From Information Management to Knowledge Management: Beyond the 'Hi-Tech Hidebound' Systems

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Abstract

Most extant knowledge management systems are constrained by their overly rational, static and acontextual view of knowledge. Effectiveness of such systems is constrained by the rapid and discontinuous change that characterizes new organizational environments. The prevailing knowledge management paradigm limits itself by its emphasis on convergence and consensus-oriented processing of information. Strategy experts have underscored that the focus of organizational knowledge management should shift from 'prediction of future' [that cannot be computed] to 'anticipation of surprise.' Such systems may be enabled by leveraging the divergent interpretations of information based upon the meaning-making capability of human beings. By underscoring the need for synergy between innovation and creativity of humans and the advanced capabilities of new information technologies, this article advances current thinking about knowledge management.

"To conceive of knowledge as a collection of information seems to rob the concept of all of its life... Knowledge resides in the user and not in the collection. It is how the user reacts to a collection of information that matters." -- Churchman (1971, p. 10).

Introduction

The current conceptualization of information technology (IT) enabled knowledge management suffers from the fallibility in imposing the traditional information-processing model on the strategic needs of contemporary organizations. The traditional knowledge management model emphasizes convergence and compliance to achieve pre-specified organizational goals. The knowledge management systems were modeled on the same paradigm to ensure adherence to organizational routines built into information technology. Optimization-based routinization of organizational goals with the objective of realizing greater efficiencies was suitable for an era marked by a relatively stable and predictable environment.

However, this model is increasingly inadequate for an era characterized by increasing pace of discontinuous environmental change (Arthur, 1996, Nadler *et al.*, 1995). The new era requires continual reassessment of routines embedded in organizational decision-making processes to ensure that

underlying assumptions are aligned with the changing environment. Hence, the primary focus is *not* as much on *doing things right* as it is on *doing the right things* (Drucker, 1994b). Convergence and consenus-oriented nature of traditional information systems is relevant for 'freezing' the meaning of information for achieving optimization-based efficiencies. However, 'unfreezing' of meaning embedded in information is critical for reassessing and renewing the routines embedded in organizational decision-making processes.

The proposed model of knowledge management attempts to achieve simultaneous 'freezing' and 'unfreezing' of meaning to ensure that effectiveness of decision-making (*doing the right things*) is not sacrificed at the altar of increased efficiencies (*doing things right*). It does so by proposing a balance between the optimization-based predictive capacity of information-processing systems and the divergence of meaning [of information] based on innate human sense-making capabilities.

By laying the theoretical and conceptual bases for the proposed model, this article provides the bases for organizational deployment and further refinement by practitioners and scholars. The article also provides the bases for developing measures and methodologies for understanding and deploying 'enhanced' knowledge management model in contemporary organizations.

Next section discusses the prevailing information-processing view of knowledge management and provides the background for the proposed model. Subsequent discussion on contemporary thinking about organizational strategy highlights the limitations of the predominant information-processing view of knowledge management. Thereafter, the theoretical bases of the proposed model are reviewed, the model is presented in definitional terms, and its key implementation characteristics are discussed. Finally, it is explained how the explicit emphasis of the proposed model on the creation of new knowledge builds upon the strengths of the information-processing capabilities of computer-based knowledge management systems.

Information-Processing Paradigm of Knowledge Management

Growing interest in knowledge management stems from the realization that in the knowledge era, organizational knowledge is a strategic corporate asset that needs to be garnered, retained, updated, disseminated and applied to future organizational problems (cf: Drucker, 19934a; Stewart, 1997). Recent advances in information technology such as Lotus Notes, Internet and World Wide Web have offered the means to organize various scattered pockets of information into organizational 'knowledge repositories.' Popular examples of such repositories include Anderson's Knowledge Xchange, Booz Allen & Hamilton's Knowledge On-Line, CAP Gemini's Knowledge Galaxy, Ernst & Young's Center for Business Knowledge and Monsanto's Knowledge Management Architecture. The principal motivation for development of such knowledge repositories is that information technology can enable the sharing of information between various employees, thus preventing duplication of information work while offering the advantage of immediate access to information. Such repositories of organizational knowledge are expected to serve as enablers of access to companywide information at any time, at any place and in whatever form (Davidow & Malone, 1992). These repositories are even expected to enable adaptive functioning and survival of the firm long after the original purveyors of information have departed (Applegate et al., 1988, p. 44; italics added for emphasis):

> "Information systems will maintain the corporate history, experience and expertise that long-term employees now hold. The information systems themselves -- *not the people* -- can become the stable structure of the organization. People will be free to come and go, but the value of their experience will be incorporated in the systems that help them and their successors run the business."

A review of mainstream scholarly and trade publications similarly suggests the centrality of the computer in most mainstream explanations of knowledge management. The concept of information technology as the key enabler of knowledge management (cf: Maglitta, 1995) is not a new idea. Over the last decade, this concept has been discussed in various forms. Proponents of artificial intelligence

and machine learning have emphasized the key role of such technologies in the process of knowledge generation (Ford, 1989). Considering numerical-data as the basis for decision-making, decision support systems have also been depicted as encompassing knowledge management (Shen, 1987). Other computer-based technologies such as expert systems (Candlin & Wright, 1992; Chorafas, 1987; Strapko, 1990) and networked databases (Anthes, 1991) have been described as central to organization's knowledge management objectives. Illustrative examples of the conception of knowledge management based on the computer-based information-processing paradigm are given in Table 1.

Table 1. Knowledge Management: The Information Processing Paradigm

The process of collecting, organizing, classifying and disseminating information throughout an organization, so as to make it purposeful to those who need it. (Albert, 1998)
Policies, procedures and technologies employed for operating a continuously updated linked pair of networked databases. (Anthes, 1991)
Partly as a reaction to downsizing, some organizations are now trying to use technology to capture the knowledge residing in the minds of their employees so it can be easily shared across the enterprise. Knowledge management aims to capture the knowledge that employees really need in a central repository and filter out the surplus. (Bair 1997)
Ensuring a complete development and implementation environment designed for use in a specific function requiring expert systems support. (Chorafas, 1987)
Knowledge management IT concerns organizing and analyzing information in a company's computer databases so this knowledge can be readily shared throughout a company, instead of languishing in the department where it was created, inaccessible to other employees. (CPA Journal, 1998)
Identification of categories of knowledge needed to support the overall business strategy, assessment of current state of the firm's knowledge and transformation of the current knowledge base into a new and more powerful knowledge base by filling knowledge gaps. (Gopal & Gagnon, 1995)
Combining indexing, searching, and push technology to help companies organize data stored in multiple sources and deliver only relevant information to users. (Hibbard 1997)
Knowledge management in general tries to organize and make available important know-how, wherever and whenever it's needed. This includes processes, procedures, patents, reference works, formulas, "best practices," forecasts and fixes. Technologically, intranets, groupware, data warehouses, networks, bulletin boards videoconferencing are key tools for storing and distributing this intelligence. (Maglitta, 1996)
Mapping knowledge and information resources both on-line and off-line; Training, guiding and equipping users with knowledge access tools; Monitoring outside news and information. (Maglitta, 1995)
Knowledge management incorporates intelligent searching, categorization and accessing of data from disparate databases, E- mail and files. (Willett & Copeland, 1998)
Understanding the relationships of data; Identifying and documenting rules for managing data; and Assuring that data are accurate and maintain integrity. (Strapko, 1990)
Facilitation of autonomous coordinability of decentralized subsystems that can state and adapt their own objectives. (Zeleny, 1987)

Knowledge management is the strategic application of collective company knowledge and know-how to build profits and market share. Knowledge assets-both ideas or concepts and know-how-are created through the computerized collection, storage, sharing, and linking of corporate knowledge pools. Advanced technologies make it possible to mine the corporate mind. (Zuckerman & Buell, 1998)

Paradoxically, it has also been suggested that a firm's capacity for knowledge creation may even become unduly impaired by a heavy reliance on IT-based knowledge management (Gill, 1995). It has also been argued that such solutions often specify the "minutiae of machinery" while disregarding how people in organizations actually go about acquiring, sharing and creating new knowledge: "they glorify information technology and ignore human psychology" (Davenport, 1994, p. 119). Based primarily upon a static and 'syntactic' view of knowledge, such solutions consider only a partial perspective of the organizational knowledge creation process. By considering the meaning of knowledge as "unproblematic, predefined, and prepackaged" (Boland, 1987), they ignore the human dimension of organizational knowledge creation (Manville and Foote, 1996). Such restricted perspective of the IT-enabled organizational knowledge management may even have detrimental influence on the firm's learning and adaptive capabilities (Drucker, 1994b). This perspective is increasingly problematic given the dynamically changing organizational environments that demand multiple interpretations of information, as well as their ongoing evaluation.

The alternative model of knowledge management -- based upon the synergy of innovation and creativity of humans and the advanced capabilities of new information technologies -- delineated in this article, seems to ameliorate the weaknesses inherent in the mechanistic nature of the information-processing model.

The next section describes how changing organizational environments limit the effectiveness of the information-processing model of knowledge management. The proposed model of knowledge management is explained in the subsequent section.

New Organizational Environments & Changing Knowledge Needs

More than three decades ago, Emery and Tryst (1965) had observed that the organizational environments were changing -- at an ever-increasing rate, and toward ever-increasing complexity. More recently, increased significance of environmental change for organization's knowledge creation needs is apparent in the suggested need for more flexible and adaptive organizations (cf: Malone and Crowston, 1991).

Organizational change is generally described as a response to the increasing environmental complexity and environmental turbulence. While environmental complexity is a function of the numerosity, diversity and interdependence of other entities in the organization's environment, environmental turbulence is a consequence of the decreasing cycle-time of the individual events [such as new product introduction, customer response, etc.]. It has been suggested that the levels of both environmental complexity and turbulence, as well as their absolute rates of growth will be significantly greater in the future than in the past (Huber & Glick, 1993). Hence, future environmental change is expected to be more rapid and more discontinuous in nature (Handy, 1990).

Increasing complexity and turbulence of the external environment impose upon the organization greater demand for processing information and making quick decisions (Huber, 1984). Within this scenario, organizational response to environmental change is the crucial determinant of its effectiveness (Bennis, 1974, p. 22). Radically changing organizational environments that demand ever-faster rate of information-processing, information-renewal and knowledge creation have motivated contemporary managers' interest in retrieving, archiving, storing and disseminating their organization's information by using advanced information technologies. Organizations are devising means to accumulate employees' knowledge in electronic databases to use them as repositories of the shared, firm-wide "structural intellectual capital" (Stewart , 1997).

However, for most post-industrial organizations, characterized by dynamically complex and uncertain environment, more and more knowledge *utilization* as well as knowledge *creation* is *needed* at the interface of the organization and the environment. The information-processing model of knowledge management is overwhelmed by the intense information flows required for (Bartlett & Ghoshal, 1995):

(a) keeping the centralized knowledge base and its custodians (managers) *continuously* current with the *discontinuously changing* external environment,

(b) continually updating the employees on the latest changes in their outputs (goals) and changes in procedures to achieve those outputs.

Furthermore, increasing hyperturbulence and discontinuous change are not conducive for sustained role of managers as custodians of organizational knowledge (Landau & Stout, 1979, p. 148): "...control is a function of knowledge [of managers], and in uncertain environments, knowledge [of managers] often does not exist." Within such environments, it is more efficient to handle complexity wherever and whenever it first enters the organization – efficient operations in the new environment require a more equitable distribution of knowledge and authority (Zuboff, 1995). Such environments impose the need for *anticipating the future* based on multiple interpretations instead of predicting the 'right forecast' (Brown & Eisenhardt, 1997). Members of such organizations would need to be "effective anticipators" (Nadler & Shaw, 1995, p. 3) who can carry out the mandate of a faster cycle of knowledge-creation and action based on new knowledge. However, the prevailing information-processing view of knowledge management that is tuned to optimization-based efficiency is unable to provide the organizational agility and adaptability that is necessary for radically changing environments.

'Hi-Tech Hide Bound' Knowledge Management

Current thrust of organizational knowledge management efforts is on archiving 'best practices' for later reference by other employees. It is popular belief that archival and subsequent observance of such practices would facilitate efficient problem-solving and prevent unnecessary allocation of sources to inefficient search processes. Incidentally, in due course archived 'best practices' tend to define the

'dominant logic' (Bettis & Prahalad, 1995) or the 'company way'. Knowledge management *solutions* characterized by memorization of best practices tend to define the assumptions that are embedded not only in information databases, but also in the organization's strategy, reward systems and resource allocation systems. However, most such solutions represent “a temporary event, specific to a context, developed through the relationship of persons and circumstances" (Wheatley 1994, p. 151). Such *recipes* for specific problem based situations [with the implicit assumption of *ceteris paribus*] may turn out to be recipes for disaster when future solutions need to be either thought afresh or in discontinuation from past solutions (Landau 1973, p. 536).

The 'dominant logic' often persists even after the underlying assumptions have changed fundamentally. Hardwiring of underlying assumptions in organizational knowledge bases may lead to “perceptual insensitivity” (Hedberg & Jonsson., 1978, p. 47-49) of the organization to the changing environment. Due to the changing business environment, such organizations may find themselves doing “more of the same” better and better, however, with diminishing marginal returns (Drucker, 1994b). The locked-in behavior patterns lead to decreasing sensitiveness to the obsolescence of yesterday's 'best practices' archived in knowledge repositories. Just like the ‘boiling frog’ that is unable to sense the gradual change in temperature and ultimately boils to death (Senge 1990a), the cycle of doing "more of the same" leads to the organizational "death spiral" (Nadler & Shaw 1995, p. 12-13).

Yesterday's core capabilities embedded in information technologies could become tomorrow's core rigidities (Gill, 1995; Leonard-Barton, 1995). Institutionalization of 'best practices' by embedding them in information technology might facilitate efficient handling of routine, 'linear,' and predictable situations during stable or incrementally changing environments. However, when change is radical and discontinuous, there is a persistent need for continual renewal of the basic premises underlying the practices archived in the knowledge repositories. Often, effective knowledge management in such

environment may need “imaginative suggestions more than it does concrete, documented answers" (Hedberg et al., 1976, p. 53).

Unfortunately, the information-processing paradigm of knowledge management is devoid of capabilities that are essential for continuous learning *and* unlearning processes mandated by radical and discontinuous change. To ensure that yesterday's 'core capabilities' do not become tomorrow's 'core rigidities' (Leonard-Barton, 1995), organizations' capacity to *unlearn* ineffective 'best practices' assumes increased significance (Bettis and Prahalad, 1995; Hedberg, 1981; and Hedberg et al., 1976). However the mechanistic and rigid nature of the routines embedded in information-processing based knowledge management is incapable of keeping pace with dynamic knowledge-creation needs for wicked environments.

In contrast, the proposed model of knowledge management is based upon more proactive involvement of human imagination and creativity (March, 1971) to facilitate greater internal diversity [of the organization] to match the variety and complexity of the dynamically discontinuous environmental change (Ashby, 1956).

Beyond ‘Hi-Tech Hidebound’ Knowledge Management Systems

Churchman (1971) had explicated that knowledge does not reside in the collection of information, and had underscored the importance of humans in the process of knowledge creation. More recently, Nonaka and Takeuchi (1995) have argued that “knowledge, unlike information, is about *beliefs* and *commitment*.” Davenport and Prusak (1998, p. 5) have also defined knowledge as deriving from minds at work: “Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.”

Churchman's (1971) emphasis on the human nature of knowledge creation seems more pertinent now than it was three decades ago given the increasingly 'wicked' environment characterized by discontinuous change (Nadler & Shaw, 1995) and "*wide range of potential surprise*" (Landau & Stout, 1979). The new business environment defeats the traditional organizational response of *predicting* and *reacting* based on pre-programmed heuristics. Instead, it demands more *anticipatory* responses from the organization members who need to play a more proactive role in the faster cycle of knowledge-creation and action (Brown & Eisenhardt, 1997; Nadler & Shaw, 1995).

The information-processing model of knowledge management [and knowledge repositories] discussed above is suitable for predictable environment characterized by incremental and continuous change. As noted above, such technology-based conceptualizations of knowledge management, based upon heuristics -- embedded in procedure manuals, mathematical models or programmed logic -- capture the preferred solutions to the given repertoire of organization's problems. Such computer-centric systems of organizational knowledge management have: "implicitly assumed...a well-structured problem, a data or model basis, an operational control-hierarchical authority organizational context and an impersonalistic [sic] computer printout mode of presentation" (Mason & Mitroff, 1973, pp. 484-485). Following Churchman (1971), such systems are best suited for (Mason & Mitroff, 1973, p. 481):

(a) "well-structured problem situations for which there exists a strong *consensual* position on the nature of the problem situation," and
(b) "well-structured problems for which there exists an analytic formulation with a solution."

Type (a) systems are known as Lockean systems and type (b) systems are known as Leibnitzian systems. Current conceptualization of organizational knowledge repositories is motivated by projected efficiencies that would follow from [almost] impassive acceptance of institutionalized and archived 'best practices.' Based primarily upon the above consensus-building models, such knowledge repositories tend to institutionalize the *status quo*. Organizational routines that were originally embedded in the standard

operating procedures and policies, practices, rules and norms become embedded in the 'shared' knowledge databases in the form of 'best practices' (Hedberg et al., 1978, p. 53):

> "Formalized information systems tend to be mechanistic and inflexible, and they incorporate assumptions that their designers have already identified the organizational and environmental properties deserving attention."

As evident, the information-processing view of knowledge management is primarily based upon a Lockean and Leibnitzian logic of consensus building. This view of knowledge management seems to be an extension of the decades old predisposition of information systems designers for Leibnitzian and Lockean inquiry systems (Churchman, 1971).

However, such *consensus building* systems are generally capable of providing "only one view of the problem," and hence are not very suitable for discontinuously changing environments (Mason & Mitroff, 1973, p. 481). Dynamic environments not only require multiple perspectives of solutions to a given problem, but also diverse interpretations of the problem based upon multiple views of future. Two other types of 'inquiring systems' discussed by Churchman (1971), may however facilitate understanding, development and deployment of such divergence-oriented systems.

Following Churchman (1971), there are two other kinds of inquiry systems that are more conducive to ill-structured environments. Kantian systems attempt to give multiple *explicit* views of "complementary" nature and are best suited for "moderate" ill-structured problems (Mason & Mitroff, 1973, p. 482). In contrast, Hegelian systems provide multiple "*completely antithetical*" representations that are characterized by "intense conflict" because of the contrary underlying assumptions and are, best suited for "wickedly" ill-structured problem domains (Mason & Mitroff, 1973 p. 482).

The proposed model of knowledge management based upon Kantian and Hegelian systems is expected to facilitate multiple interpretations of archived 'best practices.' This divergence-oriented process would ensure that the best practices and their underpinning assumptions are subjected to continual re-examination and modification. Continuously challenging the current 'company way,' such

systems are expected to prevent the "core capabilities" of yesterday from becoming "core rigidities" of tomorrow (Leonard-Barton, 1995).

Proposed Model of Knowledge Management

Drawing upon the above discussion, the proposed model of knowledge management takes a strategic view of organizational information processes and knowledge creation activities. It attempts to synthesize the information-processing capabilities afforded by new information technologies with the innovative and creative capabilities of human and social elements of the organization. By doing so, it develops the bases for achieving simultaneous 'freezing' and 'unfreezing' of meaning to ensure that effectiveness of decision-making (*doing the right things*) is not sacrificed at the altar of increased efficiencies (*doing things right*). The proposed model of knowledge management is defined in the following terms (Malhotra 1998):

> *"Knowledge management caters to the critical issues of organizational adaption, survival, and competence in face of increasingly discontinuous environmental change. Essentially, it embodies organizational processes that seek synergistic combination of data and information-processing capacity of information technologies, and the creative and innovative capacity of human beings."*

The proposed model addresses the knowledge creation and dissemination processes that are "both *participative* and *anticipative*" (Bennis & Nanus 1985, p. 209). Instead of a formal step-by-step rational guide, this model favors a "set of guiding principles" for helping people understand "not how it should be done" but "how to understand what might fit the situation they are in" (Kanter 1984, p. 305-306). This model assumes the existence of "only a few rules, some specific information and a lot of freedom" (Wheatley, cited in Stuart, 1995).

An illustration of such model is suggested by the practices of the retailer Nordstrom that has earned a reputation for unequalled quality of customer service. Surprisingly, this organization uses a one-sentence policy manual (Taylor 1994): "Use your good judgment in all situations. There will be no additional rules." The primary responsibility of most supervisors is to continuously coach the employees

about this philosophy for carrying out the organizational pursuit of "serving the customer better" (Peters 1989, p. 379).

The proposed model builds upon the strengths of the extant conceptualizations based on the archival, retrieval and dissemination capabilities afforded by advanced information technologies. However, its key contribution lies in overcoming the weaknesses of the information-processing view by explicit integration of the human and social creative and innovative capacities in the knowledge creation and dissemination processes.

Next section discusses the key characteristics of the proposed model of knowledge management that distinguish it from the information-processing model. Subsequent section explains how these characteristics integrate individual and organizational innovation and creativity with the strengths of the information-processing view.

Key Characteristics of the Proposed Model

The proposed model of knowledge management may be distinguished from the information-processing view discussed earlier based on four key characteristics of all organizational processes and activities:

(a) playfulness in organizational choices (b) shift from error avoidance to error detection and correction,

(b) strategic planning as 'anticipation of surprise,' and (d) creative chaos through organizational vision.

a) 'Playfulness' in Organizational Choices

The information-processing model of knowledge management is constrained by its overemphasis on consistency that is often institutionalized in the form of 'best practices.' The proposed model of knowledge management is expected to break this cycle of reinforcement of institutionalized knowledge. Instead of emphasizing unquestioning adherence to pre-specified goals or procedures, it encourages the use of intuition through 'playfulness' (Cooper et al. 1981, p. 179):

> "*Not* requiring consistency in behavior may be achieved by encouraging playfulness in the choice process in organizations, allowing intuition to guide action without sanction."

'Playfulness' (Cooper et al. 1981) in organizational choice process enables internal diversity that can match the variety and complexity of the dynamically changing environment (Ashby 1956). It can be facilitated by treating goals as hypotheses, treating intuition as real, treating organizational memory as enemy and treating experience as a theory which requires ongoing reassessment (Landau 1973, March 1971). Playfulness creates an environment conducive to the subjective, interpretative and constructive aspects of knowledge creation that are guided by individual and organizational 'sense making' (Weick 1990).

Within the proposed model, the designers of organizational knowledge management systems can, at best, facilitate the organization's 'self-designing' (Hedberg et al. 1976, p. 43): "not only would the organization's members define problems for themselves and generate their own solutions, the members would also evaluate and revise their solution-generating processes." By explicitly encouraging experimentation and rethinking of premises, it promotes reflection-in-action and creation of tacit knowledge.

b) Shift from Error Avoidance to Error Detection and Correction

The information-processing model of knowledge management is based on avoidance of errors by meticulous obedience of pre-specified plans, goals, procedures, rules, etc. Characterized by "*overdefinition* of rules and *overspecification* of tasks" (Landau & Stout 1979, p. 153), this model nurtures those who conform to the rules regardless of the results. While errors are informational, compliance is not. Knowledge management systems designed to ensure compliance might ensure that the rules and procedures are exactly followed, i.e., the variance between the *pre-specified* rules and the actual execution is minimized. However, they do not ensure the detection of error (Landau & Stout 1979, p. 153). Unquestioning obedience to rules is synonymous with avoidance of errors: it motivates organization members to reduce "the risk of error through conformance to existing patterns of meaning"

(Landau 1973, p. 540). In this model, "information is selectively processed so as to minimize the rate and extent of change required, [and] the repertoire of response remains impervious to experience" (Landau 1973, p. 540).

The current conception of knowledge repositories with its emphasis on replicating archived 'best practices' suffers from this frailty. In absence of *explicit* recommendation for providing contrary [or complementary] alternatives, legitimization of *any kind* of 'practices' by embedding them in technology is expected to result in the above outcome. It is essentially a negative activity since it defines "what *cannot be done*" (Stout 1980, p. 90). Hence, such practices reinforce a process of single loop learning with its primary emphasis on error avoidance (Argyris 1994). The explicit bias for seeking compliance makes such systems inadequate for motivating divergence-oriented interpretations that are necessary for ill-structured and complex environments.

In contrast, the proposed model of knowledge management deploys "unprogrammed processes for monitoring errors [which] utilize discontent and emit signals through dissent, complaint, discontent, and controversy." (Hedberg et al.1976, p. 58). It facilitates a process of error detection and error correction which seeks to identify "what *can* be done" (Stout 1980, p. 90) within the constraints imposed by the task environment. These distinguishing features of the proposed model facilitate development of a large repertoire of responses that reify alternative (complementary and contradictory) solutions, as well as diverse approaches for implementing such solutions.

c) Strategic Planning as 'Anticipation of Surprise'

The information-processing model of knowledge management focuses on the reduction of variance between *planned* and *actual* performance. The decision rules embedded in knowledge repositories assume the character of predictive 'proclamations' which draw their legitimacy from vested authority in 'best practices', not necessarily because they provide desirable solutions (Hamel & Prahalad

1994, p. 145). Challenges to such decision rules tend to be often perceived as challenges to the authority embedded in best practices (Landau 1973).

In contrast, the proposed model of knowledge management is more conducive to a future marked by "wicked" environments characterized "*wide range of potential surprise*" (Landau & Stout 1979, p. 149)? An illustrative example of knowledge management based on 'anticipation of surprise' is provided by the Chief Learning Officer of GE, who has underscored the need for emphasizing *anticipation* over *prediction* of the future (Kerr 1995, p. 43):

> "The future is moving so quickly that you can't anticipate it...We have put a tremendous emphasis on quick response instead of planning. We will continue to be surprised, but we won't be surprised that we are surprised. We will anticipate the surprise."

Within the proposed model of knowledge management, organizational planning activities are not eliminated. However, organizational plans are seen not as a set of instructions for what will take place, but rather as an ideological device that functions to build constituency, and to define the limits of responsible opinion. In this view, the organization plans for its futures, but does not rely on its plans (Hedberg et al. 1976, p. 59).

The primary objective of this process is a faster cycle of knowledge-creation and action based on the new knowledge, by enabling continuous and rapid detection and correction of any discrepancies between 'the plan' and the dynamically changing business environment.

In this model, access to organizational information base, authority to take decisive action, and the requisite skills are embedded at the frontlines where real action takes place. Individual organization members devise their objectives based on the organization's vision, they measure their own performance against those objectives, and they take their own corrective actions. The dialectical approach (Mason, 1969) could be adapted for this purpose by infusing it into the organization members on the frontlines. Contrary to the traditional role of reinforcing the embedded knowledge through policy statements of "the company way," emphasis is on maintaining a "dynamic imbalance" by "challenging conventional

wisdom, questioning the data behind accumulating knowledge, and recombining expertise to create new capabilities" (Ghoshal & Bartlett 1996, p. 34).

How should the organization ensure that its aspirations for its long-term goals are fulfilled while allowing subjective, interpretative, constructive and social interactive processes of knowledge creation? This is where the most important role of the senior management comes in: as the architect of the organizational vision. The most critical task of top management in this view is "to conceptualize a vision about what kind of knowledge should be developed and to operationalize it into a management system for implementation" (Nonaka & Takeuchi 1995, p. 74).

d) Creative Chaos through Organizational Vision

Within the proposed model, the organization's vision serves a dialectical purpose: it *binds* the organization members together within relatively *flexible* goal and task definitions. The primary obligation of employees is *not* the fulfillment of pre-specified goals and tasks laid out in detail, but devising whatever goals and tasks are best to realize the shared vision of the organization (Nonaka & Takeuchi 1995, p. 76):

> "autonomous individuals and groups in knowledge-creating organizations set their task boundaries by themselves to pursue the ultimate goal expressed in the higher intention (vision) of the organization."

Organizational vision is a picture of "what might be" which generates a "creative tension" necessary for moving toward tomorrow's opportunities from the "current reality" (Senge 1990b). This *shared* picture ('hologram') of the future possibilities emerges from a collective of *personal* visions of the various organization members and typifies an ever-evolving product of a continuous process (Senge 1990b, p. 13).

In this view, top management creates a knowledge vision that defines the world they live in and the general direction of knowledge they ought to create. The knowledge vision fosters personal commitment of middle managers and frontline workers by providing 'meaning' to their daily tasks. The

knowledge vision is purposefully 'equivocal' and open-ended to allow diversity of multiple 'personal' perspectives. The "strategic equivocality" of the top management's vision encourages an "active investigation of the alternatives to established procedures" (Nonaka & Takeuchi 1995, p. 79). At the level of the implementing staff, ambiguity of the knowledge vision translates into "interpretive equivocality" which facilitates "reflection-in-action" (Schön 1983) resulting in "creative chaos" (Nonaka & Takeuchi 1995, pp. 79-80).

The information-processing model of knowledge management assumes a problem as given and the solution as based upon a "preset algorithm" (Nonaka & Takeuchi 1995, p. 79). In contrast, the proposed model constructs the definition of the problem "from the knowledge available at a certain point in time and context" (Nonaka & Takeuchi 1995, p. 79). While the individual autonomy in the proposed model facilitates the divergence of individual personal perspectives, the organizational vision facilitates the various views to converge in a given direction. This process avoids premature closure or convergence.

The distinguishing characteristics of the proposed model of knowledge management thus provide means for balancing the optimization-based, consensus-oriented focus on efficiency with divergence of meaning that continuously assesses the validity of fundamental assumptions. Given the emphasis on constructive conflict, the proposed model of knowledge management is better suited to detecting changes in external environment and taking corrective action. Since organizational mission is shared across all members in terms of the broad vision, the detection and correction of error occurs where it is first encountered -- on the frontlines. Diversity of perspectives provides interpretive flexibility to organization members who are better tuned to multiple views of the future and are thus better prepared for adapting to changing circumstances.

These characteristics of the proposed model integrate the ‘sense-making’ capabilities that are necessarily human and social, with the information-processing capabilities of archival, retrieval and dissemination that are the forte of the new computer-based technologies.

Toward Knowledge Management that ‘Makes Sense’

Knowledge management includes various processes such as acquisition, creation, renewal, archival, dissemination and application (conversion of new knowledge into action or behavior modification) of knowledge. The processes of collecting, organizing, classifying and disseminating information (cf: Albert 1998) are served well by the searching, indexing, collating, archival and transmission capabilities of new technologies.

However, the prevailing information-processing focus of knowledge management systems doesn’t address creation of new knowledge: ongoing reassessment and re-framing of existing and new information given the dynamically changing context of application. As discussed earlier, the proposed model is expected to address this critical shortcoming in the understanding of knowledge management for new organizational environments. Within the proposed model, creation of new knowledge is central to the organization's knowledge management activities. Explicit focus on knowledge creation also aims to address the existing "virtual neglect" (Nonaka & Takeuchi 1995) of this crucial aspect of knowledge management in extant theory, practice and research.

The ‘creative’ aspect of knowledge management accounts for some key processes that are critical for a richer understanding and practice of knowledge management:

(a) tacit dimension of knowledge creation;

(b) subjective, interpretative and sense-making bases of knowledge;

(c) construction of meaning in knowledge creation; and,

(d) social interactive nature of knowledge.

a) Tacit Dimension of Knowledge Creation

The current conception of IT-enabled knowledge repositories misses the creative aspect of knowledge processing - especially processing of tacit knowledge which is "deeply rooted in an individual's action and experience, ideals, values, or emotions" (Nonaka & Takeuchi 1995, p. 8). Although tacit knowledge lies at the very basis of organizational knowledge creation, its nature renders it "highly personal and hard to formalize, making it difficult to communicate or to share with others" (Nonaka & Takeuchi 1995, p. 8). The current conception of knowledge management is capable of handling explicit knowledge that is "transmittable in formal, systematic language" and can be stored in specifications, reference manuals and company handbooks (Nonaka & Takeuchi 1995, p. 59). However, it is not capable of transferring the "associated emotions and specific contexts" (Nonaka & Takeuchi 1995, p. 63) in which that information is embedded.

By explicitly taking into consideration the innovative and creative aspects of knowledge creation, the proposed model integrates aspects of knowledge [such as intuition and insight] that are difficult to formalize or communicate by computer-based information-processing mechanisms.

Nonaka and Takeuchi (1995) have suggested that knowledge is created through the interaction between tacit and explicit knowledge through four different modes. These modes are: *socialization* , which involves conversion from tacit knowledge to tacit knowledge; *externalization*, which involves conversion from tacit knowledge to explicit knowledge; *combination*, which involves conversion from explicit knowledge to explicit knowledge; and *internalization*, which involves conversion from explicit knowledge to tacit knowledge.

The information-processing view of knowledge management is limited in its support of knowledge creation through *socialization* since it cannot provide the "shared experience" (Nonaka & Takeuchi 1995, p. 63) necessary for relating to another individual's thinking process. In case of

knowledge creation through *externalization*, information-processing view of knowledge management is limited since it doesn't explicitly address the process of dialogue or collective reflection. The proposed model, by integrating these aspects of knowledge creation, seems to overcome the limitations of the information-processing view.

b) Subjective, Interpretative and Sense-Making Bases of Knowledge

Dynamically changing environments call for interpretation of new events and re-interpretation of extant practices (Boland et al., 1994). Daft and Weick (1984) defined interpretation as the process through which people give meaning to information. However, the information-processing view generally ignores the critically important construct of "meaning" which is essentially a function of human interpretative and constructive activities (Boland, 1987; John Holland, 1995) personal communication, June 21, 1995). It fosters an image of the knowledge base in which "the human meaning of knowledge and action are unproblematic, predefined and prepackaged" (Boland, 1987 p. 365) and the process of "continuous human problem of accomplishing meaning is replaced by a technology of packaging data" (Boland, 1987 p. 372).

'Prepackaged' or 'taken-for-granted' interpretation of knowledge residing in archived best practices works against the generation of multiple and contradictory viewpoints that is necessary for ill-structured environments. Simplification of contextual information for storage in computer-based repositories doesn't preserve the complexity of multiple viewpoints (Davenport, 1994). Institutionalization of definitions and interpretations of events and issues works against the exchanging and sharing of diverse perspectives. It hampers "the trial-and-error process" that can enhance the "capacity for effective action" (Senge cited in Koch & Fabris, 1995).

The proposed model explicitly addresses multiple and diverse interpretations (Eisenhardt 1989, 1992) that are necessary for preventing oversimplification or premature decision closure (Imai et al.

1985, Senge 1990a). The proposed model of knowledge management is expected to facilitate diverse views within a framework that is broad enough to encompass individual differences (Fiol 1994, p. 403).

c) Construction of Meaning in Knowledge Creation

In the computational metaphor that is characteristic of computer-based repositories of best practices, "information is [considered] indifferent with respect to the message...meaning is preassigned to messages" (Bruner 1990, p. 4). However, this assumption is questionable because "*construction* of meaning" and "the *processing* of information" are profoundly different matters" (Bruner 1990, p. 4). These meanings would not exist "if human beings would not have created the objects and entities" in them in the first place (Strombach 1986, p. 77). The syntactic dimension of information, which has been the primary focus of the information-processing view, is only a carrier for semantic and pragmatic dimensions (Morris 1938).

Something would make sense only if it can be related or connected to the existing frameworks or schemas: "To grasp the meaning of a thing, an event, or a situation is to see it in its *relations* to other things..." (Dewey 1933, p. 137). New experiences are interpreted with reference to the existing mental models which, in turn, are modified by newer experiences. The process is highly individualized and based on one's existing system of personal constructs (frames of reference), is aimed at finding meaning and making sense of the situations (Kelly 1963). Individuals respond to "*what they interpret the stimulus to be*," which is a function of the constructs they detect or impose upon their world (Bannister and Fransella 1971, p. 21, Bannister and Fransella 1986, p. 10).

Hence, for most ill-structured situations, it is difficult to ensure unique interpretation of 'best practices' residing in computer-based repositories since knowledge is created *by the individuals* in the process of using that data. Also, because individuals adjust their constructs [to better match the environment] *to improve predictions of their actions*: "all of our present interpretations of the universe are subject to revision or replacement" (Kelly 1963, p. 15). The constructive aspect of knowledge

creation embraced by the proposed model is expected to enable the organization's [desirable] *anticipatory response* to discontinuous change (Brown & Eisenhardt, 1997).

d) Social Interactive Nature of Knowledge

New knowledge may be facilitated by divergence of meanings and perspectives based upon Hegelian and Kantian inquiry. The diversity of interpretations -- of extant and new information -- may be motivated by the social interactive process of continuous dialog (Senge, 1990a). Dialog is important for surfacing and challenging existing assumptions and continually renewing the "pool of common meaning" (Bohm cited in Senge, 1990a, p. 240). This is the very essence of the process of dialogue: "meaning passing or moving through...a free flow of meaning between people..." (Bohm cited in Senge 1990a, p. 240). It is the flow of “meaning”, and not the flow of “information,” that constitutes knowledge flow. "Meanings express personal views of reality" (Stamper 1987), therefore diversity of meanings and conflicts between various interpretations is *not* unexpected. The current organizational thrust on IT-enabled knowledge repositories ignores the critical social and interactive nature of knowledge creation: "Information is not a resource to be stockpiled as one more factor of production. It is meaning, and it can only be achieved through dialogue in a human community" (Boland, 1987, p. 377).

Discontinuously changing hyperturbulent environments impose upon the organization a need for "creative synthesis" resulting from a "dialectical confrontation of opposing interpretations" (Mason & Mitroff 1973, p. 482). In his observation that (p. 32): "Successful knowledge transfer involves neither computers nor documents but rather interactions between people," Davenport (1995) has also asserted the relevance of social interaction in the creation of new knowledge.

The characteristics of the proposed model thus leverage the tacit knowledge of individuals; the subjective and interpretative biases of diverse perspectives; and dynamism of meaning with changing contextual conditions based on the social interactive process of dialog. The proposed model

recommends for the synthesis of these characteristics and related processes with the information-processing emphasis of the mainstream notion of knowledge management systems.

Conclusion

The mainstream model of knowledge management based on the information-processing view is problematic because of its focus on premature convergence of problem definitions and related solutions. The theoretical, conceptual and pragmatic bases for building upon the strengths of the information-processing model while minimizing its limitations were discussed. The need for better synergy between the human innovation and creativity and the existing information-processing focus on knowledge management was underscored. The theoretical bases of the proposed model were reviewed, and the model was presented in definitional terms, and its key implementation characteristics were discussed. It was also explained how the explicit emphasis of the proposed model on the creation of new knowledge builds upon the strengths of the information-processing capabilities of computer-based knowledge management systems.

In sum, this article underscores how organizations' strategic needs for creating [and re-creating] new knowledge can be met by a synergy between data- and information-processing capabilities of advanced information technologies and innovative and creative capabilities latent in their human members. While providing the theoretical, conceptual and pragmatic bases for advancing practice and research, the article ameliorates the weaknesses of the existing model by proposing an enhanced model of knowledge management.

The information-processing model is apparent in the knowledge management practice of a major US-based global communications company: "*What's important is to find useful knowledge, bottle it, and pass it around*" (Stewart & Kaufman 1995). In contrast, the model proposed in this article is illustrated in practice by an alternative approach taken by Pfizer (Dragoon 1995, p. 52):

"*There's a great big river of data out there. Rather than building dams to try and bottle it all up into discrete little entities, we just give people canoes and compasses...*"

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