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Bhanu S. Ragu-Nathan
The University of Toledo

Charles H. Apigian
Middle Tennessee State University

T.S. Ragu-Nathan
The University of Toledo

Qiang Tu
Rochester Institute of Technology

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Bhanu S. Ragu-Nathan, University of Toledo, 2801 West Bancroft, Toledo, OH 43606, (419) 530-2340
Charles H. Apigian, Middle Tennessee State University, P.O. Box 45, Murfreesboro, TN 37132 (615) 898-2362
T.S. Ragu-Nathan, University of Toledo, 2801 West Bancroft, Toledo, OH 43606, (419) 530-2427
Qiang Tu, Rochester Institute of Technology, 105 Lomb Memorial Drive, Rochester, NY 14623-5608, (585) 475-2314

Abstract: The strategic use of information systems (IS) has become a vital aspect of business strategy. Companies have tried to differentiate themselves based on their use and adaptation of new technology. To accomplish this, top management support has become an integral part of the IS function. The literature has conceptually supported this notion, but empirical evidence has been lacking. This paper develops a framework for the support from top management (TMS Model) as well as empirically tests the relationship between top management support, the IS function, and IS performance with structural equation modeling, with the results supporting the direct and indirect relationship of top management support and IS performance.

INTRODUCTION

With rapid changes in IT applications and sophisticated information systems (IS) structures that are continuing to become more affordable and easier to use, IS has evolved from being a back office infrastructure support to becoming an integral and strategic part of the business environment (Raghunathan et al., 1998). As the strategic nature of IS changes in an organization, the role of leadership, impact of organizational structure, and the IS management processes will change. To fully realize the strategic impact of IS, organizations must have a highly supportive management strategy that will accommodate the role and functionality of IS in its business strategy. Information systems is not a subset of a strategy, in many instances, it is the business strategy (Earl and Feeny, 2000).

Top management support (TMS) has been recognized as a key attribute of business strategy (Wong, 1996). Executives have also recognized the need to align business strategy with the information systems function (Lederer and Mendelow, 1988), especially more so now with the line between business and IS continuing to blur. Although the need for top management support has been conceptually hypothesized in the literature (Doll, 1985), an empirical test of its relationship to the IS function and IS performance is lacking, with few exceptions (Choe, 1996).

Top management has two main responsibilities with its relationship to IS. The first is the development or structuring of the IS function within the organization (Applegate et al., 1999). The next responsibility is the management of the current and future portfolio of IS applications, as well control over the processes of IS. This leads to a two-tiered system of management support that will then lead to an effective application of the IS function (See Figure 1).

The importance of top management support to the IS function has been conceptually supported in the IS literature. Frameworks focusing on the importance of top management support have been proposed (McFarlan and McKenney, 1983) and tested in the literature (Raghunathan and Raghunathan, 1988). However, the effect of top management support on various aspects of IS and IS performance has not been empirically tested as a comprehensive model.

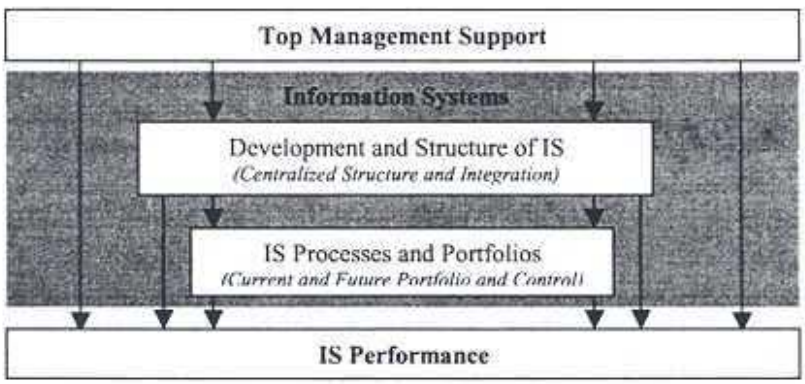

Figure 1:Two-Tiered Top Management Support (TMS) Model

This paper empirically tests the effect of top management support on development and structure of IS and its relationship to performance as depicted in the model in Figure 1.

DESCRIPTION OF VARIABLES AND HYPOTHESES DEVELOPMENT

Top management can have an effect on many areas within a business. The IS area has been described as a business within a business (Applegate et al., 1999). They discuss the importance of support from top management in developing a structure that continues to improve and integrate systems, and in overseeing IS management processes. This research examines the link between top management support, the development and structure of an IS department, and IS performance. The variables used in the model are described below.

- Top management support
- Structure of IS
- Integration of IS
- Control of IS

Top Management Support

Top management support (TMS) of information systems is defined as the degree to which top management understands the importance of the IS function and the extent to which it is involved in IS activities. TMS has consistently been identified as a key aspect of IS performance. In a study of key information management issues, managers were asked to rank the issues affecting IS success (Yang, 1996). Top management support was found to be the most significant attribute, with improving communication, goal alignment, creating competitive advantage, and IS strategic planning, the next four highest ranked attributes. TMS has been linked to IS performance by Doll (1985) and Choe (1996). Raghunathan and Raghunathan (1988) verified the impact of top management support on successful IS planning. A highly supportive top management team appears to provide the IS function with an environment that motivates higher levels of performance. It is, therefore, hypothesized that:

H1: The higher the level of Top Management Support, the higher the level of IS Performance.

Structure of IS

The structure of the IS function is primarily built around the extent of centralization/decentralization of the function. With computing becoming less expensive and more powerful, organizations have moved away from a centralized structure (which is typically considered efficient for a mainframe-computing environment) to a more decentralized structure (Fiedler, 1996). However, decentralization has caused many problems within an organization, such as lack of standardization and control of data, and duplication of staff, there by increasing costs and complexity within the system (Cash, McFarlan et al. 1992). This has lead to a re-centralization of the IS function, and establishment of company-wide standardization of software and hardware (Von Simpson, 1990). Where top management is more actively involved in supporting IS it is more likely that they will encourage the latter types of company-wide IS efforts that could lead to a more efficient IS function. It is then hypothesized that:

H2: The higher the level of Top Management Support, the higher the level of centralization IS Structure.
H3: The higher the level of centralization of IS Structure, the higher the level of IS Performance.

Integration of IS

IS integration refers to how well IS activities are integrated with organizational and functional activities, such as marketing, manufacturing, human resources, etc. The notion of strategic alignment between business and IS is a measure of the integration of IS (Tavalokian, 1989; Chan et al., 1997; Gupta et al., 1997; Sabherwal and Chan, 2001). These activities may include cross-functional problem solving, strategic planning, and data sharing. A model of strategic alignment between IS and business has included two dimensions of integration: functional and strategic (Henderson and Venkatraman, 1993). Functional integration refers to the fit between internal activities of IS and a business unit, and strategic emphasizes the fit between external strategies and the internal IS function. These two types of integration have been considered essential to IS success (Venkatraman, 1989). The integration of IS planning and business planning has also been argued as essential to IS success (Teo and King, 1997), which leads to a key relationship

between integration and top management support. For integration between IS and business in any facet of an organization, the communication and support from top management is essential to facilitate this relationship. It is therefore hypothesized that:

H4: The higher the level of Top Management Support, the higher the level of Integration of IS.
H5: The higher the level of Integration of IS, the higher the level of IS Performance.

Control of IS

IS control is defined as the degree to which the IS function has authority over its related decisions (Tu, et al., 1999). The level of control that an IS area perceives to have is directly related to the autonomy and authority that is given by management. IS control has been found to be a critical success factor of IS organizations (Raghunathan, et al., 1989). This lack of control can lead to failure to coordinate and operate at an optimal level. In a related context, Cash et al. (1992) indicated that when there is more decentralizing of structure, IS executives feel more loss of control of IS activities. Further, the more integrated the IS is the greater the scope for IS management to maintain standardization and control over systems, data, etc.
It is therefore, it is hypothesized that:

H6: The higher the level of Top Management Support, the higher the level of Control of IS.
H7: The higher the level of Structure of IS, the higher the level of Control of IS.
H8: The higher the level of Integration of IS, the higher the level of Control of IS.
H9: The higher the level of Control of IS, the higher the level of IS Performance.

RESEARCH METHODOLOGY

Data Collection

A self-administered questionnaire was mailed to 800 IS executives, who were selected at random from a list of 3000 potential respondents. The list was obtained from a directory of top IS executives in more than 10,000 organizations in the U.S. The complete list covers all types of industries, sizes, and geographic locations. From the 800 questionnaires that were mailed, 237 responses were obtained of which 231 were complete and usable. This resulted in a 28.9% response rate. It is worth noting that 85% of the sample was represented by firms that had sales of more than $50 million (See Table 2). The industries that were part of the sample included primarily manufacturing and finance/insurance (See Table 3). This information is relevant while generalizing the results of this study.

Annual Sales	Number of Respondents	% of Respondents
Less than $100 million	51	22.1%
$100 to less than $250 million	33	14.2%
$250 million to less than $500 million	25	10.8%
$500 million to les than $1 billion	43	18.6%
$1 billion and above	57	24.6%
Others (Sales was not indicated)	22	9.7%
TOTAL	231	100%

Table 2: Size of Firms Represented in Sample

Industry Type	Number of Respondents	% of Respondents
Business Services	7	3.0%
Finance/Insurance	52	22.5%
Government	3	0.8%
Manufacturing	86	37.2%
Medicine/Law/Education	10	4.3%
Petroleum	5	2.1%
Public Utility	12	5.2%
Transportation	10	4.3%
Wholesale/Retail	22	9.5%
Others	24	10.1%
TOTAL	231	100%

Table 3: Industries Represented in the Sample

Measurement Items

The variables used in the questionnaire were measured on a 5-point Likert scale ranging from "strongly disagree" to "strongly agree". Negatively worded questions were reverse-scored. The means of the items comprising a construct were used as the value for that construct. A list of the questionnaire items is provided in Appendix A.

Data from the respondents were compiled and confirmatory factor analysis was used to identify the variables proposed in this study. All items had factor loadings above 0.5. Each observed variable was also tested for validity and fit using LISREL estimates of CFI, GFI, NFI, and RMR (Results available upon request). The reliability values for each variable were calculated using Cronbach's alpha, with all results above 0.8, which is well above the recommended minimum value of 0.7 (Nunnally 1978). The analysis indicates that the items used for each variable show a good fit, with high validity and reliability.

Data Analysis

Path analysis was used to test the relationships between the variables as proposed in the model (Figure 1), using the LISREL statistical software package. All relationships were hypothesized to be positive. The results are presented in (Table 4). Twelve of the thirteen hypotheses are shown to be supported. The only hypothesis that is not supported is the Hypothesis H6c linking Integration of IS to Control of IS. Results indicate the Top Management Support has a significant relationship with all of the IS functional variables as well as IS performance. Further, Top Management Support has significant indirect relationship with IS performance through IS structure, IS control, present portfolio, and future portfolio. The results for the individual paths support the overall concept of the model, which is that top management support has a significant relationship with IS performance.

There is no single statistical test that best describes the overall fit or strength of a model's predictive power (Tu, Raghunathan et al. 1999). However, several measures of fit may be used to test for goodness of fit (Maruyama, 1997). In LISREL models (Joreskog and Sorbom, 1986), these measures are divided into three categories: Measures of absolute fit, measures of incremental fit, and measures of parsimonious fit (Hair, Anderson et. al., 1992)

Hypothesis	Variable	Predictor Variable	Relationship	Path Coefficient	(p-value)
H1	Top Management	IS Performance	Positive	.16**	(.002)
H2	Top Management	Structure of IS	Positive	.32**	(.000)
H3	Structure of IS	IS Performance	Positive	.07*	(.048)
H4	Top Management	Integration of IS	Positive	.58**	(.000)
H5	Integration of IS	IS Performance	Positive	*.05^{NS}*	*(.358)*
H6	Top Management	Control of IS	Positive	.28**	(.000)
H7	Structure of IS	Control of IS	Positive	.12*	(.012)
H8	Integration of IS	Control of IS	Positive	*.00^{NS}*	*(.969)*
H9	Control of IS	IS Performance	Positive	.31**	(.000)

Note:
NS = Not significant
** = *significant p-value < 0.01*
* = *significant p-value < 0.05*

Table 4: Results of Path Analysis

The Goodness-of-Fit Index (GFI) and Root Mean Square Residual (RMSR) are measures of absolute fit. GFI is a non-statistical measure ranging from 0 (very poor fit) to 1 (perfect fit) that represents the overall fit without being adjusted for degrees of freedom. RMSR is the square root of the mean squared difference between elements of the predicted and observed matrices (Maruyama, 1997). Models with a score below 0.10 are considered to be a good fit (Chau, 1997).

The Normed Fit Index (NFI) and Comparative Fit Index (CFI) are used to test for incremental fit. Incremental fit refers to comparing the proposed model to a baseline model (Bentler and Bonnett, 1980). If the values for NFI and CFI are greater than 0.90, they are considered to good indications of model fit.

The final type of measures, parsimonious fit, relate the Goodness-of-Fit model to the number of estimated coefficients required to achieve this level of fit. To test for this, the Adjusted Goodness-of-Fit Index (AGFI) is used, which is an extension of GFI. AGFI adjusts for the degrees of freedom for the null model, and a value greater than 0.90 is evidence of good model fit (Hair, Anderson, et al., 1992).

The model proposed in this research has excellent fit with GFI of 0.99, RMSR of 0.004, NFI of 1.00, CFI of 1.00, and an AGFI of 0.998. All of these measures are well above the 0.90 that is required, with RMSR well below the 0.10 that is needed to indicate a good fit.

DISCUSSION

The strategic role of IS has been an important aspect of business strategy (Ahituv, Zviran, et al., 1999). No longer can organizations rely on their IS infrastructure to give them an advantage over their competitors without strategically positioning themselves in a way that makes them more efficient, more flexible in responding to change (Porter, 2001). Top management support of IS structure and IS management processes play a critical part in enabling the organization to respond dynamically to environmental changes.

The results of this study indicate that top management support does have a significant impact on the IS function in an organization. While the individual IS functional variables such as IS control and IS Structure appear to be having a significant effect on IS performance, top management support, both directly and indirectly through these variables play an added and significant role in the success of IS. Further, while everyday management issues of people, tasks, and environment may lie within the domain of the functional IS manager (Applegate, McFarlan et al. 1999), the support and involvement of top management with substantive issues that shape the course and direction of IS such as the current and future portfolios can significantly benefit the success of IS.

CONCLUSION

The support of top management has been identified as critical to the success of key organizational activities. Although this has been conceptualized in the literature, empirical evidence has been lacking in this area. This paper establishes a framework for understanding the impact of support from top management on the IS function. Specifically, the impact on critical IS variables, and on IS performance, was studied, using a conceptual model. Empirical testing of the model relationships and model fit was conducted using structural equation modeling. The results provide strong support for the model.

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