

8-2010

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Max Erik Rohde

University of Auckland, m.rohde@auckland.ac.nz

David Sundaram

University of Auckland, d.sundaram@auckland.ac.nz

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Recommended Citation

Rohde, Max Erik and Sundaram, David, "Challenges in Knowledge Management" (2010). *AMCIS 2010 Proceedings*. 508.
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Max Erik Rohde

Dept. of Information Systems & Operations Mgmt.
University of Auckland
Auckland, New Zealand
m.rohde@auckland.ac.nz

David Sundaram

Dept. of Information Systems & Operations Mgmt.
University of Auckland
Auckland, New Zealand
d.sundaram@auckland.ac.nz

ABSTRACT

Knowledge management is an ever researched area in the discipline of information systems. Though the terminology might change with the waves of fashion, how information systems can support the multiple dimensions of knowledge management is an underlying theme in many streams of research. This article examines literature on knowledge management in order to synthesize a number of key challenges, which emerge from a multidimensional and boundary-spanning view on knowledge management. Six interrelated issues attempt to explain some of the essential aspects of knowledge in the organizational context: these issues are (1) standardization of processes, structures, and systems, (2) contextualization, (3) invasiveness in natural ways of working, (4) strategic alignment, (5) intelligence, and (6) cultural environment.

Keywords

Knowledge Management, Challenges, Issues, Literature Review

INTRODUCTION

Knowledge is not only seen as a key resource for today's organizations (Drucker, 2001), there is also little doubt that increasing the productivity of those working with knowledge can be extremely beneficial for modern societies (Davenport, Thomas, and Cantrell, 2002). Even in 2001, information systems could support various aspects in the storage, retrieval, transfer, and application of knowledge (Alavi and Leidner, 2001). However, these capabilities of knowledge-oriented information systems are often not leveraged in modern organisations. Even if organisational information systems, such as enterprise resource planning systems, lead to tremendous improvements in the efficiency of transactional processes, for activities relying on unstructured knowledge such as human insight, similar improvements cannot be observed; in nearly every organisation, the highly standardised processes embedded in transactional systems are accompanied by myriads of unstructured and unstandardized personal "toolkits" (Thompson and Walsham, 2004).

While previous research has proposed many tools to support knowledge management, often these tools are designed for a specific domain. These domains are, for instance, organization design (Markus, Majchrzak, and Gasser, 2002) or new product development (Ding and Peters, 2003). Furthermore, many researchers primarily focus either on the knowledge management of organizations as a whole, for instance in organizational learning, or on knowledge management from the perspective of individuals, for instance in human-computer interaction or personal information management.

Research in information systems on the subject of knowledge management faces many challenges, one of which is that the literature on knowledge management is diverse and numerous. The challenges and problems identified in the course of uncountable studies are manifold and researchers attempting to achieve improvements in the field of knowledge management have the choice of addressing any of these challenges. We provide a brief list of what we see as key challenges in knowledge management, which can be of use to find orientation in knowledge management projects. Furthermore, we neutralize these challenges to issues or dimensions, which can help to reveal the dynamics and contradictions in organizational knowledge management.

In this article, we first present a multi-dimensional view on knowledge, spanning multiple units of aggregation and multiple managerial perspectives. Based on this view, we review knowledge management literature to identify common challenges and problems. Grounded in this review of the literature and the myriad of common problems identified therein, we synthesize six key challenges in the field of knowledge management. In order to provide additional guidance for future research, we further propose neutral issues or dimensions.

KNOWLEDGE MANAGEMENT FRAMEWORK

In order to be able to review the broad literature on knowledge management, we want to guide our review by frameworks, which can be helpful in the context of knowledge management in an organizational context. We synthesize existing frameworks in the literature into two dimensions: firstly, knowledge in units of aggregation refers to the place in which knowledge resides or is applied, and secondly, a managerial perspective, breaking up knowledge-related activities between business and IT.

Tiwana (Tiwana, 2002, p. 42) describes how knowledge is aggregated on different levels. Individuals accumulate knowledge but if they collaborate in a team context or in their department, knowledge on a team level is created. Teams can collaborate with other teams, which leads to knowledge being created on the organizational level. The organization itself can be part of a business network that exchanges and creates knowledge. These units of aggregation can further be interpreted in a way that knowledge is managed by individuals (Kim, 1993; Lansdale, 1988), by organizations (Tanriverdi, 2005) and between organizations in business networks (Dyer and Nobeoka, 2000). We express these units of aggregation in a dimension ranging from individuals to business networks. This dimension represents two issues: first, each unit can be the location of knowledge as argued by Tiwana, and, second, each unit represents an organizational object that can be subject to efforts of knowledge management. There is a strong interaction between the knowledge residing in different units of aggregation. The same can be assumed for the management of the individual units. For instance, management of knowledge in business networks requires management efforts that are directed towards face-to-face interactions of individuals (Dyer and Nobeoka, 2000).

From a managerial perspective, many knowledge management initiatives are either IT or people driven (Schönström, 2005; J. Swan, Newell, and Robertson, 2000; Jacky Swan, Newell, Scarbrough, and Hislop, 1999; Walsham, 2001). Benbya et al. (2004) have provided a finer distinction that differentiates between a “technical context” that considers the design, usability and effectiveness of systems, a “managerial context” that considers questions of leadership in knowledge management initiatives and its alignment with the firm's strategy, and a “social context” that reflects commitment to knowledge management, the influence of the organizational culture, and issues of trust. These three contexts intersect and influence each other. El-Sawy (2001) shows the relation between information systems and strategy in the context of business process reengineering. He defines the three layers of business strategy, business processes and information systems. These perspectives are linked; the business strategy provides guidance for the redesign of processes and the processes provide guidance for the implementation of information systems.

We synthesize the different levels between the business side and the IT side into a dimension of managerial perspectives. This dimension consists of the following layers: (1) *Culture*: Close to the 'business side' is the level of culture. This layer is adapted from Benbya et al.'s (2004) “social context” and refers to the organizational culture and issues of trust. (2) *Strategy*: The culture layer surrounds the strategy layer. This is derived from El-Sawy's (2001) “business strategy” layer and Benbya et al.'s (2004) “managerial context”. (3) *Process*: The strategy layer surrounds and drives the business process and structure layer. This layer is derived from El-Sawy's (2001) “business process” layer and still corresponds to Benbya et al.'s (2004) “managerial context”. (4) *Information Systems*: The lowest layer, and the closest to the IT side, is the information systems layer. This layer relates to El-Sawy's (2001) “information systems” layer and Benbya et al.'s (2004) “technical context”. These layers are interwoven where the higher, business layers, surround the lower, technical layers.

Using the dimension of different levels of aggregation and the dimension of managerial perspectives, a space can be constructed which shows twelve areas of importance for knowledge management (Figure 1). The area XII, for instance, is concerned with cultural values of business networks, such as the establishment of a “common identity” (Dyer and Nobeoka, 2000).

Culture	X	XI	XII
Strategy	VII	VIII	IX
Process	IV	V	VI
Information Systems	I	II	III
	Individual	Organization	Business Network

Figure 1 Two dimensions of knowledge management

KEY CHALLENGES IN KNOWLEDGE MANAGEMENT

Based on the two dimensions of knowledge introduced in the prior section, we review the knowledge management literature in order to identify challenges and problems in this field. We will synthesize challenges for the information systems, processes, strategy and culture perspectives discussed earlier. For each of these perspectives, we will look at particular challenges for the different units of aggregation, namely individuals, organizations, and business networks. After we have given the challenges related to the perspectives, we synthesize these challenges into key challenges for knowledge management.

Information Systems Perspective

The major challenge for supporting knowledge management with information systems is that these are often considered to be too inflexible to be able to support the rapidly changing processes of knowledge management and learning (Alavi and Leidner, 2001; Cole, 1998). On the level of *individuals*, the users can incorrectly interpret the information that information systems provide. Information that has been encoded by one individual may not necessarily be decodable by another individual if the information lacks the right context (Hall, 2006). Furthermore, individuals tend to store their information in various places and formats (Gemmell, Bell, Lueder, Drucker, and Wong, 2002) as organizational information systems do not support them appropriately with filing and accessing information (Krishnan and Jones, 2005). Individuals, for instance, use email clients as archives to keep track of their activities; these applications offer limited possibilities to structure and use information (Ducheneaut and Bellotti, 2001). *Organizations* are confronted with the challenge that they generate huge amounts of data but that they are often unable to 'make sense' of it (Bettis and Prahalad, 1995). One reason for this can be that they employ heterogeneous systems that are not interlinked and that cannot be linked to external systems (Joo and Lee, 2009). This leads to data 'islands' that are not connected and that prevent "smart applications" (Allemang and Hendler, 2008, p. 4), which could be used to make more sense of data. *Business Networks* face similar challenges as systems in different organizations are often incompatible (Stein, 2003). Incompatible enterprise resource planning systems and legacy systems can, for instance, complicate the establishment of alliances between organizations (Ciborra and Andreu, 2001).

Process Perspective

Process related challenges and problems are discussed from the viewpoint of how knowledge management can help organizations with their value creating activities. A major process related problem in knowledge management is that knowledge is often not encoded or not encoded with the right degree of context as knowledge storing activities are deemed to interfere with work practices. So, organizations do not have the knowledge available that they need and, furthermore, knowledge management activities are deemed to take additional time that would be better used for really 'useful' activities. For *individuals*, storing or encoding knowledge creates additional work (Kwan and Balasubramanian, 2003). This is can be due to multiple reasons: (1) Human knowledge is "complex and disorganized", "fluid, heterogeneous, ever changing, and often of inconsistent nature" (Sowa, 1999, p. 348), and therefore difficult to encode. (2) Individuals are not well supported in their work by information systems because processes involving knowledge are often ad hoc and collaborative and these processes are difficult to support with information systems (Alonso, Agrawal, Abbadi, and Mohan, 1997). One consequence of this is, for instance, that information systems lead to individuals being overloaded with information (Fischer and Otswald, 2001) such as emails (Whittaker and Sidner, 1996) and (3) individuals do not have enough time for knowledge acquisition, sharing and codification in their everyday work (van Zolingen, Streumer, and Stooker, 2001). These challenges faced by individuals have a number of consequences for *organizations*. First and foremost, the knowledge of individuals is not accessible by organizations (Groth and Eklundh, 2006). Individuals build their own "toolkits" of personal documents that are not accessible for others (Thompson and Walsham, 2004). As already mentioned, they, for instance, use email or local documents that are, in most cases, not visible for the organization (van Zolingen et al., 2001). Secondly, even when individuals try to encode knowledge, this encoded knowledge is often not helpful for others (Jacky Swan et al., 1999) as it lacks the correct context (Thompson and Walsham, 2004). This leads to information systems that do not provide sufficient shared context for users to understand the information provided to them (Bannon and Bodker, 1997). Thirdly, information systems often cannot provide the information that is necessary for executing processes as support systems for finding knowledge are inefficient (Alavi and Leidner, 2001; Huber, 1999). In *business networks*, assuring that actors are enabled to find relevant information has also been identified as an important factor. (Dyer and Nobeoka, 2000)

Strategy Perspective

Strategy related challenges and problems are discussed from the viewpoint of how knowledge management can enable organizations to be successful and sustainable. The most important factor found in the literature is that knowledge management must follow a clear strategy and must be aligned with the organization's business strategy (Tiwana, 2002, p. 62; Vera, Crossan, Easterby-Smith, and Lyles, 2003). This is of particular importance as knowledge is a key resource for organizations (Drucker, 2001) knowledge management is often expensive (Hill and Hoskisson, 1987), and the benefits for

information systems supported knowledge management are considered to be particularly difficult to realize (Walsham, 2001). For *individuals*, often the knowledge management systems that are put in place by organizations are not designed to fulfill the real user requirements (Benbya et al., 2004). An important problem for *organizations* results from a lack of alignment. The same knowledge is often developed in multiple places in the organization (Maier, HÄdrich, and Peinl, 2009, p. 356; van Zolingen et al., 2001). This is mainly due to three reasons: (1) different departments often have their own knowledge management system (van Zolingen et al., 2001), (2) organizations do not employ a common framework or a common structure for their knowledge management initiatives (Davenport and Prusak, 1998, p. 159; Maier et al., 2009, p. 358), and (3) the responsibility for these initiatives is often not clearly defined (Maier et al., 2009, p. 357). For *business networks* it is problematic that many knowledge management initiatives do not focus on knowledge flows across organizational borders or on the acquisition of external knowledge (Maier et al., 2009, p. 356) leading, for instance, in new product development, to an increase in development times and inferior technologies (Aggarwal and Walden, 2009).

Cultural Perspective

The most important culture related challenge for organizations is that the organizational culture must enable and support knowledge sharing. When the environment does not favor knowledge sharing and trust, *individuals* may fear to lose prestige when 'giving away' their knowledge (van Zolingen et al., 2001). *Organizations* often fail to create such environments of trust (De Long and Fahey, 2000) or a knowledge sharing culture (Tiwana, 2002, p. 61) and therefore cannot motivate their employees to share their knowledge (Davenport and Prusak, 1998, p. 158; Wasko and Faraj, 2005). On the level of *business networks*, the establishment of a common identity has been identified as an important factor for knowledge sharing success. Such an identity can be deemed as a cross organizational culture that can help overcome complications due to heterogeneous organizational and country specific cultures in the business network (Levinson and Asahi, 1996).

We have synthesized the discussed challenges and problems into a number of key challenges:

Key Challenge 1. Knowledge management solutions are not aligned with the way individuals have to conduct their every day work. Information systems are too inflexible to adapt to changing work practices and knowledge management activities interfere with value generating business processes as they require additional effort.

Key Challenge 2. Knowledge management systems and databases are not integrated. In all units of aggregation, different and incompatible systems are employed.

Key Challenge 3. The information stored in information systems is often not useful because users have no shared understanding to help them interpret the data in the right way.

Key Challenge 4. Furthermore, users of knowledge management systems often cannot find the information they require for their work, ultimately leading to organizations that are not aware of what knowledge they possess.

Key Challenge 5. Organizations often do not manage their knowledge management activities in a thorough way. This leads to, on the one hand, resources being used inefficiently and ineffectively, and, on the other hand, to potential benefits that remain unrealized.

Key Challenge 6. Some organizations fail to provide a balanced environment in which knowledge management activities can flourish.

These challenges represent a selective view and we do not claim for them to be complete or even the most important knowledge management challenges. Given the evidence from the literature, we do, however, assume that all of these challenges are valid challenges in today's organizations. Furthermore, all of these challenges originate from academic sources so that we assume that these challenges are, besides being practically relevant, likewise relevant from a scholar's perspective.

Issues in Knowledge Management

The key challenges that we have outlined in the previous section help us to guide the direction of research. However, although they originate from academic texts, they describe quite specific phenomena in organizations. In this section, we aim to synthesize these challenges to more general issues; meaning that if the issues are addressed in the right way, multiple challenges are addressed. In the following, we list an issue relating to each of our key challenges. For each issue, we further state to which of the knowledge management challenges discussed in the previous section the issue relates.

The issue of *invasiveness* describes the degree to which knowledge management activities interfere with individuals' work practices. The issue of invasiveness is thereby strongly related to key challenge 1. So, for instance, if a project manager has to write a formal and comprehensive project report that is to be stored in a knowledge repository, this is likely an interference with what she usually has to do on her job. Therefore, such practices represent a high degree of invasiveness. Discussion

forums, on the other hand, that are used to enhance collaboration and communication can help individuals in their every day work and still capture valuable knowledge. Using such technologies represents a lower degree of invasiveness. However, the lowest possible degree of invasiveness is not always desirable. Some information can hardly be gathered as part of the work. Especially work that requires a high degree of formalization and quality of information, such as research, depends on complex and time-consuming encoding of knowledge.

The issue of *standardization* relates to the process of standardizing multiple aspects of organizations, for instance IT infrastructure (Akkermans and Horst, 2002), work processes, work outputs, and skills of individuals conducting the work (Mintzberg, 1979). Standardization is therewith related to key challenge 2. Standardization is an important prerequisite for data integration. However, especially on the level of work processes, a high degree of standardization can be perceived as undesired uniformity that can make organizations vulnerable to changes in the environment. Too high a degree of standardization on the level of information systems can lead to rigid and inflexible systems that are incompatible with emergent, knowledge-intensive processes (Alavi and Leidner, 2001). The standardization of processes or software can lead to a higher degree of invasiveness as the 'standard' way of doing something might not be the preferred way to work for everyone. Furthermore, if organizations highly standardize the technologies or processes they rely on, it could become more difficult for them to adapt to new technological developments in case these are incompatible with the enforced standards.

A further issue is that of *contextualization*. We understand contextualization from two angles: (1) the process of creating context and (2) the degree to which one piece of information is interrelated with other relevant information that can help to understand and interpret the piece of information. Key challenge 3 is the most related to this issue. Contextualization is positively correlated with the issue of invasiveness; meaning that, in many circumstances, a higher degree of contextualization results in a higher degree of invasiveness as actors are required to 'create' contextual information. A high degree of contextualization is therefore not always desirable. Furthermore, too much contextual information can confuse individuals and lead to an 'information overload'. It is critical for organizations to find the right degree of context for information, without interfering too much with work practices or creating too much information.

Key challenge 4 relates to the issue of *intelligence*. We define the term intelligence here in the spirit of business intelligence or, more generally, intelligent decision support (Dhar and Stein, 1996). Intelligence is a process and a capability to interpret data into knowledge. Dhar and Stein (1996) use the term intelligence density, which we adopt as the degree of intelligence. A high degree of intelligence is often desirable for organizations. However, the discussion of contextualization shows that this might often not be achievable when information lacks the correct context and creating context might, in some instances, only be achieved at the costs of an interference with individual's work practices as expressed by the issue of invasiveness.

We see the issue relating to key challenge 5 as *strategy*. We understand strategy here as constituted of two dimensions: (1) the degree of alignment between business strategy and knowledge management strategy and (2) the degree of coordination between knowledge management initiatives. Of course, organizations aim at increasing the level of alignment and coordination. However, coordination activities require additional work and formalized procedures that may inhibit organizational flexibility (Levinthal and Rerup, 2006).

Key challenge 6 relates to the issue of *culture*. We understand this issue as relating to the degree to which organizations are able to provide a well-balanced environment for knowledge management related activities. These often require an open environment of trust (De Long and Fahey, 2000), freedom, and autonomy for individuals (Davenport, Jarvenpaa, and Beers, 1996). On the other hand, if the environment becomes too open, it becomes more difficult to control and manage the activities (Davenport et al., 1996), for instance resulting in challenges for strategic alignment.

As already argued for some individual issues, there are certain interactions between these issues and the challenge is not only to find the 'sweet spot' of the right degree of the individual issues but also weighting the issues against each other and finding the right spot in a multidimensional space (Figure 2). We do not claim for the issues to be a comprehensive and complete discussion of knowledge management issues. Knowledge encompasses nearly every aspect of organizational reality and it is therefore difficult to cover all dimensions. However, we have provided issues that cover significant parts of the taxonomies discussed earlier: information systems, business process, strategy, and culture are considered as the discussion of challenges is based on this differentiation. Further, different levels of abstraction are considered: from a concrete and encoded level that relates to invasiveness, standardization and contextualization to an implicit and tacit social level that relates to intelligence, strategy and culture.

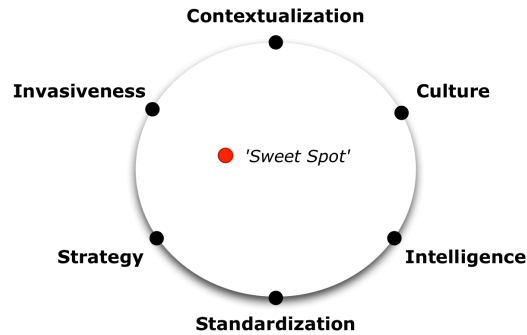


Figure 2 Proposed Issues in Knowledge Management

CONCLUSION

We have tried to approach knowledge from a holistic perspective and not limit our investigation to a certain domain or unit of aggregation. Information systems that support organizations in their learning processes from this holistic perspective must deal with a number of complex, interrelated issues.

In providing a list of key challenges and issues in knowledge management, we hope to provide some guidance for future research. The issues can help to find focus for a study, without losing sight of important aspects to be considered in the context of knowledge. For instance, studies dealing with the issue of contextualization, attempting to provide more useful encoded knowledge, must also consider the issue of invasiveness. As such, that encoding of additional information must be weighed against the inference with natural ways of conducting work; both invasiveness and contextualization can be understood as dimensions, and a solution must find the 'right spot' in the two-dimensional space in order to be a useful solution.

However, exclusively looking at contextualization and invasiveness is still an insufficient approach in the complex world of knowledge; all the interactions between the issues must be considered to avoid leaving out important aspects of knowledge management. Although we do not claim for our key challenges and issues to be the only possible choice of challenges and issues in knowledge management, these are based on an extensive selection of literature and can at least give indication of some important aspects, which point to both challenging and possibly fruitful facets of knowledge management from a scholar's perspective.

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