conclusions of this study. First is the "One-Way Analysis of Variance" or "Unconditional" model where no predictor is specified at both levels. The unconditional model is used to provide proof that hierarchical linear models exist in the research data. Second is the "Slopes-as-Outcomes" or "Conditional" model where industrial predictors are added to further explain the level-2 variance. For explanatory purposes, all level-1 indicators are centered on a group mean (group-mean centering) and all level-2 indicators except sector are centered on a grand mean (grand-mean centering).

One-Way Analysis Of Variance (Unconditional Model)

The first condition specifies systematic within and between group variance in IS performance. This condition is used to partition the total variance into within and between group variances. The variance between groups should turn out significant in order to test the hypothesis 3 (u_{0j}). Consequently, if the result is not significant, there is no need to test hypothesis 4 to 7. The following equations can be used:

Level-1: $\text{IS Performance}_{ij} = \beta_{0j} + r_{ij}$ (1)

Level-2: $\beta_{0j} = \gamma_{00} + u_{0j}$ (2)

Where: Variance (r_{ij}) = σ^2 = within group variance
Variance (u_{0j}) = τ_{00} = between group variance in IS performance
β_{0j} = mean IS performance for group j
γ_{00} = grand mean IS performance

An intra-class correlation (ICC), which is represented as the ratio of the between group variance to the total variance in IS performance, indicates the amount of total variation that is due to between industry variation.

$$ICC = \rho = \tau_{00}/(\tau_{00} + \sigma^2) \quad (3)$$

Slopes-As-Outcomes (Conditional)

Organizational level model is:

$$Y_{ij} = \beta_{0j} + \beta_{1j}X_{1ij} + \beta_{2j}X_{2ij} + r_{ij} \quad (1)$$

Where: Y_{ij} is the IS performance
X_1 is user support
X_2 is IS budget
r_{ij} is the adjusted residual
β_{0j} and β_{ij} are intercept and slopes estimated separately for each business category

Industrial level model is:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_{1j} + \gamma_{02}W_{2j} + u_{0j} \quad (2)$$

$$B_{1j} = \gamma_{10} + \gamma_{11}W_{1j} + \gamma_{12}W_{2j} + u_{1j} \quad (3)$$

$$B_{2j} = \gamma_{20} + \gamma_{21}W_{1j} + \gamma_{22}W_{2j} + u_{2j} \quad (4)$$

Where: W_{1j} is the business sector
W_{2j} is group mean of top management support
u_{ij} are the level-2 residuals
γ_{i0} and γ_{ij} are the intercepts and slopes relating to W_{ij} in level-2

$$\rho = \tau_{00}/(\tau_{00} + \sigma^2)$$

$$= 0.4254/(0.4254+3.6074)$$

$$= 0.11$$

The results (Table 6) suggest that about 11% of the variance in IS performance is between industrial sectors. Therefore, *hypothesis 3* is supported. The average of organizational performance (u_{0j}) is significantly different at < 0.0001 between industrial sectors. Based on these results, we can further examine the random coefficient regression model.

RESULTS

One-Way Analysis Of Variance

Table 6: Unconditional Model Results.

Fixed Effects		**Coefficient**	**Std. E.**	**p Value**
Average IS performance, γ_{00}		8.5116	0.2476	0.000
Random Effects	**Variance Component**	**Df**	χ^2	**p Value**
Business sector mean, u_{oj}	0.4254	10	25.1006	0.005
Level-1 effect, r_{ij}	3.6074			

Slopes-As-Outcomes

Table 7 shows the interaction effects after adding more predictors for business sector's slopes. Both user support and IS budget were not significantly different across industries (γ_{11} and γ_{21}). Therefore, hypotheses 4 and 5 were not supported. Top management support was found to be positively related to user support slope (γ_{12}) at significantly level < 0.02. Therefore, hypothesis 6 was supported. However, top management support was significantly related to IS budget slope (γ_{22}). Therefore, hypothesis 7 is not supported. The predicted equation for organizational performance can be represented in a combined HLM form:

$$\text{IS performance}_{ij} = 8.52 + 0.27\,(\text{User support}_{ij}) + 0.46(\text{IS budget}_{ij}) + 0.005(\text{Top Management Support})(\text{User support}_{ij})$$

This combined model shows the moderating effect between user support and top management support.

Table 7: Conditional Model Results

Fixed Effect	*Coefficient*	*Se*	*t Value*	*p Value*
Model for user support slope				
Intercept, γ_{10}	0.2559	0.2027	1.26	0.243
Business sector, γ_{11}	-0.9974	0.6346	-1.57	0.154
Top management support, γ_{12}	0.0080	0.0026	3.06	0.017
Model for IS budget slope				
Intercept, γ_{20}	0.4889	0.1099	4.45	0.002
Business sector, γ_{21}	0.0794	0.4117	0.19	0.852
Top management support, γ_{22}	-0.0004	0.0016	-0.24	0.815

Note – the results show only parameters related to hypotheses

DISCUSSIONS AND CONCLUSION

HLM methods as a multilevel analytical tool have been utilized in medical, health, and social and behavioral sciences where we have a nesting structure in the research design; however, the applications of these analytical methods are sparse in the IS literature. For example, Huttenlocher, Haight, Bryk, and Seltzer (1991) investigated how exposure to language in the home predicted the development of each child's vocabulary over time. Nye, Hedges, and Konstantopoulos (2000) reanalyzed data from the Tennessee class size experiment, which involved students nested within classrooms within schools. Raudenbush, Cheong, and Fotiu (1999) analyzed the U.S. National Assessment of Educational Progress, which involved students nested within schools within states. Hofmann and Garvin (1992) estimated growth curves for major-league baseball players and found different patterns of intra-individual performance.

The applications of HLM from other disciplines seem to show premise as a statistical tool for IS researchers studying interactions between IS organizations and the environment where contextual factors (e.g., culture, business sector, countries) play a major role in defining individual and group characteristics distinctively. While the nesting is a common factor in research settings, the nesting structure of the data is often ignored and inappropriate analysis tools are employed in IS literature. This study purports to fill this gap by taking the nesting structure into account and examining the interaction effect between organizational factors (e.g., IS budget and user support) and industry factors (industrial sectors and top management support). Similarly, a number of studies investigating a cross-level interaction between an organization and its environment using HLM can be found in other disciplines; for example, numerous theoretical discussions and empirical investigations have identified relationships between variables that reside at different levels such as the relationships between: organizational environmental factors and organizational structures (e.g., Aldrich and Pfeffer, 1976; Pfeffer and Salancik, 1978), organizational technologies and organizational structures (e.g., Comstock and Scott, 1977; Fry and Slocum, 1984; Thompson, 1967).

Focusing on the main effects, the results from this study show a confirmative direct relationship between organizational factors (User support, IS budget, Top management support) and performance found in previous studies (Cash et al., 1992; Byrd et al., 1997; Nelson and Cooprider, 1996; Foster, 1978; Raghunathan and

Raghunathan, 1988; Tu, Raghunathan, and Raghunathan, 1999). For example, Nelson and Cooprider (1996) purported 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. Raghunathan and Raghunathan (1988) verified the importance of top management support as a critical ingredient in the success of IS planning. For managerial implications, a supportive managerial attitude and environmental nourishment would provide IS personnel with an encouraging environment in which they believe that their work will be recognized and appreciated. The HLM results also show that industrial sector variable was not significantly related to IS performance. For managers, this implies that IS activities are considered equally important across IS organizations regardless of the industry. IS activities should be a strategic priority and given sufficient attention by top management position because IS activities are the source of organizational effectiveness in an organization.

Regarding the interaction effect, top management support was found to moderate the relationship between user support and IS performance. The practical implication of the results suggests that supporting team and top management should collaborate closely in order for organizations to be effectively managed. IS activities are capital intensive and IS projects are mostly approved by IS executives. If IS executives are aware that an IS project is a strategic imperative for organizations to sustain organizational effectiveness, each IS project should be provided with adequate resources and personal attention. The more support from top management the project has, the higher the chance the project can survive. User support in this study was treated as an organizational level variable where as top management support was treated as industry level variable. For managers, this implies that the level of top management support varies significantly across the organizations. In some industrial sectors such as manufacturing, IS projects are most likely to be successful because top management realizes the importance of IS activities and provides serious attention and sufficient resources to the project from the early phase of implementation. However, in some industrial sectors such as retail and construction where the main business is not IS related activities, the only support the users can get is from IS personnel, not from top management. In this situation, IS activities focus more on functional or day-to-day operations. Therefore, IS implementation in such industrial sectors is less likely to be successful.

For academic implications, the interaction between user support and top management support as indicated by using HLM may guide research into a new direction. In order to fully understand the real dynamics of the organization, researchers not only need to focus on the main effects of organizational factors within the organization, but also focus on the side effects caused by interactions between the organization and its boundaries. These issues include realizing the extent of organizational factors (e.g., user support, top management support, IS budget) varying across the industry level. This will help explain some managerial issues that traditional IS research might not be able to explain. This indicates many possibilities for future research; for example, the study of organizational factors on the interaction between organizational functions such as marketing, finance, and manufacturing. The finding of such research will help improve the whole organization and at the end, global economy.

While this study has provided theoretical and statistical importance of HLM in IS research, it might not answer all questions regarding the applications of such a method. The first potential avenue of future research is to study the interaction between end-users computing performance at an individual level and organizational factors such as user support and IS budget. This will give researchers an insight into how end-users react to organizational factors differently within and between organizations. The second aspect to be improved concerns the variables included in each level. A questionnaire measuring additional variables should be administered in order to capture the true characteristics of the data for each level. Such studies might provide additional dimensions to accurately measure the true confounding nature of respondents in each level.

The lesson learned from this study contributes to both academicians and practitioners. For academicians, the research findings help confirm the existing theory published in IS literature. In addition, this study is a precursor for the application of HLM in the business research arena especially IS research. Similar to management, psychological, behavioral and educational research, this study can be used as a testament to prove that multilevel units do exist in IS organizational settings. The success of this research can be seen as trend setting for IS researchers to apply HLM as a statistical tool in their research. HLM might be used to enhance the accuracy and validity of IS research in the future. For practitioners, the research findings suggest appropriate strategies and remedial actions suitable for a particular group of individuals in order to gain organizational effectiveness. The interaction effects of the environment and organization can enhance practitioners' knowledge to adapt their strategies to fit into different situations dictated by different environments. Finally and most importantly, academicians and practitioners should improve their research designs by taking into consideration the nesting structure of the data.

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