From knowledge theory to management practice: towards an integrated approach

Minsoo Shin a,*, Tony Holden a,1, Ruth A. Schmidt b,2

a Decision Support Group, Manufacturing and Management Division, Department of Engineering, University of Cambridge, Mill Lane, Cambridge CB2 1RX, UK
b Department of Retailing and Marketing, Manchester Metropolitan University, Aytoun Building, Aytoun Street, Manchester M1 3GH, UK

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Abstract

This paper critically contrasts the three main schools of thought on knowledge – namely, those that respectively conceptualize knowledge as situated in mind, process, and object – and assesses the resulting implications for knowledge management (KM). Against the background of the existing diversity of definitions of KM an integrated and holistic view of the KM value chain is put forward. Within this theoretical framework five main research streams (culture, knowledge location, awareness, evaluation, and absorption) are identified with a view to devising a practical concept of KM applicable in a business context. With a focus on knowledge flow and detailed approaches to potential solutions, conflicts and compatibilities between existing business strategies and KM are examined. A conceptual model is devised to offer a holistic integration of the theoretical and practical themes in order to serve as a framework for developing a future research agenda for the development of theoretically grounded, yet practical, KM business tools and applications. © 2001 Elsevier Science Ltd. All rights reserved.

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1. Knowledge

In managerial circles, Knowledge Management (KM) is increasingly viewed as a crucial factor for competitive success (Ernst & Young, 1997). At the same time, the academic question of how knowledge should best be defined is a subject of a lively epistemological debate. On one hand knowledge can be seen as a representation of the real world, on the other it can be conceptualized as a product of the interaction between individual cognition and reality (Krogh, 1998). Arguably the quest for the discovery of ‘new truth’ from the analysis of the literature is of limited use in evoking researchers’ or practitioners’ interests in and in helping make progress in managing knowledge on a practical level. However, an examination of the various perspectives on the definition of knowledge and their implications for knowledge management forms a useful starting point enabling researchers and practitioners alike to understand their own standpoint in relation to the different positions and directions of knowledge management research.

All schools of thought agree in presuming that knowledge is something different from information and data. Principally there are two approaches to defining knowledge. One uses the concept of a value chain or hierarchical structure among data, information, and knowledge. The other focuses on the analysis of the process of knowing. These theoretical perspectives are complemented by a growing amount of managerially focused practitioner research.

Dretske (1999) regards knowledge as a production that is made from raw material – information. Zack (1999) defines data as observation or facts, with information as data in a meaningful context and knowledge as meaningfully organized accumulation of information. Greenwood (1998) suggests that information is raw material and knowledge is information, which is valuable for a specific organization. Kock and McQueen (1998) regard data as carrier of information and knowledge, information as relating to descriptive and historical fact, and knowledge as new or modified insight or predictive understanding. Knapp (1997) defines information as raw material and knowledge as selected useful information for certain jobs. Vance (1997) suggests that knowledge is authenticated information and information is interpreted data. Harris’s (1996) definition states that data is known fact, information is analyzed data, and knowledge is a combination of information, context, and experience. Bohn (1994) suggests that knowledge is something that prescribes what to do (e.g., prediction), information is organized or structured data, and data is raw material. Kogut and Zander (1992) define information as factual statement and knowledge as a statement of how to do (e.g., recipe).

The common factor of those definitions is that ‘knowledge’ is located at the top of a hierarchical structure. This indicates that information is one representation of knowledge, but information itself is not knowledge. Churchman (1971) notes that to define knowledge as a collection of information does not consider the complicated interactions between the users of information and the collection of information. The implication is that knowledge is a combination of a process element (such as, e.g., authentication, user’s perception, or context) and information. Arguably, this viewpoint implies that knowledge and information are not radically different from each other but represent different aspects of the same, freely convertible into each other. Once information is processed through the user’s brain, it becomes the user’s knowledge. When the user articulates knowledge with the intent of transmitting it, it becomes information. Blumentritt and Johnston’s (1999) knowledge–information model describes this viewpoint well, implying that a tool to
support knowledge management can be developed on standard information technologies. The information technologies can be the platform for effective knowledge management.

However, within the value chain school of thought, there are different views on the status of knowledge made from information. One group of researchers regards knowledge as an object (e.g., Zack, 1999; Greenwood, 1998; Knapp, 1997; Hibbard, 1997; Vance, 1997; Tenkasi & Boland, 1996; Gopital & Gagnon, 1995; Zeleny, 1987) that is stored and manipulated. Once information has been proved to be true or useful in a context, then it becomes applicable knowledge and is stored.

The second school of thought defines knowledge as a process related to application (e.g., McDermot, 1999; Zack, 1999; Frappaolo & Capshaw, 1999; Bohn, 1994; Kogut & Zander, 1992). Detailed procedures of application or applicability depend on the users’ interpretative capabilities. Harris’s (1996) viewpoint can be classified as a belief in mind, i.e., personalized information or the cognitive status of knowing. This frequently adopted viewpoint coincides with, e.g., Blumentritt and Johnston (1999), Sveiby (1998), Takeuchi (1998), Marshall (1997), Malhotra (1997), Nonaka and Takeuchi (1995), and Nonaka (1994). Nonaka and Takeuchi (1995) identify both justified belief and commitment anchored to the overall epistemological structure of the holder as key ingredients of ‘knowledge’. Spender (1996) further adds to this definition of Nonaka and Takeuchi that to know is to be able to take part in the process that makes the knowledge meaningful. Davenport, Long and Beers (1998a) conclude that knowledge is a high-value form of information that is ready to be applied to decisions and actions.

Recently, many researchers have been trying to define knowledge in a more managerial context. KPMG (1998) defines knowledge as business information about customers, products, processes, and competitors. Consequently they argue that knowledge can be filed on paper or in electric form. Im and Hars (1998) deconstruct knowledge into its components (e.g., document templates), frameworks (e.g., ISO 9000), patterns (e.g., best practices), and general principles (e.g., organizational vision). Millar, Demaid and Quintas (1997) suggest five categories: catalogue knowledge (know-what), explanatory knowledge (know-how), process knowledge (know-how), social knowledge (know-who), and experiential knowledge (what-was). While less concerned with academic distinctions and definition, these debates on knowledge are particularly well placed to become concerned with managerial initiatives (e.g., better decision making or faster responses to key issues).

A further key question of knowledge research concerns the relationship and interaction between tacit and explicit knowledge. Tacit knowledge resides in the individual’s experience and action. Explicit knowledge is codified and communicated in symbolic form or language. Nonaka (1994) posits the notion that knowledge is created by the interaction between tacit knowledge and explicit knowledge. The boundary between explicit and tacit knowledge, however, is not clear. Spender (1996) indicates that the boundary is both porous and flexible. This means that tacit knowledge is created by explicit knowledge and vice versa. The other problem of the dichotomy is an overemphasis on tacit knowledge. Tacit knowledge is presumed to have more value than explicit knowledge because tacit knowledge is very difficult to articulate. The real danger of this assumption is to regard tacit knowledge per se as a central force of knowledge management. Bohn (1994, p. 62) defines (technological) knowledge as “understanding the effects of input variables on the output”. He suggests that knowledge is valuable when it can be explicit. Tacit knowledge is important not because it cannot be articulated, but because it has not been articulated yet. The
task of knowledge management is to identify and facilitate the utilization of valuable tacit knowledge that is potentially useful when it becomes explicit, not to elucidate tacitness itself.

There are two main theoretical perspectives of the interaction types of tacit and explicit knowledge, focusing on taxonomy in character and on the nature of organizational knowledge respectively. The taxonomists understand organizations as interpretation systems. In this view, the organization is a system that produces and tests knowledge. Fleck (1997), Spender (1996), Blackler (1995), and Collins (1993) suggest a matrix of knowledge based on such criteria as tacit, explicit, individual (created by and resides in individual), and social (created by and resides in social interaction) knowledge. Taxonomies of knowledge are summarized in Table 1.

Using the analysis provided by value chain school of thought, the taxonomists’ knowledge definitions can further be classified into three categories, namely, state of mind, process, and object. The Automatic/Embodied/Tacit school regards knowledge as situated in the mind. The Conscious/Embrained/Informal/Contingent and the Collective/Embedded/Encultured/Meta/Contingent views see knowledge as a process. The Objectified/Encoded/Formal perspective considers knowledge as an object.

In contrast the second theoretical school is concerned with the nature of organizational knowledge (e.g., Cook & Brown, 1999; Brown & Duguid, 1998, 1991; Shah, 1998; Nicolini & March, 1995; Krogh, Roos & Slocum, 1994; Gergen, 1994; Weick & Roberts, 1993; Walsh & Ungson, 1991) and models organization based on human brains or minds. They emphasize the connectivity of the brain and argue that individual knowledge is developed in response to social systems which the individual is engaged in. Such individual knowledge becomes a collective knowledge of social systems. Thus, in this view, the organization is a distributed knowledge system.

The differences in viewpoints on knowledge suggest different implications for knowledge management (KM) strategies and implementing systems, as summarized in Table 2.

McQueen’s (1998) research on four views of knowledge integrates the different views by treating them as different aspects of knowledge as summarized in Table 3.

The above discussion of the underlying characteristics of the hierarchical, taxonomist, and collective knowledge perspectives points to two shared fundamental core characteristics of the multitude of knowledge definitions which are therefore adopted in this paper. First, knowledge is

Table 1
Knowledge matrix

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>Automatic/embodied(^b,c)/tacit(d)/instrumentalities(d)</td>
<td>Instinctive skill, know-how, or technique of individual</td>
</tr>
<tr>
<td>Conscious/embrained(b,d)/informal(b)/contingent(d)</td>
<td>Explicit knowledge of individual, syntax of individual speech</td>
</tr>
<tr>
<td>Collective/encoded(b)/encultured(d)/meta(d)/contingent(d)</td>
<td>Tacit knowledge of social system, corporate culture</td>
</tr>
<tr>
<td>Objectified/encoded(b,d)/formal(d)/symbolic(c)</td>
<td>Explicit knowledge of social system, operation manual, signs</td>
</tr>
</tbody>
</table>

\(^a\) Spender (1996).
\(^b\) Blackler (1995).
\(^c\) Collins (1993).
\(^d\) Fleck (1997).
information validated through a proof against experience either by the individual or the organization. Thus, knowledge is distinguished from opinion or speculation and can be repeatedly used for effective action (e.g., problem solving). Second, tacit knowledge becomes explicit through both interrelated individual actions and collective organizational activities. Thus knowledge is transferable when individuals or organizations share the context.

### 2. Knowledge management

A universally accepted definition of KM does not yet exist. Ideally such a definition would bring out the tensions between the emerging knowledge-based view of firm and the two most frequently adopted organizational strategies in the last decade – process re-engineering and re-structuring. Scarbrough (1998) discusses that the knowledge-based view of a firm focuses on fostering specialization of employees’ knowledge and on creating internal networks of these human knowledge sources, while business process reengineering focuses on external relationships for rapidly growing performance complemented by generalization of the knowledge source. A better understanding of the degree of compatibility between KM and process reengineering and re-structuring is needed to aid the reduction of existing tensions and to facilitate the advancement of the application of KM best practice.

Both restructuring and process engineering can pose problems of implementation which, in many circumstances, might well be remedied through the application of KM principles. Typically, restructuring aims at maximizing local utility (e.g., profit) through the empowerment
of organizational fractals with each component part deciding its own behavior. Due to bounded rationality, however, there may be inconsistent goal settings among fractals. This may lead to conflicts with customers’ preferences. Likewise, process reengineering assumes that an organization is able to precisely describe and analyze enterprise-wide business process. This requires a centralized approach or at least a global perspective (Hammer & Champy, 1995). In contrast, KM assumes that tacit knowledge is highly context-dependent (Tsoukas, 1996), the transfer of knowledge is problematic and requires an integrating mechanism (Kogut & Zander, 1992), and knowledge is developed by interactions between individuals and organization. Although all three strategies have many other different characteristics and the complexities are hard to capture in brief, the main relationships between them can be summarized as in Fig. 1.

While there is debate as to whether knowledge itself is a cognitive state, a process, an object, the description of KM as a process, based on understanding organization as a knowledge system (Grant, 1996), dominates. This view examines the nature of individual knowledge and collective knowledge, and their interactions. While authors differ in the terminology used in describing the KM process, the aggregate of their works can be described as a simple KM value chain as depicted in Fig. 2.

The KM value chain reflects sociology of knowledge. Tsoukas (1996) indicates that individual knowledge is built up by social practices engaged in by the individual; therefore the two kinds of knowledge are highly interdependent. Thus, the value chain can be used to explain to some degree social knowledge and its interactions with individual knowledge. It is essential that the KM value chain should be strategically driven in order to realize the objectives of an organization, and resulting in a continuously cycling process.

Knowledge creation relates to knowledge addition and/or the correction of existing knowledge. Nonaka (1994) and Nonaka and Takeuchi (1995); Nonaka, Reinmoeller and Senoo (1988) suggest a comprehensive model of knowledge creation. The model emphasizes interactions between individuals and organizations. Due to the emphasis on interaction, questions of knowledge overload (Maes, 1994) and limited cognitive capability problems (Skyrme & Amidon, 1997; Nonaka et al., 1988) arise. A further key question concerns the ontological platform (Nonaka

Fig. 1. Conflict and compatible factors among strategies.
et al., 1988) required to make the knowledge creation model operational and to devise suitable incentive systems.

Knowledge storage relates to individual and organizational memory. While organizational memory reflects the shared interpretation of social interactions, individual memory depends on the individual’s experiences and observations. As an individual represents the fundamental unit of memory, staff turnover and other sources of disorder are organizational barriers to effective memory retention. Other main questions concern the nature of trade-offs between semantic (declarative) and episodic (procedural) memory (Hutchins, 1991), the need for search processes taking context into consideration (Moorman & Miner, 1998), and the conflict resolution methodology as organizational memory reflects conflicts between organizational units (Levitt & March, 1988). Another important question is related to the individual’s concern about potential power shifts as he or she shares informal knowledge.

Knowledge distribution is the dyadic exchange of knowledge between source and receiver. As information technologies advance, the gap between sources and users widens (Junnarkar & Brown, 1997). Thus, identification and transfer of knowledge emerges as one of the most important and widespread practical managerial issues. This parallels the problems with the user’s capability to process knowledge gained. User capability is determined by both the user’s own frame of reference and cognitive ability (Husyman, Creemers & Derkson, 1998). It also relates to the extent of access to knowledge, as reflected in investigations of ‘sticky knowledge’ (Von Hippel, 1994; Szulanski, 1996; Pascarella, 1997; Detmer & Shortliffe, 1997). Knowledge application seeks to locate the source of competitive advantage. Here a major challenge is how to integrate internal knowledge and the knowledge gained from outside. Studies on teams, feedback mechanism, rewards for integrating knowledge, advice network, and inter-functional climates for internal integration of knowledge have occupied attention (Lyles, 1988; Moenaert & Souder, 1990; Hamel, 1991; Levintthal & March, 1993). Boundary spanning positions, formal strategy for knowledge acquisitions, and rewards for attaining knowledge have been investigated for external knowledge integration (Hamel, 1991; Pisano, 1994; Leonard-Barton, 1995). Grant (1996) adds to that by suggesting other mechanisms such as ‘directives’, ‘organizational routines’, and ‘self-contained task teams’.
3. Future research directions

In order to present important research issues the pursuit of which would lead to the enhancement of knowledge usage in an organization, research questions related to each step of KM value chain can be categorized into five interrelated main research streams.

3.1. The impact of culture on knowledge creation

Krogh (1998) suggests that cultures with a quality of ‘care’ facilitate organizational members’ communication and sharing of knowledge. Based on studies of the relationship between R&D productivity and the information environment in the pharmaceutical industry (see Koenig, 1983, 1990, 1992, 1992a), Koenig (1995) also finds that the information environment of the more productive companies is significantly distinct from that of the less productive companies. Koenig (1995) argues that the more productive companies are characterized by greater openness and access to information, both internal and external, and unobtrusive managerial structure.

This thematic area aims at investigating the relationships between knowledge creation and certain types of organizational culture. The underlying concern of this area is the tacitness of knowledge. A related area to investigate is organizational design. Nonaka et al. (1988) suggest that knowledge creation can be influenced by space, which involves availability and accessibility of knowledge. This suggestion brings out two research streams. The first investigates the extent of context sharing – and looks at which environment is best suited to create knowledge (out of tightly connected in shared space, loosely connected in distant place and other combinations). The second stream looks at how to implement the operational model ‘action–reflection–trigger’ (ART) of socialisation–externalisation–combination–internalisation (SECI) process (Nonaka et al., 1988).

3.2. Knowledge location and quality management

Hu, Hung, Kuse, Su and Wang (1998) suggest that the quality of information is one of roadblocks in transforming individual knowledge into organizational knowledge. This problem is created by the high noise-to-signal ratio of the non-essential content of knowledge repositories. This problem also arises due to a lack of reliable approaches to the quality measurement of knowledge. The problem is most serious when the knowledge base is growing and knowledge seeking needs much time and efforts. If the problem deepens, it may adversely impact on knowledge sharing and ultimately on knowledge creation. The question is how to reapply the individual’s knowledge and how to filter out valuable from less valuable knowledge.

3.3. Knowledge absorption

Individual human agents have their own unique mental representation of the world and, itself is a subject of representation (Tsoukas, 1996). Tsoukas also suggests that to relate unarticulated background to human understanding, we have to be equipped with subsidiary particulars, a focal target, and a person who can link the two. This means that it is not sufficient to provide codified knowledge and to ask individuals to understand it. Another line of concern is to do with the
potential negative consequences of the possible blind application of existing organizational memory. If an individual uses existing knowledge without any modification acceptable to a new situation, it may provoke disaster. The issue is how to support the individual’s choices to adapt knowledge to a given situation.

3.4. Knowledge awareness

Nonaka et al.’s (1988) ART system suggests that knowledge should be built up by identifying other individuals’ knowledge needs as the first stage. The individual level of knowledge management application concerns the factors by which cognitive processing is triggered. The traditional view is that information is distributed as an outcome of a ‘desire to get information’ approach. The underlying problem of this approach is to assume that a man who has knowledge already knows what he knows (Davenport & Klahr, 1998). A second problematic assumption is that the users who want to get knowledge know in advance what they want to have. This is opposite of the learning viewpoint. Huber (1991) also indicates that one of chief problem in organizational memory is that members who want to find information often are not aware of the existence of information processed by other members. The issue is how to develop organizational and technical strategies to generate awareness of what knowledge is needed and known.

3.5. Knowledge evaluation

KPMG (1998) reports that the reasons for the creation of knowledge management initiatives cited by most companies are facilitating better decision making, increasing profit, and reducing costs. There is a common belief that knowledge management brings a competitive advantage to the company. One of the most important managerial concerns is which process (e.g., security of knowledge or rapid knowledge creation) contributes most to the competitive advantage. Another line of concerns is how to measure the performance outcomes of an implemented knowledge management process in an organization. These concerns are about the extent to which how knowledge management efforts coincide with and support organizational strategies.

The related research questions of the five research streams are described in Table 4.

4. Knowledge flow

KPMG’s (1998) survey suggests that the biggest barrier to organizational knowledge usage is a blocked channel between knowledge provider and knowledge seeker. Blockages arise from causes such as temporal limitations, lack of staff motivation and willingness, and lack of incentives. Ruggles’s (1998) study of 431 US and European companies shows that ‘creating network of knowledge workers’ and ‘mapping internal knowledge’ are the top two ‘should do’ missions for effective knowledge management. Knowledge flow is concerned with developing channels or networks between knowledge provider and seeker and seems to be the most practical area in KM.

Knowledge flow in an organization is fundamentally driven by communication processes and information flows. Analyzing communication theories, Krone, Jablin and Putnam (1987) observe
that all communication systems consist of a sender (source), a message, a receiver, a channel, and coding/decoding schemes. Some researchers (e.g., Von Hippel, 1994; Szulanski, 1996; Leonard-Barton, 1990; Rogers, 1983) suggest that knowledge flow is most likely influenced by four factors: knowledge transferred, source, recipient, and context in which the knowledge flow takes place. On the other hand, some other researchers exclusively emphasize characteristics of knowledge transferred as the most influential factor for effective knowledge flow (e.g., Zander & Kogut, 1995; Winter, 1987) or the context (e.g., Arrow, 1969). However, Von Hippel and Szulanski’s studies indicate that all four factors relate to knowledge flow although to varying degrees of statistical importance. Thus, this paper adopts all four factors as a framework to find barriers, which prevents effective knowledge flow.

These various barriers to knowledge flow identified from a review of the literature, and their relationships with the main research streams identified on KM value chain are summarized in Table 5. This summary shows that research in the two fields of KM and knowledge flow overlaps in all thematic areas identified in developing a future research agenda, except for the area of knowledge evaluation (however, the latter could also be incorporated as a concern over quality monitoring and evaluation of knowledge flow systems and processes).
The following offers a critical analysis of the four main research streams from the perspectives of knowledge flow taking the barriers shown in Table 5 into consideration.

4.1. Knowledge absorption and knowledge awareness

Many researchers have noted the difficulties of knowledge flow under conditions of weak co-location (Cohen & Levinthal, 1990; Gupta & Govindaraja, 1991; Appleyard, 1996). Co-location means sharing of place. Sharing of (working) place implies a high probability of face-to-face contact and frequent responses to actions. In a co-location environment, individuals meet each other relatively easily and often purposefully, and enjoy face-to-face communications. As a result of this interactive communication process, individuals can understand relatively easily each other’s actions and the background. Through shared context, co-location implies common language (verbal and non-verbal) and achieves high levels of understanding (Dougherty, 1992;
Brown & Duguid, 1991). The relationship between the shared context and the level of understanding highlights the relative immobility of knowledge-based resources (Stopford, 1995).

Many consulting companies’ efforts (e.g., Anderson Consulting’s Knowledge Xchange® (URL: http://ac.com:80/careers/location/asg/asg_thought_kx.html)) show how, at least in theory, co-location may be simulated by geographically dispersed firms by developing effective systems for the storage and transfer of knowledge. The systems can then function as a virtual place and act as building blocks of emerging global electronic communities.

However, these theoretical efforts may be deceptive when it comes to practical application. The development of communication channels does not necessarily guarantee a full understanding of knowledge which prevents blind application. A recipient is assumed to understand knowledge enough to decide upon it. Knowledge, specifically tacit knowledge, resides inside the individual or organizational units. Thus, what flows is ‘representation’ of knowledge. Knowledge recipients try to interpret knowledge in their own contexts. Thus, there is no guarantee that recipients’ and senders’ interpretations of knowledge would be the same (Brannen & Wilson III, 1996). To minimize the risk arising from context-dependent knowledge, formal methodology should be developed, in order to guide matching knowledge with recipient requirements, thus increasing the probability of a correct interpretation.

One possible direction for methodology development is to investigate how to break down complex knowledge requirements and map causal relationships among the resultant components. The same approach can be applied to knowledge awareness. Knowledge awareness may be resolved fundamentally by analyzing the basic building blocks of given problems which are the elements of collective knowledge. Since human beings have limitations in cognitive processing, a tool that can enhance analyzing inter-relationships and resolving conflicts among the building blocks should be developed.

4.2. Culture and knowledge creation

Knowledge is produced via an iterative process between idea generation brought about by continuous investment in innovation and idea validation through experiential tests of proof. Because such investment and tests are costly, the resultant valuable knowledge is unlikely to be shared, and the ownership of knowledge can potentially earn Ricardian rents (see Perroni & Whalley, 1998; Montgomery & Wernerfelt, 1988; Winter, 1987; Singer, 1981; Dewey, 1979).

Ricardian rents are earned when a firm has more productive factors to carry out an activity than other firms have for the same activity. When Ricardo (1973) studied these rents, he used land as an example. Good land produces more agricultural outputs per acre, thus at lower unit cost, than poor land does. In the modern world, most production factors are machinery, workers, and operational systems, not land. These factors are deliberately created by knowledge. This knowledge can contribute to developing better machinery or systems, and equipping workers with better know-how (Spender, 1994). Thus, Ricardian rents in modern firms can be generated from knowledge because a firm with superior knowledge can produce unique or better products (Liebeskind, 1996).

Williamson (1979) emphasizes the benefits of control in response to situations in which there are difficulties in writing or enforcing complete contracts (see also Williamson, 1971, 1983; Teece, 1980; Klein, Crawford & Alchina, 1978). The fundamental thought of this argument is that, first,
transactions will be organized in the firm provided that the cost of doing this is lower than the cost of using the market. Second, the costs of constant re-contracting with an outside firm can be higher than signing a contract with employees inside the firm. Third, contractual relationship between separately owned rights can be plagued by opportunistic behavior in situations in which there is large amount of surplus but there is no ex ante contract on a clear division of the surplus.

Grossman and Hart (1986), however, indicate that transaction cost-based arguments do not exactly address the benefits of organizing transactions in the firm (see also Barkos & Nault, 1997; Brynjolfsson, 1994; Hart & Moore, 1990). They postulate that, to exactly address the benefits, transaction cost-based arguments should investigate both the scope of behavioral changes of a self-interested owner according to the contractual relationship (e.g., when the self-interested owner becomes the employee of the other owner) and also the definition of integration (e.g., who is more committed to the firm between employees and sales agents). These arguments are fundamentally based on the fact that real world employment contract is almost always ‘incomplete’. Grossman and Hart (1986, p. 695) presume that integration does not change the cost of contract, but ‘who has control over the provisions not included in the contract’. There are always some unforeseen contingencies which are often too expensive to enumerate in detail. Thus, an organization can create only quasi-property rights to govern knowledge. In particular the right to sell is problematic with regard to knowledge. Because knowledge, in particular tacit knowledge, resides in the individual and is difficult to protect legally, an individual always has a latent incentive to reject knowledge sharing and sell knowledge by leaving an organization. Therefore there is a clear need for rewarding knowledge ownership. The question remains how to distribute knowledge ownership between the organization and the individual. The ideal solution must balance the organization’s and individual’s bargaining positions because such equilibrium guarantees minimal loss of knowledge value.

4.3. Knowledge location

Sharing all knowledge between all individuals would be inefficient, not to say impossible. Even if the exact knowledge required is transferred to the recipient, there are still numerous potential barriers to the recipient’s correct interpretation. Cognitive psychologists have concluded that the amount of information processed by humans under varying information-processing loads actually follows an inverted U-shaped curve (Taylor, 1984). As noted in many decision-making studies, decision-makers often face the trade-offs between quality information and accessible information. When there is time pressure, the decision-makers tend to accept lower quality information that is more accessible (O’Reilly, 1982; Todd & Benbasat, 1991; Ahituv, Igbaria & Sella, 1998). One of the appropriate goals of knowledge management in an organization would be to provide rapid access to quality knowledge.

The other challenge of knowledge location is that individuals are seldom aware of the existence of the knowledge they are looking for. This can be the case regardless of co-location (Kogut & Zander, 1996) and modern geographically distributed organizations, in particular lateral organizations, have similar problems (George, Easto, Nunamaker & Northcraft, 1990). One of solutions is to build a tool to expand individuals’ networks. The solution may be achieved by locating domains of knowledge and tracing utility of knowledge to given problems.
5. Discussion and conclusions

Epistemological debates on knowledge have shown the multi-faceted nature of knowledge and its dependency on organizational settings. Many researchers still regard knowledge as an intangible being and focus on philosophical aspects (e.g., Sveiby, 1998; Malhotra, 1997). However, increasingly a research perspective is emerging which takes on a more managerial focus and attempts to develop practical KM tools for real-life business application. While the first group emphasizes the tacit and cognitive aspects of knowledge, as located in the human brain, the latter group of researchers focus on the process of explicit knowledge creation and the application of information technologies and other methodologies. At first glance, it may seem that the two schools have no common grounds and objectives. However, definitions from both perspectives do share the important insight that knowledge is fundamentally different from information and data, and that it is a competitive resource. This insight implies three important facts. First, knowledge should be found and used in any form. Second, knowledge resides in human and makes great contributions to human actions such as decision-making. Third, knowledge is transferred by interactions such as communication.

The above second implication is supported by the taxonomists’ views of inseparable characteristics of explicit and tacit knowledge and the perspectives from collective knowledge that individual action/contribution is based on the belief of validity or usefulness of his knowledge. As noted before, this implication distinguishes knowledge from speculation or opinion. The concept also takes knowledge into management dimension because it expresses an ontology of knowledge. The above third implication is supported by the taxonomists’ views on knowledge being articulated by communicating about and analyzing given problems and views from collective minds that new organizational actions are developed by individuals’ action enacting collective knowledge. These concepts emphasize the practical function of KM – that is, KM is to find and use valuable tacit knowledge that is useful for specific problems and to develop an environment facilitating communications.

The above discussion has also highlighted the different school of thought present in the current debate on KM, which was related to other existing business strategies such as restructuring and process reengineering. The strength of KM lies in its emphasis on knowledge as a core asset, which it aims to make tangible. Whereas restructuring emphasizes the retention of tacit knowledge and its usefulness for business, KM gives equal weighting to both tacit and explicit knowledge, thus counteracting any potential weakness restructuring may have in co-ordinating the two. Process reengineering focuses on the collective mind, which – from a KM perspective – may result in the loss of tacit knowledge situated in the individual. KM is not suggested as a means of replacing existing strategies, but as a way of compensating for the above weaknesses. It can contribute as a unifying tool for bringing together the other strategies by focusing on core competence.

While knowledge can be described as belief in mind, process, or object, most researchers look on KM as a process. This is rooted in the view of the organization as a knowledge system and knowledge as competitive resources. As the existence of an organization implies social interactions with and between the individual who make up the organization, KM also consists of an interaction procedure – or value chain – linking up individual knowledge to create social knowledge. The procedure includes creation, storage, distribution, and application. To deliver value, this procedure must become a controlled implementation aspect of organizational strategy and vision.
Knowledge creation is mainly related to finding more sources of knowledge, as well as the extension of the knowledge network. Knowledge storage is about offering a wider and deeper historical knowledge base, and facilitating ease of knowledge retrieval. Knowledge distribution is about offering more communication channels, and enhancing the collective mind. Knowledge application is about offering knowledge integration methods to solve various problems.

As each phase of the value chain is interrelated with the others and, in practical application terms, based on an organization-specific context, they all share the same barriers for effective chain development. The analysis on the value chain reveals five major research streams which should be pursued in the future to develop managerial tools for more effective KM. They have been discussed under the umbrella headings of ‘culture’ (e.g., how to care for good working place), ‘knowledge location’ (e.g., how to find quality knowledge in time), ‘absorption’ (e.g., how to adapt knowledge gained), ‘awareness’ (e.g., how to support ontology of knowledge) and ‘evaluation’ (e.g., how to measure the performance of knowledge management efforts). Because of the direct relationships between the issues identified under these headings and the value chain, they can also be conceptually presented as a research circle, as shown in Fig. 3.

Conceptually and managerially, ‘culture’ has been identified as the most fundamental issue over all KM researches. The themes of ‘knowledge location’, ‘absorption’, and ‘awareness’ can be depicted as the source of cyclic research questions. ‘Knowledge evaluation’ should be performed at each arc to drive the chain toward the right direction for competitive advantage. Thus the model presented in Fig. 3 serves to integrate the different streams of the current academic debate on KM and is intended to serve as a holistic theoretical framework to guide both future research and managerial thinking.

The latter is of particular importance, because even though there are many reports on KM, there are still some doubts over the viability of KM in real business. Some researchers have expressed concern about it being a mere fad (e.g., Whiting, 1999). To deliver practical value, KM needs to focus on problems that require immediate solutions. Thus it is clear from the survey studies discussed above (KPMG, 1998; Ruggles, 1998), that one of the most important research fields to be developed is the area of knowledge flow, an issue which penetrates and impacts on all of the five research streams identified. A likely research agenda would encompass questions of the minimization of misunderstandings, especially in the context of non-co-location environments;

Fig. 3. Five research streams.
the facilitation of accessibility of quality information; the generation of a win-win equilibrium in
the distribution of the ownership and ‘rent’ of knowledge between individual and organization; as
well as issues of reducing the costs of ‘re-inventing the wheel’ via incentives for knowledge sharing.

In tackling these issues, three research questions in particular should be awarded priority status.
First, to extract context independent knowledge, a common tool is required which will enable the
recipient (e.g., decision-maker) and the source to achieve a shared perception of the given problem
and to identify the knowledge required for the particular area of concern. Second, a method to
support knowledge location is required which will help the decision-maker maximize the utility of
knowledge and to evaluate potential trade-offs between accessibility and quality. The numerous
knowledge location methods currently in existence (intuitive process (Wegner, 1986), critical
document storage (Kovel, Quirk & Gabin, 1996), organizational intranet (Zorn, Marshall &
Paned, 1997; Senna, 1997), group member’s directory (Anand, Manz & Glick, 1998), and taxo-
nomies of knowledge (Olley, 1997)) are too narrow in their capabilities of supporting the clas-
sification of knowledge or providing a truly useful content directory. These methods have only
limited uses, i.e., when there are only a few sets of knowledge and recipients know exactly what
they want and can therefore estimate the value of knowledge. Third, to reward knowledge
sharing and to prevent staff turn-over, there must be a mechanism to analyze the costs and benefits
of different patterns of knowledge ownership and control and of establishing the context-specific
relative importance of ownership in the context of knowledge flow which can be defined as a set of
participants and a portfolio of assets. In conclusion, it is envisaged that the model depicted in
Fig. 3 should be a helpful starting point for developing such tools and laying the conceptual
foundations of an integrated framework for the development of truly useful and effective practical
KM tool.

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