Association for Information Systems
AIS Electronic Library (AISeL)

AMCIS 2007 Proceedings

Americas Conference on Information Systems (AMCIS)

December 2007

Do Task Complexity and Knowledge Recency Affect Knowledge Reuse? Implications for Knowledge Management Efforts

Suryanarayanan Ravindran
Arizona State University

Govind Iyer
Arizona State University

DO TASK COMPLEXITY AND KNOWLEDGE RECENCY AFFECT KNOWLEDGE REUSE? IMPLICATIONS FOR KNOWLEDGE MANAGEMENT EFFORTS

Govind Iyer **Sury Ravindran**
govind.iyer@asu.edu sury.ravindran@asu.edu
Department of IS, W. P. Carey School of Business
Arizona State University

ABSTRACT

This study examines the impact of task complexity and document recency along with the effect of incentives on knowledge contribution and reuse by knowledge workers in an organization through a Knowledge Management System (KMS). Task complexity has been shown to be an important factor in the use of decision support systems (Wober and Gretzel 2000). When task complexity is high, individuals are more likely to try and solve a given problem using a decision support system. A recent survey showed task complexity to be an important factor in the adoption and diffusion of knowledge management systems (Xu and Quaddus 2005). It is possible that when individuals face a task which is very complex, they are more likely to perceive that a knowledge management system will help them to achieve this task. Another study explored the effects of validity ratings on the use of knowledge objects in a repository (Poston and Speier, 2005). This study showed that individuals are likely to avoid knowledge objects with low validity ratings. Documents which have been published more recently are likely to be more credible in the eyes of individuals who wish to use knowledge contained in those documents for some task. In that regard, the date that a document was published or last updated may be an indicator of the recency of that document and and thus it's validity. The more recent a document, the more likely it is that it will be perceived by a potential user to be a relevant document for accomplishing a specific task. Thus, knowledge reuse will be favorably impacted when the recency factor is high. To contribute knowledge to a KMS, people must invest time to capture or document their knowledge as well as categorize and store it. People may also feel that they are losing a degree of power as a result of their contribution which could weaken their position within the organization. To offset these costs, organizations often implement incentive schemes to encourage individuals to use the system (Markus 2001). However, it is not always clear whether these incentives achieve their desired outcome. There are contextual factors which may affect whether or not incentives for knowledge management will be successful. We explore contextual factors which may affect the success of incentives for knowledge sharing and subsequent knowledge reuse. Specifically, we explore the effects of incentives to contribute knowledge using task complexity and knowledge object recency as contextual factors impacting knowledge reuse. This being a work in progress, we report partial results of an experimental study that we conducted to validate our model.

Introduction

Organizations are increasingly coming to believe that one of their most valuable assets is employees' knowledge. Organizations which have been able to encourage knowledge sharing among employees have also been able to improve organizational performance (Argote and Ingram 2000, Epple *et al*. 1996, Galbraith 1990). In order to facilitate the sharing (as a precursor to its reuse) of knowledge within an organization, many organizations have implemented knowledge management systems (KMS). KMS allow individuals within an organization to contribute and/or locate explicit knowledge in a repository, or to list sources of expertise in a repository and locate individuals or experts who can provide tacit knowledge. Once successfully transferred from source to recipient (or repository), knowledge must be used or applied in order for it to serve some benefit for the organization. This final step is a crucial piece which has been overlooked by researchers and perhaps by many organizations which have implemented knowledge management initiatives. As far back as 1999, Tata Consultancy Services (a prominent management and IT consulting firm based in Mumbai, India) had realized the importance of knowledge reuse (Alluri 1999). In their words:

"…many companies, when building knowledge into their work, focus on gathering the knowledge base of the organisation and rewarding those who contribute to it. ……. while collecting knowledge is an important first step, it is the actual use of the knowledge where value is generated."

The participants in a knowledge management system may be categorized into knowledge suppliers and knowledge customers. The knowledge supplier is involved in the creation and contribution of knowledge objects. The knowledge object is put to use by the knowledge customer. Hereafter, we use the term knowledge use and knowledge reuse synonymously. An individual may be a knowledge supplier as well as a knowledge customer. It is true that hurdles exist on both the supplier side (Bock, Zmud, Kim & Lee 2005; Kankanhalli *et al.* 2005a; Wasko & Faraj 2005 and on the customer side (Garud & Kumaraswamy 2005, Husted & Michailova 2002). With respect to knowledge reuse, Markus (2001) suggests that different types of knowledge reusers have different requirements for knowledge repositories. For instance, when faced with complex tasks, knowledge seekers turn to experts or sources of expertise for face to face transfer of knowledge rather than rely on documented knowledge objects from a repository (Bystrom 2002). Solutions for promoting both contribution and reuse include careful consideration of human and technical factors as well as incentives. The primary motivation for this study stems from the limited attention paid to the twin factors of "task complexity" and "current nature" (of knowledge objects found in a knowledge repository). In contrast, factors like usefulness, incentives, and trust have been extensively examined (both conceptually and empirically). Another reason is that while knowledge contribution is an important part of the knowledge sharing process, in order for knowledge sharing to increase organizational performance, the contributions must also be used by other individuals within the organization.

Prior Research

In participating in knowledge management efforts, individuals weigh the potential benefits against their potential costs. Costs related to knowledge contribution include time and effort involved in codifying knowledge (Goodman and Darr 1998; Kankanhalli *et al.* 2005a; Markus 2001), and perceived loss of power (Davenport and Prusak 1998). To offset these costs individuals are often given incentives for contribution (Ba *et al.* 2001; Wasko and Faraj 2000). Knowledge reuse is also influenced by similar costs and benefits. Individuals are unlikely to reuse knowledge if they perceive that the time and effort of searching for and retrieving valuable knowledge are very high (Davenport and Prusak 1998), or if they perceive that using a knowledge repository is difficult (Goodman and Darr 2001; Kankanhalli, Tan and Wei 2005b). Individuals may be reluctant to use knowledge if it comes from outside their immediate work group. This is commonly referred to as the *Not Invented Here* syndrome (Katz and Allen 1982). However, if it is likely that the search process will yield knowledge which is useful, and will help them improve quality and timeliness of their decisions, individuals may be motivated to reuse knowledge. The key issue for a firm is then to create conditions that will sustain the steps of knowledge creation/contribution as well as reuse. Markus (2001) notes that one driver could be the degree of the usefulness of the KM system. A knowledge repository which is perceived to contain up-to-date or current knowledge documents will naturally be perceived as useful. By similar reasoning, knowledge workers faced with complex tasks may be more motivated to turn to a knowledge repository because of the belief that anything they find therein will be helpful in reducing the time taken for task completion.

Research Model and Hypotheses

We test the effect of different types of task complexity and the degree of recency of knowledge objects (i.e., how up-to-date are they?) on the likelihood of success of KMS using an experimental design. The empirical research model is depicted in Figure 1. The theoretical justification for the model is drawn from the Theory of Planned Behavior – TPB (Ajzen 1985; Taylor and Todd 1995). TPB is helpful in explaining the use of information systems applications including those used in knowledge management initiatives, namely KMS. There are other factors either mentioned or used in prior research in KM systems, knowledge sharing or knowledge reuse. These are factors of reciprocity, trust, pro-sharing norms, ease of use, availability of resources including time, effort and opportunities to participate in KM efforts or to use the KMS. In the experimental design that we use, these factors can be controlled for and are hence excluded from our empirical model. However, incentives are commonly instituted in organizations to promote knowledge contribution (Markus 2001) and hence need to be included as a factor of interest as e have done in the empirical model.

It should be noted that the focus of the experiment is on *intent* to contribute and *intent* to reuse. We focus on the intent (rather than on actual behavior) because: (i) according to TPB (Ajzen 1985), the dominant theory in this area, intention to perform a particular behavior is the most immediate and important determinant of future behavior; and more importantly (ii) by measuring intent rather than observing behavior based on a specific task, we avoid other confounding effects such as task complexity, system characteristics, ease of use, program interface etc. as potential explanations for observed results. Accordingly, we are better able to explain our findings as a consequence of manipulated variables (thus mitigating omitted variables bias). However, we acknowledge and remind the readers of the standard caveats regarding the correlation between intent and actual behavior.

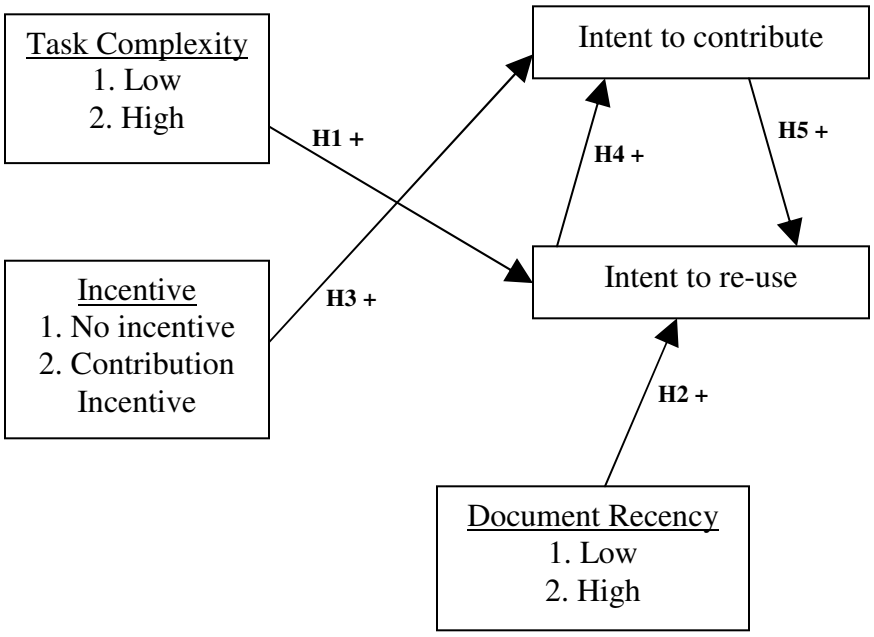

Figure 1: Empirical Model

Participants consisted of students enrolled in a large southwestern state university. A total of 300 students (junior and senior level undergraduates belonging to the accounting and information systems disciplines) were invited to take part in the experimental study. All the students had prior exposure with knowledge management initiatives either during their internship experience or their work experience. A manipulation check was conducted at the end of the experiment to confirm whether the manipulations of the exogenous variables had been effective. Based on this check, 61 responses were eliminated and the remaining 239 data points were used in the actual analysis.

All participants were presented with a scenario in which task complexity levels (high– **HC**,and low –**LC**) and document recency levels (low – **LR** and high – **HR**) were manipulated, along with two levels of incentive **NI** (no incentive) and **IC** (contribution incentive). In the different scenarios, each participant was placed in the role of a consultant for a nationally renowned consulting firm. The scenarios (condensed version provided in Appendix 1) provided an explanation of a knowledge management system and the reasons for which individuals use knowledge management systems. From that followed questions about whether the participants would use the system to solve problems they encountered as consultants. The participants were required to read the case carefully and then indicate on a seven point scale their intent to (i) contribute knowledge to the knowledge management system – **KC** and (ii) reuse knowledge from the knowledge management system – **KR**. These two variables (KC and KR) were the dependent variables.

As explained earlier, the recency and complexity related hypotheses result from a straightforward application of the theory of planned behavior (Ajzen 1985; Taylor and Todd 1995). Knowledge reusers may search through a knowledge repository (of a KMS) to locate reusable documents. If they perceive the likelihood of obtaining a relevant or reliable document as on the low side, they will clearly be less likely to expend the effort required to retrieve anything from the repository. Conversely, if the likelihood is seen as high, knowledge reusers will be better motivated to search the repository since this effort will be seen to more than offset the effort required to carry out their actual task. Thus, we expect to find strong main effects for our experimental variables. Note that these are stated hypotheses for knowledge reuse and not for knowledge contribution. Absent any incentive, we do not expect knowledge contribution to be affected by either task complexity or knowledge object recency which leads to our incentive related hypotheses. We have no prior expectations regarding the interaction effect between complexity and recency and will examine the empirical results to derive implications for practice.

H1: Higher task complexity leads to increased intent to re-use of knowledge from a Knowledge Management System's (KMS) knowledge repository
H2: Increased document recency leads to increased intended knowledge re-use from a KMS
H3: Incentives will result in increased intent to contribute knowledge to a repository

Impact of knowledge contribution on reuse

Anecdotal evidence from participation in discussion boards or in open source software development projects such as Linux suggests that active contributors are also active users. By analogy, contribution to knowledge bases may drive reuse of knowledge from these same knowledge management systems. Therefore we propose:

H4: Higher intent to contribute knowledge increases intent to reuse knowledge

Results and Discussion

Since we have two dependent variables (KC and KR), we analyze the data using multivariate analysis of variance (MANOVA). The MANOVA results are provided in Table 1. From Table 1 it is clear that the joint distribution of Knowledge Contribution intent (KC) and Knowledge Re-Use intent (KU) is affected by the factors of complexity (CL and CH), incentive (NI and IC) and recency (RL and RH). No dual interaction effects are present, while the three-way interaction is marginally significant. We had not expected any interaction effects and what we observe is entirely consistent with the presence of the individual effects of each factor in isolation. Table 2 shows the tests of means for the experimental design in our empirical study.

Table 1: MANOVA results

Null Hypothesis	Wilks Lambda	F-Value (p-value)
No overall complexity effect	0.9779	2.59 (0.0772)
No overall incentive effect	0.9513	5.88 (0.0032)
No overall recency effect	0.7594	36.44 (0.0001)
No overall complexity * incentive effect	0.9944	0.65 (0.5250)
No overall complexity * recency effect	0.9985	0.18 (0.8382)
No overall incentive * recency effect	0.9930	0.81 (0.4480)
No overall complexity * incentive * recency effect	0.9797	2.39 (0.0940)

Table 2: Test of Means

DV	Mean Values						Test of differences t-value (p-value)[@]		
	NI	IC	CL	CH	RL	RH	IC > NI	CH > CL	RH > RL
KC	4.81	5.43	5.06	5.18	5.27	4.97	3.14 (0.00) **H3*** **	0.60 (0.55)	1.49 (0.14)
KU	4.69	5.07	4.67	5.09	4.14	5.61	2.01 (0.05) **H4** **	2.28 (0.02) **H1** **	7.94 (0.00) **H2*** **

** 5 % significance *** 10% significance [@] two-tailed tests

As expected, incentives are required to motivate knowledge contributions. This is not the key finding of this study, it merely confirms anecdotal evidence that knowledge contributions take time and effort and individuals must be compensated for this time and effort. If participation in KM efforts (specifically sharing one's knowledge) is not recognized and rewarded in some way, it is likely to be treated as a non-essential activity and relegated to the category of tasks performed "if I have the time". Note also that complexity and recency positively impact knowledge reuse intent. All these are in line with our priors. However, the result that incentives (for contribution) positively impact reuse intent is not one of our hypotheses and we explain this result by observing that incentives impact contribution intent which in turn influences re-use intent. What this does is provide support for hypothesis H4.

Implications for Practice

Anecdotal and case oriented studies of KM practices in firms have looked at firms that practice the codification and personalization strategies and attempted to classify them into categories that fit one or the other strategy (Davenport et al. 1998, Hansen et al. 1999, Kankanhalli et al 2003). These studies provide several examples which suggest possible courses of action to firms thinking about KM.

These firms may be constraining themselves by the "one size fits all" mindset. We recommend that firms bifurcate their knowledge sharing and reuse requirements based on complexity of tasks performed by different teams. Bifurcating knowledge bases on task complexity has the advantage of keeping the repositories at an optimal size level. This benefits the users by reducing the time taken to search through a repository, making the classification scheme for knowledge objects and documents easier to manage, and reducing the effort needed to refresh repositories by removing out-of-date entries.

For instance, consulting and public accounting firms like KPMG, or Ernst and Young rely heavily on the codification strategy. They have internalized the practice of conducting debriefing sessions for teams at the conclusion of a consulting or other project in order to capture lessons learned. These knowledge objects are placed in a KMS (KPMG's KWorld or Ernst and Young's AskErnie) repository and available for use by other project teams which may be geographically dispersed.

Our study would have such firms identify knowledge objects and experts required for different task types in our continuum (relatively simple versus relatively complex) and create separate KM systems with separate repositories for each. Finally, we had hoped to discover an interaction effect between the factors of recency and incentive which could have led to interesting practical implications. Extending the concept of knowledge object usefulness to include multiple dimensions such as timeliness and relevance in addition to recency may lead to further insights.

Conclusion and Future Research

Knowledge management initiatives tend to increase the level of uncertainty and ambiguity in the organization. Therefore, knowledge sharing and reuse (intent or action) may depend on an individual's tolerance of ambiguity. We are extending this study further to include ambiguity tolerance and factors such as "knowledge quality" rating and readiness to participate in KM efforts as potential determinants of KM success. Future research in this area may attempt to look at actual behavior (of knowledge contribution and reuse) in a field experiment or other field setting instead of looking at intentions as in the current study.

REFERENCES

1. Alluri, R. R., "Operating Knowledge Base," Computers Today May 31, 1999, pp. 74.

2. Argote, L., and Ingram, P. "Knowledge Transfer: A Basis for Competitive Advantage in Firms," Organizational Behavior and Human Decision Processes (82:1) 2000, pp. 150-169.

3. Ajzen, I. From intentions to actions: A theory of planned behavior, In J. Kuhl & J. Beckman (Eds.), Action-control: From cognition to behavior, Heidelberg: Springer1985. pp. 11-39.

4. Ba, S., Stallaert, J., and Whinston, A. "Optimal Investment in Knowledge within a Firm Using a Market Mechanism," Management Science (47:9) 2001, pp. 1203-1219.

5. Bock, G., Zmud, R., Kim, Y., and Lee, J. "Behavioral Intention Formation in Knowledge Sharing: Examining the Roles of Extrinsic Motivators, Social-Psychological Forces, and Organizational Climate," MIS Quarterly, (29:1) 2005, pp. 87-112.

6. Bystrom, K. "Information and Information Sources in Tasks of Varying Complexity," Journal of the American Society for Information Science and Technology (53:7) 2002, pp. 581-591.

7. Davenport, T. and Prusak, L. Working Knowledge: How Organizations Manage What They Know, Boston, Massachusetts: Harvard Business School Press, 1998.

8. Davenport, T.H., De Long, D.W.; and Beers, M.C. "Successful knowledge management projects," Sloan Management Review (39:2) 1998, pp. 43–57.

9. Epple, D., Argote, L., and Murphy, K. "An Empirical Investigation of the Micro Structure of Knowledge Acquisition and Transfer through Learning by Doing," Operations Research (44) 1996, pp. 77-86.

10. Galbraith, C. "Transferring Core Manufacturing Technologies in High Technology Firms" California Management Review (32:4) 1990, pp. 56-70.

11. Garud, G. and Kumaraswamy, A. "Vicious and Virtuous Circles in the Management of Knowledge: The Case of Infosys Technologies," MIS Quarterly (29:1) 2005, pp. 9-34.

12. Goodman, P., and Darr, E. "Computer Aided Systems and Communities: Mechanisms for Organizational Learning in Distributed Environments," MIS Quarterly (22) 1998, pp.417-440.

13. Hansen, M. T., Nohria, N., and Tierney, T. "What's Your Strategy for Managing Knowledge?," Harvard Business Review (77:2) 1999 pp. 106-116.

14. Husted, K., and Michailova, S. "Knowledge Sharing in Russian Companies with Western Participation," Management International. (6:2) 2002, pp. 17-27.

15. Kankanhalli, A., Tanudidjaja, F., Sutanto, J., and Tan, B. C. Y. "The Role of IT in Successful Knowledge Management Initiatives," Communications of the ACM, (46:9) 2003 pp. 69-73.

16. Kankanhalli, A., Tan, B., and Kwok-Kee, W. "Contributing to Electronic Knowledge Repositories: An Empirical Investigation," MIS Quarterly (29:1) 2005a, pp. 113-143.

17. Kankanhalli, A., Tan, B., and Kwok-Kee, W. "Understanding Seeking from Electronic Knowledge Repositories: An Empirical Study," Journal of the American Society for Information Science and Technology (56:11) 2005b, pp. 1156-1166.

18. Katz, R., and Allen, J. "Investigating the Not Invented Here (NIH) syndrome: A look at the performance, tenure, and communication patterns of 50 R&D Project Groups," R&D Management (12), 1982, pp. 7-19.

19. Markus, L. 2001 "Toward a Theory of Knowledge Reuse: Types of Knowledge Reuse Situations and Factors in Reuse Success," Journal of Management Information Systems (18), pp. 57-93.

20. Poston, R., and Speier, C. "Effective Use of Knowledge Management Systems: A Process Model of Content Ratings and Credibility Indicators," MIS Quarterly (29:2) 2005, pp.221-244.

21. Taylor, S., and Todd, P. A. "Understanding Information technology Usage: A Test of Competing Models," Information Systems Research (6:2) 1995, pp. 144-176.

22. Wasko, M. and Faraj, S. "It is what one does: why people participate and help others in electronic communities of practice," Journal of Strategic Information Systems (9) 2000, pp.155-173.

23. Wasko, M., and Faraj, S. "Why Should I Share? Examining Social Capital and Knowledge Contribution in Electronic Networks of Practice," MIS Quarterly (29:1) 2005, pp. 5-35.

24. Wober, K., and Gretzel, U. Tourism Manager's Adoption of Marketing Decision Support Systems, Journal of Travel Research. (39:2) 2000, pp. 172-181.

25. Xu, J., and Quaddus, M. "Adoption and Diffusion of Knowledge Management Systems: An Australian Survey," The Journal of Management Development (24:4) 2005, pp. 335-361.

Appendix 1

Your current client, Mercador Inc. is a medium sized manufacturer of farm equipment and is currently experiencing loss of sales, profits, and market share. Mercador has approached RSC (your company) to identify the problems and provide actionable solutions to recapture lost market share and restore the company to profitability. As a consultant on the engagement, your current assignment is to analyze Mercador's business processes and compare them with the best practices in the industry. This is a fairly routine task that is performed at the beginning of almost every engagement. You may if you wish use the knowledge management system provided by your firm to search for and take the aid of any knowledge object therein if it is useful and helps you with your project. It is not mandatory that you use the knowledge management system. Additionally, you may (if you so desire) prepare a knowledge object at the end of the engagement to be included in the knowledge management system that will be made available to everyone. Your firm specializes in this kind of consulting project and many other teams have dealt with similar projects in the past (and some even currently). Although not mandatory, you know that almost all consultants routinely create knowledge objects at the end of their project. These are promptly added to a knowledge management system and made available to others. Your compensation is based on (i) fixed salary and (ii) incentive bonus. The incentive bonus is based upon finishing the engagement ahead of schedule – the faster the engagement is finished the greater the bonus amount. The time taken to search the knowledge management system is included in the total time taken to finish the engagement.

(The above is a condensed version of the experimental task instructions)