Knowledge Management Orientation:

Construct Development and Empirical Validation

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Abstract

We introduce the concept of *knowledge management orientation* (KMO) – the degree to which a firm demonstrates behaviors of organized and systematic knowledge management (KM) implementation. Based on an extensive review of the KM literature, the KMO concept is operationalized as a second-order latent construct consisting of four main component factors: organizational memory, knowledge sharing, knowledge absorption, and knowledge receptivity. We then validate the KMO construct using data from 213 United Kingdom firms. The findings provide strong support for the unidimensionality, reliability, discriminant validity, and convergent validity of the KMO construct. We also test the impact of KMO on firm performance and find a significant, positive relationship, providing support for the predictive validity of the KMO construct. Our findings suggest that KMO is an effective measure of the firm-level KM-oriented behaviors. The theoretical, methodological, and practical implications of the KMO construct are also discussed.

Keywords: Knowledge management orientation, scale development, confirmatory factor analysis

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Introduction

Knowledge management (KM) encompasses cross-disciplinary concepts and practices. Specifically, the information systems (IS) literature has long encompassed a formal approach to KM (Earl, 2001). The fundamentals of this formal approach are to capture information in knowledge-based systems, through which such information is made available and accessible to others in the organization for decision making purposes. While knowledge-based systems are essential to KM efficiency, the management literature has established that tacit knowledge (such as personal experience), although it cannot be easily codified and stored, plays a crucial role in KM effectiveness (Gupta and Govindarajan, 2000). The tacit element of KM has been increasingly embraced by IS research, as pointed out by O'Keefe and Paul (2000, p.1): "We know in IS research that implementations driven by just technology, or just strategy without technology understanding, or sometimes those that simply ignore personal factors, are often doomed." Through a case study of a global European bank, Newell et al. (2001) vividly illustrate that Intranet technology by itself could not achieve organization-wide sharing of information. Most recently, the *European Journal of Information Systems* 2006 Special Issue "Facilitating – or inhibiting – knowing in practice" was dedicated to the cross-fertilization of KM literature from IS and organization studies perspectives. In the Guest Editorial, Newell and Galliers (2006, p.441) comment that "knowledge enables the interpretation of data to provide information in a particular context or for a particular purpose so that information systems are key to understanding knowledge processes."

In relation to the above literature, our core argument, framed in the knowledge-based theory of the firm (Kogut and Zander, 1992; Nonaka and Takeuchi, 1995; Grant,

1996), is that a firm's capability and mechanisms to manage both explicit and tacit knowledge as well as the conversion between tacit and explicit knowledge, are of paramount importance to KM efficiency and effectiveness, and consequently firm performance. The knowledge-based theory emphasizes that knowledge is a valuable strategic asset (Davenport et al., 1998; Brown and Duguid, 1998), and that performance differences between firms are a result of their different knowledge bases and differing capabilities in developing and deploying knowledge (Bierly and Chakrabarti, 1996). A firm that is better at exploiting the existing knowledge and exploring new knowledge demonstrates dynamic capability that is required to compete in the highly competitive marketplace (Prieto and Easterby-Smith, 2006). Grant (1996) goes further and suggests that the knowledge-based theory goes beyond the simple acquisition and creation of knowledge, and that it is the firm's ability to integrate individuals' specialized knowledge that gives the firm its *raison d'être* and competitive advantage. The underlying assumption is that the better a firm is at KM, the more competitive it will be in the market, and the better its performance. However, such a theoretical proposition is still subject to empirical testing. In particular, there is little research on the effect of a firm's systematic KM implementation on firm performance. Exacerbating the research gap is the lack of validated and robust KM constructs.

We introduce the concept of *knowledge management orientation* (KMO), grounded in the knowledge-based theory of the firm (e.g., Grant, 1996), the knowledge-creation perspective (Nonaka and Takeuchi, 1995), information processing theory (Huber, 1991), and organizational learning theory (Sinkula et al., 1997). More specifically, we define KMO as the degree to which a firm demonstrates behaviors of organized and systematic KM implementation in terms of building on its *existing* knowledge (organizational memory) as well as sharing tacit knowledge (knowledge sharing), assimilating external knowledge within the existing, internal knowledge frame (knowledge absorption), and being receptive to *new* knowledge (knowledge receptivity)

(e.g., Szulanski, 1996; Holtshouse, 1998; Popper and Lipshitz, 1998; Davenport et al., 1998; Hansen et al., 1999; Gray, 2001; Alavi and Leidner, 2001; Hult, 2003). The four dimensions of the KMO concept encapsulate the organizational mechanisms of managing explicit and tacit knowledge within and from outside the organization, and underpin KM efficiency and effectiveness, which are conducive to firm performance (Gupta and Govindarajan, 2000).

The objective of this study is first to conceptualize the KMO construct and its four key component factors. We then validate KMO as a second-order construct using data from 213 United Kingdom firms. Furthermore, we test whether KMO has a direct effect on firm performance, since KM is cited as an antecedent to firm performance (Lee et al., 2005). By pursuing this objective, we aim to answer one key question: "What are the key elements of a systematic KM implementation for improving firm performance?" We intend to make a contribution to the KM and IS literatures by providing a validated KMO construct that can be used in future research to examine the effect of KM on building organizational capabilities and enhancing firm performance, and by providing a practical tool for firms to periodically assess their KM implementation.

Research Background

Grant (1996) considers the knowledge-based view, which focuses on knowledge as the firm's most strategically important resource, to be an outgrowth of the resource-based view of the firm. The resource-based view centers on strategic resources – assets and capabilities that are valuable, rare, and difficult to imitate and substitute (Barney, 1991; Chi, 1994). To the extent that a firm possesses and capitalizes on strategic resources, its performance is expected to be strong (Wernerfelt, 1984). The knowledge-based view argues that the sharing of tacit and explicit knowledge of individuals and groups within a firm, the use of existing knowledge, and the creation of

new knowledge can give rise to strategic resources and capabilities that enable some firms to outperform others (Kogut and Zander, 1992).

While a large body of theoretical work has laid a foundation for KM research (e.g., Grant, 1996; Alavi and Leidner, 2001), and contributed to what Swan and Scarbrough (2001, p.913) refer to as the knowledge management 'field', the knowledge-based view lacks empirical findings to substantiate its theoretical development. This is particularly the case where the effect of systematic KM implementation on firm performance is concerned. This research gap is exacerbated by the lack of robust measures as prior studies have largely focused on specific aspects of KM implementation. For example, the study of organizational memory has a long tradition in the IS literature (e.g., Wijnhoven, 1999; Randall et al., 2001). However, it is increasingly recognized that organizational memory or a knowledge-based system alone is not sufficient (O'Keefe and Paul, 2000; Newell and Galliers, 2006), and tacit knowledge is of paramount importance to KM effectiveness. Knowledge sharing (Nonaka and Takeuchi, 1995; Szulanski, 1996; Bock et al., 2005; Cabrera and Cabrera, 2005) is considered to be an effective mechanism for transferring tacit knowledge and creating new knowledge. Moreover, knowledge creation also requires the assimilation of new, often external, information with existing organizational knowledge, which is referred to as absorptive capacity (Cohen and Levinthal, 1990; van den Bosch et al., 1999). Above all, a knowledge-friendly, learning-oriented culture must be in place to promote a sense of open-mindedness and willingness to take on board new information (Davenport et al., 1998).

While the fragmented (and sometimes contradictory) research findings have stimulated further research, KM theory development requires understanding of systematic KM implementation as called for by Hult (2003) and Newell et al. (2001). The few exceptions that have attempted to examine KM processes in a systematic manner include the work by Lee et al. (2005), Sabherwal and Becerra-Fernandez (2003), and

Darroch and McNaughton (2003). However, each of these studies has theoretical and methodological limitations. Specifically, Lee et al.'s (2005) 'knowledge management performance index' (KMPI) measures the efficiency of a firm's knowledge circulation process comprising knowledge circulation, accumulation, sharing, utilization, and internalization, but overlooks KM effectiveness. While KM efficiency gauges the cost and speed at which knowledge becomes available to the knowledge seeker, KM effectiveness reflects the extent to which the organization receives and understands the knowledge needed to perform its tasks (Gupta and Govindarajan, 2000), and is equally, if not more important than, KM efficiency.

Sabherwal and Becerra-Fernandez (2003), on the other hand, relate KM effectiveness to Nonaka's (1994) four KM processes: internalization, externalization, socialization, and combination. However, their measures of KM implementation were indirectly assessed through examining the usage of 25 KM tools supporting the KM processes. These tools were specific to John F. Kennedy Space Center, and are likely to be unique to the organization under study and, therefore, difficult to apply more generally. Furthermore, Darroch and McNaughton (2003) define and operationalize KM orientation as analogous to market orientation, consisting of knowledge acquisition, dissemination, and responsiveness. Although recognizing that "a knowledge-management orientation is a broader concept, encompassing both *market-based* information and information about *non-market factors* (Italics added)," Darroch and McNaughton (2003, p.572-573) only operationalized KM orientation as "acquiring *knowledge about customers and competitors* (Italics added) and sharing this information between functional areas within a firm." Therefore, whilst acknowledging the value of prior work, we contend that the development of alternative, more robust KM measures to capture firms' systematic KM implementation is essential to uncover the effect of KM on firm performance. Below, we discuss the three stages (i.e. domain

definition, instrument construction, and evaluation of measurement properties) recommended by Lewis et al. (2005), but begin with the definition of the KMO domain.

Knowledge Management Orientation

Our purpose in this paper is to offer an alternative measure to the research community and to enrich the KM field by adding empirical evidence regarding the role of systematic KM implementation in firm performance. We adopt a broad definition of organizational knowledge as "credible information that is of potential value to an organization" (Hult, 2003, p.189) that can enhance a firm's capability for effective action (Nonaka, 1994; Alavi and Leidner, 2001). To enable efficient and effective KM, firms must demonstrate behaviors of organized and systematic KM implementation, which we label as *knowledge management orientation* (KMO). In particular, we focus on four important dimensions of KMO, which have been cited most frequently in the KM literature, namely organizational memory, knowledge sharing, knowledge absorption, and knowledge receptivity (e.g., March and Olsen, 1976; Cohen and Levinthal, 1990; Huber, 1991; Hamel and Prahalad, 1994; Nonaka and Takeuchi, 1995; Szulanski, 1996; Holtshouse, 1998; Popper and Lipshitz, 1998; Davenport et al., 1998; Hansen et al., 1999; Cross and Baird, 2000; Alavi and Leidner, 2001; Becker, 2001; Gray, 2001; Hult, 2003). Each of these component factors has been examined in four theoretical streams that underpin the KMO construct: (i) information processing theory (Huber, 1991); (ii) organizational learning theory (Sinkula et al., 1997); (iii) the knowledge-based view of the firm (Grant, 1996), and (iv) the knowledge creation perspective (Nonaka, 1994; Nonaka and Takeuchi, 1995).

Information processing primarily comprises four dimensions: information generation, dissemination, interpretation, and memory (Huber, 1991; Day 1991; Hult, 2003). Information generation involves the acquisition of new (often referred to as market) information (Day, 1991). The essence of information dissemination lies in the

process by which information is shared and diffused in multiple directions within the organization (Argyris and Schön, 1978). Information interpretation focuses on the process by which information is given commonly understood meaning(s), as Huber (1991, p.89) suggests “an organization learns if any of its units acquires knowledge that it recognizes as potentially useful to the organization.” Finally, memory is the process of knowledge codification and storage (Huber, 1991).

Informed by the information processing theory, Sinkula et al. (1997) develop a learning orientation construct that consists of three elements: commitment to learning, open-mindedness, and shared vision. An organization that is committed to learning is likely to instill a learning culture that stimulates learning activities (Senge, 1990). Moreover, learning sometimes must be accompanied by ‘unlearning’, as deeply routed beliefs and systems may hinder new learning to occur (Sinkula et al., 1997). Therefore, a learning organization must be open-minded and willing to challenge long-held beliefs and assumptions. The learning (and unlearning) culture underpins our KMO construct, in particular, the knowledge receptivity and absorption factors in terms of willingness to take up new ideas.

The knowledge-based view of the firm depicts an organization as an “institution for integrating knowledge” (Grant, 1996, p.109). Individuals, as learning agents, acquire, disseminate, and evaluate knowledge, and create new knowledge (Simon, 1991). However, a prime challenge lies in how organizations integrate individual learning to enhance organizational learning (Sabherwal and Becerra-Fernandez, 2003), in other words, how organizations can collect individuals’ knowledge and share it organization-wide or embed it in organizational memory (Argyris and Schön, 1978). The challenge is highly associated with the nature of tacit knowledge – “knowledge rooted in actions, experience, and involvement in specific context” (Alavi and Leidner, 2001, p.113). Therefore, Alavi and Leidner (2001, p.115) consider organizations as ‘social collectives and knowledge systems”, which consist of four sets of socially enacted knowledge

processes: creation, storage/retrieval, transfer, and application. Specifically, Alavi and Leidner (2001) focus on the implications of these knowledge processes on information technology/system, for example, the usage of information technology (IT) can facilitate knowledge storage and transfer (captured in our organizational memory factor), the development of knowledge directory and 'people finder' (encapsulated in our knowledge sharing factor), and the access to, and acquisition of, external knowledge (encompassed in our knowledge absorption factor).

Finally, the knowledge creation perspective provides additional insights to this study. Focusing on the integration of individual knowledge in organizational knowledge, and the conversion between tacit and explicit knowledge, Nonaka (1994) and Nonaka and Takeuchi (1995) describe a spiral process of organizational knowledge creation involving internalization, socialization, combination, and externalization. Externalization focuses on the articulation of tacit knowledge into comprehensible forms that others can understand (Nonaka, 1994). Socialization involves the sharing of tacit knowledge among individuals. Combination focuses on integration of knowledge at the group and organizational levels, through which new knowledge is generated. For instance, Huang et al. (2001) focus on cross-functional knowledge integration and find that the penetration of different organizational boundaries is important to obtain required knowledge, achieve shared understanding, and reconfigure organizational memory to create new knowledge.

The common themes to emerge from the discussion of the theories above are that the main KM components are organizational memory (Huber, 1991; Day, 1991, Hult, 2003; Grant, 1996, Simon, 1991), knowledge sharing (Huber, 1991; Day, 1991, Hult, 2003; Grant, 1996; Nonaka and Takeuchi, 1995), openness to ideas from within the organization (Sinkula et al., 1997), which we term knowledge receptivity, and openness to ideas from outside the organization (Alavi and Leidner, 2001; Cohen and Levinthal, 1991), which we term knowledge absorption. Informed by the above theories and

perspectives, we delineate the domains of the KM component factors and their linkages to the general KMO construct below.

Organizational memory

Organizational memory is an organizational mechanism that captures, stores, and disseminates knowledge learned from previous experience that can be brought to bear on decisions (Huber, 1991; Walsh and Ungson, 1991). Such knowledge can be explicit or tacit, such as "past events, promises, goals, assumptions, and behaviors" (March and Olsen, 1976, p.62). In an attempt to illustrate that organizational memory exists in every aspect of organizational life, Walsh and Ungson (1991) proposed multiple 'bins' of organizational memory, including organizational culture, transformations of production processes and work procedures, organizational structure, work ecology, and (internal and external) information archives. Nonetheless, in practice tacit knowledge in individuals' minds and organizational routines is difficult to capture and preserve, and therefore, some companies tend to follow a centralized and structured approach to organizational memory, that is, to explicate knowledge in terms of organizational policies and procedures, and often store it in the knowledge repository enabled by information technology (Hamel and Prahalad, 1994; Hansen et al., 1999; Cross and Baird, 2000; Alavi and Leidner, 2001). Whilst recognizing the value of Walsh and Ungson's (1991) multidimensional approach to organizational memory, we take the knowledge repository approach to organizational memory. This helps to distinguish organizational memory from the other component factors of the KMO construct. Specifically, tacit knowledge is encapsulated in the knowledge sharing factor, and organizational culture is captured in the knowledge receptivity factor, which we elaborate below.

The benefits of organizational memory are commonly recognized as allowing the centralization and organization of otherwise scattered information and promoting

knowledge preservation, sharing, retrieval, and use (Hansen et al., 1999). Organizational knowledge is dispersed by nature, for example, in the experiences of project successes and failures. This poses challenges for organizational management in terms of increased resource demand, the lack of knowledge transparency, knowledge asymmetries, and uncertainty in decision-making (Becker, 2001). To alleviate the problem, it is recommended that managers support and foster experiential learning, including experimentation and learning from mistakes (Becker, 2001), and that organizational memory act as a mechanism for the organization to 'remember' what worked successfully and why, so that such information and knowledge can be brought to bear on future decisions (Hult, 2003).

Another important criterion for an effective organizational memory is the maintenance and currency of knowledge captured and stored (Gray, 2001). If left unchallenged, organizational memory could become a source of organizational inertia (Walsh and Ungson, 1991), and may constrain adoption of new knowledge and building of new capabilities (Leonard-Barton, 1992). Thus, an effective organizational memory system must be updated, and serve as a mechanism for remembering what worked and what failed; the latter is equally important as it can be used to refine or delete obsolete routines (Hult, 2003).

Given the above discussion, we build on the 'knowledge repository' approach, and view organizational memory as the extent to which firms collect, codify, store, and maintain a stock of relevant codified knowledge that is readily available for dissemination, with the aid of information technology. In particular, we develop eight items to capture the essence of organizational memory. These include four items (KM1, KM2, KM3, and KM9) based on theoretical insights from Hansen et al. (1999) to measure the extent to which the firm captures, categorizes, stores, and encourages employees to retrieve and use information stored in the organizational memory; two items (KM6 and KM7) based on Gray (2001) to measure the extent to which information

and knowledge stored in the organizational memory is updated, relevant, and sufficient; and two items (KM4 and KM5) based on Becker's (2001) recommendation to measure the extent to which organizations de-brief projects, record good practices and mistakes to inform future decision-making.

Knowledge sharing

Knowledge sharing is the transfer of (particularly tacit) knowledge, skills, and technology among organizational members and between organizational subunits (Tsai, 2002). Whilst explicit knowledge can be captured and stored in organizational memory, tacit knowledge possessed by individuals and embedded in firm practice is 'sticky' (Szulanski, 1996), and hence cannot simply be segregated from its contexts, nor easily codified and stored in organizational memory. Therefore, knowledge repository or organizational memory cannot be used as an effective mechanism to mobilize tacit knowledge. Instead, Nonaka and Takeuchi (1995) suggest that socialization, a process where people socialize and interact with others face-to-face on both formal and informal occasions, is most effective for transferring tacit knowledge and developing shared understandings of information generated (Huber, 1991; Hult, 2003). Moreover, although knowledge sharing is centered on people, moderate use of information technology (i.e. telephone, email, and video conferencing) can facilitate conversations and promote knowledge sharing, as well as connect knowledge seekers with the knowledge owner through the function of a knowledge directory or 'people finder' (Hansen et al., 1999; Alavi and Leidner, 2001).

The quintessence of knowledge sharing is to mobilize knowledge, because effective KM requires a constant flow of knowledge (Holtshouse, 1998). Knowledge flow is a phenomenon that not only occurs through the conventional top-down approach, but also bottom-up and horizontal knowledge exchanges (Mom et al., 2007). It requires multi-directional, mutually beneficial systems of exchange. Sharing information and

knowledge with people at different levels and different functions of the firm as well as with people in the communities of interest enhances the development of shared values and understandings of organizational knowledge (Holtshouse, 1998; Hult, 2003). Knowledge sharing also underlines the collective nature of organizational knowledge (Hult, 2003). As most work is a collective and cooperative venture, most work-related know-how is collective (Brown and Duguid, 1998). The tacit nature of much of such know-how underscores the fact that the willingness to share is critical to knowledge sharing. Davenport et al. (1998) argue that such personal willingness is underpinned by the organization's overall knowledge environment in terms of respect for knowledge and knowledge ownership.

Based on the above discussion, we view knowledge sharing as the extent to which an organization establishes systems and avenues for encouraging organizational members to share (particularly tacit) knowledge. More specifically, we develop eight items to measure knowledge sharing. These include one item (KM8) based on Davenport et al. (1998) to measure the extent to which organizations treat people's (tacit) skills and experience as a very important part of knowledge assets; four items (KM11, KM12, KM13, and KM14) based on the insights of Holtshouse (1998) to measure the extent to which organizational members share information and knowledge vertically (with superiors and subordinates) and horizontally (with people of similar interests even if they are from different departments); and three items (KM10, KM15, and KM16) based on the theoretical insights of Nonaka and Takeuchi (1995) and Hansen et al. (1999) to capture knowledge sharing as facilitated by effective communications, either face-to-face or aided by information technology, and the ease of identifying knowledge owners in the organization.

Knowledge absorption

Knowledge absorption approximates to what Cohen and Levinthal (1990, p.128) define as absorptive capacity, namely "firms' ability to recognize the value of new, external knowledge, assimilate it, and apply it to commercial ends." Lack of absorptive capacity is regarded as a key impediment for firms to exploit outside sources of knowledge (Szulanski, 1996). Firms develop capabilities not just through internal learning, but also through absorption of knowledge from external sources. External new knowledge is often critical to learning and innovation, as evidenced by the development of 'hot spots' – clusters of firms in one industry located in close geographic proximity (Pouder and St. John, 1996). Therefore, a firm's ability to acquire new knowledge and learn from its network is crucial to knowledge creation. It is also argued that close ties in a community limit the chances of new ideas because people in a close-knit network tend to possess similar information (Robertson et al., 1996). Therefore, Alavi and Leidner (2001) suggest that knowledge creation requires organizational members to reach beyond their formal communication lines, and information technology provides an effective aid for individuals to access a wide range of information.

The key to knowledge absorption lies in the combination of external, new information with internal, existing knowledge, and it is the contrast between novelty and familiarity that triggers creative cognition (Ward, 2004). Hence, the organizational capability that enables the maintenance and understanding of different types of knowledge in order to maximize its potential leverage is critical for improving business outcomes (O'Dell et al., 1999). Knowledge absorption echoes what Alavi and Leidner (2001) describe as 'knowledge as a state of mind'. In other words, knowledge absorption requires individuals expand their personal knowledge by exposing to, and exploiting, external knowledge, and applying it to the organization's needs.

Based on the above discussion, we view knowledge absorption as the extent to which a firm acquires external information, comprehends it, and transforms it into firm

embedded knowledge in order to effectively leverage it to deliver better value. In particular, we develop four items to measure knowledge absorption, including two items (KM17 and KM19) based on O'Dell et al. (1999) and Cohen and Levinthal (1990) to measure the extent to which the organization uses knowledge from its past experience and from external sources, but most importantly, through information and knowledge exchange, new ideas emerge to improve the business; and two items (KM18 and KM20) based on the insights of Szulanski (1996) and Alavi and Leidner (2001) to measure the extent to which the organization exchanges and shares knowledge with other organizations or external networks (often aided by information technology).

Knowledge receptivity

Knowledge receptivity reflects the ease with which new ideas are taken up internally. Davenport et al. (1998) argue that in KM-oriented organizations people tend to have a positive orientation to knowledge: employees are intellectually curious, and willing to explore new ideas and consider possible adoption of such new ideas; executives or managers encourage employees to contribute their new ideas without fear of making mistakes. Additionally, a culture that promotes open-mindedness and commitment to learning must be in place (Sinkula et al., 1997). These viewpoints underline a key concept of knowledge receptivity, i.e. new ideas must be received positively, and subsequently evaluated effectively and regularly. Closely allied to knowledge receptivity is the concept of issue orientation, the extent to which new ideas are judged according to their merit, divorced from the identity and status of the contributor (Popper and Lipshitz, 1998). Issue orientation helps to open up communication channels (McGill et al., 1993), and reinforces the mechanism for evaluating the quality and usefulness of the processed information (Hult, 2003).

Another important factor that enhances knowledge receptivity is the incentives for contributing ideas. Extant research suggests that financial rewards and, more

importantly, linking idea contribution to idea development and implementation are effective incentives to encourage people to contribute their ideas (Nemeth, 1997). Popper and Lipshitz (1998) and March and Olsen (1976) also suggest that, for people to be empowered, they must feel accountable for their own actions and consequences. Knowledge receptivity is the facilitative internal counterpart of knowledge absorption. The extent to which external knowledge can be absorbed is reliant on internal perceptions, attitudes, and systems toward new ideas and new ways of doing things. As part of the organizational orientation, it reflects the attitude and internal capacity to ensure open sharing of knowledge and rapid uptake of new ideas. Thus, knowledge receptivity implies a positive attitude toward new ideas, and facilitates the extent of internal uptake and implementation. The more knowledge receptive is the organization, the more accepting and accommodating it is toward new ideas, new systems, structures, and new modes of operating.

Based on the above discussion, we view knowledge receptivity as the extent to which a firm encourages ideas and evaluates them on a fair, effective, and regular basis, and subsequently incorporates them into business practice. Specifically, we develop ten items to measure knowledge receptivity. These include seven items (KM21-KM27) based on the insights of Davenport et al. (1998) and Popper and Lipshitz (1998) to measure knowledge receptivity in terms of whether knowledge is valued as a strategic asset to improve performance, whether people are encouraged to articulate their ideas without fear of repercussions, and whether the ideas from individuals are evaluated equitably and regularly based on their merits; and three items (KM28, KM29, and KM30) based on Nemeth (1997) and Popper and Lipshitz (1998) to measure knowledge receptivity in terms of the effects of financial reward, personal development linked to idea contribution, and personal accountability in creating a knowledge receptive culture.

The KMO construct

We consider KMO as a higher-order phenomenon consisting of the above four components factors; each component factor is important, but not individually sufficient, for reflecting the latent construct (e.g. Barney and Mackey, 2005; Godfrey and Hill, 1995). Theoretically, the four component factors are distinct dimensions of KMO, but reasonably correlated to reinforce the effects of systematic KM implementation. For example, it is noted that organizational memory extracts and detaches knowledge from individuals and hence, significantly reduces a knowledge provider's control over who has access to this knowledge, whilst increasing managers' control over employees (Gray, 2001). It is, therefore, not surprising that employees are sometimes resistant to contributing to organizational memory (Davenport and Prusak, 2000). Organizational memory must be complemented by other aspects of KM, particularly the organization's receptivity to new information and willingness to evaluate such information. Based on the merits of new information, organizational memory must be upgraded and renewed (Hedberg, 1981; Sinkula et al., 1997), so that firms are equipped with up-to-date knowledge to enable them to perceive external changes, and consequently acquire new information as encapsulated in knowledge absorption. In that sense, organizational memory serves both as the 'storage' of knowledge and as the starting point for future knowledge acquisition (Huber, 1991; Hult et al., 2004).

Our KMO measure has several distinct features. Firstly, it emphasizes the importance of *existing* knowledge (organizational memory), but also the assimilation of *new* knowledge (knowledge absorption) en route to knowledge upgrading and recreation. Secondly, the codification, collection, and dissemination of *explicit* knowledge via organizational memory are complemented by sharing of *tacit* knowledge and creating an internal culture that favors knowledge receptivity. Thirdly, new knowledge often emerges when *external*, unfamiliar information is evaluated in an open-minded manner (knowledge receptivity), and absorbed into, and assimilated with,

the *internal*, existing knowledge. Finally, the KMO construct not only emphasizes *KM efficiency* through the centralization and dissemination of explicit knowledge through organizational memory, but most importantly, promotes tacit, shared understanding of information and knowledge according to its value to the organization. Hence, *KM effectiveness* is at the heart of the KMO construct. We generated 30 items in total, as illustrated above, to measure the KMO construct based on the existing literature. Details of the items used are in the Appendix A. We discuss reliability and validity of the KMO construct in the following sections.

KMO and firm performance

Most recent research has begun to examine the effect of KM on firm performance. For example, Lee et al. (2005) found significant correlations between KM processes (with a focus on KM efficiency) and three financial measures: stock price ($r=0.23$, $p<0.05$), price earnings ratio ($r=0.21$, $p<0.1$), and R&D expenditure ($r=0.26$, $p<0.05$). Sabherwal and Becerra-Fernandez (2003) find that internalization and externalization impact individual-level KM effectiveness whilst socialization and combination influence group- and organizational-level KM effectiveness at John F. Kennedy Space Center. Nevertheless, given the limitations of these studies, more empirical evidence is required to examine the impact of a firm's KM efforts on bottom-line performance.

Theoretically, efficient and effective KM offers substantial prospect for firms to gain competitive advantage and hence firm performance (Grant, 1996; Hult, 2003). Specifically, our KMO measure underpins KM efficiency and effectiveness. Organizational memory emphasizes the efficiency of KM by capturing and centralizing existing knowledge, and making it readily available to meet the organization-wide knowledge needs (Day, 1991; Hansen et al., 1999). Whilst, knowledge sharing, absorption, and receptivity are imperative to the effectiveness of KM, given that they promote a sense of openness, trust, and common understanding of the firm's

knowledge needs (Popper and Lipshitz, 1998; Holtshouse, 1998). Furthermore, knowledge receptivity and absorption also emphasize the generation and integration of new knowledge in order to achieve competitive advantage through new product and/ or process developments. Therefore, KMO is conceptually linked to firm performance, and the better a firm is at implementing KM, the more likely it will have improved financial performance.

Research Methodology

As the objective of this paper is to develop and validate a KMO construct, a large-scale survey research is required to generalize firms' knowledge-oriented behaviors. In particular, we use confirmatory factor analysis and structural equation modeling, which also require a large dataset. Therefore, a mail survey was employed given its balance of efficiency and effectiveness for data collection (Creswell, 2003). Prior to the full-scale data collection, we conducted three sets of pretests to evaluate the general quality of the research design and to provide an assessment of the face- and content validity of the items. The first pretest involved six executives in three firms. These six people were asked to comment on the general theoretical aspects of the study as well as provide managerial insights that could be helpful to design the survey. The second pretest involved twelve managers and academics. In this stage of the survey development, the objective was to assess the face- and content validity of the items, particularly with respect to the newly developed KMO scale. Based on the input of the twelve people, we refined some items and removed others. This resulted in a survey that included thirty items for KMO, and three items for performance (along with control variables, etc.). The third pretest involved two executives from two companies with the purpose of gaining feedback on the mechanics of filling out the survey and the time it would take, on average, to complete it. These three steps ensured that the final questionnaire incorporated the basic issues involved in survey research (e.g., face- and content

validity; clarity, understandability, conciseness, meaningfulness, and relevance of the measures).

The full-scale data collection (using seven-point Likert scales) involved a sampling frame of 1,500 companies based in the United Kingdom (each with at least 50 employees) randomly selected from the FAME Database. The firms involved in the pretests were excluded from the sampling frame. We followed Dillman's (2000) guidelines for data collection and Huber and Power's (1985) method on how to obtain quality data from key informants. To obtain quality data and to ensure that the managers surveyed had sufficient knowledge of the study's measures in the context of their firms, we included only company directors and senior executives (such as Managing Director, Director of Organizational Learning, Director of Intellectual Capital, Human Resource Director, Chief Information Officer, etc.) in the sampling frame. Each manager was sent a questionnaire with a cover letter and a pre-paid return envelope. Following two reminders, a total of 231 surveys were received; a 15.4% response rate. After discounting non-valid and incomplete responses, 213 usable responses remained for analyses, including 5.6% retailing, 53.5% in manufacturing industries, 40.8 in services. Our effective response rate of 14.2% slightly exceeds the 10-12% rate that Hambrick et al. (1993) describe as typical for surveys of executives. Thirteen percent of respondents were medium-sized firms (with self-reported 50-249 employees based on the OECD definition), and 87% were large firms (with self-reported 250 or more employees). The self-reported firm size was highly correlated ($r=0.76$, $p<0.01$) with the firm size provided by the FAME database, providing some evidence of the representativeness of our sample.

We performed ANOVA tests to examine possible non-response bias, as suggested by Armstrong and Overton (1977). Respondents were divided into three groups based on whether they responded to the first mailing, the first follow-up or the second follow-up. It is assumed that the group who responded to the second follow-up

is most similar to non-respondents (Armstrong and Overton, 1977). The results revealed that there was no significant difference between the three groups on all study variables (i.e. all variables of KMO and firm performance). Moreover, we also tested potential non-response bias by firm size (the number of employees) and the age of the firm, and found no significant differences in the two demographic variables among three respondent groups. Thus, there was no evidence of non-response bias in this study.

This study relies on self-reported data from single informants, which introduces the potential for common method variance (Podsakoff et al., 2003). Whilst the generally held view is that common method bias can potentially bias results (e.g., Williams et al., 1989; Bagozzi and Yi, 1990), a number of studies also contend that the effects of common method bias may be overstated (Spector, 1987; Crampton and Wagner, 1994). Given this debate, scholars reckon that it is good research practice to adopt procedural and statistical methods to check and minimize the bias (Tepper and Tepper, 1993; Podsakoff et al., 2003). To reduce common method bias we ensured the anonymity of the respondents to reduce evaluation apprehension (a procedure recommended by Podsakoff et al., 2003). Further, we conducted Harman's one-factor test, a widely used test for common method variance (Podsakoff and Organ, 1986), by entering all study variables (i.e. KMO, and firm performance) into an exploratory factor analysis. No single factor emerged from this analysis, nor was there a general factor that could account for the majority of variance in these variables: the first factor accounted for only 15% of the total variance. This indicates that common method bias is not a major problem in this study.

Data analysis

A two-stage analysis (Anderson and Gerbing, 1988) was adopted in this study. Firstly, the KMO scale was assessed through confirmatory factor analysis (CFA) utilizing Maximum Likelihood estimation (ML) method. The results are reported in the

Research Findings section. Secondly, structural equation modeling (SEM) was conducted to test the relationship between KMO and firm performance. The results are reported in the Reliability and Validity section. The statistical software AMOS 6.0 was employed for the analysis.

The ML method demands fulfilling several assumptions (Byrne, 2001): (i) a reasonable sample size (at least 200 cases); (ii) the scales of the observed variables are continuous; (iii) the hypothesized model is valid, and (iv) the distribution of the observed variables is normal. First, the data of this research meet the first two criteria. Furthermore, the measurement model of KMO was based on extant KM theories, following extensive literature review, and the hypothesized relationship between KMO and firm performance is also theoretically grounded. Finally, the normality of the observed variables was tested, following the rules of thumb suggested by West et al. (1995): for a sample size of 200 or less, moderately nonnormal data (univariate skewness <2, univariate kurtosis <7) are acceptable, i.e. the robust standard errors provide generally accurate estimates. Recent research also shows that ML estimation method can be used for data with minor deviations from normality (Raykov and Widaman, 1995). In our data, the absolute values of skewness and kurtosis for KMO variables are no more than 1.041 and 1.254 respectively. The absolute values of skewness and kurtosis for firm performance variables are no more than 0.186 and 0.171 respectively. Thus, our data also fulfills the requirement of the fourth assumption.

The psychometric properties of the KMO scale were assessed using χ^2/df, goodness-of-fit index (GFI) (Jöreskog et al., 1999), the comparative fit index (CFI) (Bentler, 1992), and the root mean square error of approximation (RMSEA) (Hu and Bentler, 1999). χ^2 is sensitive to sample size and assumes a perfect fit between the hypothesized model and the sample data. Thus, in complex models χ^2 tends to be very large, and its associated p value tends to indicate insignificance. Hence, researchers

often use χ^2/df to address limitations of the χ^2 statistics. The threshold for χ^2/df should be less than three (Premkumar and King, 1994). Values of GFI and CFI should be over, or at least close to, 0.90. RMSEA values less than 0.06 represent good fit, and values as high as 0.10 are acceptable (Brown and Cudeck, 1993; Byrne, 2001)

Research Findings

Firstly, we tested the first-order KMO construct, incorporating 30 items partitioned into four factors (see Appendix A), correlated to each other. The model fit indexes were: χ^2=1043.018, df=399, p=0.000, χ^2/df=2.614, GFI=0.753, CFI=0.821, RMSEA=0.087. GFI and CFI results were below the acceptable cut-off point for the initial model, although χ^2/df and RMSEA were acceptable. We, therefore, conducted item purification through CFA tests, eliminating items based on substantive reasons in conjunction with empirical examination (Mentzer et al., 1999). Empirically, each item was evaluated based on the loading, critical ratio (t-ratio), squared multiple correlation, error variance estimate, and evidence of items cross-loading on more than one component factors as indicated by large modification indexes (Kohli et al., 1993). Upon eliminating items, the incremental improvement of the overall KMO scale was evaluated. Average variance extracted (AVE), composite reliability (Fornell and Larcker, 1981), and internal consistency reliability were also used to assess the overall model fit.

Most importantly, to ensure the logic and consistency of data with the theoretical framework (MacCallum, 1996), substantive reasons for item deletion included checking whether the results were consistent with theory, whether two items from different components had strong conceptual linkages, and whether items may cause ambiguous interpretation by respondents. For example, for the organizational memory factor, KM6 was deleted because it overlapped with KM7, both capturing KM updatedness and relevance of organizational memory. The conceptual overlapping was evidenced in the

high covariance modification index between KM6 and KM7. However, KM7 was retained because it conceptually focused on the process of maintaining and updating organizational memory, which is in line with the overall construct, whilst KM6 focused on the content of organizational memory. Take KM17 as another example – KM17 conceptually captured the usage of knowledge from the past experience and external sources, and therefore, was essentially a double question. This conceptual ambiguity was reflected in the low squared multiple correlation of KM17 and provided the substantive reason for deletion.

Based on the above criteria, a stepwise approach was taken to modify the model and only one item was deleted in each step. A total of 14 items were eliminated and 16 items remained (see Appendix A). The final first-order KMO model resulted in an adequate fit: χ^2=198.102, df=98, p=0.000, χ^2/df=2.021, GFI=0.896, CFI=0.945, RMSEA=0.069. GFI was close to 0.9, and all other assessed indicators were above the recommended cut-off point. Table 1 summarizes the results of the first-order CFA test, and the items that remained in the scale. The loading of each item onto its respective first-order factor ranged between 0.60 and 0.88 ($t>1.96$, $p<0.001$). All the inter-factor correlations were also significant, with values ranging from 0.44 to 0.76, ($t>1.96$, $p<0.001$) (see Table 2). The final first-order KMO scale includes four items for organizational memory, four items for knowledge sharing, three items for knowledge receptivity, and five items for knowledge receptivity (see Table 1). In the item pruning process, we aimed to retain a maximum number of items in line with the KM theory in order to provide a pool of KMO items for future adoption and validation, although from a purely empirical point of view reducing one or two more items would have resulted in improved statistical fit.

Insert Table 1 Here

Given our theoretical proposition and the relatively high first-order inter-factor correlations, we then tested the second-order KMO construct using confirmatory factor analysis, with KMO as a latent construct consisting of the four component factors. The second-order model also resulted in an adequate fit: χ^2=224.926, df=100, p=0.000, χ^2/df=2.249, GFI=0.885, CFI=0.932, RMSEA=0.077. All estimated model fit indexes were adequate, while GFI was close to 0.9. The loading of each first-order factor to the general KMO factor was significant (t>1.96, p<0.001), ranging from 0.66 to 0.88 (see Table 1). More specifically, three of the second-order loadings were above 0.70 and only one was just below at 0.66. This complies with Chin's (1998) recommendation that, for a second-order construct, a high proportion of the second-order loadings should be at or above 0.70. Moreover, we assessed the target coefficient as recommended by Marsh and Hocevar (1985), by calculating the ratio of χ^2 of the first-order model to the χ^2 of the second-order model (both adjusted for degrees of freedom). The target coefficient of the KMO first- and second-order models was 0.90 (or 90 percent), providing further evidence that KMO is a second-order construct.

Evaluation of the KMO construct

As the objective of this study is to validate a KMO construct, we systematically evaluated dimensionality, reliability, and validity of the KMO construct, following the scaling procedures recommended by Netemeyer et al. (2003).

Dimensionality

Unidimensionality requires that a set of items forming a scale all measure just one thing in common, and is considered a prerequisite to reliability and validity, given that a primary goal of scaling is to develop a construct that measures its effect on the dependent variable accurately, disentangling its effect from the unwanted variation of

any other constructs (Gerbing and Anderson, 1988; Netemeyer et al., 2003). In the first-order KMO construct, each item is unidimensional as it loaded significantly onto its respective first-order factor only (loadings ranged from 0.60 to 0.88, $t>1.96$, $p<0.001$), without any cross-loadings. Each first-order factor also loaded significantly onto the general KMO construct (loadings ranged from 0.66 to 0.88, $t>1.96$, $p<0.001$). Therefore, each item of the KMO construct is unidimensional reflecting only one first-order factor and subsequently the general KMO construct.

Reliability

The Cronbach alpha internal consistency measure of reliability was employed to test the reliability of the KMO scale. The overall Cronbach alpha coefficient for the KMO scale was 0.917, well above 0.7, the widely advocated threshold (Nunnally, 1978; Netemeyer et al., 2003). The Cronbach alpha coefficients for each of the component factors ranged from 0.785 to 0.865 (see Table 2). The item-total correlation for each item was above 0.4, as recommended by Churchill (1979). Moreover, Gerbing and Anderson (1988) reckon that the reliability of the composite score should be assessed after unidimensionality has been accepted. Following Fornell and Larcker's (1981) formula, composite reliability for the general KMO factor was 0.883. For each first-order factor, composite reliability was over 0.70, above the recommended threshold for acceptance (see Table 2).

Construct Validity

We adopt the classification of construct validity discussed by Netemeyer et al. (2003). First, face validity refers to observational meaningfulness of the construct while content validity refers to the theoretical meaningfulness of the construct (Bagozzi et al., 1991). In line with research practice on new scale development, the items of our KMO scale were generated from theoretical discussion through extensive literature review. All

items were checked against KM theories in terms of face validity and content validity. Expert advice (from academics and practitioners) collected through three pretests was also incorporated to optimize both face- and content validity. Most importantly, the item purification procedure considered substantive reasons for item deletion in conjunction with empirical results to maximize the face- and content validity of the KMO construct. Examination of the retained items also suggests that this was achieved as the remaining items tap specific aspects of their respective construct domains (see Appendix A).

Second, convergent validity refers to the degree to which two or more measures of the same theoretical constructs are in agreement (Netemeyer et al., 2003). As there was no existing validated KM scale at the point of our data collection, we are not in a position to provide evidence to support that our KMO scale is highly correlated to an independent KM measure. Therefore, the average variance extracted (AVE) was used as an alternative measure for convergent validity (Fornell and Larcker, 1981; Bagozzi and Yi, 1988). As shown in Table 2, AVEs for the first-order factors and the overall KMO scale were above 0.5, the threshold recommended by Bagozzi and Yi (1988). Therefore, convergent validity is established for the KMO construct.

Third, discriminant validity requires that “a measure does not correlate too highly with measures from which it is supposed to differ” (Netemeyer et al., 2003, p.77). As recommended by Fornell and Larcker (1981), discriminant validity of KMO and firm performance was tested by comparing the AVE of each component factor with the shared variance between the component factor and all other component factors. As demonstrated in Table 2, for each comparison, the AVE exceeds all combinations of shared variances. Therefore, discriminant validity is accepted.

Insert Table 2 Here

Fourth, evidence of predictive validity of the KMO construct is provided through testing the effect of KMO on firm performance. Three subjective indicators were used to measure firm performance: respondents were asked to compare the return on capital employed, earnings per share, and sales growth of their own firm with those of their main competitors in the past five years. We first examined the CFA results for the firm performance construct (see Appendix B). The construct resulted in a good model fit: χ^2=1.800, df=1, p=0.000, χ^2/df=1.800, GFI=0.994, CFI=0.996, RMSEA=0.054. All loadings were significant (t>1.96, p<0.001). The alpha coefficient and composite reliability of the firm performance scale were both above the recommended levels (see Table 2). We then ran a SEM with KMO as the independent variable and firm performance as the dependent variable, resulting in: χ^2/df=3.089, df=13, p=0.000, GFI=0.955, CFI=0.951, RMSEA=0.099. χ^2/df results were close to the cut-off points, and results of GFI, CFI and RMSEA were adequate. The standardized regression weight from KMO to firm performance was 0.41 (t=4.781, p<0.001). The results were consistent with the theoretical predication on the KMO and firm performance relationship thus indicating the predicative power of the KMO scale.

Finally, to test the invariance between different groups to demonstrate the stability of the construct, we performed a multiple-group structural equation analysis (Jöreskog et al., 1999) to examine if the effect of KMO on firm performance varies across different industry types (a control variable). Two broad industry groups - manufacturing and services (including retailing) - were submitted for analysis, examining if χ^2 difference (Anderson and Gerbing, 1982) is significant between a free model (where the influence of KMO on firm performance is allowed to vary across the two groups) and a constrained model (where the influence of KMO on firm performance is constrained to be equal across the two groups). The free model resulted in χ^2=50.949, df=26. The constrained model resulted in χ^2=51.350, df=27. Therefore, the χ^2 difference test

($\Delta\chi^2$=0.401, Δdf=1) was insignificant, indicating no evidence of differential effect of KMO on firm performance across the two broad industry groups.

Discussion

We set out on a task of developing and validating a KMO construct to measure a firm's systematic KM implementation with a view to enhancing bottom-line firm performance. The findings above provide evidence that KMO is a reliable and valid measure for KM oriented behaviors. The presence of a validated KMO construct has theoretical, methodological, and practical implications.

Theoretically, we conceptualize KMO as a second-order construct, consisting of four component factors: organizational memory, knowledge sharing, knowledge absorption, and knowledge receptivity. Previous research has largely examined the KM dimensions in isolation (e.g. Szulanski, 1996; Wijnhoven, 1999; van Den Bosch et al., 1999; Tsai, 2002) rather than in an integrated manner. We argue that the four dimensions together underpin a firm's systematic KM efforts to build on its *existing* knowledge as well as share, assimilate, and be receptive to *new* knowledge. Each factor is necessary, but not sufficient by itself for efficient and effective KM. As shown in Table 2, amongst the four factors, knowledge receptivity and knowledge absorption had the highest correlation coefficient (0.759, $p<0.001$). Theoretically, knowledge receptivity promotes a sense of openness to new ideas *internally* (Popper and Lipshitz, 1998); such new ideas are often acquired from outside the organization or even beyond its close-knit network (Robertson et al., 1996). On the other hand, new, external knowledge must be received and evaluated equitably so that a shared understanding of the information is developed (Hult, 2003), and new knowledge is absorbed within the existing knowledge frame (Cohen and Levinthal, 1990). Therefore, the findings confirm that knowledge receptivity and absorption are closely associated.

Knowledge sharing and knowledge receptivity had the second highest correlation coefficient (0.754, $p<0.001$), whilst organizational memory and knowledge receptivity had the lowest correlation coefficient (0.441, $p<0.001$). Knowledge sharing enables a multi-directional knowledge flow (Mom et al., 2007), and mobilizes tacit knowledge that is crucial to knowledge evaluation and receptivity, whilst organizational memory emphasizes the codification and centralization of knowledge (Hansen et al., 1999), and involves reduced contextual information for knowledge evaluation. On the other hand, knowledge receptivity promotes a sense of openness; the more open-minded people are, the more willing they are to share knowledge. Therefore, the findings support the theoretical predication that, compared with organizational memory, knowledge sharing has a stronger association with knowledge receptivity.

Given the above discussion, the four component factors together underpin a firm's capacity to effectively manage *explicit* and *tacit* knowledge as well as *internal* and *external* knowledge sources. Moreover, our findings provide evidence that KMO has a significant, direct effect on firm performance (standardized regression weight=0.41, $t=4.781$, $p<0.001$). These findings complement those of Lee et al. (2005) and Sabherwal and Becerra-Fernandez (2003) pertinent to the significant role of KM processes in firm performance and organizational effectiveness. Knowledge as a strategic asset (Grant, 1996), and knowledge management as a capability that differentiates higher performer from mediocre or lower performers (Bierly and Chakrabarti, 1996) are key pillars of the knowledge-based theory.

Researchers can use this systematically developed and validated KMO construct as a starting point in the examination of the effects of KM on building firm capabilities and improving firm performance. A large body of theoretical work supports this research area (i.e. Kogut and Zander, 1992; Grant, 1996; Hult, 2003). However, there is a need to develop empirical studies to examine systematic KM implementation (Newell et al., 2001; Hult, 2003), but progress has been hindered by the lack of effective measures for

a firm's systematic KM implementation. The work by Lee et al. (2005), Sabherwal and Becerra-Fernandez (2003), and Darroch and McNaughton (2003) attempted to address KM processes in a systematic manner, but demonstrates both theoretical and methodological limitations, restricting the prospect of more generalizable studies. In this study, the model fit of the KMO scale was systematically examined and reported. Moreover, we follow the advanced scaling procedure recommended by Netemeyer et al. (2003), and the results of scale dimensionality, reliability, and validity were satisfactory, providing a sound basis for adoption in future research. Furthermore, the KMO scale can be used to inspire future research to develop alternative measures for KM or re-validate the KMO scale in different industry or organizational contexts.

The practical implication is that the KMO measure can be used by firms as a practical tool for measuring its KM efforts. The lack of effective measures for KM hinders corporate practice. Some firms assess KM outcomes at the project level, i.e. to calculate the ratio of input and output of a single KM program. This may serve to justify investment in information technology or knowledge-based systems but, unfortunately, neglects the impact of KM on overall performance (Newell et al., 2001). Our research findings provide evidence that simply developing a knowledge repository or organizational memory alone is not an effective solution for KM, as already evidenced in firm practice (McDermott, 1999; Cross and Baird, 2000). The conventional approach of simply investing in advanced information technology does not automatically lead to success of KM initiatives. Firms can use the KMO measure to establish a baseline for managing knowledge. Subsequently, it could be used to chart the progress of the firm in developing KMO through periodic surveys that could then be used to assess the effect of particular KM initiatives as well as identify areas of weaknesses. The KMO measure could also be used to establish target levels of KM practice based on strategic objectives or competitor benchmarking.

The findings of this study provide several opportunities for future research. Firstly, further replication studies are needed to provide more elaborate support for the robustness of the KMO construct. In particular, future research may employ a larger sample size and test whether KMO demonstrates known-group validity across firms of different sizes, ages, in different industry sectors, or even in different nations, to provide further evidence for the external validity of the KMO construct. Furthermore, future research is needed to test the convergent validity of the KMO scale, including alternative KM measures, for example, the knowledge circulation process construct (Lee et al., 2005), to test whether the two closely related constructs, indeed, demonstrate a high level of convergent validity. Moreover, we conceptualized the KMO construct in a particular way based on our prioritization of KM dimensions as informed by the four theories we discussed above. Future studies could consider alternative measures for organizational memory, knowledge sharing, absorption, and receptivity.

Secondly, this study tested the impact of KMO on performance to establish its predicative validity. However, it must be noted that the KMO and performance relationship is a complex one, and it is anticipated that several organizational factors could play a mediating role in the relationship. In other words, firms must not only develop KM capabilities, but also have other mechanisms, such as market orientation (Day, 1991), product innovation (Madhavan and Grover, 1998), and entrepreneurial orientation (Wiklund and Shepherd, 2003), to exploit KM capabilities. Further studies should incorporate the KMO construct in a nomological network, consisting of antecedents to KMO (e.g., learning climate), mediating factors (e.g., market orientation, product innovation, entrepreneurial orientation), and outcomes (e.g., organizational performance).

Finally, our use of single informants may limit the insights we were able to generate and has potential to cause common method bias. However, the results of Harman's one factor test indicated no evidence of such problem. Nevertheless, future

studies may consider re-testing the KMO construct by adopting multi-method approach to mitigate the risks of common method bias. Overall, the development and validation of the KMO construct is in line with the guidelines for construct development (see for instance, Lewis et al. 2005), and the empirical results provide strong evidence that the KMO construct is a valid and reliable tool for both researchers and practitioners.

Conclusion

KM brings together multi-disciplinary practices, and its implementation requires a systematic approach to organizational development. Whilst existing literature acknowledges that KM goes beyond IS or technology, the organizational mechanisms that make effective KM happen remain under-researched. By conceptually developing and empirically validating the KMO construct consisting of the four component factors, this paper conveys an important message that effective KM implementation requires an organization systematically develop an organizational memory, but most importantly, promote a culture that favors knowledge sharing and receptivity as well as enhance knowledge absorptive capacity. Our KMO construct can be used by researchers and company executives to guide future KM research and practice.

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Appendix A. The Knowledge Management Orientation (KMO) Scale

Organizational memory		**Literature sources**
KM1	We have systems to capture and store ideas and knowledge.	Hansen et al. (1999)
KM2	We have systems to codify and categorize ideas in a format that is easier to save for future use.	Hansen et al. (1999)
KM3	IT facilitates the processes of capturing, categorizing, storing, and retrieving knowledge and ideas in our company.	Hansen et al. (1999)
KM4	We systematically de-brief projects, record good practices that we should extend and mistakes that we should avoid.	Becker (2001)
KM5	We make efforts to remember mistakes we made and avoid making similar mistakes in the future.	Becker (2001)
KM6	Information and knowledge stored in our systems is relevant and sufficient.	Gray (2001)
KM7	We constantly maintain our information systems and upgrade knowledge stored in the systems.	Gray (2001)
KM9	People are encouraged to access and use information and knowledge saved in our company systems.	Hansen et al. (1999)
Knowledge sharing		**Literature sources**
KM8	We treat people's skills and experiences as a very important part of our knowledge assets.	Davenport et al. (1998)
KM10	When we need some information or certain knowledge, it is difficult to find out who knows about this, or where we can get this information (*reverse coded*).	Hansen et al. (1999)
KM11	We have systems and venues for people to share knowledge and learn from each other in the company.	Holtshouse (1998)
KM12	We share information and knowledge with our superiors.	Holtshouse (1998)
KM13	We share information and knowledge with our subordinates.	Holtshouse (1998)
KM14	We often share ideas with other people of similar interest, even if they are based in different departments.	Holtshouse (1998)
KM15	There is a great deal of face-to-face communications in our company.	Nonaka and Takeuchi (1995)
KM16	We use information technology to facilitate communications effectively when face-to-face communications are not convenient.	Hansen et al. (1999)

	Knowledge absorption	Literature sources
KM17	We very often use knowledge that our company possesses, either from the past experience or from external sources.	Cohen and Levinthal (1990); O'Dell et al. (1999)
KM18	We use information technology to access a wide range of external information and knowledge on competitors and market changes, etc.	Szulanski (1996); Alavi and Leidner (2001)
KM19	Through sharing information and knowledge, we often come up with new ideas that can be used to improve our business.	Cohen and Levinthal (1990); O'Dell et al. (1999)
KM20	We have networks of sharing knowledge with other organizations on a regular basis.	Alavi and Leidner (2001)
	Knowledge receptivity	**Literature sources**
KM21	Managers value knowledge as a strategic asset, critical for success.	Davenport et al. (1998)
KM22	Our company culture welcomes debates and stimulates discussions.	Popper and Lipshitz (1998)
KM23	We hesitate to speak out our ideas because new ideas tend to be highly criticized or ignored (*reverse coded*).	Popper and Lipshitz (1998)
KM24	In our company, new ideas are evaluated equitably.	Popper and Lipshitz (1998)
KM25	In our company, we evaluate ideas based on their merits, no matter who comes up with the ideas.	Popper and Lipshitz (1998)
KM26	In our company, we evaluate new ideas rapidly on a regular basis.	Popper and Lipshitz (1998)
KM27	There is a general culture in our company where people respect knowledge and knowledge ownership.	Davenport et al. (1998)
KM28	People who contribute new ideas are rewarded financially in our company.	Nemeth (1997)
KM29	People who contribute new ideas are invited to participate in future development and implementation of this new idea.	Nemeth (1997)
KM30	We are held accountable for our own actions and consequences.	Popper and Lipshitz (1998)

Note: (1) Respondents were given instructions to circle the number (ranging from 1, "strongly disagree" to 7, "strongly agree") that corresponded to their degree of agreement to each of the above statements. (2) Items highlighted and underlined remain in the final KMO scale.

Appendix B. The Firm Performance Measures

Code	Performance	Literature Sources
P1	Return on capital employed	e.g., Jaworski and Kohli (1993); Vorhies and Morgan (2005)
P2	Sales growth	e.g., Jaworski and Kohli (1993); Vorhies and Morgan (2005)
P3	Earnings per share	e.g., Jaworski and Kohli (1993); Vorhies and Morgan (2005)

Note: Respondents were asked to compare their own performance in the past five years with their main competitors (ranging from 1, “much worse” to 7, “much better”).

Table 1: Results of the first- and second-order CFA for KMO

First-order factor	Items	Mean	Standard deviation	Squared multiple correlation	First-order loading (t-ratio)				Second-order loading (t-ratio)
					Organizational memory	Knowledge sharing	Knowledge absorption	Knowledge receptivity	
Organizational memory	KM1	4.502	1.677	0.74	0.86[1]				0.66[1]
	KM2	3.836	1.541	0.73	0.85(14.814)				
	KM3	4.310	1.696	0.57	0.76(12.544)				
	KM7	4.423	1.498	0.47	0.69(10.969)				
Knowledge sharing	KM11	4.441	1.509	0.47		0.69			0.83(7.027)
	KM12	5.080	1.299	0.74		0.86(11.183)			
	KM13	4.981	1.296	0.77		0.88(11.345)			
	KM14	4.723	1.364	0.50		0.71(9.444)			
Knowledge absorption	KM18	5.023	1.449	0.56			0.75		0.88(7.304)
	KM19	4.709	1.397	0.70			0.84(11.292)		
	KM20	4.225	1.500	0.40			0.63(8.724)		
Knowledge receptivity	KM23	5.108	1.477	0.36				0.60	0.85(6.549)
	KM25	4.850	1.449	0.61				0.78(8.648)	
	KM26	4.127	1.466	0.64				0.80(8.808)	
	KM27	4.765	1.314	0.54				0.74(8.343)	
	KM29	4.268	1.535	0.42				0.65(7.606)	

Notes:

1. For model identification purpose, the path of each first- and second-order factor to its first item is fixed. Hence, t-ratio for this path is not available.
2. The first-order KMO model fit indexes: χ^2=198.102, df=98, p=0.000, χ^2/df=2.021, GFI=0.896, CFI=0.945, RMSEA=0.069. The second-order model fit indexes: χ^2=224.926, df=100, p=0.000, χ^2/df=2.249, GFI=0.885, CFI=0.932, RMSEA=0.077.

Table 2: Correlations and shared variances

	1	2	3	4	5
1. Organizational memory	1.000	0.583 [2]	0.680	0.441	0.262
2. Knowledge sharing	0.340[1]	1.000	0.666	0.754	0.277
3. Knowledge absorption	0.462	0.444	1.000	0.759	0.273
4. Knowledge receptivity	0.194	0.569	0.576	1.000	0.331
5. Firm performance	0.069	0.077	0.075	0.011	1.000
AVE	0.625	0.622	0.620	0.513	0.562
Alpha coefficient	0.865	0.855	0.785	0.836	0.775
Composite reliability	0.869	0.895	0.785	0.839	0.790

Notes:

1. Shared variances are reported in the lower diagonal half of the matrix.
2. Pearson's correlations are reported in the upper diagonal half of the matrix, and significant at $p < 0.001$.