December 2003

Intranets for Knowledge Management: Applications Affording User Participation

Dick Stenmark
Göteborg University

Rikard Lindgren
Viktoria Institute

INTRANETS FOR KNOWLEDGE MANAGEMENT: APPLICATIONS AFFORDING USER PARTICIPATION

Dick Stenmark
Department of Informatics
Göteborg University
stenmark@informatik.gu.se

Rikard Lindgren
Telematics Group
Viktoria Institute
rikard@viktoria.se

Abstract

Most of today's organisations implement intranets to support, amongst other things, their knowledge management processes. Although intranets appear to be ideal arenas for organisational members to meet and share knowledge quickly and efficiently, actual usage in organisational practice seems limited. Intranets are typically marginalised to one-way communication channels for corporate information. The ambition of this research has been to produce knowledge on how intranets can be designed to better support knowledge management in organisations. We argue a prerequisite for the intranet to function as a knowledge management platform is a critical mass of usage and a content relevant for everyday work. Building on the evaluation results of two implemented interest-based prototype systems, we posit that an intranet must be equipped with applications that actively afford user participation. In this paper we contribute knowledge on how such intranet applications for knowledge management can be designed to take advantage of users' everyday actions. Such design-specific knowledge is important for organisations trying to transform their intranets from static electronic bulletin boards to useful knowledge management platforms.

Keywords: Intranet design, knowledge management, intranet applications, knowledge use

Introduction

The Internet existed quietly for many years without affecting the ordinary man's life. It was not until the advent of the World Wide Web (hereafter the web) that the Internet exploded in terms of both users and content. This distributed hypermedia system was initially developed to be "a pool of human knowledge, which would allow collaborators in remote sites to share their ideas…" (Berners-Lee et al., 1994, p. 76), and as such, it was designed to facilitate publishing and sharing of information by everyone. The ability to seamlessly connecting users from different computing environments, regardless of topologies or operating systems, opened for a dynamic, vivid, creative, and border-crossing environment where a multitude of file formats, topics, and content were mixed.

Internet solutions were soon to be brought inside the organisations. Separated from the rest of the Internet by firewalls, these corporate-internal webs became known as intranets. Implemented by most of today's organisations, intranets are often hailed as the ultimate solution to many issues, including support for the generation, representation, storage, transfer, and application of organisational knowledge (see *e.g.*, Scott, 1998). The possibility to be able to connect every employee via a unifying and single client promised to make the intranets ideal arenas for organisational members to meet and share knowledge quickly and efficiently. Even though the dissemination of intranets has been successful and the access to the technology is high, however, actual usage in organisational practice seems to be limited. The reports concerning actual business value have been largely anecdotal (Ryan & Martin, 1997) and in addition complemented with negative reports on hidden costs and performance limitations (Scott, 1998). Regarding knowledge management (KM) specifically, some commentators are suggesting that intranets are encouraging fission instead of integration and are in fact reinforcing existing barriers to knowledge sharing (Newell *et al*., 1999).

The ambition of this research has been to produce knowledge on how intranets can be designed to better support knowledge management. Such design-specific knowledge is particularly important for designers of intranets intended to support KM in large

and/ or geographically dispersed organisations where the organisational members do not know or know of each other and the organisation as a whole does not know what it knows. Benefiting from the knowledge of the individual employees becomes increasingly important in what we refer to as knowledge-based organisations, *i.e*., organisations depending on co-operation across boundaries, self-governing project groups, quick communication, and tight networks to achieve a competitive advantage in an unpredictable business environment (see *e.g*., Boland and Tenkasi, 1995; Tsoukas, 1996). Leveraging the intranet from a KM perspective means that the individual employees, and therefore the organisations as a whole, are able to make better use of their knowledge through regular intranet activities.

Creating a database of competence profiles is not enough for an organisation to establish a working competence system. The profiles must reflect competence-in-action not to become dead archive records of past achievements (Lindgren & Stenmark, 2002). Analogously, adding a web interface to a static KM system does not turn an intranet into a knowledge management environment. Obviously, content and usage is somewhat related but we argue it is not so much the content as the usage of the intranet that matters. Intranets must therefore be equipped with applications capable of capturing or making salient the actions the users perform during a regular work day. The pool of knowledge to which everyone would contribute envisioned by Berners-Lee needs a critical mass of relevant content for users to come there in the first place. Only when a sufficient ratio of producers exists amongst the consumers can the intranet become self-generating, and constitute a useful KM platform. Exploiting the traces that these users' everyday activities leave behind in form of web server log files, published documents, or submitted search engine queries, might be a feasible and unobtrusive way to leverage organisational knowledge. Based on a 29-month action case study conducted at Volvo Information Technology in Göteborg, Sweden, this research contributes knowledge on how intranet applications for knowledge management can be designed to take advantage of the user's everyday actions.

This paper is organised as follows. Section 2 presents KM and intranet research. Section 3 describes the research site, while section 4 presents the research method applied. Section 5 discusses the intranet application prototypes implemented and evaluated. Section 6, finally, contains the lessons learned from this research.

Knowledge Management and Intranet Research

Although some commentators have argued that intranets offer poor support for KM (cf. Newell *et al*., 1999), intranets still seem to interest the KM community and KM-related intranet studies continue to be published. We shall in this section categorise previous efforts in KM-related intranet research and use the result to position our own work. KM is largely regarded as an organisational process consisting of a number of activities where both the number and the labels of these activities differ between authors (Alavi and Leidner, 2001). In the absence of a generally agreed-upon definition, Alavi and Leidner suggest that a minimum of four basic KM processes can be identified – creating, storing/retrieving, transferring, and applying knowledge – and we structure this section on related work accordingly.

Research on intranets for knowledge creation examines intranets as a facilitator of innovation. It is argued that innovation cannot be "engineered", i.e., planned and controlled in the traditional sense, but should instead be "cultivated" and treated as garden work and it had been suggested that the pull-based access mechanism of the intranet is well suited for this management mode (cf., Yen and Chou, 2001). However, intranet efforts are noticed to be successful only when accompanied by relevant "people management" and organisational practices, and research efforts are made to predict under what circumstances intranets can assist and when they may hinder innovation and knowledge creation. Since knowledge depends more on (social) networking than on (physical) networks, care must be taken to ensure that intranets support social networking (Swan et al., 1999). Similar ideas can be traced in some of the latter work of Damsgaard and Scheepers (2001). To support knowledge creation, they argue, publishing must be paired with other intranet use modes to match different aspects of knowledge creation.

Research on *intranets for knowledge storage/retrieval* has developed along two different tracks. The intranet is described either as an unstructured knowledge base or as a media for free flow and exchange of information. The discussion in this discourse has parallels to the commodity vs. community perspectives on knowledge described by Swan et al. (1999). On the knowledge base side, researchers deal with basic concepts of and conceptual frameworks for KM and how these relate to intranet technology (cf., Scott, 1998). From the information flow perspective, intranets are being investigated from an information dissemination and collaboration point of view (cf., Lai and Mahapatra, 1998). Regardless of whether you see knowledge as static or dynamic, the intranet can be seen as an infrastructure for knowledge work (Choo et al., 2000) or as a general knowledge system. Some researchers claim, however, that the intranet's full potential to leverage organisational knowledge depends on appropriate user interfaces that can provide the organisational members with alternative views of the stored information (Standing and Benson, 2000).

Research on intranets for knowledge sharing acknowledges that the competitive edge of today's organisations lies in their ability to transfer knowledge between their members. Since organisations typically already have a number of separate "knowledge silos", i.e., non-interconnected repositories of vital information, an overarching KM system must be implemented to make these silos useful from a KM perspective. Such a KM system should preserve the functionality of each sub-system whilst enabling universal access to their content (Offsey, 1997). The intranet, which has dramatically lowered the barriers between such silos, is the natural base for a KM system of this sort, and the intranet's ability to achieve such transfer in a both user-friendly and cost-effective way has been highlighted (Cantoni *et al*., 2001). For example, one way of transferring organisational knowledge is via intranet-based online communities (*cf*., Cothrel and Williams, 1999). Though intranets can be useful to overcome localisation, however, it does not necessarily solve cultural problems (Ruppel and Harrington, 2001). Recognising that knowledge transfer depends not solely on technology but on social practices, research in this category is also aimed at management practices, reward systems, and cultural initiatives for the development of intranets that stimulate active sharing (Cantoni *et al*., 2001).

Research on *intranets for knowledge application* is concerned with how organisational members interact over the intranet to make use of their knowledge. For example, Choo *et al*. (2000) have monitored the information seeking behaviour of intranet users to study such interactions. The way in which the organisational actors search, create, and use information is to Choo and his colleagues central to how intranets that facilitate the use and re-use of knowledge should be designed. They suggest that intranets are to be understood as "socio-technical systems in which information seeking and use take place, rather than as systems that merely support the retrieval of information" (Choo et al., 2000, p. 103). Based on behavioural-ecological theories, they argue in favour of an intranet design that supports communication and collaboration.

To generalise, we assert that much of the existing KM research on intranets implicitly perceives intranets as information repositories with which different agents interact. Resulting from this assumption, improvements suggested have typically involved a re-organisation of either the information itself (e.g., add structure) or of the people using it (e.g., support social networks). We find that little attention has been paid to *what sort* of information needs to be present, *who* should provide the information, or the *ontological* dimension (i.e., whether the entire organisation, a smaller subset, or individual employees are affected). As a result of the focus on information or social issues, the design of new intranet *tools* to support KM has not been sufficiently explored and we intend to address this problem. It has been argued that whilst processes of knowledge creation, storage, and transfer do not necessarily result in improved organisational performance, effective knowledge application does (Alavi and Leidner, 2001). Similarly, Grant (1996) argues that the competitiveness of an organisation depends on its ability to effectively apply the existing knowledge and to take action rather than on the existing knowledge *per se*. We therefore advocate the introduction of intranet applications with the potential to support and leverage knowledge use in organisations, and intend to show principles underpinning such applications. This type of design-specific knowledge is important for organisations trying to transform their intranets from static electronic bulletin boards to useful platforms for KM.

The Research Site: Volvo Information Technology

With a global presence including offices in Belgium, Brazil, Great Britain, Malaysia, Sweden, and USA, Volvo Information Technology (VIT) is a large IT consultant firm. Originally being a Volvo internal resource and expertise centre for IT solutions, VIT now also have many customers outside the Volvo Group. By the time we finished our study in year 2000, VIT had approximately 2,500 employees of which some 1,400 worked in Sweden and roughly 900 in the Göteborg area, where VIT's head office is located. The intranet, which had been in place since 1995, was growing rather quickly both in terms of content, servers, and users. In the autumn of 1998, there were some 450 web servers and approximately 400,000 documents on the intranet. Two year later, those numbers had increased to over 700 web servers and close to 750,000 pages. Although these figures may suggest that Volvo had a vivid intranet, many employees experienced the opposite. In spite of the fact that all employees has their own computer (PCs or UNIX terminals) and were all connected to the intranet, only a handful of centrally located information department employees were actively publishing. Consequently, the information was biased towards official corporate information and not much personal information on employee level could be found. Further, the navigation structures of the official intranet pages promoted a top-down view of the content, with which the employees had trouble identifying. Hence, the employees had problems finding the information they needed or knowing when relevant information had been updated or added and the intranet therefore played a rather marginalised role in the organisation. The information staff regarded it their responsibility to provide the rest of the organisation with information but no KM activities were planned or initiated. As action researchers, we intended to show the organisation how to transform their intranet into a useful platform for knowledge management by introducing knowledge-enabling intranet prototype applications.

Research Method

Much design-oriented work on computer systems has been based on what Hughes and colleagues call "quick-and-dirty" ethnography (Hughes *et al*., 1994). However, such an approach captures only a very specific situation and without knowledge of the larger picture, it can be difficult to interpret the position correctly. This paper constitutes a useful contrast since it is based on a period of 29 months during which the authors have been able to follow and influence an organisation and its intranet usage.

The fact that one of the authors also has been employed by the organisation adds to the in-context understanding used during the analysis. Being an organisational member, one of the authors has had plenty of opportunities to both observe how the intranet has been used and to device and introduce new intranet applications. This has been used to influence the organisation's understanding of their intranet and intervene in the shaping of their information publishing policies. Consistent with the action research agenda (Baskerville and Wood-Harper, 1996), our work has thus contained a change-oriented element. Since introduction of new information systems normally brings about a certain amount of disruption, the prototypes that we have devised have been instrumental in provoking the organisational members to a more explicit sense making than otherwise necessary (*cf*., Zuboff, 1988; Schultze, 2000). The second author, not being part of the organisation, has been useful to balance what may otherwise have been a biased view of the organisation and its processes. In collaboration and dialogue, we have been able to pair deep contextual understanding with analytic distance in a fruitful way.

This research is primarily based on 33 semi-structured interviews (see Table 1). It has been argued that interviewing alone is not a sufficient foundation for IT design (Fagrell, 2000), and therefore we have collected data also via informal observations, archival records, moderated discussions and workshops, and focus groups sessions. Such triangulation requires both time and human resources and in addition to the two authors, four master students have been engaged in the fieldwork.

Table 1 Numbers and Categories of Respondents Interviewed During the Fieldwork

Role	Watson	VIP	Sum:
Systems developer	3	4	7
Technician	1	2	3
Systems programmer		3	3
Project manager		5	5
Department Manager	1	3	4
Human Relation staff		3	3
Analyst		3	3
Information staff	2	1	3
Technology watcher		1	1
Product manager		1	1
Sum:	**7**	**26**	**33**

The role of theory in interpretive studies may take one of three forms: as an initial guide to the study as such, as part of the data collection and analysis phase, and as a research outcome (Eisenhardt, 1989). Although the boundaries between these are obviously somewhat fuzzy, our primary use of theory has been as part of the iterative process of data collection and analysis, as in Orlikowski's (1993) study of CASE tool adoption. We have thus approached the data in a bottom-up and open-minded manner in order not to restrain ourselves to a pre-established agenda, and the decision about what conceptual framework to apply in each case has been based on a local/emergent orientation rather than on an elite/a priori understanding (Schultze and Leidner, 2002).

Intranet Application Prototypes

The work described in this paper focuses on two intranet application prototypes: Watson (read *What's on*) and Volvo Information Portal (VIP). The two prototypes are similar both in technology and rationale, as we shall describe below. However, they have been approached from two different perspectives; information management and knowledge management, respectively. This drift in perspective can be attributed to the insights we as researchers and the organisation together have arrived at. The process that our 29-month account is describing has altered both the researchers understanding and the organisations way of working.

The Watson application, developed with an information management perspective, was implemented in the autumn of 1998 as an attempt to provide a complement to the existing search engine (Stenmark, 2001). The objective of the Watson project was to build an application that would be able to provide the employees with more targeted information for a lower user effort. At the outset, the motive for Watson was purely information processing. The users expressed their information needs or interests in natural language profiles, which were turned into digital representations or "fingerprints". In parallel, the system crawled Volvo's intranet for web document that were also synthesised into this digital representation. Every night, the documents' fingerprints were compared with the user profiles, and whenever there was a match, the user was sent an email. This enabled users to be updated on intranet contributions in their area of interest. In addition, the users were supposed to create a free text-based description of their job role or work responsibilities, which also would be converted to a digital representation. When matched against each other, these role profiles could be used to locate and make users aware of peers in their "Community of Practice".

Instead of comparing interest profiles with document profiles to find relevant information, we realised that interest profiles could also be compared to each other. This feature allowed user not only to find people with similar role descriptions but also people with similar information needs. The unexpected result of the Watson study was that explicit role description profiles were considered dull and predictable, and not conceived as trustworthy. Instead, the interest-based profiles were considered interesting and much more trustworthy, since they were based on theory in use rather than on espoused theory. This way of finding similar users was highly appreciated but due to the relatively small number of test users, the system often returned few or no hits and it never became more than a nice demo.

On a superficial level the VIP application is merely an up-hotted version of Watson: a way to effortlessly satisfy the organisational members' information needs. The information processing agenda in form of retrieval agents were kept since this provided the incentive necessary for the organisational members to willingly and voluntarily engage in the technology. Indeed, the VIP application builds on its predecessor and shares many of the features, but the work with VIP started almost a year after we had analysed the Watson results and the insights gained from the previous work had caused our attention to shift. Although VIP was introduced to the organisation as an information portal, the analytic focus was on knowledge, and the information finding function provided a backdrop for the knowledge use we were interested in making tangible.

The role descriptions the Watson users were supposed to create and maintain were excluded in the VIP implementation, since they were not considered useful by the users. Consequently, the VIP application instead built on and further exploited the implicit profiles. While these were just a last minute addition in Watson, added because it was easy to implement, the implicit profiles became the cornerstone of the VIP system. Because these implicit profiles were the result of actual user behaviour in ordinary work situation, they did not tax the user's resources in form of time or cognitive capacity. Nor were they created for the artificial purpose of satisfying someone else's agenda. As a result, the profiles were kept up-to-date and regarded highly relevant, which is the direct opposite to what you find in most KM systems based on explicit profiles (*cf*., Lindgren and Henfridsson, 2002).

A second distinguishing addition in the VIP system was the Find Competence feature. During the evaluation of Watson, we realised that the employees not only were interested in finding similar people but also people with competences that they themselves lacked. The Find Competence feature was therefore implemented to enable search for an arbitrary competence. Since the Find Competence feature listed people who had set up and trained agents in the sought-for areas, the feature did obviously not locate people with formalised competence but people with an interest. To label this feature "Find Competence" was a deliberate provocation intended to cause the organisational members to reflect upon their assumptions and understanding. Even if many employees did not verbally acknowledge the relationship between interests and competence, they treated interests and competence in similar manners through their actions (Lindgren and Stenmark, 2002; Lindgren *et al*., 2003). However, being a prototype, VIP experienced the same problem as did Watson: some competences were never found because of the limited number of users being aware of the system.

Lessons Learned

Both these two prototypes – Watson and VIP – were successful in the sense that they managed to deliver an added value without requiring extra efforts from the beneficiaries. The users created and maintained their interest profiles motivated by the fact that it resulted in better information delivery. In addition, they got a tool that enabled them to find people interested in and therefore presumable also knowledgeable in any given topic. As argued elsewhere (Lindgren and Stenmark, 2002; Lindgren *et al*., 2003), we think this shows that spin-offs can be successfully exploited for KM purposes. The intranet being based on web technology is an important prerequisite when aiming to use spin-off effects. Unlike a payroll system, which is designed and implemented for a well-defined task, the web is not a "given" technology created for a specific and static purpose. Instead, web technology is

malleable and should be understood as multi-purpose and highly dynamic (Damsgaard and Scheepers, 1999; Lyytinen *et al.*, 1998). Whilst a payroll system has few spin-offs that might be exploited from a KM-perspective, an intranet can be set up to host a number of tools suitable for such leveraging. Even if activities such as sending email or reading and writing documents could be leveraged in a similar way, applications such as email systems and document management systems are often proprietary and not always possible to hook into, and also often implemented and managed in a top-down fashion. An intranet, in contrast, is typically built by the organisation and, even if management tries to apply control and exercise authority, to a larger degree a bottom-up technology that encourages user participation.

Although the spin-off principle was working, the prototypes remained on the test level. We attribute this failure to the lack of critical mass. An important prerequisite for an organisational KM system to work is therefore to have a sufficient number of users. If only a narrow vertical niche or a thin horizontal sub-level is represented, one risk running into the problem experienced in our work. One of the traits of an intranet is the ability to reach all corners of the organisation and it should thus have less of a problem gathering users. Analysing our failure in this respect, we see two possible explanations. First, we did not advertise our activities actively outside the group of approximate 100 employees who were aware of the experiments. Had we used corporate newsletters and magazines, internal mailing lists, or in-house seminars to inform the organisation of our work, we may have generated a much larger user community. Second, in order to find information about, say, database management, someone has to publish such information. The Volvo intranet was however strongly biased towards corporate-level information such as strategy documents and news on organisational changes. Top management and their information staff do not have access to the kind of detailed information useful for narrow employee categories such as technicians or mechanics. Such information would have to come directly from members of these communities themselves, but information publishing were not part of their work descriptions. Many employees therefore had little incentive for using the intranet.

Designing the intranet to support knowledge use in organisations means taking advantage of the tangible traces of everyday work on-line activities leave behind in form of published documents and server log entries. By exploiting the user's actions in an unobtrusively manner, ordinary workday tasks can be transformed into organisational benefit. An intranet that supports KM processes must hence be an intranet that is *used*. The more on-line activities the employees can engage in and the larger portion of the organisation that is mobilised, the more added value in form of KM spin-offs can be generated. With exception of the occasional surfing, the (semi-)static electronic bulletin boards that most of today's intranets constitute offer little opportunities for actions. Needed are applications. The applications should server two purposes: Firstly, enable users to act (e.g., to publish, to collaborate, to engage in dialogue, or – as in our case – to search), and secondly, capture and make salient these actions. Taken together, this would generate a critical mass of both users and relevant information, and only then can the intranet become the pool of human knowledge originally envisioned by Berners-Lee.

References

Alavi, M. and Leidner, D. E. (2001). Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues, MIS Quarterly, Vol. 25, No. 1, pp. 107-136.

Baskerville, R. L. and Wood-Harper, A. T. (1996). A Critical Perspective on Action Research as a Method for Information Systems Research, Journal of Information Technology 11, pp. 235-246.

Berners-Lee, T., Cailliau, R., Luotonen, A., Frystyk Nielsen, H., and Secret, A. (1994). The World Wide Web, Communications of the ACM, Vol. 39, No. 8, pp. 76-82.

Boland, R.J. and Tenkasi, R.V. (1995). Perspective Making and Perspective Taking in Communities of Knowing, Organisation Science, Vol. 6, No. 4, pp. 350-372.

Cantoni, F., Bello, M., and Frigerio, C. (2001). Lowering the Barriers to Knowledge Transfer and Dissemination: The Italian Cooperative Banks Experience, in Proceedings of ECIS 2001, Bled, Slovenia, pp. 665-673.

Choo, C. W., Detlor, B., and Turnbull, D. (2000). Web Work: Information Seeking and Knowledge Work on the World Wide Web, Kluwer Academic Publishers, Dordrecht.

Cothrel, J. and Williams, R. L. (1999). On-line Communities: Helping Them Form and Grow, Journal of Knowledge Management, Vol. 3, No. 1, pp.54-60.

Damsgaard, J. and Scheepers, R. (1999). Power, Influence, and Intranet Implementation: A Safari of South African Organisations, Information, Technology & People, Vol. 12, No. 4, pp. 333-358.

Eisenhardt, K. (1989). Building Theories from Case Study Research, Academy of Management Review, Vol. 14, No. 4, pp. 532-550.

Fagrell, H. (2002). Mobile Knowledge, Doctoral Dissertation, Department of Informatics, Gothenburg University, Sweden.

Grant, R.M. (1996). Towards a Knowledge-Based Theory of the Firm, Strategic Management Journal, Vol. 17 (Winter Special Issue), pp. 109-122.

Hughes, J., King, V., Rodden, T., and Andersen, H. (1994). Moving Out of the Control Room: Ethnography in System Design, in Proceedings of CSCW '94, Chapell Hill, NC: ACM Press, pp. 429-439.

Lai, V. S. and Mahapatra, R. K. (1998). Evaluation of Intranets in a Distributed Environment, Decision Support Systems, Vol. 23, pp. 347-357.

Lindgren, R. and Henfridsson, O. (2002). Using Competence Systems: Adoption Barriers and Design Suggestions, Journal of Information & Knowledge Management, Vol. 1, No. 1, pp. 65-77.

Lindgren, R. and Stenmark, D. (2002). Designing Competence Systems: Towards Interest-Activated Technology, Scandinavian Journal of Information Systems, Vol. 14, pp. 19-35.

Lindgren, R., Stenmark, D. and Ljungberg, J. (2003). Rethinking Competence Systems for Knowledge-Based Organisations, European Journal of Information Systems, Vol. 12, Issue 1.

Lyytinen, K., Rose, G., and Welke, R. (1998). The Brave New World of Development in the Internetwork Computing Architecture (InterNCA), Information Systems Journal, Vol. 8, pp. 241-253.

Newell, S., Scarbrough, H., Swan, J., and Hislop, D. (1999). Intranets and Knowledge Management: Complex Processes and Ironic Outcomes, in Proceedings of the 32nd Hawaii International Conference on System Sciences.

Offsey, S. (1997). Knowledge Management: Linking People to Knowledge for Bottom Line Results, Journal of Knowledge Management, Vol. 1, No. 2, pp. 113-122.

Orlikowski, W. J. (1993). CASE Tools as Organisational Change: Investigating Incremental and Radical Changes in Systems Development, MIS Quarterly, Vol. 17, No. 3, pp. 309-340.

Ruppel, C. P. and Harrington, S. K. (2001). Sharing Knowledge through Intranets: A Study of Organisational Culture and Intranet Implementation, IEEE Transactions on Professional Communication, Vol. 44, Issue 1, pp. 37-52.

Ryan, D. and Martin, K. "Intranet Business Value: Return on Investment Analysis", Meta Group Consulting, June 19, 1997.

Schultze, U. (2000). A Confessional Account of an Ethnography about Knowledge Work, MIS Quarterly, Vol. 24, No. 1, pp. 3-41.

Schultze, U. and Leidner, D. (2002). Studying Knowledge Management in Information Systems Research: Discourses and Theoretical Assumptions, MIS Quarterly, Vol. 26, No. 3, pp. 213-242.

Scott, J. E. (1998). Organisational Knowledge and the Intranet, Decision Support Systems, Vol. 23, pp. 3-17.

Stenmark, D. (2001). Leveraging Tacit Organisational Knowledge, Journal of Management Information Systems, Vol. 17, No. 3, pp. 9-24.

Standing, C. and Benson, S. (2000). Irradiating Intranet Knowledge: The Role of the Interface, Journal of Knowledge Management, Vol. 4, No. 3, pp. 244-251.

Swan, J., Newell, S., Scarbrough, H., and Hislop, D. (1999). Knowledge Management and Innovation: Networks and Networking, Journal of Knowledge Management, Vol. 3, No. 4, pp. 262-275.

Tsoukas, H. (1996). The Firm as a Distributed Knowledge System: A Constructivist Approach, Strategic Management Journal, Vol. 17, pp. 11-25.

Yen, D. C. and Chou, D. C. (2001). Intranets for Organisational Innovation', Information Management & Computer Security, Vol. 9, No. 2, pp. 80-87.

Zuboff, S. (1988). In the Age of the Smart Machine, Basic Books, New York, NY.