A Model for the Study of Knowledge Management Support Systems

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Abstract

"Knowledge markets" have been proposed as an organizational structure to promote knowledge exchange for increased organizational profitability and survivability. However, the economics and organizational behavior literatures in administered hierarchies suggest that knowledge markets and their component reward systems could suffer from a variety of abuses, inequities, and inefficiencies. These literatures, and the information systems investigations they have spawned, are parlayed into a model for knowledge management research.

Introduction

Facilitating effective and efficient knowledge sharing among organizational members is a primary objective of organizational knowledge management research and practice. To this end, Davenport and Prusak propose that knowledge—much like other products and services—can be traded in markets. They argue that organizational knowledge markets offer a fair and efficient coordination mechanism for knowledge exchange because price structures within those markets facilitate the evaluation of risks and rewards between knowledge "buyers" and "sellers." In turn, efficient and effective knowledge exchanges increase the potential for organizational profitability and long-term viability (Davenport and Prusak, 1998).

In contrast to Davenport and Prusak's market-centered approach, Nonaka (1994) argues that middle managers should administer and coordinate knowledge exchange. Their crucial position at "the intersection of the vertical and horizontal flows of information in the company" allows middle managers to combine "strategic, macro, universal information" from strategic organizational levels with the "hands-on, micro, specific information" from operational levels. Nonaka concludes that middle managers are "the true 'knowledge engineers' of the knowledge creating organization" (p. 32).

The two opposing views over an optimal knowledge exchange coordination structure are reminiscent of a similar competition between market-based and administered coordination structures during the late 19th and early 20th Centuries. At that time large vertically-integrated corporations such as Carnegie Steel, Standard Oil, and Sears and Roebuck displaced many wholesaler-retailer supply chains. Though the results of this "market failure" (Williamson, 1975) are widely accepted, the reasons behind that failure are not. On one side of the debate are those who argue that the change resulted from the greater efficiencies of administered hierarchies (Coase, 1937; Williamson, 1975; Williamson and Ouchi, 1981a,b). On the other side are those who argue that the change resulted from the use and abuse of economic and political power by large corporations (Perrow, 1981a,b).

The market failures debate is germane to IS-enabled knowledge management (KM) research for several reasons. First, the success of IS-enabled KM tools may be significantly linked to underlying characteristics of market-based and administered coordination structures. Second, the market failures debate has not only examined the nature of those characteristics, but has contributed to information systems research relevant to KM study and practice. Third, the debate links organizational structure and culture—two factors of interest in the KM literature (Wiig, 1995; Davenport and Prusak, 1998; Alavi and Leidner, 1999). Finally, the debate highlights the potential for knowledge exchange abuse.

The purpose of this paper is to explore the application of the market failures debate to the realm of knowledge management. The above reasons suggest this debate may provide critical theoretical grounding for future knowledge management research. To this end, these two opposing perspectives are coupled into a model that highlights important variables and relationships, thus providing a guide to future knowledge management support systems (KMSS) investigations. Our model is developed as follows. First, we lay a theoretical foundation for the framework by briefly summarizing the market failures debate, then drawing connections to current issues in knowledge management. Second, we incorporate those dimensions identified in the first part of the paper into a model for KMSS research.

Theoretical Foundation

The market failures debate is relevant to knowledge management research because the two sides have forwarded theories that have been used in the design of IS-enabled tools that can be adopted for knowledge management. On one side is Williamson's work on transaction costs. It was based on Coase's (1937) model of the firm, and later served as a foundation for Malone's (1987) model of coordination structures. Malone et al. (1987) used that model to argue that information systems could reduce transaction costs to the point that market
structures would be more efficient than administered structures. They extended that argument to predict that this change in cost structures would reverse the past trend of substituting markets for hierarchies. On the other side of the debate, Perrow extended his early work on task (Perrow, 1967) to the relationship between task and the distribution of organizational power. His line of research served as a foundation for Poole’s (1978) information-task model, which was used in turn by DeSanctis and Gallupe (1987) in their development of a framework for group decision support systems (GDSS).

The market failures debate concerns underlying theories about the transition from market to administered structures in the late 1800s and early 1900s. Those in the transaction cost perspective camp (e.g., Williamson, 1975) argue that the primary reason that large organizations arose was due to their ability to mitigate problems of uncertainty and bounded rationality inherent in large markets. These organizations pursued strategies of vertical integration, instituting multidivisional administrative hierarchies to manage the resulting complexity. Administered hierarchies permitted lower search and bargaining costs, thus enhancing efficiency and competitiveness in retail markets. Proponents of this position suggest that efficiency is a key factor, and that transaction frequency, uncertainty and costs are the variables of greatest concern.

In opposition to the transaction cost approach, those in the power perspective (e.g., Perrow, 1981a,b) argue that the change from markets to hierarchies was due primarily to the ability of large organizations to acquire and exert economic power. According to this viewpoint, those large firms used their tremendous economic power to "force communities and workers to bear costs and not have those costs reflected in the price of the goods and services" (Perrow, 1981a: 372). Proponents of this perspective argue that research and practice should concern the control of organizational power. Although legal and political remedies are often forwarded, the perspective also acknowledges the crucial role of organizational culture in shifting and maintaining organizational structures. Perrow (1981a: 386) advocates organizational structures based on "communal efforts with norms of other-regarding behavior" rather than markets "where there is more concern with opportunism" and hierarchies "which are predicated upon the fear of autonomy." Surprisingly, Williamson (in Williamson and Ouchi, 1981a) also mirrors some of these sentiments to some degree, acknowledging that "clan-type management styles" can leverage socialization processes to enhance efficiency.

The market failures debate provides useful theories on the influence of power and transaction cost on organizational structure. In the past, those theories have provide concepts and constructs useful to several streams of IS research. Those streams appear especially relevant to KMSS research and practice.

**IS Research and its Roots in the Market Failures Debate**

An examination of those research streams that were rooted in the market failures debate and have flowered in IS domain can provide a set of variables and relationships for KMSS research. Variables and relationships from those streams will now be identified and linked within a model for the study of KMSS.

**Task, Organizational Power, and IS Research**

Perrow (1967) noted that technology, which he defined as “the actions that an individual performs upon an object, with or without the aid of tools or mechanical devices, in order to make some changes in that object” (p. 195), must be carried out in the midst of human interactions. Whether those objects are raw materials, symbols, or even other individuals, the form those interactions take are the organization’s structures. When technology is placed in an organizational context, those actions will primarily consist of tasks of “work imposed by a person in authority or an employer or by circumstance” (Webster’s).

In refining his framework, Perrow argued that control and coordination form the two dimensions of task structure. Control can be further decomposed into task discretion and resource mobilization. Coordination can entail planning or negotiation. Of these two dimensions, Perrow (1979) argued that control is the more important dimension, especially concerning the use (and abuse) of organizational power.

Perrow’s framework provided a seminal foundation for later research. Van de Ven and Delbecq (1974) extended Perrow’s (1967) analysis to formulate a task-contingent model of work-unit structure based upon task difficulty and task variability. Task difficulty corresponds to “the degree of complexity of the search process in performing the task, the amount of thinking time required to solve work-related problems, and the body of knowledge that provides guidelines for performing the tasks.” Task variability corresponds to “the number of exceptional cases encountered in the work requiring different methods or procedures for doing the work” (p. 183).

Poole (1978) applied this general framework to the description of strategic choice in governing organizational communication for information acquisition. He considered two variables of communication structure: the structures of the communication network and the mechanisms of information evaluation and integration. He revived Perrow’s concerns about the use of organizational power by examining its dependence upon communication structure.

Poole began by extending Van de Ven and Delbecq's task-contingent model with Thompson’s (1967) concept of task interdependence. He then applied that extension to communication structure. This information task model
was constructed upon the mediating information task constructs of availability, uniformity, and independence. Availability refers to perceptions of suitability and obtainability of information. Uniformity refers to perceptions that information requirements are consistent in terms of amount, type, and report timing. Independence refers to the ability of a work unit to meet its knowledge requirements. Poole hypothesized that availability and uniformity affected both communication network structure and mode of information evaluation and integration, a hypothesis we will later exploit in concatenating the power and transaction cost perspectives. Organizational power, on the other hand, was hypothesized to be dependent only upon information independence.

The task-organizational structure model is applicable to IS-based KMSS research in at least two ways: First, it addresses the use and abuse of power, a concern that has continually surfaced in the knowledge management and organizational learning literature (Brown and Duguid, 1991; Davenport and Prusak, 1998). Second, this model conceptualizes how organizational culture could mitigate abuse of power in knowledge exchange, especially concerning the use of IS-based knowledge management support systems.

**Transaction Costs, Organizational Structure, and IS Research**

Coase (1937) investigated the increased use of hierarchical supervisor-subordinate relationships in turn-of-the-century organizations. He argued that entrepreneurs could avoid significant costs and risks associated with the extended use of markets by instituting long-term employee labor contracts. It is this "system of relationships which comes into existence when the direction of resources is dependent upon an entrepreneur" that for Coase constitutes the firm.

Williamson (1975) extended Coase’s argument by detailing the strengths and limitations of hierarchies and markets. He constructed an "organizational failures framework" from three sets of conditions. Economic conditions were described with Coase’s use of transaction costs, risk, and contractual relations. Human conditions were described via bounded rationality and opportunism—which Williamson defined as "self-interest seeking with guile" (p. 26). Environmental conditions were described by uncertainty and small-numbers exchange. These conditions determined the transaction cost of an organizational structure, and it was the responsibility of the entrepreneur to choose the most cost-efficient structure.

At this point the transaction cost perspective can be divided into technology and culture paths. The technology path diverges with Baligh’s (1986) reexamination of the markets versus hierarchies debate. Concluding that Williamson’s work is "clearly about hybrids of hierarchies and markets" in organizations (p. 1489), Baligh differentiates markets from organizations on the basis of decision rules and transactions. Individuals make decisions, and can delegate decision-making authority to their subordinates within organizational structures. Organizations can thus be defined as "a set of people logically ordered by decision rules" (p. 1483). Markets, on the other hand, are not decision-making units—they are arenas of exchange transactions.

Malone (1987) drew upon Baligh’s (1986) distinction in his investigation of the relationship between task, task processors, task processor managers, and organizational coordination structures. Given the scope of transaction costs, Malone (1987:1319) identified three costs associated with coordination structures: production costs, coordination costs, and vulnerability costs. Production costs include “the costs of production capacity and the costs of delays in processing tasks.” Coordination costs include “the costs of maintaining communication links (or ‘channels’) between actors and the costs of exchanging ‘messages’ along these links.” Vulnerability costs include “the unavoidable costs of a changed situation that are incurred before the organization can adapt to a new situation.” Malone showed that trade-offs between production cost and governance cost economies can be framed in the context of transaction costs. Conclusions from that line of research were further explored in Malone et al. (1987) work on information technology and coordination structure choice. It hypothesized that the increased use of information technology could reduce coordination costs associated with task coordination, thus leading to a greater use of market structures.

Malone et al.’s (1987) prediction for increased market structures can be seen as a theoretical support for knowledge exchange markets. However, orthogonal to that view is the cultural viewpoint that predicts a very different form of organizational structure. This second viewpoint originates in Williamson’s acknowledgement of the importance of task variation in determining risk-taking behaviors in groups engaged in unrelated, common, and integrated sets of tasks. Peer groups have an advantage over markets when those groups are engaged in a common task or an integrated set of tasks because group members are better able to discern "requisite attributes" for group admission and to monitor for inefficient or unwanted behaviors. In addition, Williamson acknowledged that members of peer groups involved in common or integrated tasks could accrue "associational benefits." These include benefits to those "who feel a sense of responsibility to do their fair share as members of a group" involving "a transformation of involvement relations, from a calculative to a more nearly quasimoral mode" (p. 44).

The similarities between Williamson’s "associational benefits" and elements of organizational culture are unmistakable. As with Perrow, culture has been acknowledged as an important factor in organizational structure. The importance of culture was noted by Ouchi’s
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The opposing theories of market-to-administration shifts are germane to knowledge management because they can help guide predictions on alternative knowledge management support systems. Relevant questions include the following: What is the significance of organizational power and transaction costs in knowledge markets? To what extent do variations in organizational power and transaction costs induce shifts from knowledge markets to administered allocations? What is the role of culture in the use of organizational power in knowledge management programs? Under what conditions will both knowledge markets and hierarchies fail, and be ultimately replaced by a "clan" structure based on cultural values? Under what conditions do markets, hierarchies, and clans coexist within an organization's knowledge management program(s)? To what extent will organizations hybridize market, hierarchical, and clan structures in knowledge management programs?

KMSS research can exploit these and other questions derived from Perrow's and Williamson's works to guide the design, application, and use of IS-enabled KMSS tools. Poole's model can provide guidance on the relationships among knowledge tasks, communication networks, and organizational power; Malone's work on coordination theory and Ouchi's work on the influence of organizational culture guide the set of organizational structures that those communication networks are likely to take.

Like GDSS research, KMSS research may investigate features that mitigate unwanted behaviors. Like electronic communications research, KMSS research may investigate technologies that reduce the time and expense of coordinating knowledge acquisition, organization, and communication tasks. Thus, KMSS research not only has practical advantages in providing useful tools for organizations, it can also shed light on a long-standing academic debate.

We can now begin the task of unifying the power and transaction cost perspectives into an integrated framework. Task, coordination structure, and culture constitute the major subsections of the framework. Power and transaction costs, the variables of interest, are positioned at the intersection of the three subsections. These components are displayed below in Figure 1.

One key point that must be addressed in the unification of power and cost perspectives is the different levels of analysis: Poole's model is set at the work unit level, while Malone's work is at the organizational. This might ordinarily mean that the two are quite distinct, until it is recognized that Poole's hypothesis that independence is a cornerstone of organizational power implies power flows across networks within organizational structures. When Poole's work unit level power hypothesis is projected across organization level networks, two organization level variables result: power flows and power differentials.

It is through these variables that Poole's and Malone's work can be joined and a unified framework for KMSS research can be constructed. In this way, Poole's dimensions of availability, uniformity, and independence help explain distributions of power. More specifically, they help identify power sources and sinks. When overlaid upon the hierarchies and markets in Malone's studies, the two perspectives can be interlinked.

The final component of the KMSS model is organizational culture, whose importance has been recognized by both sides of the debate: Perrow in his reflections on the abuse of organizational power, Williamson in his references to "atmosphere" and "collective spirit" (pp. 58, 77) and in his work with Ouchi concerning the differentiation of "hard" and "soft" organizational contracting. Culture serves to balance power, and consists of the final variable in our model. Culture also facilitates socialization, guiding the way in which novitiates become members of a community of practice. In this way, our model incorporates suggestions from the knowledge management and organizational learning research promoting the social construction and transfer of knowledge (Senge, 1990; Brown and Duguid, 1991; Resnick et al., 1991; Davenport and Prusak, 1998).

The KMSS research model is displayed below in Figure 2. It is admittedly large in comparison to most models used for experimental or theoretical intents. However, our objective is not to formulate a concise model for specific KMSS investigations or designs, but
rather to inspire debate and inquiry. In that sense our model should be seen as a resource of theoretically-grounded variables and relationships that can be drawn upon and individualized for future research.

Conclusions

Knowledge management research and practice is exploring the development and use of IS-enabled tools to facilitate knowledge acquisition, sharing, and storing. Rigorous research in this domain must be well-grounded in theory. Our work here identifies important variables and relationships from the economics and organizational structure domains, and then presents those variables and relationships in a model prototype. Future research can draw upon our model as a first step toward the development of models for study and implementation.

References


Figure 1. A Framework for KMSS Research
Figure 2. A Model for the Study of Knowledge Management Support Systems