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An Empirical Assessment of the Performance Impacts of IS Support for Knowledge Management

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Abstract: In this study, the performance impacts of information systems (IS) support for two key knowledge management activities (knowledge creation and knowledge sharing) were assessed with both survey and archival data. The results showed that IS support for knowledge creation and IS support for knowledge sharing had direct positive effects on labor productivity. Coupled with unique, complementary organizational resources, both types of IS support exerted positive effects on profitability.

Keywords: knowledge management, information systems, firm performance, competitive advantage.

I. Introduction

With the widespread recognition of knowledge as a critical source of sustainable competitive advantage (Spender & Grant, 1996), developing and mobilizing value-creating knowledge for competitive advantage and superior economic performance becomes a central issue facing academics and practitioners alike. In the field of IS management, the past decade has witnessed a proliferation of research on IS roles in knowledge management (see Alavi & Leidner (2001) for a review of the related research). While much of the extant literature has identified various ways a firm can use IS to generate and leverage its knowledge resources for improving its competitive position and performance (Gold et al., 2001), it remains unclear whether such IS deployment would actually result in positive economic returns for the firm, due to little empirical evidence linking IS support for knowledge management directly to the bottom-line performance of firms.

Moreover, while IS have traditionally been viewed as one of the key enabling tools for knowledge management, researchers have increasingly entertained the notion that IS alone would not lead to knowledge-based competitive advantage and that other organizational resources need to work in conjunction with IS in order to generate the economic benefits from IS support for knowledge management (Ciborra & Patriota, 1998; Davenport et al., 2001). Unfortunately, discerning the moderating effects of complementary organizational resources on the performance impacts of IS support for knowledge management has received little attention in the extant literature. This study

was undertaken to assess the performance impacts of IS support for two key knowledge management activities: knowledge creation and knowledge sharing. The study also examined and tested the potential moderating effects of certain unique organizational resources that complement the IS support.

II. Theory and Hypotheses

II. 1 IS Support for Knowledge Creation and Firm Performance

While nowadays knowledge (e.g., insights and ideas) is often distinguished from data and information (e.g., facts and numbers) in the literature (Drestke, 1981), it is well recognized that data and information are indispensable to knowledge creation (Kogut & Zander, 1992). The communication and storage capabilities of IS can be used to enhance a firm's ability to collect critical information for creating useful knowledge. The electronic communication capabilities of IS allow the firm to overcome time, geographical and organizational barriers in gathering data and information (Stroud, 1998). The ongoing increases in storage capacities of IS along with automatic capturing, on-line access and user-friendly interface greatly expand the firm's capacity to retain more data with completeness and precision and facilitate information access and retrieval (Huber, 1991). Moreover, expert systems and case-based reasoning systems facilitate the capture and accumulation of valuable and firm-specific expertise and skills (Lado & Zhang, 1998) and extract valuable knowledge from existing databases (Chopoorian et al., 2001).

IS can also be used to enhance a firm's ability to obtain valuable information from external sources in a timely and efficient manner. With online access to various external databases, executive information systems (EIS) enable managers to search and retrieve a large amount of external information in a timely manner (Young & Watson, 1995). Web-based network systems (e.g., extranets) facilitate the collection of information about customers and market trends (Stroud 1998). There is growing empirical evidence that IS support for external information gathering has led to improvements in firm performance. Several field studies of inter-organizational systems have reported faster response to market changes and significant operational efficiencies accruing from IS-enhanced information exchange between firms (Scott, 2000). EIS research has also indicated that IS support for environmental scanning has led to improved

productivity, more successful new product introduction, and improved decision making (Ahituv et al., 1998).

Hypothesis 1: IS support for knowledge creation is positively related to firm performance.

II. 2 IS Support for Knowledge Sharing and Firm Performance

It is evident in the literature that IS can play an important role in the knowledge sharing process. Early studies of the electronic communication systems found that the systems greatly increased the speed and spread of information delivery and supported synchronous communication (Adam et al., 1993). More recent communication systems (e.g., Lotus Notes) and systems with sophisticated search technologies (e.g., semantic network and adaptive pattern recognition processing) foster company-wide exchange of best practices and facilitate the process of matching solutions to problems (Goodman & Darr, 1998). Moreover, video conferencing allows for the transmission of information and knowledge in rich media (Fulk & DeSanctis, 1995). Web-based intranets reduce costs and time in preparing and transferring information in ultra-rich content and promote information sharing across global boundaries (Boudreau et al., 1998). Intranets also facilitate contacts between individuals that seek information and knowledge and those who possess them by supporting electronic bulletin boards, discussion groups and corporate directories (Andreu & Ciborra, 1997). Aside from facilitating internal knowledge sharing, IS allow the firm to share critical information and knowledge with its business partners for economic gains (Scott, 2000).

There is growing evidence that firms may enjoy performance improvements from IS support for information and knowledge transfer. Goodman and Darr (1998) have found that computer-aided systems helped firms increase sales, market share, customer satisfaction and organizational productivity by facilitating the sharing of useful information and expertise in a timely and cost-effective manner. Case studies of IS support for cross-functional sharing and integration of information in both manufacturing and service firms have also documented such operational benefits as improved productivity, reduced lead times and increased flexibility (Goldhar & Lei, 1995). Moreover, research on the organizational benefits of intranets has reported lower communication costs and higher labor productivity associated with the use of intranets (O'Dell & Grayson, 1998). In a recent study, Andersen and Segars (2001) have found a positive impact of IS enhancement of internal communications on the financial performance among large companies.

Hypothesis 2: IS support for knowledge sharing is positively related to firm performance.

II. 3 Moderating Effects of Unique, Complementary Organizational Resources

It is evident from several streams of research that a firm's

organizational culture and structure are instrumental in influencing its ability to derive competitive benefits from IS-enhanced knowledge creation and sharing. Recent research on organizational barriers to knowledge management suggests that firms may not be able to turn data and information into useful knowledge and organizational results from their IS without a supportive organizational culture and structure (Davenport et al., 2001). Even if new knowledge is created from employing IS, sharing the new knowledge may be limited by cultural and structural constrictions (Ciborra & Patriota, 1998). The absence of organizational culture and structure that support the smooth implementation and use of IS has been documented as a major cause of many system failures in the IS implementation and adoption literature (Constant et al., 1996). The business process reengineering research also shows that firms whose structures and processes are not aligned with their new IS have experienced difficulty in reaping the benefits of the IS (Keen, 1993). Aside from affecting the economic impacts of IS-based knowledge creation and sharing, firm-specific organizational culture and structure make it difficult for competitors to imitate the IS they complement because organizational culture and structure tend to be intangible and costly to imitate (Barney, 1986).

A firm's unique competitive scopes (geographic, segment, vertical, and industry) can also affect its ability to effectively use IS for knowledge creation and sharing. For instance, firms with a broad geographical presence and product breadth are in a better position to generate and exchange more expertise among more locations and product lines than those with narrow geographical and product coverage (Feeny & Ives, 1990). Firms can also combine the scale advantage from their unique vertical integration and related diversification with IS to develop and transfer critical skills and expertise from multiple markets for competitive advantage (Clemons & Row, 1991).

Hypothesis 3: The interaction between IS support for knowledge creation and unique, complementary organizational resources is positively related to firm performance.

Hypothesis 4: The interaction between IS support for knowledge sharing and unique, complementary organizational resources is positively related to firm performance.

III. Methods

III. 1 Sample and Data Collection

The data tapping the independent and moderating variables were gathered via a mail survey. The data about the performance and control variables were obtained from the Research Insight database. The target respondents of the survey were senior IS executives in large firms in the U.S. Before mailing the survey instrument to the target respondents, the instrument was pre-tested and refined for content validity and item clarity with CIO from five large companies headquartered in a mid-western state. Of the 778 firms that received the questionnaires, a total of 153 usable

responses were returned (20% response rate).

III. 2 Measures

Based on the above literature review, six items were developed to measure IS support for knowledge creation and five items to measure IS support for knowledge sharing. For each item, the respondents were asked to indicate the extent to which their IS had provided a particular type of support during the previous three years on a five-point, Likert-type scale with anchors ranging from "Very great extent" (=5) to "No extent" (=1). A joint factor analysis of the eleven items revealed two factors explaining about 50% of the total variance and corresponding with IS support for knowledge creation ($\alpha = .80$) and IS support for knowledge sharing ($\alpha = .72$), respectively.

Unique, complementary organizational resources were defined as a set of firm-specific organizational resources that complemented IS support for knowledge creation and IS support for knowledge sharing. In keeping with Feeny and Ives (1990) and Clemons and Row (1991), this measure included unique organizational culture, unique organizational structure, and unique competitive scopes (geographical area, breadth of products, vertical integration, and range of related industries). The respondents were asked to indicate the extent to which the use and implementation of their IS required each of these six resources on a five-point, Likert-type scale with anchors ranging from "Very great extent" (=5) to "No extent" (=1). A factor analysis of the six items revealed a single factor explaining about 50% of the total variance, confirming the unidimensionality of the scale ($\alpha = .80$).

Both profitability and labor productivity were used to assess the performance impacts of IS support for knowledge creation and IS support of knowledge sharing. A popular profitability ratio, return on sales, was chosen to measure profitability. Labor productivity was measured as sales to employees. To smooth annual fluctuations and average out short-term effects, a three-year average was used for both dependent variables. Moreover, six control variables were used to control for industry conditions, firm size, technological resources and organizational slack.

III. 3 Analyses and Results

To test the hypothesized main effects and moderating effects, two sets of hierarchical regression analyses were performed, using ROS and sales to employees as the dependent variables. The results indicate that IS support for knowledge creation and IS support for knowledge sharing were both associated with sales to employees at the .05 significance level. Both variables also interacted with unique, complementary organizational resources in predicting ROS at the .05 significance level.

IV. Conclusion

Contrary to the growing skepticism towards the performance impacts of IS support for knowledge management (Husted &

Michailova, 2002), the findings from this research suggest that IS may represent more than a strategic necessity for knowledge management and that IS support for two critical knowledge management activities can actually lead to superior economic performance. Hence, firms should continue to invest in and deploy IS resources to facilitate the development and sharing of valuable and firm-specific knowledge.

While generally confirming the competitive value of IS support for knowledge management, the moderation results herein reveal that the profitability impacts of the IS support depend on the presence of certain firm-specific, complementary organizational resources. Absence such resources, both types of IS support only influenced labor productivity. Accordingly, it is not sufficient for firms to simply invest in IS to facilitate knowledge creation and knowledge sharing if they expect profitability gains from such IS investments. Firms also need to invest in the development and leveraging of other firm-specific resources that not only facilitate the implementation and exploitation of IS for knowledge creation and knowledge sharing, but also make such IS less susceptible to imitation.

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