

2006

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Recommended Citation

Lichtenstein, Sharman; Parker, Craig M.; and Hunter, Alexia, "Toward an Integrative Role for Intranets: An Interpretive Case Study of Intranet-based Dynamic Knowledge Integration in Socio-technical Networks" (2006). *ACIS 2006 Proceedings*. 84.
<http://aisel.aisnet.org/acis2006/84>

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Toward an Integrative Role for Intranets: An Interpretive Case Study of Intranet-based Dynamic Knowledge Integration in Socio-technical Networks

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Abstract

An increasing challenge for contemporary businesses is to be able to respond to perceived opportunities and threats by dynamically integrating knowledge dispersed across and beyond the organisation. This paper provides findings from two interpretive case studies that illustrate how corporate intranets can be dynamically interwoven with other knowledge technologies in socio-technical networks (STNs) to integrate distributed formal and informal knowledge. A key finding suggests that businesses should carefully examine employee use of intranets for dynamic knowledge integration, and any implications stemming from this new integrative role for intranets. The paper also provides a theoretical framework for dynamic knowledge integration in STNs, which can underpin future research in this area.

Keywords

Intranet, intranet management, knowledge integration, socio-technical network, knowledge sharing

INTRODUCTION

Dynamic knowledge integration is an increasingly important organisational capability and should therefore be supported (Grant, 1996). Seeking to respond to emerging opportunities and threats in real time, sense-and-respond organisations (Haeckel 1999) must dynamically integrate knowledge distributed across systems, disciplines, organisational boundaries, communities, time zones and regions (Alavi & Tiwana 2002). Recognised knowledge integration mechanisms include routines, rules, problem-solving groups, virtual teams, boundary spanners, cross-functional projects, communities of practice (CoP) and knowledge brokers (Alavi & Tiwana 2002; Lamb 2003; Wenger 1998). However such approaches, while effective in many organisational contexts, do not account for evolving patterns of informal interactions occurring between people and technologies in sense-and-respond organisations where any person may be a useful knowledge source or a conduit to a useful knowledge source.

We argue that the transient organisational form “socio-technical network” (STN) is a potentially valuable dynamic integrative mechanism for sense-and-respond organisations (after Boland et al, 2003; Borgatti & Cross 2003). STNs have been defined as “the enactment of patterns of interaction and relationship which occur between individuals, within and between organizations and institutions, and through information and communications technologies (ICT) which embed, and are embedded in interactions” (Davidson & Lamb 2001, p.1). To understand how STNs might help draw together knowledge found flowing through different technological and human channels, we first sought guidance from the knowledge management literature, where we discovered very little theory on how and why knowledge workers choose particular ICTs to share and integrate knowledge in social networks. In addition, with few exceptions we discovered an emphasis in the literature on the organisational and social aspects in isolation from the technological issues. Recently, information systems experts called for researchers to refocus on the ICT artefacts in systems and organisations while paying attention to the social aspects of technology use (Orlikowski & Iacono 2001). This study acknowledges this call and explores a new integrative role for *corporate intranets* for dynamic knowledge integration in STNs. Intranets, with their open non-proprietary architecture, are considered potentially valuable tools for sharing and integrating corporate information and knowledge (Lamb, 2003; Skok & Kalmanovitch 2005).

In this paper we propose a theoretical framework for dynamic knowledge integration in STNs. Intranets play a special integrative role in our framework as we will show. This framework makes an important contribution to the knowledge management literature because previous frameworks that conceptualise knowledge integration (i) focus on static knowledge integration rather than taking a dynamic approach, (ii) overlook the potential value of

ad hoc STNs for facilitating dynamic knowledge integration, (iii) overlook the symbiotic relationship between formal and informal organisational knowledge and (iv) overlook the potentially valuable integrative role of corporate intranets. The paper also contributes to the intranet literature by providing preliminary evidence of a new dynamic integrative role for intranets. Practical implications from this study include important insights that can inform corporate intranet policy-making.

In the next section we propose and describe a theoretical framework for dynamic knowledge integration in STNs. We then overview the research design, after which we present key findings from two interpretive case studies that illustrate the value of the theoretical framework. After reflecting on the theoretical and practical implications of this research, we conclude with final comments and propose future research directions.

THEORETICAL FOUNDATIONS

In this section we propose and explore a theoretical framework for dynamic knowledge integration in STNs (figure 1). We emphasise that this paper does not aim to validate this framework but rather to illustrate its theoretical concepts, as well as to use it to frame the succeeding empirical analysis.

First, we overview the framework and second, we review its elements. In the framework, the impetus for dynamic knowledge integration derives from responding to a practical problem (that is, an opportunity or threat) sensed by one or more people in the organisation (Haeckel 1999). This is henceforth termed a “sense-and-respond” situation. The framework proposes that in order to identify a solution (or make a decision), distributed formal and informal knowledge from within and outside the company must be assembled and integrated. A distributed organisational memory is therefore accessed, comprising social actors (*actors*), processes, norms, standards and technologies (Ackerman & Halverson 2000). Actors tap into needed knowledge found in organisational memory and/or the external environment (e.g. the World Wide Web or a business partner) using ICTs (knowledge technologies) as needed in order to synthesise assembled knowledge and develop a solution or make a decision. Dispersed formal and informal knowledge are integrated during interaction and negotiation processes that are enabled by ICTs. The synthesised knowledge extends organisational memory. Following, we review key elements from the framework. Paper size constraints clearly limit the detail which can be provided in this review.

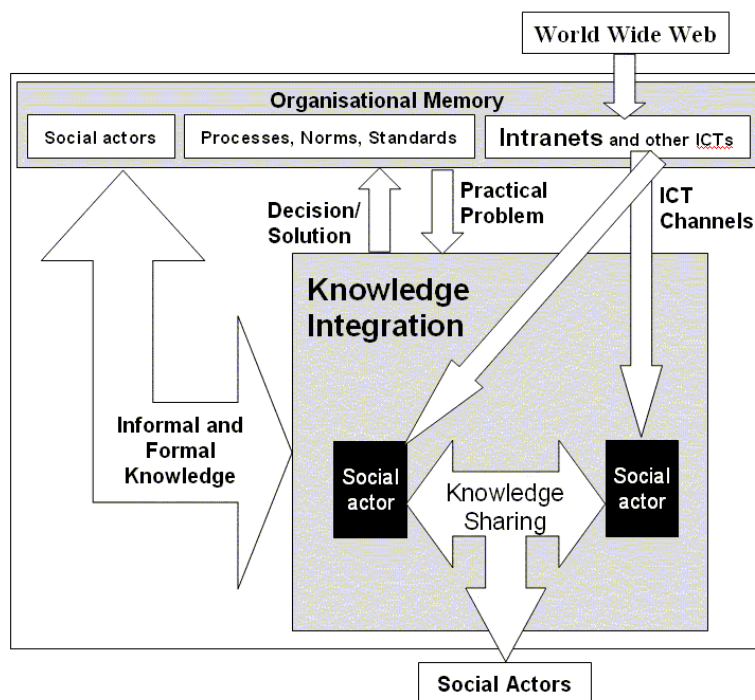


Figure 1: Dynamic knowledge integration using intranets in socio-technical networks

Informal and formal knowledge

We define knowledge according to Barabba and Zaltman’s (1991) transformational view of data, information, intelligence and knowledge. In this view, codified observations are obtained from a marketplace of data which, when placed in some decision context, are transformed into information. In the analysis of information, intelligence is developed. When high levels of confidence are developed in a body of intelligence, knowledge is created. Hildreth and Kimble suggest that knowledge has dual complementary aspects – hard and soft knowledge

– and that knowledge is embedded in practice and therefore has a social aspect (Hildreth & Kimble 2002). We adopt the epistemological position that knowledge has dual complementary aspects of formal and informal knowledge, which Hildreth and Kimble note are closely related to hard and soft knowledge.

Formal knowledge is the product of knowledge workers and includes reports, plans, designs, memos and structured formal business processes. Such knowledge is general and rule-like and has been called “know-what” (Garud 1997). Some formal knowledge has longevity and is reused frequently over an extended period. Such knowledge can be stored in shared repositories such as intranets where the knowledge can be easily accessed and updated. However, such formal knowledge can also be difficult to locate, retrieve, understand, contextualise and integrate with other knowledge (Kautz & Mahnke 2003).

Informal knowledge includes knowledge that is created and used in the process of creating a final result and includes knowledge-based answers to reflective questions such as: “Why did we do it that way?” (Conklin 1996, p.7) Conklin lists various types of informal knowledge such as ideas, facts, assumptions, questions, decisions, guesses and viewpoints. While informal knowledge is considered just as important as formal knowledge, Conklin points out that informal knowledge is rarely captured in Western societies which tend to value results rather than what happened on the way to the results. Informal knowledge usually flows through and beyond organisations and can be difficult to access. Experts have attempted to categorise the different types of informal knowledge. A key type of informal knowledge is “know-why” (Garud 1997), such as “lessons learned”. A second key type of informal knowledge (“know-how”) is the ability to put “know-what” into practice from experience or interactive assistance (Garud 1997). A third category of informal knowledge is the weakly structured business processes that are increasingly prevalent in businesses yet prove difficult to define (Papavassiliou & Mentzas 2003).

Conklin suggests that informal knowledge can act as the glue that holds formal knowledge together and provides context (Conklin 1996). The combination of formal and informal knowledge would be valuable in a sense-and-respond context where knowledge sources are highly distributed and it is unclear which sources are needed for a response. Such sources may be formal or informal. Ideally, formal and informal knowledge in organisations should be made available to actors as components of organisational memory (Euzenat 1996).

Organisational memory

Organisational memory is “the collection of historical corporate knowledge that is employed for current use through appropriate methods of gathering, organizing, refining, and disseminating the stored information and knowledge” (Nilakanta et al. 2006). For currency, memory must clearly be up-to-date while for use, trust in the memory is needed. Nilakanta and colleagues provide a comprehensive review of organisational memory (Nilakanta et al. 2006). However here we are primarily interested in the centralised/distributed nature of organisational memory and its ability to support linkages between formal and informal knowledge.

A centralised memory is comprised of the knowledge of an organisation compiled and integrated over time and is stored in global repositories structured by global ontologies or in shallow structures accessed through information retrieval (Van Elst et al. 2004). This knowledge is most probably formal knowledge as it has longevity. There is no connection between that knowledge and informal knowledge. In distributed memories, which we propose as shown in figure 1, organisational memory retains the distributed knowledge of actors; processes, norms and standards in which memory is also embedded; and ICTs (Ackerman & Halverson 2000). This knowledge may be comprised of informal and formal knowledge. Researchers recently proposed a shared ontological structure to link distributed group memories (Van Elst et al. 2004) and transactive memory systems to support group memory (Nevo & Wand 2005). However, group-based structures do not support sense-and-respond situations where knowledge needs are emergent and any person within or without the structure may be an important knowledge source. Clearly a supportive structure is needed to underpin the linking of components of distributed memories.

Role of socio-technical networks in supporting dynamic knowledge integration

We contend that a STN is a potentially valuable supportive organisational form for dynamic knowledge integration in sense-and-respond organisational contexts. STNs coalesce around the cooperation, collaboration and knowledge work of fluid, transient configurations of “social actors” (*actors*) who use Web-based technologies and other ICTs across and beyond organisations (Davidson & Lamb 2001; Lamb & Kling 2003; Tiwana 2003). In STNs, knowledge may be integrated by actors who access local components of distributed organisational memory and diverse external sources such as the World Wide Web and external experts. Actors are empowered (Fuchs, 2003) and in dynamic sense-and-respond situations may therefore bypass established communities of practice and other organised networks if they adjudge that the relevant knowledge is best shared or retrieved in informal networks enacted according to immediate knowledge needs. In informal transient networks, a wider, flexible, responsive pool of knowledge-based resources is accessible (Bradley & Nolan 1998). Further, STNs serve to mobilise valuable social capital to support future knowledge sharing (Cross 2004). Despite their apparent potential as a supportive organisational structure for integrating knowledge in dynamic

sense-and-respond contexts, STNs have not been well-explored for this purpose in the knowledge management literature.

In this research, we are particularly interested in studying actor selection of intranets and other knowledge technologies for knowledge integration in STNs. Clearly, the technologies chosen as knowledge sources and conduits by actors who integrate knowledge in STNs will influence knowledge outcomes (problem solutions and decisions) and the effectiveness and efficiency of the knowledge integration process. It is also important to note that actors orient their use of different technologies according to social - as well as technical - factors (Lamb & Kling 2003).

Integrating knowledge using intranets and ICT channels

We argue that corporate intranets can play a valuable role in the dynamic integration of dispersed formal and informal knowledge in STNs with assistance from other supporting ICTs. First, in the past decade intranets have proliferated in medium- and large-size businesses globally (Singh 2005). By offering shared Web-based access to formal knowledge, corporate intranets can ground knowledge integration efforts in a common formal knowledge base (Choo et al. 2003; Lamb 2003; Skok & Kalmanovitch 2005). In an integrative role, intranets represent boundary objects for open knowledge work between dispersed actors (Hall 2004). Recent accounts of challenges for developing effective corporate intranets portray them as collections of independent silos of knowledge rather than useful boundary objects (Lamb 2003; Newell et al. 2001) with the silo trend expected to continue (Singh 2005). Therefore to be useful in sense-and-respond situations, the formal knowledge found in intranet silos must be integrated in real time with the valuable formal and informal knowledge located in other sources. Vaast (2004) has observed how intranets can link CoPs to form "Networks of Practice. Similarly, in STNs the formal content of intranets could be accessed and combined with informal knowledge flowing in other ICT channels (e.g. electronic mail) where a symbiotic relationship exists.

How are ICTs chosen for organisational knowledge sharing and integration, and is a symbiotic relationship likely to be found in the choices made? Experts have noted that the use of organisational technologies can drift with time to new uses which were never intended (Ciborra et al., 2000). In support of this theory there are important social explanations for why people choose ICTs to share knowledge and communicate, such as the need to reach a target audience and the desire to influence others (Straub & Karahanna 1998; Lichtenstein et al. 2004; Firth 2004). Similarly, Stenmark has suggested that intranet use tends to evolve according to environmental and social influences, not all of which promote effective intranet use (Stenmark, 2006).

Clearly, intranet strategy, management and policy will affect the integration of knowledge where intranets are involved. Academic discussions surrounding intranet strategy centre on comparing the benefits obtainable from centralised management (Damsgaard & Scheepers 2000) with those obtainable from an evolutionary distributed approach (Stenmark 2006). The benefits of a centralised approach include the potential to have a single view of explicit knowledge across the firm (cf. centralised organisational memory). However, such intranets tend to be unwieldy, inflexible and difficult to reorganise when organisational knowledge requirements evolve. The benefits of a grass-roots distributed approach include content that reflects local knowledge needs rather than management power (Stenmark 2006). An evolutionary strategy provides a greater opportunity for actors to hone local intranets to meet rapidly changing local needs while sharpening the potential dynamic integrative value of the intranets.

We now explore the research topic empirically, as explained in the next section.

RESEARCH METHODOLOGY AND DESIGN

As dynamic knowledge integration using intranets is not well-understood, the research called for inductive exploratory studies where the findings are ground in proximate observation of the phenomena of study (Galliers 1992). We conducted two interpretive case studies as part of a larger study of organisational knowledge sharing. The cases were a large Australian retail organisation, OzRetail, and the Australian headquarters of a large multinational information technology corporation, GloTech. The case-related names are pseudonyms. Both companies had deployed intranet technologies for several years although GloTech's intranet use was considerably more advanced, and only GloTech possessed a formal knowledge management strategy. These differences enabled important insights to be developed that related to managerial versus grass roots effects of intranet evolution. The units studied comprised teams of system developers, analysts, web developers, corporate marketers, testers, team leaders and technical team managers. Thus the views of actors with a very good understanding of knowledge technologies and related social issues were tapped.

The main data gathered comprised seventeen audio-taped, semi-structured, single interviews of an hour's duration. We also attended and observed several meetings, made written observations of knowledge sharing venues and knowledge technology use (in particular, intranet use), and collected relevant documents. At the start of the interviews, key terms and definitions were provided to participants. Interview questions probed the decision to share knowledge with others, individual rationale for the selection of ICTs for sharing knowledge,

and issues that motivated or limited knowledge sharing (see Hunter 2003 for the complete set of questions). We discovered in an initial analysis that often when intranets were employed, they were used in conjunction with other ICTs in transient networks in order to develop integrated responses to emergent problems (Lichtenstein et al. 2004). This finding led to a more focused study of dynamic knowledge integration, the results of which are reported in this paper.

Coded themes were inductively developed from a qualitative content analysis (Krippendorff 1980) of the interview transcripts that focused on identifying key themes relating to the use of the intranet for dynamic knowledge integration in STNs (figure 1). Themes evolved to conclusive states over iterative readings. Additional insights gained from observations and documents were used to validate and enhance the themes.

INTRANETS AT CASE COMPANIES

A brief overview of each company's intranet deployment and utilisation follows. In GloTech's Australian head office, the official knowledge management strategy had not filtered down to the team level, as employees interviewed were unaware of such a strategy. Nevertheless, many teams had developed their own sections on the corporate intranet, following directives from management. Teams were actively publishing, sometimes using the services of an internal Web Services team. Intranet sections existed for human resources, quality control, finance, marketing, and corporate news, among many others. Some sections were accessible by the public or business partners, who in some cases were providing content. For example, a marketing agency developed advertisements that were e-mailed to the company which published the advertisements publicly on the marketing team's intranet. However, informal knowledge sharing largely took place within teams or units, either face-to-face at desks, by e-mail, or in meetings.

In contrast to GloTech, at OzRetail there were no formal knowledge management initiatives. Most intranet sites had evolved as group initiatives and were group-oriented in content. Few intranet sites existed apart from the main corporate portal and a few product brand sites that managed marketing and selected sales. The intranet sites were maintained by three technical teams which worked closely together and with an external software provider to develop applications. Others in the company were prohibited from publishing although they could submit requests for publication to a technical team. Formal business processes were the main type of knowledge stored. The architecture of the official intranet pages promoted group-based content, leading employees to take little direct interest outside their own group's intranet site.

At each company, whenever there was a perceived knowledge need which could not be answered within the group concerned, employees interacted electronically with other dispersed employees, partners, providers, customers and suppliers, to share and integrate knowledge informally, thereby enacting *ad hoc* STNs.

FINDINGS

In this section we discuss key findings in relation to the theoretical framework (figure 1). These findings were compiled from the themes that emerged in the data analysis, in respect of the theoretical framework. In the ensuing discussion, the study's participants are representative of the internal actors shown in the figure. All quotes included here were articulated during interviews. We discuss organisational memory and the role that intranets played in them, intranet and e-mail use for sharing formal and informal knowledge in STNs, and the dynamic integration of knowledge when intranets were involved and STNs employed. We also point out that, while participants were given a definition differentiating knowledge and information, they sometimes used the term "information" rather than "knowledge" in their responses. To ensure that we correctly interpreted such responses, the researcher checked with such participants to ascertain whether they were, in fact, discussing knowledge rather than information. We have marked all such corrected instances by "[knowledge]".

Organisational memory and the role of intranets

The organisational memory at each company was distributed, comprising employees, business processes, norms, standards, e-mail messages, personal computers and, of particular interest in this research, a corporate intranet. In this section we focus on the two corporate intranets, which were used by employees to share business processes, events, and various other types of formal knowledge and information. What had evolved at each company as its "corporate intranet" was, in fact, a collection of distributed intranet sites which were treated by participants as distinct intranets. Each team maintained team-based knowledge on its intranet, as now discussed.

As each team was specialised, its knowledge was stored in specialised sections which were effectively isolated by team member password protection and/or lack of interest from others outside the team. Thus participants did not seek knowledge from (most of the) other intranet sections as they had little understanding of how such knowledge related to their work. As one developer remarked: "*Most users may only need [knowledge] in their division, so it is easy for them to go to their department's section on the intranet to find what they are looking for*".

[Developer]. Moreover, lack of time and inadequate awareness had resulted in a lack of familiarity with other sites: *"I generally don't have enough time to look at GloTech news. [Also] I didn't know GloNet existed until two months into working here, probably because I never had to use it"* [Analyst]. This insular pattern of knowledge seeking led to difficulties when actors needed specialised knowledge that lay outside their domain: *"I use a search engine to find [knowledge] I need on other teams' pages [team intranets] and if I can't find what I am looking for using this search engine, then I will ask other employees. As a last resort, I will ask my manager."* [Marketing administrator]

As discussed in the theoretical foundations section, organisational memory should be kept up-to-date to remain current and therefore be used. While the distributed intranets were key components of organisational memory, the consensus from most participants at GloTech was that intranet content was only about eighty (80) per cent accurate, leading participants to distrust intranet content. Explanations offered in that company for inaccurate content were first, that the publication process was tedious and cumbersome, and second, there was not enough time to publish absolutely everything: *"I have papers in my drawers explaining the minor details that have been left out of the eGlo procedures pages which I use when I complete some tasks at work. I might update these pages to include these details at a later date but that will depend on time"* [Developer]. Contractors at GloTech mentioned that content updating was considered unproductive by managers and that they were being paid to show results (which apparently did not include updating). Updates did not present a visible contribution and were considered boring: *"The truth is that no one ever enjoys documentation, and that's why they won't do it"* [Analyst]. In both companies, intranet publishing was not directly integrated with everyday work practices, thus contributing to outdated content: *"We don't update the intranet pages that often. Since I have been here I have not updated the intranet pages, ever"* [Developer]. Content management was recognised as necessary for an accurate intranet component of organisational memory: *"The intranet also has to be updated a lot, so you have to have someone in the team who is dedicated to documentation, and updating that documentation that is stored on the intranet"* [Analyst]. However, because of small team sizes, managers considered that a technical position of this kind for each team would be too expensive.

Other organisational memory components were not the focus of this research, but included e-mail messages and informal personal understandings of business processes and other business issues. Some participants were outsourced contractors and therefore some of their knowledge was not considered part of the organisation's memory, although their knowledge could theoretically be accessed for the duration of a contract.

We now turn to findings concerning the different knowledge technologies used to share formal and informal knowledge, focusing on the use of intranets and e-mail, as it was found that these technologies were often used in combination in order to integrate knowledge.

Intranet and e-mail use for sharing formal and informal knowledge

The main technology used for knowledge sharing in conjunction with intranets was e-mail, with each technology used to share a different type of knowledge. The profile of knowledge shared directly by e-mail was: informal, *ad hoc*, "what is done," descriptive, situated, time-sensitive, accountable, personalised, contextualised, detailed, fragmented, urgent, important, unapproved, reflective, and customised. In contrast, the profile of knowledge shared directly by intranets was: formal, structured, one-to-many, generalised, incomplete, static, complex, non-urgent, not immediately relevant, long lifespan and prescriptive.

E-mail was the primary electronic channel used for sharing informal knowledge when there was an *ad hoc* knowledge need: *"E-mail is our primary form of contact with clients, so I use it all day at work"* [Intranet manager]. If the knowledge was urgent, e-mail was often chosen to share it: *"If there is something that is urgent that the group needs to know about, it's either sent through e-mails or basically, I just turn around and talk to our team"* [Developer]. If the knowledge had to be recorded as well as immediately shared, e-mail was selected: *"E-mail [is selected] so that the message is documented, so if they forget or if I forget what I have said, they or I can go back to the message and check"* [Systems engineer].

Intranets were mainly consulted on the first occasion that a process was needed. However, once a participant knew the process, he/she was able to share it with others: *"Once you get used to completing your daily tasks on a routine basis you no longer have to look at eGlo procedures regularly"* [Web services developer]. Intranets were used by participants to share business processes, events, and various other types of formal knowledge. The size of the audience for whom the knowledge was relevant was also a factor in the selection of the intranet for sharing knowledge: *"If it is a common process that they and others within the team need to know then I will publish a page of eGlo procedures on the intranet"* [External intranet contractor]. Intranets also provided links to other actors: *"We have applications that we use on the intranet for locating people in the organisation"* [Systems engineer].

What is surprising is that employees had intuitively understood the complementarity of intranets and e-mail for sharing formal and informal knowledge (respectively) and had integrated these two channels in some interesting ways, as we discuss in the next section.

Dynamic integration of formal and informal knowledge using intranets, e-mail and people

Illustrating figure 1, formal and informal knowledge were integrated using intranets, e-mail and people via two strategies when fulfilling everyday unanticipated knowledge application needs: 'Distillation' and 'First port of call'.

Regular distillation of intranet knowledge was mentioned by most participants. At both companies, e-mail was integrated with intranets in order to market and/or informally contextualise intranet content, as follows. A distilled version of intranet content was despatched by e-mail to actors within and beyond the organisation, together with a hyperlink to an intranet page: *"If you put the knowledge on the intranet and provide the main points and a [hyper]link in an e-mail, that is more effective"* [External intranet contractor] and *"The most recent event that was advertised on the intranet was for a charity event. It was advertised mainly through e-mail blasts containing a URL to an intranet site with all the details... For this event, a web form embedded in an e-mail was sent out to everyone, who can then register via reply"* [Marketing publisher]. However, this practice served to perpetuate the habit of not reading the content on the corporate intranet: *"I don't read it [company news] on the intranet because we get e-mails detailing any important news updates, and I just read them"* [Developer].

A second integrative approach described by eight of the seventeen interviewees was the use of an intranet as a "first port of call". By a sequenced selection of technological and human channels, formal prescriptive knowledge on intranets could be integrated with informal descriptive knowledge accessible by an interactive channel. Intranet inaccuracies were sometimes handled this way: *"I use the intranet as a starting point, knowing it is probably not accurate. Then I ask someone for the rest of the information"* [Analyst]. Participants also expressed a desire to know how business processes really worked (informal knowledge) in addition to the procedures that were supposed to be carried out for a business process (formal knowledge): *"If I know that it is on eGlo procedures intranet then I will first read it there and then I will contact the person who wrote the procedures, if I need to know more or clarify anything on the procedures pages"* [Intranet manager].

DISCUSSION

In the above findings we have identified and discussed key elements of the theoretical model in figure 1 and shown how STNs are enacted by patterns of interaction. We have highlighted two emergent strategies for the dynamic integration of formal and informal knowledge using intranets, e-mail and people

Several theoretical implications arising from the findings support existing theory while others break new ground. First, supporting existing theory, social interpretations of knowledge technology had led to the formation of collective beliefs about each of the technologies that, in turn, had been shaped by past experiences. Such beliefs had evolved to become self-fulfilling prophecies, as was also found by Bansler and Havn (2004). These prophecies had shaped ICT choices and uses for knowledge sharing and integration. The four key beliefs that participants held about using intranets for knowledge sharing and integration were:

- intranet content accuracy was not one hundred percent reliable and therefore lacked value;
- it was too difficult to publish knowledge on an intranet;
- it was difficult to find knowledge on other teams' intranets;
- people read e-mail messages if short and relevant, but would not browse intranets for knowledge.

These beliefs had led to greater reliance for knowledge sharing on the use of interactive knowledge technologies where informal knowledge flowed. As a new theoretical implication, these findings suggest that informal knowledge flowing through interactive knowledge technologies is intuitively integrated with formal knowledge on intranets in a complementary way in order to exploit the benefits and address the limitations of each technology.

Second, supporting known theories of organisational technology drift (Ciborra et al. 2000) and intranet evolution (Stenmark 2006), while providing new implications for knowledge integration using intranets, the findings suggest that actors in STNs shape intranet and ICT use for knowledge sharing and integration in ways that: match their need to interact in transient STNs that include other workers, partners and other third parties; attract attention to intranet content in a convenient way; integrate different intranets, other channels and formal/informal knowledge; and contextualise, personalise and integrate knowledge.

Third, as an important new theoretical contribution, this paper has proposed a theoretical framework for dynamic knowledge integration in STNs (figure 1), which is based on a synthesis of existing literature. Relevant findings from an analysis of data sourced from two case studies on organisational knowledge sharing have provided some evidence that our framework offers a rich theoretical basis for analysing the complex interrelationships between the human and ICT channels by which dynamic knowledge integration can occur. The cases illustrate the use of the framework by showing how static intranets can be useful for dynamically integrating knowledge when the intranets are interwoven with other ICTs such as e-mail through which flows the informal knowledge needed to make sense of, and situate, formal organisational knowledge. Dynamic knowledge integration appears to be well supported by STNs.

Fourth, providing a second important new theoretical contribution, the findings suggest that the availability of alternative ICTs with relative advantage for knowledge sharing as perceived by actors in a STN may shape the choice and use of ICTs for integrating knowledge. We identified two strategies which were not apparent in the literature, namely *distillation* and *first-port-of-call*, where intranets were integrated with other channels and knowledge, illustrating that intranets can be valuable as dynamic integrative mechanisms in STNs. Future research can explore other cases to identify additional integrative scenarios in other organisational contexts.

In addition to the above theoretical implications, this paper has several important practical implications for organisational knowledge management leaders who set intranet policy. Managers should note the power that is invested in knowledge workers who distil intranet knowledge within e-mail messages and thereby influence the integrated knowledge outcome. As Firth (2004) observed, employees who share knowledge with others may be attempting to influence them. It is important that actors who distil knowledge in this way are sufficiently knowledgeable and skilled so that they develop effective, unbiased, valuable distillations. What are the consequences if receivers do not later read the intranet page that is linked and merely rely on the distilled e-mail version? As Orlikowski (1992) cautioned, technology not only enables but constrains. It is important that employees are not deceived by possibly biased fragments of knowledge appearing in e-mail when the complete version on the intranet may tell a different story. A second practical implication is that unless intranets are kept up-to-date, workers will adapt and verify the content in their own ways. A third important implication for managers is that when intranet use is evaluated, the integration strategies revealed in the case studies should also be evaluated. Managers can ensure that the intranet policy contains strategies and processes for addressing these issues. The implications for choosing between a centralised (Damsgaard & Scheepers 2000) or distributed (Stenmark 2006) intranet architecture suggest moving to a federated approach, where control of content and use is assured at a central level but local groups can develop familiarity and some responsibility for local intranets.

CONCLUSION

This paper has reported a study investigating the dynamic integration of dispersed formal and informal knowledge in STNs in an organisational setting using a newly developed theoretical framework. It has focused on how intranets may add value in a new dynamic integrative role in sense-and-respond organisational contexts. Future interpretive research involving additional case studies in other contexts is needed to determine whether the preliminary framework requires further refinement. Suggesting another research direction, Choo and colleagues developed a methodology that guides the design and implementation of intranets and which begins by co-analysing a company's information ecology and information behaviour (Choo et al. 2003). In their methodology, however, the authors do not examine specific ways in which intranets can be effectively interwoven with other ICTs to achieve dynamic knowledge integration in unpredictable circumstances. The findings from this paper may be useful for extending the researchers' approach.

Notwithstanding the significant implications of our findings for intranet and knowledge management theory and practice, the findings have an important limitation. Notably, the findings are based on interpretive case studies of only two organisations, and the intranets examined are comparatively rudimentary in terms of functionality. However, our goal in this paper was not to consider specific features of the dynamic knowledge integration framework (figure 1), but rather to use it to consider the ways in which intranets can be integrated with other knowledge technologies, and the formal knowledge available on intranets thereby integrated with informal knowledge flowing in STNs. Whether other types of dynamic knowledge integration are possible could be explored by conducting research in different organisational and inter-organisational contexts.

Bhatt observed that "what kind of knowledge is shared and how knowledge will be shared are determined by the professionals, not by the management" (Bhatt 2002, p. 33). Our study clearly highlighted this effect in that although one company had a formal knowledge management strategy and the other did not, similar integrative mechanisms had evolved. Socio-technical influences are often more powerful than managerial influences and this must be kept in mind in the new electronic business networks that employ powerful Web-based technologies. This final note has important implications for managers attempting to organise and control intranet use by intranet policy.

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