Limits of IT-driven Knowledge Management Initiatives for Interactive Innovation Processes: Towards a Community-Based Approach

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Abstract

This paper begins with a critical review of the literature on Knowledge Management (KM), arguing that its focus on IT-based tools limits its potential for encouraging the knowledge sharing that is crucial to interactive innovation processes. Interactive innovation processes depend on the integration of knowledge across disparate social communities and require the exploration (creation) of knowledge, rather than simply the improved exploitation of knowledge. Knowledge exploration depends on shared understanding, which is difficult where those involved are from different cultural and disciplinary backgrounds. In these situations, knowledge has to be continuously negotiated through interactive social networking processes. These processes are under-emphasised in most of the KM literature. Two cases of interactive innovation processes are presented. The contrast between these two cases leads to the development of two alternative approaches to KM: the community approach emphasises dialogue occurring through networks (which may be IT-enabled) while the cognitive approach emphasises linear information flows. It is argued that, at least in terms of encouraging interactive innovation processes, the community model is superior

1. Introduction

In the 1990s an emphasis on innovation was seen to replace efficiency and quality as the main source of competitive advantage for firms [1]. Reflecting this emphasis a huge body of literature has emerged which aims to identify 'best practice' in both the diffusion of innovation from suppliers to users, and in the implementation of innovation within user firms [see 2, 3 for reviews). The literature on innovation has emerged from traditional structuralist perspectives through to more process-oriented perspectives. From the structuralist perspective, innovation is seen as a 'thing' or entity with fixed parameters (e.g. a new technology

or management practice) which is developed externally, packaged ('blackboxed') by suppliers and then transferred to potential users where it can be seen to offer them competitive advantage [2]. Around this, models of innovation have been aimed, either at helping suppliers to diffuse the latest best practice innovations [4], or at helping users to implement them [5].

Structuralist perspectives have been criticised for under-emphasizing the dependency of innovation on the social and organizational context [6]. In particular, the notion of 'best practice' - i.e. of an objectifiable innovation which is universally applicable in all contexts - has been questioned for all but the most simple examples of innovation [7]. In contrast, process perspectives argue that innovation should be seen, not simply as a 'thing' to be transferred from place to place, but as a complex, time phased, politically-charged design, decision process often involving multiple social groups within organizations. For example, despite the grandiose claims of some proponents, technologies such as Business Process Reengineering cannot simply be inserted into firms by top management. They are highly sensitive to the organizational context and depend on knowledge, skills and commitment of multiple groups and stakeholders. Process perspectives on innovation, then extend structuralist perspectives by examining those more dynamic cognitive, social and political processes through which new ideas are developed, communicated, transferred, and implemented over time within particular organizational contexts and identifying ways of facilitating these processes. According to this approach innovation may be defined as: 'the development and implementation of new ideas by people who over time engage in transactions with others in an institutional context' [8]. The sharing of knowledge among social communities is centre-stage in process perspectives and is reflected in this definition. Social communities are essentially collections of individuals, between whom there is communication and dialogue. These 'communities of interaction' can span

departmental and organizational boundaries. The extent of interaction within these communities influences how far individuals develop shared understanding and trust, both of which are essential for the sharing and creation of knowledge [9]. While these social communities can and do develop informally, their development can also be formally encouraged using a variety of people management practices. For example, introducing cross-functional team-working, corporate wide development programmes, discussion groups, seminars and workshops can all facilitate the development of social communities.

This paper builds from a process perspective on innovation but argues that this too needs to be extended. This is because the unit of analysis in process research has tended to be localised to the single firm or business unit. Here we argue that, as firms enter the next decade the context for many is shifting to one of flatter, less bureaucratised, more decentralised and networked (even virtual) organizational arrangements with key areas of expertise (e.g. IT) often being provided externally. This, coupled with ever more sophisticated information technologies and pressures for dealing with global customers, is placing a much greater emphasis on innovation that allows integration both within and across traditional organizational and inter-organizational boundaries. Thus many innovation processes are becoming increasingly interactive, requiring the simultaneous involvement of multiple 'communities of practice' (e.g. functional groups, business units, IT suppliers) sometimes on a global scale. This involves negotiation among different social communities, which may have distinctive norms, cultural values and interests in the innovation process [6, 10]. Knowledge needed for innovation is therefore increasingly distributed both within organizations (e.g. across functions and geographically dislocated business units) and across organizations (e.g. across IT suppliers, consultants and user firms). This poses new challenges for innovating firms in terms of creating, sharing and managing knowledge and expertise. The recent surge in interest in Knowledge Management (herein KM) is arguably a reflection of this challenge. However, this paper will argue that the contribution of the KM literature to date in terms of understanding innovation has been limited by a rather narrow focus on IT-based tools and systems premised on a cognitive information-processing view of KM. This emphasis, we suggest, needs to be balanced by an approach which takes greater account of localised communities of practice and the importance of social networks in KM. This is especially critical when trying to understand innovation processes, which are characteristically interactive.

The paper will begin with a brief overview of the literature on KM to date. This highlights an overwhelming emphasis on IT and major gaps in the treatment of people [11]. Next, limits of IT-based approaches to KM in terms of understanding innovation will be considered, in particular focusing on processes of exploitation and exploration. Two case studies will be presented as empirical examples of interactive innovation. These demonstrate the limits of IT-based approaches to KM and strengthen the argument for moving toward the development of a community model of KM innovation for achieving interactive innovation.

2. Knowledge Management and innovation - a review of the current position

One of the first things to be said about KM and innovation is that definitions abound. In this article KM is defined very broadly, encompassing any processes and practices concerned with the creation, acquisition, capture, sharing and use of knowledge, skills and expertise [12] whether these are explicitly labelled as 'KM' or not. KM, then, is about harnessing the intellectual capital of an organization in order to improve its learning capability, recognising that knowledge and not simply information, is the primary source of an organization's innovative potential [13, 14]. The objective of KM can be to enhance exploitation (i.e. where existing knowledge is captured, transferred and deployed in other similar situations) or exploration (i.e. where knowledge is shared and synthesised and new knowledge is created). The purpose of exploitation is to reduce problems of 'reinventing the wheel' by using existing knowledge more efficiently. Although this is important for innovation, it is largely exploration through knowledge sharing that allows the development of genuinely new approaches.

Interest in the topic of 'KM' has undoubtedly boomed over the last two to three years. A review of KM articles listed in searchable databases (e.g. Proquest Direct) during the period 1990 to 1998 compared the interest afforded to KM with that compared to related discourses of organizational learning and the 'learning organization' [11]. This showed that a decline in interest afforded to the learning organization since 1995 was mirrored by a sharp increase in references to KM. Indeed, there were more references (over 150) to KM in the first six months of 1998 than cumulatively in the previous 5 years. Interestingly, the profile reflected the normal distribution associated with management fads observed by Abrahamson [15]. KM could then, be easily dismissed as yet another management fad. However, the growing emphasis on innovation through leveraging 'knowledge assets' (as opposed to labour or capital), and 'knowledge work' and 'knowledge workers' as the

primary source of productivity in contemporary society, suggests that the need to manage knowledge will endure as a core business concern, even if the label may change [16]. This is not to say that knowledge was ever insignificant - what is distinctive about the current period is that knowledge now acts upon itself in an accelerating spiral of innovation and change. Castells [14] summarises this shift: '*What characterises the current technological revolution is not the centrality of knowledge and information but the application of such knowledge and information to knowledge generation and information processing/communication devices, in a cumulative feedback loop between innovation and the uses of innovation.....For the first time in history, the human mind is a direct productive force, not just a decisive element of a production system.*' (p.32).

There are also clearly organizational trends which are aligned to this focus on KM in innovation. In organizational terms, the new 'era' is typified by flatter structures, debureaucratisation, decentralisation, networked forms of organization and co-ordination through increasing use of Information and Communication Technologies (ICTs). However, as businesses are stretched across time and space, reorganized along process or product lines, and restructured around virtual teams and networks, they lose opportunities for innovation through the casual sharing of knowledge and learning induced by physical proximity. As Prusak [17] puts it: '*If the water cooler was a font of useful knowledge in the traditional firm, what constitutes a virtual one?*'. Gibbons et al. [18] notes further that 'modes of knowledge production' are changing from the conventional (Mode 1) disciplinary-based model, to a new (Mode 2) model where knowledge is produced interactively at the point of application among heterogeneous groups. In short, innovation processes are becoming more interactive - more dependent on knowledge which is widely distributed - therefore KM is increasingly central. Although the term 'KM' may ultimately become another fad, the impetus for it is the profound problems posed by new kinds of organization and innovation.

KM for interactive innovation has distinct implications for the deployment of ICTs as well as for the management of people and social networks. However, Scarbrough et al's [11] review highlighted a major gap in the KM literature in terms of its treatment of people. While the learning organization literature had emphasized people management issues (such as selection, motivation and rewards, trust, organizational development and culture) the KM literature has so far paid little attention to these issues and focused rather on information technology (IT) and information systems (IS). For example, IT/IS was the focus of nearly 70% of all KM articles in 1998. Despite the odd observation

that '*the most dramatic improvements in KM capability in the next ten years will be human and managerial*' [19], many articles continued to focus on developing and implementing KM databases, tools (e.g. decision support tools) and techniques for the creation of 'knowledge bases', 'knowledge webs' and 'knowledge exchanges'.

Behind this tools-based approach to KM lies a cognitive, information processing view of the firm where valuable knowledge located inside peoples' heads (i.e. the input) is identified, captured and processed via the use of IT tools so it can be applied in new contexts (i.e. the output). The aim, then, is to make the knowledge inside people heads (i.e. cognitive knowledge) widely available to reduce the threat of valuable knowledge assets literally 'walking out of the door'. Indeed the practice of KM is frequently reduced in the literature to the implementation of new IT systems for knowledge transfer: '*the idea behind KM is to stockpile workers' knowledge and make it accessible to others via a searchable application*' [20]. People do feature but only in as much as they need to be willing and able to use KM tools.

Great claims are made, then, in the literature for the use of sophisticated IT-based tools (such as intranets email, groupware, data warehousing) for knowledge capture, storage and sharing. However, these typically overestimate the utility of new ITs for delivering organizational performance improvements: '*There is increasing hype about the wonders delivered by the newest information technologies in an era characterised by knowledge as the critical resource for business activity*' [21]. This is supported by evidence, which demonstrates that there is no direct correlation between IT investment and business performance [21, 22]. The case examples that follow highlight the limits of IT-based approaches to KM in terms of their ability to facilitate interactive innovation processes.

3. Case examples

The cases outlined here are drawn from a larger study of the roles of networks and knowledge management in interactive innovation projects. Detailed descriptions and methods are presented elsewhere [23]. Suffice to say here that an understanding of the processes was enabled by systematically studying the development of innovation in each case over real time (a period of about 2 years). The purpose here is not to draw generalised prescriptions from direct case comparisons but rather to illustrate our main argument concerning KM for interactive innovation.

Both cases represent examples of multinational firms, which have attempted to introduce innovation in the provision and delivery of services to clients. Both

have grown rapidly in the past ten years mainly through acquisition. The organizations are structured, then, around geographically-dispersed business units which have in the past operated with a high degree of local autonomy. The need to provide common services to global customers has led the corporate centre in each case to launch innovation projects aimed at improving the uniformity of service delivery across their disparate business units through the introduction of common, integrated IT platforms. In the case of Ebank, this is via the development of a global intranet and in the case of Brightco it is via the development of a common Enterprise Resources Planning (ERP) system. In both cases, the projects require interaction among communities which are very different, both in terms of local organizational culture and 'modus operandum' and in terms of national institutional context. The technical and organizational knowledge relevant to these innovation projects is widely distributed (e.g. across functional departments, business units, corporate staff, and nations).

4. The case of Ebank - an example of 'mad practice'

Ebank is located across 70 countries world-wide, and is one of Europe's largest investors in IT. Despite calling itself 'the networked bank', the reality was quite different. Each country and each department operated relatively independently with its own systems, services and processes. Ebank's 'Vision 2000' innovation project was launched in 1996 when a major client left the bank because they felt they were not getting an integrated service across countries. In addition, the feeling among top management was that resources were being wasted because different units and departments failed to learn from one another thus continuously 'reinvented the wheel'. The vision from the top then was to develop a global network in order to integrate existing knowledge within the bank and to provide a global service portfolio. Key to this was to be the development of a world-wide communications infrastructure using intranet technology.

An intranet pilot project was launched, led by the corporate IT group and funded centrally. The pilot involved mostly technical (IT) specialists from different business units world-wide and was focused on creating the corporate infrastructure. This pilot highlighted the benefits of the intranet for knowledge sharing and so enthused those involved. They returned to their own divisions and persuaded them to develop their own intranet, resourced with local funds and people. Thus, the translation of the global KM vision was very much left to individuals working at the local level. The result was that the espoused objective of developing intranet

technology to increase knowledge sharing across the functional and geographical boundaries within the bank was not achieved. Instead the actual outcome was an explosion of different and discrete intranet projects. Nobody could say exactly how many sites had been developed (although someone estimated that there was at least 150 different intranet sites), where, with what purpose, or how to access them.

The use of these independent intranet sites suggested that they resulted in very limited knowledge sharing even at the local level. For example, the IT division knew about the technical requirements of intranet and had managed to develop their own very sophisticated intranet (iweb) specifically designed for knowledge sharing across the IT function. However, when asked what was actually shared via iweb the only examples they could cite was the company telephone directory and the corporate bus timetable. The latter gave information of the times of company buses running between different local sites every 20 minutes! Thus iweb was essentially being used as a digital repository of existing information which was used by some (but not all) of the staff within the division. There was no evidence that the intranet had promoted any sharing of knowledge or expertise relevant to improving business performance or innovation even within the IT division, let alone across the bank.

Moreover, the lessons learnt in the development of this intranet (which looked glamorous and technically worked well) were not shared with developers of intranets in other divisions even within the same region. There were countless examples where project teams had spent time and money on developing an application for their particular intranet only to find later that another group had done something very similar which they could have used instead. For example, a number of the intranet projects had used a particular firm of consultants and in each case there had been problems with the relationship and the service provided by this consultancy. However, given that there was limited (no) communication across the intranet projects, the same mistakes with this consultancy continued to be made. Reinvention, then, was extremely common in an innovation initiative specifically aimed at preventing such reinvention! Further, expertise was not shared across functional specialisms within the bank, especially business management and IT. The result was that some intranets (e.g. iweb) proved technically very sophisticated but offered little in the way of business-relevant innovation. In others, where business-relevant innovation (e.g. in the form of integrated service delivery) could have been achieved the intranets failed because of difficulties in appropriating the necessary technical expertise. For example, in one case failure to anticipate bandwidth problems led to the developed

intranet being abandoned because it took nearly 20 seconds to turn a page.

In terms of the global KM vision, there was recognition, at least by a small team within HQ, that the various Intranet projects needed to be more fully co-ordinated so an intranet steering committee was set up and a two-day global workshop was convened. The global workshop involved both technical experts who had the knowledge to design intranet systems and business managers who would be using the Intranet system to manage their businesses. In this sense the workshop did attempt to integrate the knowledge from technical and business experts. The problem was that those with the business expertise discussed their needs and cultural differences in terms of knowledge sharing on the first day of the workshop and then left. On the second day, the technical experts soon reverted to detailed technical issues, specifically the development of a common 'portal' based on a 'one-stop-shopping' philosophy where different intranets could be accessed through the same common window. There was no real consideration of the kinds of organizational and cultural issues that that had been discussed on day one. Again, ironically, the result of the global workshop was that on returning 'to base', individual projects were set up to develop many different portal sites in the different areas of the bank.

The most important feature of this case was thus the lack of recognition of the relevance and importance of the organizational context and people management for the effective development of KM for innovation. The focus was on the technology (i.e. developing intranet systems and technical infrastructures) rather than people (i.e. encouraging employees to share knowledge, taking account of local organizational and cultural differences). Individuals had not been encouraged to share their knowledge even within a division, never mind across the global organization. In many ways the emphasis on the technology had simply helped to reinforce existing divisions with electronic fences, rather than break down barriers as had been envisioned. Ironically, this made it more, rather than less, difficult for information to be exchanged across the organization. Adopting Intranet technology had effectively created a series of knowledge silos rather than a networked bank where knowledge was shared globally. Evidence suggests that this may not be uncommon in organizations, especially where functional and departmental boundaries remain strong. Thus: *"misused, an intranet can intensify mistrust, increase misinformation, and exacerbate turf wars"* [24].

5. The case of Brightco - an example of good practice

Brightco is one of the world's largest manufacturer and service providers of specialist materials handling equipment with its headquarters in Sweden and divisions spread across Europe, Asia and the USA. Approximately half of its business is in service rather than manufacturing. Brightco's 'Sales Services Support Project (SSP)' was launched in response to a corporate study of business processes which pointed to a need to improve co-ordination and communication across Brightco's different businesses and to provide a more integrated service for global customers. A major vehicle for this would be the introduction of a common business information system, funded centrally and implemented across all of Brightco's European divisions. It was recognised that this would represent a major upheaval because, until then, the traditional culture had been one of divisional autonomy with each European division having its own, various IT systems. Investment in IT had been relatively low, for example, there were only 10 full-time staff in the corporate IT department.

The SSP project was launched in 1996 with overall responsibility resting with the corporate IT function. The design and implementation of an integrated management information and planning system - essentially an ERP system - was its main focus. Initially a small group of senior managers was brought together to review and evaluate currently available systems on the market. They concluded that none of these could handle Brightco's core business portfolio - i.e. multisite, multinational and with a large proportion of rental service agreements. Following negotiations with various external IT suppliers, Brightco contracted a Swedish supplier, Intsoft, to design and develop a new version of their software jointly with Brightco personnel. Critically, the relationship was to take the form of a close partnership with both parties benefiting - Brightco because they would have an ERP system that fitted their business requirements, and Intsoft because they would have a new version of their system that they could market more widely to other similar businesses using Brightco as a reference site.

Although he did not specifically use the term, the project leader from IT recognised that KM would be a critical issue especially due to the limited resources available in the central IT function. For example, it was recognised early on that selection, recruitment and commitment would be a critical in developing a project team with the necessary IT and business expertise. The Human Resources Director was therefore called upon to help in designing the project management procedures to be used on the SSP prior to the work formally starting and continued to have close contact with the project

leader (albeit informally) throughout. The project team was selected through informal consultation with senior managers from the different European divisions who suggested those people locally who had the most knowledge of the systems they were currently using to manage their particular business. These were often those with detailed knowledge of operating procedures (e.g. from finance) rather than IT specialists.

The design and development phase of the ERP system was intensive with Intsoft consultants working alongside Brightco business managers representing different functional areas (e.g. sales, finance, operations) and different European divisions brought together on one site in Sweden for approximately three days a week over a twelve week period. In addition two (and later 4) graduates with business and IT backgrounds were employed specifically to work on the SSP project. These were employed by Intsoft but were offered the option of employment either with Intsoft or Brightco when the project ended (indicative of the close attention paid to HR issues in the project). These graduates worked partly on site at Brightco and partly in Intsoft so were important 'link pins' in the relationship between Brightco and Intsoft and brought valuable expertise, acquiring detailed knowledge of both the Intsoft software and Brightco's operating context.

Implementation of the ERP system was managed by three co-ordinated project teams each of which were responsible for two to four different European sites. Each team comprised representatives from Intsoft, corporate IT managers, and business managers who (where possible) were those that had been involved during the design phase. The teams were thus mutliskilled and, importantly, involved representatives from most of the different social communities that would be affected by the system and whose local knowledge was important. They were also selected to comprise different 'personality' types. For example, where it was known informally that a team leader was less 'dynamic' (but suitably senior) they would be complemented by one of the more active IT or Intsoft staff.

These teams travelled to the sites to deliver initial training in the software. However, it was continuously stressed that implementation itself had to be owned locally (hence the label 'Sales Support Project'). Therefore local divisions provided their own project managers who were seconded to the SSP project during implementation. Importantly, although the three teams travelled two weeks in three, these periods were, where possible, timed so that all three teams returned to Sweden on the third week. This was specifically so that knowledge could be shared across the teams, and hence across the European Divisions they were responsible for. Email was used extensively for communication both within and across teams and across divisions. This allowed lessons from implementation in one division to be codified, captured and transmitted to another. For example, an email site which emerged initially informally for 'frequently asked questions' provided an important network for users at local sites to learn from one another about implementation problems in other sites. However, importantly this IT-based communication of written information was supported by a high degree of verbal communication, either face-to-face or by telephone (every team member was provided with a mobile phone). The SSP project, then, did use IT for communication and this encouraged exploitation. However, the project was characterised by a high degree of strategically co-ordinated formal and informal networking across those various widespread social communities whose knowledge was needed to develop and implement a common and business relevant information system and this encouraged innovation through exploration. It is too early to tell whether the SSP project would meet the initial vision of performance improvement via a more integrated business but Brightco were at least successful in implementing a common business information system which was being used by most of its European divisions.

6. Discussion - the problems with IT-led Knowledge Management for innovation

In each of the cases of interactive innovation presented here the role of IT for KM was considered. The Brightco case illustrates that the use of IT-enabled communication can facilitate KM for innovation. However, this is where it is used alongside relevant people management and organizational practices, in particular those which encourage knowledge sharing across disparate social communities of practice. The conceptualisation of KM in Brightco was broad encompassing both the use of IT and the use of processes concerned with the sharing, development and utlization of knowledge, skills and expertise. Thus both exploitation and exploration were embraced by Brightco's approach to KM. In contrast, Ebank demonstrates the limitations of approaches to KM which rely too heavily on IT. In this case, even exploitation of existing knowledge was limited with what was published via the intranet adding little in terms of Ebank's potential to innovate. This confirms arguments by recent critics (including IS experts) that there has been far too much reliance on the idea that KM has to do with IT systems: '*successful KM requires a skilful blend of people, business processes and IT*' [25].

These cases illustrate several fundamental problems with IT-driven approaches. First, they assume that all, or most, relevant knowledge in an organization can be made explicit and codified. Second, they are underpinned by a partial view of KM, focusing more on processes of exploitation rather than on processes of exploration. Third, they are supply driven - assuming that if information is widely available it will be applied in new ways to develop innovation.

1. Problems of codification and the importance of tacit knowledge: The approach in Ebank was essentially to codify existing knowledge into explicit forms and share this widely via the use of IT tools. This emphasis is also clearly reflected in the literature on KM. However, it is argued that it is tacit rather than explicit knowledge which will typically be of more value to innovation processes [26, 27]. Yet tacit knowledge is knowledge which cannot be communicated, understood or used without the 'knowing subject [28, 29]. This suggests that KM that focuses on transferring only explicit forms of knowledge will be severely limited in terms of the contribution to innovation. There are a number of reasons why the most valuable tacit knowledge in a firm may not lend itself to capture via the use of IT. It may be too difficult to explain, too uncertain, considered unimportant to anyone else, too changeable, too contextually specific, too politically sensitive, or too valuable to the individual or group concerned [30]. Therefore attempts to codify tacit knowledge may only produce knowledge which is: useless (if it is too difficult to explain); difficult to verify (if it too uncertain); trivial (if it is too unimportant); redundant (if it is subject to continuous change); irrelevant to a wider audience (if it is too context dependent); politically naïve (if it is too politically sensitive); inaccurate (if it is too valuable and is therefore secreted by the 'knower'). Tacit knowledge therefore, cannot easily be articulated or transferred in explicit forms because it is personal and context-specific. Indeed this is what makes it critical for innovation - because it is hard to transfer and so difficult for other firms to copy.

IT-led KM, which emphasises codification, typically fails to consider these problems in sharing tacit knowledge. For example, in Ebank important tacit knowledge about how 'good' particular consultants were may have been difficult to codify. In contrast, in Brightco, informal face-to-face modes of communication were often used heavily precisely because the limits of IT, in terms of its ability to act as a medium for the exchange of valuable tacit knowledge, were recognised.

The sharing and exchange of tacit knowledge may arguably be even more difficult where innovation processes are interactive. This is because the communication of tacit knowledge requires some shared system of meaning so that it can be understood and applied [9]. Interactive innovation, however, involves disparate social communities which can have very different systems of meaning. For example, in the cases, languages, behavioural norms, cultural symbols and organizational routines varied widely across business divisions and functional groupings. Nonaka [9] highlights the importance of 'redundancy' for knowledge creation arguing that some knowledge must be possessed by individuals even if they do not regularly need it because it allows them to engage with and interpret the knowledge of others. Although, Brightco's use of mobile, multi-skilled project teams who travelled across Europe was enormously time consuming for those involved, it did allow them to develop a common 'language' and to appreciate each others' world views. This then made it easier to develop a common sense of purpose and a common system that was actually seen as relevant across different communities and was therefore much more likely to encourage integration. In contrast in Ebank, the focus on IT and relative neglect of any considerations about managing interfaces among different communities of practice, meant that each group developed their own system which actually encouraged further *dis*-integration.

2. Exploitation vs. exploration: Unnecessary reinvention is a common problem in many firms. The case of Brightco shows how IT-based tools (e.g. email) may increase the exploitation of existing knowledge by recording and storing the lessons from one implementation attempt (in the form of 'frequently asked questions') making these available to others. In this way IT-based tools were useful for processing information that already existed in the organization, and for transferring information between Brightco and their IT suppliers. However, exploitation of existing knowledge is only a small part of what constitutes KM in innovation projects. Also crucial are processes of exploration, whereby *new* knowledge is created. Exploration may be informed by lessons from the past, but should not be constrained by them.

In turbulent business environments the source of innovation is not merely the more efficient processing of existing information but the application of knowledge to knowledge itself [15]. This dilemma between efficiency and innovation has been noted in the organizational literature for some time [31]. Yet most of the emphasis in IT-driven approaches has been on increasing efficiency by exploitation of existing knowledge rather than on encouraging more explorative processes. In Ebank, for example, the intranet tool *was* KM (indeed the development of the intranet was even referred to as a KM project) and the focus was therefore

almost entirely on developing the infrastructure. It is ironic then, that that there was very little awareness of the difficulties of managing knowledge, particularly for encouraging exploration, in this KM project.

Moreover, as demonstrated in the case of Ebank, the introduction of tools to formalise knowledge sharing may introduce rigidities into the system and reinforce existing organizational boundaries that then makes processes of knowledge sharing and creation more difficult. This is supported by evidence which demonstrates that there is no direct correlation between IT investment and business performance [21]. As seen Ebank was one of Europe's biggest spenders on IT. Yet, the intranet(s) they developed actually appeared to offer little in terms of improving business performance through the provision of integrated services. The cases presented here demonstrate the varied and multiple impacts IT tools may have on KM in innovation projects. They show that these impacts can only be understood by taking into account the organizational and social communities into which these tools are introduced and applied.

3. Problems of supply and demand: In these cases it is possible to distinguish broadly between 'supply-driven' (Ebank) and 'demand-driven' (Brightco) approaches to KM. Supply-driven approaches focus on using IT-based tools to supply knowledge and information which will then, somehow miraculously, be applied and used to develop innovative solutions. This assumes that the problems of KM are to do with the flow of knowledge and information across the organization. The aim is to increase that flow by capturing, codifying and transmitting knowledge using IT. However, even where knowledge can be codified, stored and broadcast, it does not follow that this knowledge will be used or applied by others. For example, on the demand side a major problem many managers face is information overload. In order to manage knowledge for innovation there is a need to understand the difference between knowledge and competency or expertise. Competency or expertise is more than a 'bucket of knowledge'; it is the also insight to be able to apply that knowledge [32]. Supply-driven approaches therefore suffer from the drawbacks of IT-led approaches outlined above.

On the other hand, initiatives that are demand driven tend to be more concerned with the creation and application of knowledge in innovation projects. The motivation and attitudes of multiple stakeholders are seen as crucial and consequently there is a more focal concern with human and organizational processes which can encourage sharing and use of knowledge which is relevant for innovation. This is not to say that supply-driven initiatives ignore these factors but they are seen as peripheral to the problems associated with the technology rather than as core features of KM.

There are obvious implications, then, for KM in terms of facilitating innovation, of attending to processes that encourage knowledge sharing and exploration. Interestingly, the cases show how people management practices are often more fundamental to knowledge sharing than the use of IT. For example, even in Ebank where there were high levels of technical expertise and familiarity with systems and high expenditure on IT, IT was only used for fairly low-level information exchange (e.g. the digital telephone directory). In Brightco, face-to-face and verbal interaction were used for knowledge sharing, despite difficulties of international travel, with those involved recognising that deeply embedded tacit knowledge is difficult, if not impossible, to share through other media particularly where local practices and cultures differ widely. However, although intense face-to-face interaction was a crucial media for knowledge sharing, it could also be seen that this was extremely challenging for those involved. Working away from home, for example, for two weeks in three over a period of over a year was generating significant stress. The challenge for IT developers, then, is not to develop systems that aim to replace people as the primary source of expertise but to develop systems that allow experts to network more effectively in environments that are media-rich enough to encourage knowledge sharing and organizational learning where it is relevant for innovation.

7. Conclusions - developing a community view of Knowledge Management for innovation

A core assumption in the literature on KM is that technology enables effective knowledge sharing. However, this privileges an information processing view where knowledge is seen as cognitive abilities (inputs) which can be processed using technology to produce certain outputs. This equates knowledge to the skills and cognitive abilities of individuals – a cognitive model. In contrast, organizational theorists highlight the need to understand knowledge as also embedded in, and constructed from and through social relationships and interactions [33, 34] - a community model. According to this view, knowledge (unlike information) cannot simply be processed; rather it is continuously re-created and re-constituted through dynamic, interactive and social networking activity. This is especially important for innovation processes that are interactive. For example, the team working in Brightco was not simply about moving knowledge around from person to person, it was also about creating new knowledge and shared

understandings through the synthesis and interaction of team members. The cognitive model appears to underpin most previous KM examples (and is illustrated again in Ebank) and certainly fits with most of what is written about KM tools. On the other hand, a community model, perhaps summarises the more realistic view, certainly when considering the issue of knowledge exploration rather than knowledge exploitation. The core differences between cognitive and community views of knowledge and KM are shown in Table 1, below.

The community model highlights the importance of relationships, shared understandings and attitudes to knowledge formation and sharing within innovation processes. It is important to acknowledge these issues since they help to define the likely success or failure of attempts to implement KM practices that facilitate innovation. The community model suggests that, whilst it might be relatively easy to share knowledge where innovation is localised and groups are homogenous, it is extremely difficult where the innovation is interactive and groups are heterogeneous. Yet, it is precisely the sharing of knowledge across functional or organizational boundaries, through using cross-functional and inter-organizational inter-disciplinary and inter-organizational teams, that is seen as the key to the effective use of knowledge for innovation [18]. Cognitive, IT-led approaches to KM typically fail to take into account the pre-existing organizational structures, norms and cultural values that lead different groups to have divergent, possibly even irreconcilable, interpretations of what needs to be done and how best to do it. Rather, knowledge has to be continuously negotiated through interactive social networking processes. Thus the community model emphasises dialogue occurring through networks (which may be IT enabled) rather than linear information flows.

Seeing knowledge as constructed through processes of social interaction among communities of practice means that issues of social networking, power and social inclusion/exclusion come to the forefront [35]. Therefore a crucial feature raised by these cases is the importance of social co-ordination and networking (formal and informal) in managing knowledge. In some cases (e.g. Brightco) communication technologies compliment these processes by increasing the ability to communicate across boundaries of time and space. In other cases IT may actually undermine knowledge sharing and creation (e.g. in the case of Ebank) by reducing opportunities for informal contact or strengthening, electronically, the existing organizational walls, based on functional or geographical differentiation. Thus careful attention is needed to the potential impact of IT on KM for innovation in relation to existing social networks and communities within organizations.

Table 1. Two contrasting views of the KM process.

Cognitive Model (e.g. Ebank)	Community Model (e.g. Brightco)
• **Knowledge for innovation is equal to objectively defined concepts and facts.** • **Knowledge can be codified and transferred through text: information systems have a crucial role.** • **Gains from KM include exploitation through the recycling of existing knowledge.** • **The primary function of KM is to codify and capture knowledge.** • **The critical success factor is technology.** • **The dominant metaphors are the human memory and the jigsaw (fitting pieces of knowledge together to produce a bigger picture in predictable ways)**	• **Knowledge for innovation is socially constructed and based on experience** • **Knowledge can be tacit and is transferred through participation in social networks including occupational groups and teams.** • **Gains from KM include exploration through the sharing and synthesis of knowledge among different social groups and communities** • **The primary function of KM is to encourage knowledge-sharing through networking** • **The critical success factor is trust and collaboration.** • **The dominant metaphors are the human community and the kaleidoscope (creative interactions producing new knowledge in sometimes unpredictable ways)**

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