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AN INTEGRATIVE FRAMEWORK FOR KNOWLEDGE MANAGEMENT EFFECTIVENESS

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Abstract

This study identifies the main elements of knowledge management structures and examines their effects on knowledge management adequacy and subsequently on knowledge management effectiveness. A path model representing the antecedents of knowledge management structure adequacy and the consequence on knowledge management effectiveness is developed and tested empirically. The results indicate that knowledge management strategy, technology fit, leadership, and culture all significantly affect the adequacy of knowledge management structures and, subsequently, knowledge management effectiveness. Strategy had the strongest effect followed by technology fit and leadership. Surprisingly, culture had the weakest effect.

Keywords: Knowledge management effectiveness, knowledge management process.

INTRODUCTION

In this new era of rapidly changing business environment, intellectual capital has become a critical organizational asset. By managing its knowledge assets effectively, an organization increases its flexibility and adaptability to the environment and enhances its long-term competitiveness and survival. These anticipated benefits explain the increasing awareness of practitioners and researchers alike of the importance of knowledge management (KM). KM can be defined as a systematic process for identifying, acquiring, organizing, storing, distributing, applying, and measuring both explicit and tacit organizational knowledge so as to achieve the organizational goals (Alavi and Leidner 1999).

The KM topic is generating a growing interest in multiple disciplines, e.g., management, computer science, and information systems. There is an increasingly abundant literature on various aspects, from different perspectives, of knowledge management. Some studies examined managerial and social issues while others focused on technological issues. For example, some studies (e.g., Alavi and Leidner 1999; Pentland 1995; Zack 1999) stressed the importance of the strategy driving KM and the organizational culture within which KM takes place. Other studies focused directly on specific processes and activities within KM, e.g., knowledge acquisition, generation, storage, distribution, application and measurement (e.g., Alavi 1997; Holsapple and Joshi 1999). There are, of course, those studies that investigated the role of information technology (IT) in KM in general (e.g., Alavi and Leidner 1999; Newell and Scarbrough 1999) or for specific KM activities in particular (e.g., Fischer et al. 1999; Khalifa 1998; Petraglia and Glass 1999). Previous studies identified several factors that can significantly affect KM effectiveness. However, these factors were studied in isolation and we still lack a good understanding of their relative importance.

Organizations that initiated knowledge management programs are still struggling with the development of appropriate metrics to assess the effectiveness of their initiatives. But does KM always make financial sense or should it be instead viewed as a long-term strategic asset analogous to investing in pure research that may some day lead to innovations and increased efficiency? In any case, linking KM initiatives to important aspects of organizational performance helps to justify KM investments to senior leaders.
management and more importantly improves the organization ability to manage knowledge effectively. However, linking KM initiatives to performance measures, both tangible and intangible, is not enough. Such linkages help to determine the outcome of KM initiatives, but without explaining it. To explain the effects of KM on organizational performance, it is important to examine the contributions of specific characteristics of the KM structures.

Although most researchers agree on the importance of the existence of adequate KM structures and the proper usage of these structures for KM to be effective, it is still not clear what is meant by adequate KM structures. What are the important determinants of adequate KM structures? Are they equally important or are some determinants more important than others? We need clarification on the answers to these questions. Before being able to predict and explain KM effectiveness, it is important to define the characteristics of adequate KM structures.

The main objective of this research is, therefore, to identify the determinants of KM structure adequacy and study their relative importance. More specifically, we develop and empirically test a path model identifying the antecedents of KM structure adequacy and its consequence on KM effectiveness. This model can serve as an initial framework for researchers to perform further studies on KM effectiveness. The results of this study will also be useful for practitioners in identifying the requirements for effective KM and in evaluating their current KM environments.

The layout of the paper is as follows. In the following section, we describe the research model and explain its theoretical foundation. We then present the research methodology and describe the empirical study. That is followed by a discussion of the results and their implications. In conclusion, we summarize the contributions of this research and suggest future research directions.

**RESEARCH MODEL**

To explain the effects of KM initiatives on organizational performance, it is important to draw on appropriate theories enabling the analysis of the impact of KM on organizational performance through a social-technical perspective, since KM critically entails both technology and management perspectives. One such theory, which has been receiving a great deal of attention in the IS literature, is *adaptive structuration theory* (AST) (DeSanctis and Poole 1994). AST posits that social outcomes (e.g., decision effectiveness, organizational performance) do not result directly from the effects of input variables such as technology and tasks. Rather, social outcomes reflect the manner in which an organization appropriates the structures of the input variables within a specific context. According to AST, *appropriation* is the manner through which technology and other social structures are adapted by an organization for its own use through a process called *structuration* (Gopal et al. 1993). Structures in AST include, among other things, rules, resources, tasks, technology, organizational culture, group norms, and the knowledge held by the participants in a social system. In the context of KM, appropriation accounts for the differences in outcomes when different organizations use the same KM structures.

In our research model (Figure 1), the existence of adequate KM structures in an organization does not necessarily lead to KM effectiveness (as measured by organizational performance impacts), unless these structures are used properly. In other words, adequate KM structures are ones that will lead to effective KM if the structures are used properly. The appropriation of KM structures by the members of an organization will determine the final outcome in terms of organizational performance impacts. Hence, the relationship between KM structure adequacy and KM effectiveness (organizational performance impacts) is moderated by appropriation (the way KM structures are used by organizational members). The role of appropriation can be viewed as a mediating role in a process sense (transforming the input variables into social outcomes) or as moderating role in a causal sense (strengthening/weakening the effect of the structures on the outcomes). Since our model is a causal one, we represent the effect of appropriation as a moderating effect.

Several studies examined appropriation and its components, such as faithfulness of appropriation (gap between spirit of structures and usage of structures) and consensus and attitude toward appropriation (e.g., Chin et al. 1997; DeSanctis and Poole 1994). In this research, we focus on the antecedents and consequence of KM structure adequacy rather than the moderating role of appropriation. Our main objective is to identify the elements of KM structures that are likely to affect KM effectiveness, as measured by the impact on organizational performance, and to determine the relative importance of these characteristics. These elements of KM structures are hypothesized as the determinants of the appropriateness of these structures. Assuming reasonable appropriation, adequate KM structures will lead to effective KM.

\[ H_1: \] KM structure adequacy has a positive significant effect on KM effectiveness.
Excluding appropriation from the scope of this study is a limitation. The seriousness of this limitation, however, depends on whether $H_1$ is verified or not. If we cannot establish a significant relationship between adequacy and effectiveness, we would not be able to explain whether that is due to the moderating effects of appropriation or to some other reason. If we find a significant relationship, on the other hand, then we can conclude that our assumption of reasonable appropriation is verified, as KM structures, even when adequate, cannot be effective unless appropriated.

To identify the determinants of KM structure adequacy, we had to identify the components of the KM structures. The quality of these components determines the adequacy of the structures. To identify the components of KM structures, we conducted a comprehensive review of the KM literature and elicited the beliefs of KM practitioners. Belief elicitation was done through electronic focus group meetings. For this purpose, 200 KM practitioners were randomly selected from a list of participants in a KM discussion group and were then invited to join an asynchronous online discussion for the elicitation of the characteristics of adequate KM structures. The focus group discussion resulted in 92 contributions. Most of these contributions were consistent with the literature. Based on the literature review and the belief elicitation process, four categories of KM structure characteristics were identified: strategy, technology-fit, leadership, and culture.

**KM Strategy**

Zack (1999) describes strategy as “the balancing act between the internal capabilities of the firm (strengths and weaknesses) and the external environment (opportunities and threats).” KM strategy is an important dimension in KM structures not only because it helps to identify KM initiatives, but also because it guides the organization in making the best KM investment. When formulating a KM strategy, the identification of what knowledge should be managed is of paramount importance, as it helps the organization to prioritize its KM efforts (Alavi 1997; Gopal and Gagnon 1995). Identification of valuable, unique, and inimitable knowledge includes recognizing what existing knowledge categories in the organization need to be tapped; what experience is useful to be ratified as knowledge; what important knowledge areas do not exist in the organization (knowledge gaps); what sources of knowledge are to be considered; and the relative importance of the desired knowledge. KM strategy reflects the management’s choices about key concepts of their knowledge environment. The adequacy of the KM structures depends greatly on the KM strategy employed. In particular, a company strategy for KM should reflect its competitive strategy in order for KM to be effective (Davenport 1999; Hansen et al. 1999).

$H_2$: KM strategy affects significantly the KM structure adequacy.
Technology Fit

Davenport and Prusak (1998) argue that suitable tools and technologies can serve as an instrument to catalyze the movement of KM. They suggest that proper technology can enable the extraction and structuring of individual or group knowledge to make such knowledge available to organizational members and that it can extend the reach and enhance the speed of knowledge transfer. Their view is further supported by the results of the study conducted by Alavi and Leidner (1999) with 50 organizations in 12 different countries. The subjects of this study reported that KM can be facilitated by various systems such as warehousing, enterprise-wide systems, executive information systems, expert systems, intranets and the Internet as well as various tools comprising search engines, browsers, filters, software, multi-media, and decision making.

Although several technologies that can be used to support KM activities, their mere usage is not sufficient to enhance KM effectiveness unless these technologies are employed effectively. Usage by itself, especially when utilization is not voluntary or when the technology is not designed specifically for the job, does not necessarily lead to better performance. Rather, it is the task-technology fit that will significantly impact performance (Goodhue and Thompson 1995). Therefore, technology fit, which is defined as “the degree of fit between the functionality of the employed tools and technologies and the requirement of the particular KM activity being supported,” is hypothesized as another important determinant of the adequacy of KM structures.

H3: Technology fit affects significantly the KM structure adequacy.

Culture

The existence of a supportive culture in the organization is also deemed vital to the adequacy of the KM structures (Pentland 1995). A supportive culture is characterized by organizational members’ recognition of the value and importance of KM to organizational performance (Alavi 1997; Gopal and Gagnon 1995) and more importantly their willingness to engage in KM related activities and to use corresponding technologies. Traditionally, organizations rewarded employees based on their individual performance and know-how. When putting KM into action, a deep cultural renovation is required because collaboration and sharing of knowledge and insight are necessary for effective KM (Alavi 1997). Hence, the ability of an organization to publicize the KM concept and its advantages to the individual and organization is a critical yet challenging element of the KM structures.

H4: Culture affects significantly the KM structure adequacy.

Leadership

Leadership refers to a person (or a group of people) who takes ownership of KM initiatives in the organization. Leaders or champions are responsible for setting the KM vision and subsequently establishing strategic priorities, altering skills of management, facilitating suitable culture and gaining commitment from senior executives so as to move the company in the direction of that vision (Davenport and Prusak 1998; Earl and Scott 1999; Manasco 1998). Obviously, without proper leadership setting the pace, the KM endeavor may be in vain. Leadership is an important characteristic of the KM structures and, therefore, affects their adequacy.

H5: Leadership has a significant effect on KM structure adequacy.

RESEARCH METHODOLOGY

The research methodology consisted of three stages: (1) model development based on literature review and belief elicitation (described in the previous section), (2) instrument development and pre-testing, and (3) model validation through an on-line survey.

To create and validate the measurement items for the constructs of the research model, we used Moore and Benbasat’s (1991) procedure. We ended up with a total of 19 items for the six constructs. To pretest the resulting instrument, we administered it to 40 KM practitioners randomly selected from a KM discussion forum. After an examination of the Cronbach’s alphas and correlation matrices, we realized that no changes to the instrument were required.
Model Validation

The instrument resulting from the previous stage was then used to conduct an online survey administered to KM practitioners who are currently playing active roles in KM programs in their respective organizations. For this purpose, we selected randomly 1,000 KM practitioners from various KM discussion forums. To verify that the respondents were experts in the field and currently involved in KM programs, we asked them to specify their level of experience and to describe their KM role in the organization. The response rate was slightly above 19% with 191 respondents, of which 185 satisfied the sampling criteria and were included in the final analysis. The demographic profile of the respondents is described in Table 1.

Table 1. Demographic Profile

<table>
<thead>
<tr>
<th>Business Nature</th>
<th>Consulting</th>
<th>34%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Education</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>Manufacturing</td>
<td>17%</td>
</tr>
<tr>
<td></td>
<td>Service Industry</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Information Technology</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>Not specified</td>
<td>8%</td>
</tr>
<tr>
<td>Number of Employees</td>
<td>0 – 100</td>
<td>31%</td>
</tr>
<tr>
<td></td>
<td>101 – 500</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td>501 – 1000</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>1001 – 2000</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Above 2000</td>
<td>38%</td>
</tr>
<tr>
<td>Nature of Involvement of Respondent in KM Activities</td>
<td>Regular Participant</td>
<td>44%</td>
</tr>
<tr>
<td></td>
<td>Member of KM Team</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td>Managerial / Leadership Activities</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>14%</td>
</tr>
<tr>
<td>Having CKO or Equivalent Position</td>
<td>Yes</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>75%</td>
</tr>
</tbody>
</table>

We used PLS-Graph (Chin 1994) to perform the analysis. Tests of significance for all paths were conducted using the bootstrap resampling procedure (Cotterman and Senn 1992). In evaluating the measurement models, we considered path loadings to be acceptable at 0.7 or higher. In assessing the internal consistency, we used the composite reliability measure developed by Werts et al. (1974), instead of using Cronbach’s alpha, which represents a lower bound estimate due to its assumption of equal weightings of items (Chin 1998). We also used the average variance extracted, considered by Fornell and Larcker (1981) to be a more conservative measure than the composite reliability. In assessing discriminant validity, we compared the square root of the average variance extracted for each construct to the correlations between it and the other constructs. We also examined the cross-loadings and none of the items loaded higher on constructs other than the intended one.

Results and Discussion

Figure 2 provides the results of the PLS analysis. The test of each hypothesis can be mapped to each specific path in the figure. The estimated path coefficients are given along with the associated t-statistics. All significant paths are indicated with one asterisk (*) for the 0.05 significance level and two asterisks (**) for the 0.01 significance level. The R² statistic is indicated next to each dependent construct. For all constructs, most of the items had reasonably high loadings (i.e., above 0.70) with the majority above 0.80, therefore demonstrating convergent validity. Only one item had a loading below 0.70, but it was complemented by other more reliable measures. Furthermore, all items were found to be significant (all at the 0.01 level). Table 2 presents the loadings, standard errors and t-statistics of the items to their respective constructs. The composite reliability measures (see ρ in Table 2) and the average variance extracted (see Table 3) provided additional support for reliability and convergent validity. The discriminant validity of the measurement model was also verified, with the square root of the variance extracted for each construct higher than the correlations between it and the other constructs (Table 3).
All hypotheses were verified, providing the necessary support for the structural model. KM structure adequacy explained over 69% of the variance in KM effectiveness with a substantial path coefficient of 0.8 that is significant at the 0.01 level. The cross factor loadings as well as the average variance extracted indicate that adequacy and effectiveness were perceived as distinct constructs. Therefore, the sizeable path coefficient and reasonably high $R^2$ represent a strong indication that the adequacy of KM structures in the organization is a good predictor of the effectiveness of KM in supporting the organization in reaching its business goals, assuming the required appropriation of these structures by the organizational members. These results also provide the necessary motivation for the proposed framework for characterizing KM structures. The four elements of KM structures, i.e., strategy, technology fit, culture, and leadership, all had significant effects on the adequacy of the structures. They also explained 80% of the variance in KM structure adequacy. These results indicate that the belief elicitation process succeeded in the identification of a substantial part of the elements of KM structures.

KM strategy had the strongest effect on KM structure adequacy with a path coefficient of 0.57 that is significant at the 0.01 level. The respondents perceived strategy as the most important element of the KM structures, with the adequacy of these structures depending greatly on the adequacy of the KM strategy. This calls for further research on the development and evaluation of KM strategies. Wiig (1997) identified five distinctive KM strategies that enterprises pursue in practice: knowledge creation strategy, knowledge transfer strategy, personal asset responsibility strategy, intellectual asset management strategy, and knowledge strategy.
as business strategy. The knowledge creation strategy emphasizes organizational learning, research and development, and motivation of employees to innovate. In the knowledge transfer strategy, the focus is on systematic approaches for organizing, warehousing, and distributing knowledge to the points of action where it will be used. The personal asset responsibility strategy, on the other hand, emphasizes personal responsibility for knowledge-related investments and innovations as well as renewal, effective use, and availability to others of the knowledge assets within each employee’s area of accountability. In contrast, the intellectual asset management strategy focuses on enterprise-level management of specific intellectual assets such as patents, technologies, operational and management practices, customer relations, and other structural knowledge assets. Finally, the knowledge strategy as business strategy approach emphasizes knowledge creation, capture, organization, renewal, sharing, and use in all of the enterprise’s plans and operations. These strategies are not mutually exclusive, but usually one of them better describes the focus of the organization. The choice of one or a combination of these strategies should reflect the strength of the organization, the nature of its business, and the inclinations and expertise of its personnel.
Technology fit was found to be the second important determinant of KM structure adequacy with a path coefficient of 0.182 that is also significant at the 0.01 level. Several tools and technologies for supporting various KM activities have become available in the last few years. The challenge is in selecting the appropriate ones and in integrating them. Ruggles (1997) proposed a nice framework for the classification of these tools and technologies, consisting of three general categories: generation, codification, and transfer. Knowledge generation requires tools that enable the acquisition, synthesis, and creation of knowledge. Examples of products include GrapeVine, Inspiration, Idea Generator, Mind Manager, and Data Mining Suite. Knowledge codification tools support the representation of knowledge so that it can be accessed and transferred. The capabilities of these tools vary depending on the targeted knowledge, i.e., process knowledge, factual knowledge, catalogue knowledge, and cultural knowledge, and on whether the knowledge is explicit or tacit. Such tools include knowledge bases, knowledge maps, organizational thesaurus/dictionary, and simulators. Examples of products are KnowledgeX, RetrievalWare, TeleSim, and Knowledge Access. Knowledge transfer tools alleviate the temporal, physical, and social distances in knowledge sharing. Examples of such products include Lotus Notes, NetMeeting, Encompass, and Knowledge Manager. An alternative framework for classifying KM tools and technologies was developed by IBM. It consists of five categories: business intelligence, collaboration, transfer, expertise, and discovery/mapping. Such frameworks can help organizations select the appropriate technology for a given KM task.

Leadership was also found to have a significant effect on KM structure adequacy, which is of equal importance to the effect of technology fit, with a path coefficient of 0.185. Although leadership can take several forms, it is often embodied in the chief knowledge officer (CKO) or an equivalent position. The CKO role differs significantly from that of the chief information officer (CIO). While the CIO is usually in charge of the IT infrastructure, databases, networks, and software, the CKO is generally more concerned with knowledge content and motivational activities. As the benefits of KM are sometimes difficult to translate into financial metrics, the CKO can play a very important role in convincing senior management to allocate the required resources for various KM initiatives. More importantly, the CKO can also play an important role in ensuring that employees understand and support the KM objectives.

Although significant (path coefficient of 0.11 that is significant at 0.05 level), the effect of culture was found to be the least important, which is somewhat surprising given how much this factor was emphasized in the literature. One possible explanation for these results is that out of the four elements of KM structures, culture is perhaps perceived by the respondents as the least controllable. In building the KM social and technological structures, creating the required leadership positions, implementing suitable strategies, and acquiring the fitting technology are relatively easier than changing the organizational culture. Employees are not always willing to give up the knowledge they have if they view it as an asset that makes them strategic and not easily replaceable in the organization. While people may talk up team spirit, they also know that knowledge is power and few are willing to give that up. It is rather a challenging task to make sharing knowledge profitable, not just for the organization but for the employees as well. Collaboration and sharing are types of behavior that cannot be easily rewarded. According to Ernst and Young, 56% of executives identify hanging people behavior as the most important obstacle to KM initiatives (Glasser 1999). Another possible explanation of the relatively weaker effect of culture is that this construct plays a more important role in the appropriation of the KM structures than in characterizing them. A supportive culture should lead to a more faithful use of the KM structures and more favorable attitudes toward their use, moderating in this way the effect of these structures on KM effectiveness. In future research, it would be valuable to compare the relative importance of the effects of culture on structure adequacy on one hand and appropriation on the other.

CONCLUSION

We investigated the determinants of KM structures and the effect of these structures on KM effectiveness. We found a strong relationship between KM structure adequacy and KM effectiveness, emphasizing the important role of technological and social structures in KM. The elicitation of KM practitioners beliefs yielded four elements of KM structures: strategy, technology fit, leadership, and culture. All were found to significantly affect KM structure adequacy. More importantly, they explained 80% of the variance in adequacy. Strategy emerged as the main driver. This perceived important role of strategy calls for further research on what constitutes an appropriate KM strategy, as few frameworks for describing KM strategies are available. Furthermore, these frameworks have not been validated empirically. Following in importance were technology fit and leadership. Culture, however, was found to be the least important. We gave two possible reasons for the weaker effect of culture. The first reason was that culture may not be perceived as controllable as the other factors, and hence plays a lesser role. The second reason was that the effect of culture may be more in terms of appropriation than the characterization of the KM structures. In future research, we will investigate the potential dual role of culture: affecting the adequacy of the KM structures and influencing the appropriation of these structures. In future research, we will also address some of the limitations of this study, namely the...
exclusion of appropriation and relying on perceptions for measuring KM effectiveness rather than more objective measures of effectiveness (e.g., balanced scorecard). Nonetheless, the results of this study represent a good step toward the development of an integrative framework of the various KM effectiveness factors that so far were addressed separately in the literature.

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