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Abstract

This paper critically explores ways in which knowledge is defined from a hierarchical point of view and a sociological point of view. From the sociological point of view, it suggests a new categorization of knowledge relating to knowledge flow. Then it shows how the knowledge flow approach, with this new categorization, can be a complement to existing business strategies. On the basis of previous research, barriers to effectiveness in knowledge flow are identified. A conceptual model is devised, taking account of identified barriers, to serve as a framework for developing agendas of future research aimed at the development of knowledge flow support tools.

Introduction

A knowledge management survey of the senior managers in knowledge-intensive organizations shows that they consider the main problem to be lack of sufficient knowledge on the part of employees (Wurzburg, 1998). Another survey, confirming the above results, shows that nearly 90% of operational staff and managers complain of the same problem (Chase, 1997).

Many researchers (e.g. Nonaka and Takeuchi (1995)) attribute the problem to the tacitness of knowledge. Looking for means to overcome this tacitness, Nonaka et al. (1998) and many other researchers (e.g. Huber (1991)) have tried to theorize the knowledge creation and learning process. In their studies, they implicitly assume that co-location —which means sharing of places, in this case workplaces— is a principal factor fostering share of language, culture, etc. and so achieving high level of meaningful and unequivocal understanding. Researchers like Gupta and Govindaraja (1991) have noted how, on the other hand, the condition of weak co-location, with temporal, spatial, or social distance, gives rise to difficulties of knowledge usage.

As organizations face the new economic age that is characterized largely by globalization and a revolution in technology, there is an increase in the number of contingent workers and multinational corporations with branches operating across borders (Hitt, 1998). These changes no longer allow an environment of stable co-location. The survey by Ruggles (1998) brings out convincingly what, in the new economic age, the executives of 431 U.S. and European organizations consider to be the top two 'should-dos' for knowledge management, namely mapping sources of internal expertise and creating networks of knowledge workers.

Knowledge from a Knowledge Flow Perspective

There is lively academic debate over the epistemological question, how knowledge should best be defined. Broadly, there are two principal approaches to defining knowledge. One defines it in terms of the hierarchical structure of its content, in respect of knowledge, data and information. The other defines it in terms of the sociological processes of its acquisition and retention.

The hierarchical structure approach provides a static view of knowledge. In this approach to knowledge, three schools of thought are currently predominant: the first considers knowledge as situated in mind (e.g. Nonaka and Takeuchi (1995)); the second considers knowledge as process (e.g. McDermot (1999)); the third considers knowledge as object (e.g. Hibbard (1997)). These different views of knowledge, and their different implications for knowledge management (KM) strategies and information systems, are summarized in Table 1.

Table 1. Knowledge categories on the hierarchical structure view

Viewpoints	Implications for KM and information systems
State of mind	- Main focus: Development of sociological infrastructure, which facilitates knowledge exchange - Information systems only support access to existing information or explicit knowledge.
Process	- Main focus: Development of effective process of knowledge creation and distribution. - Information systems support link between source and recipient of knowledge and facilitate exchange of strategic know-how.
Object	- Main focus: How to gather and manipulate knowledge. - Information systems support effective codification, storage, and retrieval of knowledge.

The hierarchical approach is well founded in academic analysis and definition, but has the weakness that it is unable to explain knowledge in the context of its flow in organizations. The sociological analysis suggests a classification of knowledge into different types on the basis of the process of knowing. Many researchers (e.g. Fleck (1997), Spender (1996)) have attempted to develop categorization schemes for understanding how knowledge is acquired and how the different components of knowledge are linked to each other. On the basis of those various analytical schemes, a new framework for the categorization of knowledge has been developed, as summarized in Figure 1 below.

Instrumental knowledge is rooted in personal experience and skill. Personal cognitive abilities and relations have an influence over how quickly and how substantially appropriate knowledge is built up to solve a problem. *Social* knowledge includes operational routines and practices that are accepted as justified knowledge. This kind of knowledge can be transferred through working in a particular context. *Codified* knowledge is 'information-like' knowledge. When the context information appropriate to an item of social knowledge is evaluated to solve a problem and its value for problem-solving measured, social knowledge becomes codified knowledge. This kind of knowledge is then readily applied to decisions or other actions.

This tripartite classification, focusing on knowledge itself and process of knowing, can be used to develop a reliable and coherent basis for effective knowledge flow strategies and practices.

Knowledge Flow as a Complement to Existing Business Strategies

In the last decade, most large Fortune 500 companies have been pursuing two major strategic changes: restructuring and process engineering (Hill and Jones, 1998). Each strategy emphasizes only one of the types of knowledge distinguished in the knowledge flow categorization. (For introduction to the two strategies, see Garvin (1998) and Kanter et al (1992))

Restructuring puts emphasis on how instrumental knowledge relates to the changes of boundaries and relationships at the micro level. Process engineering puts emphasis on codified knowledge, because the target of the strategy is a clear structure of action, that is to say, 'a specific ordering of work activities across time and place, with beginning, an end, and clearly defined inputs and outputs (Davenport, 1993, p. 5)'.

Both strategies fail to make a link between instrumental knowledge and codified knowledge. So a possible complement to both strategies is effective knowledge flow implementation: this is summarized in Figure 2.

Figure 2. Knowledge flow as a complement

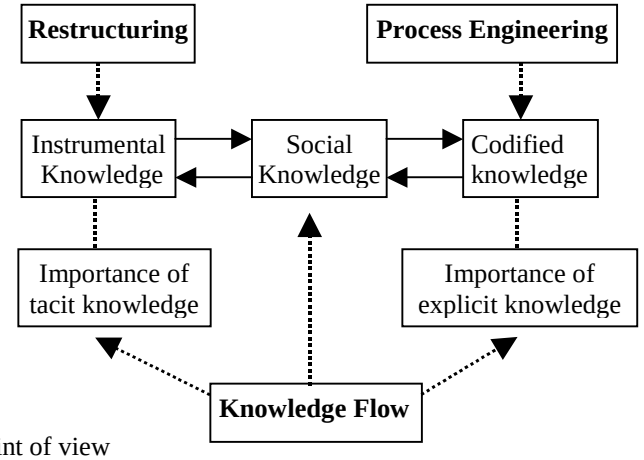


Figure 1. Knowledge categories from the knowledge flow point of view

Instrumental Knowledge	Social Knowledge	Codified Knowledge
Knowledge that is created by the experience o,f and resides within, the individual.	Knowledge that is created by social links and accepted as shared value	Knowledge that is formally codified with appropriate context information
Tacit[1&6]/ Instrumentalities[1]/ Process[2] / Automatic[3]/ Embrained[4&5]/ Embodied [5]	Informal[1] / Contingent[1]/ Social[2] / Conscious[3] / Meta[1] / Collective[3]/ Experiential[3]/ Embodied[4] / Embedded[4]/ Encultured[4&5]	Formal[1] / Catalogue[2]/ Explanatory[2] / Encoded[4]/ Objectified[3] / Explicit[6]/ Symbolic[5]

1: Fleck (1997), 2: Millar et al. (1997), 3: Spender (1996), 4: Blackler (1995), 5: Collins (1993), 6: Polanyi (1962)

According to this point of view, effective knowledge flow implementation should be founded on the significant body of existing literature in strategic management and organizational theory, as well as on relevant information technologies.

A Preliminary Process Model of Knowledge Flow

Many researchers (e.g. Von Hippel (1994); Szulanski (1996)) suggest that the most probable influences on knowledge flow, though with varying degrees of statistical significance, are the following four factors: the nature of the knowledge transferred, the source of the knowledge, the recipient of the knowledge, and the context in which the knowledge flow takes place. So this paper takes the set of all four factors, as a framework for finding find the barriers that prevent effective knowledge flow.

In a knowledge source, the obstacles to effective knowledge flow are: reluctance to make one's knowledge available through fear of a loss of power (Pasacarella, 1997; Sulanski, 1996), not being able to keep one's knowledge up to date (Detmer and Shortliffe, 1997), and negligence or a lack or commitment (Leonard-Barton, 1990).

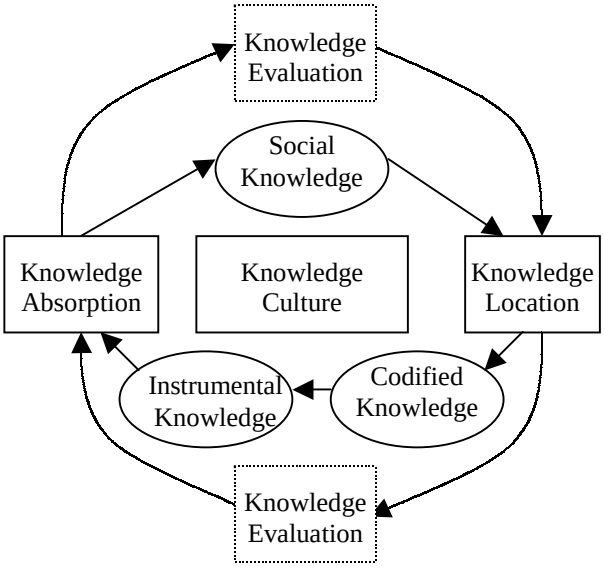
Between the knowledge source and the knowledge recipient, problems of interpretation are created by contextual ambiguity. Contextual ambiguities are chiefly a consequence of not being in a condition of co-location (Doz and Santos, 1997). Other sources of contextual ambiguity are unfriendly relationships between source and recipient (Ghoshal and Bartlett, 1994), and individuals being in a state of limited knowledge or of doubt about the network (Robertson et al., 1996). The most powerful barrier to knowledge flow is tacitness in the transferred knowledge (Nonaka, 1994); which sets up further barriers such as limitations on interpretative ability (Dougherty, 1992), and causal ambiguity (Szulanski, 1996).

For the recipient of knowledge, most obstacles are related to the recipient's cognitive ability. Many researchers indicate as barriers, the recipient's limited knowledge-processing capacity (Simpson and Prusak, 1995; O'Reilly, 1982); the recipient's lack of information as to the existence of knowledge; and limitations on the recipient's pre-existing knowledge (Cohen and Levinthal 1990). Other barriers are related to behavioral characteristics of the recipient, such as the 'not invented here' syndrome (Hu et al., 1998), and limitations on the recipient's capacity to institutionalize the application of new knowledge (Szulanski, 1996).

All these barriers lower the quality of knowledge used to solve a problem, and may result in a poor level of knowledge sharing. The salient features of these barriers are: the lack of an appropriate culture, the cognitive limitations of individuals, and the lack of understanding of context. These features are also directly related to all four elements in knowledge flow – source, recipient, knowledge transferred, context in which knowledge flow takes place.

Those four elements can be seen as interrelated components for knowledge flow: Kron et al. (1987) observe that all communication systems consist of interrelated components such as a sender (the source), a message, a receiver, a channel, and coding and decoding schemes. This view coincides with that of Tsoukas (1996) who, on the basis of Polanyi's work (1966), suggested that, to relate unarticulated background knowledge to human understanding, a system of knowledge flow should be equipped with interrelated components, namely a conversational medium (sender, receiver, and language), an artefact as the object (the knowledge), and a process as the underlying mechanism linking the two (the particular context and physical channel). Because of direct relationship between the three salient features and the four elements in knowledge flow, the features can be conceptually presented as a knowledge flow circle, which serves as a conceptual framework for knowledge flow implementation, as summarized in Figure 3.

Figure 3. A preliminary process model of knowledge flow



'Knowledge culture' has been identified, both conceptually and managerially, as the most fundamental consideration as regards all barriers to flow. 'Knowledge absorption' and 'knowledge location' both indeed have an influence on all knowledge flow processes; but 'knowledge absorption' primarily influences the process by which instrumental knowledge becomes social

knowledge, because 'knowledge absorption' mainly concerns the conversion of personal knowledge to organizational knowledge that is contextually appropriate to solving organizational problems (e.g. project implementation); while 'knowledge location' primarily influences the process by which social knowledge becomes codified knowledge, because 'knowledge location' is mainly concerns the evaluation of items of knowledge and the selection of those that are to be re-used.

There are various knowledge flow support tools, based on various disciplines such as Group Support Systems (GSS), GroupWare, neural networks, and software agents. However, GSS and GroupWare have shown weakness in supporting people's ability to analyze and integrate knowledge and information (Dennis (1996), Boiney (1998), Vandenbosch and Ginzberg (1997), Hattori et al. (1999)). Efforts in other disciplines such as neural networks and software agents are still limited to the development of intelligent interfaces, the adaptation of systems capacity to environment and task, or the analyses of communication styles.

Setting aside knowledge culture, what the possibility of effective knowledge flow implementation itself largely depends on, is the ability to analyze the context of knowledge required and to organize knowledge collection activities. It is evident that the rapid development of information technologies will provide the right means to effective knowledge flow. In particular, decision support systems which integrate cognitive mapping tools and multi-criteria decision-making tools can affect the implementation of the proposed model summarized in Fig. 3.

Knowledge Evaluation

Although 'knowledge evaluation' is not listed as a salient feature , one of the biggest managerial concerns is over which process (e.g. security of knowledge or rapid knowledge creation) contributes most to competitive advantage. For, as KPMG (1998) reports, most companies have created knowledge management initiatives in the belief that knowledge management brings a competitive advantage to the company. In the knowledge flow circle, 'knowledge evaluation' plays the roles of (1) helping to find the process most beneficial to the organization, and (2) making the activities of analyzing context and collecting knowledge conform to organizational strategies.

Knowledge Culture

Krogh (1998) suggests that cultures with a quality of 'care' facilitate the communication between members of an organization that serves knowledge flow. The underlying concern is the tacitness of knowledge. Another concern is organizational design. Nonaka et al. (1998) suggest that knowledge creation and flow can be influenced by spatial relations, which determine the availability and accessibility of knowledge. This suggestion raises two questions to be investigated. The first question is: which organizational structure or procedure — one with centralized control or one with decentralized control, one that is tightly connected in a shared place or one that is loosely connected in distant places — is best suited to knowledge creation and flow. The second question is: how to implement the operational model 'ART (Action-Reflection-Trigger)' of the SECI (Socialisation-Externalisation-Combination-Internalisation) process (Nonaka et al., 1998) by means of an investigation into related components such as employment contracts, incentive mechanisms, and knowledge ownership.

Knowledge Absorption

Many knowledge-intensive firms such as Anderson Consulting are trying to simulate co-location by implementing knowledge exchange systems such as 'Knowledge X-Change'. When a firm develops a system for knowledge transfer, they assume that the recipient of knowledge understands the message well enough to act upon it. However, knowledge is a combined set of belief, meaning, and action. Knowledge itself cannot flow: what flows is its 'representation'. When knowledge is transferred to a recipient, he will interpret the knowledge in his own context. Thus, the meaning understood by the recipient is not necessarily the same as the meaning intended by the sender. To minimize this risk, there is a need to develop a formal methodology which supports an analysis of the recipient's knowledge requirements and thus increases the probability of a correct interpretation. One possible direction for methodological development is to investigate how to make an analytical breakdown of complex knowledge requirements and map causal relationships among the resultant components.

Knowledge Location

Hu et al. (1998) suggest that a low quality of knowledge is one of obstacles re-using knowledge. This problem is caused by the high noise-to-signal ratio due to the presence of non-essential content in the knowledge repositories, and by a lack of reliable ways of measuring the quality of knowledge. The problem is most serious when the knowledge base is growing and knowledge seeking requires much time and effort. Cognitive psychologists have established that if the amount of information processed by humans is plotted against the weight of the information-processing load, it forms an inverted U-shaped curve (Taylor, 1984). When there is pressure of time, decision-makers tend to accept lower quality information that is more easily accessible (O'Reilly, 1982). One of the practical goals of knowledge management development in any organization is to assist rapid access to quality knowledge.

Discussion of Implementation Issues

This study serves as an initial step towards developing a knowledge flow mechanism. In tackling implementation issues, three research questions in particular should be given priority. The first requirement is to extract contextually unambiguous knowledge. A common tool is required which will enable the recipient (e.g. a decision-maker) and the source of knowledge to achieve a shared perception of the given problem and to identify the knowledge required for the particular area of concern. The second requirement is methods that provide support in locating knowledge, which will help the decision-maker to elicit knowledge of maximum utility, and to evaluate potential trade-offs between accessibility and quality. The numerous knowledge location methods currently in existence (e.g. intuitive process (Wegner, 19986), critical document storage (Kovel et al., 1996), organizational intranet (Zorn et al., 1997), group members' directory (Anand et al., 1998), taxonomies of knowledge (Offeys, 1997)), are too narrow in their capability to support the classification of knowledge or provide a truly useful content directory. These methods have limited use, in that they are confined to conditions under which there are only a few existing sets of knowledge to choose from and recipients know exactly what they require and can therefore estimate the value of knowledge. Thirdly, to reward knowledge sharing and to prevent staff turnover, there must be a mechanism to analyze the costs and benefits of different patterns of knowledge ownership and control. This cost-benefit analysis will serve as the basis for an ownership matrix that represents the relations between, on the one hand, the various participants in the activity, and on the other hand, the various assets in the portfolio, and thus establishes the context-specific relative importance of ownership from the point of view of knowledge flow.

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