



# Survival of the leanest: intensive knowledge work and groupware adaptation

Maxine Robertson

*Warwick Business School, University of Warwick, Coventry, UK*

Carsten Sørensen

*London School of Economics and Political Science, UK, and*

Jacky Swan

*Warwick Business School, University of Warwick, Coventry, UK*

**Keywords** *Technology, Knowledge intensive workers, Information, Management*

**Abstract** *Managing knowledge is a value-creating process in most organizations and is particularly important in knowledge-intensive firms. Explores the ways in which groupware might facilitate processes of knowledge creation within a particular type of knowledge-intensive firm. Based on a case study analysis of an expert consultancy where e-mail was used successfully for information and knowledge search, and Lotus Notes was used with mixed results in project working, argues that the complexity of articulating the knowledge creation process can be reduced by using e-mail. Furthermore, e-mail, when considered in context, is potentially a rich medium for the development of collective knowledge over time despite its purported lean characteristics. Also concludes that, although distributed Lotus Notes databases can obviously alleviate temporal and spatial complexity, this media lacks the richness required for complex processes of knowledge creation. Thus, where temporal and spatial constraints do not exist, there will be substantial barriers for using groupware to support processes of knowledge creation in this type of knowledge-intensive firm.*

## 1. Introduction

Knowledge management is now recognized as a key process in achieving competitive advantage in firms (Nonaka, 1994; Prusak, 1997). Managing knowledge, however, has always been a particularly pertinent and crucial issue for “knowledge-intensive” firms (KIFs). These are organizations, such as R&D labs, high technology and consultancy firms, which employ predominantly highly-qualified individuals who are engaged primarily in work of an intellectual nature (Alvesson, 1999). Thus, within KIFs knowledge is considered to be the firms’ primary asset and more important than other kinds of inputs or resources, with regard to achieving competitive advantage (Starbuck, 1992). Knowledge management systems might therefore be considered to be a potentially important resource and tool for project working, particularly within, for example, consultancy firms that are almost entirely reliant on the knowledge and expertise of individual organizational members. However, much of the research to date suggests that a major problem or

---

constraint here is motivating individuals to share their knowledge via a technological medium, in order to maintain the potential value and integrity of the system for processes of knowledge creation (Scarbrough *et al.*, 1999; Swan *et al.*, 2000).

This paper reports an investigation which formed part of a longitudinal case study into the way in which groupware technologies were used to facilitate the management of knowledge (specifically, processes of knowledge creation and distribution) in a scientific consultancy, referred to throughout as “universal consultancy”. The term groupware is, in the context of this paper, applied to denote information communication technologies (ICTs) supporting collaboration and communication and, hence supporting the coordination of activities distributed in time and/or space as well as shared information spaces (Ellis *et al.*, 1991; Schmidt and Bannon, 1992; Sørensen and Kakihara, 2001). Acknowledging that other more structured technologies, such as Group Decision Support Systems, also can be characterized as groupware, the term as used in this paper denotes the two particular technologies studied – e-mail and Lotus Notes discussion databases.

Scientific consultancies are a good example of KIFs, employing highly-qualified scientists and technologists (knowledge workers), and relying heavily on the integration and synthesis of their specialist knowledge to create novel products and processes in response to clients’ problems. They deal, then, during project working, mainly with processes of knowledge creation. Despite their importance, there have been relatively few systematic studies of scientific consultancies or consultancy firms more generally (Alvesson, 1995). Two crucial issues have, however, been identified for these kinds of KIFs (Blackler, 1995). The first concerns the management of individual consultants, who are a scarce resource the firm must strive to retain. The second issue concerns the management of knowledge; in particular, the structures and media for knowledge articulation, creation and distribution among experts within the consultancy (Blackler, 1995). This includes, importantly, the design of ICTs for the articulation and distribution of information and knowledge (Carstensen and Sørensen, 1996; Schmidt and Simone, 1996; Swan *et al.*, 1999; Sørensen and Snis, 2001). These are seen as critical mechanisms for knowledge creation in high-technology firms and KIFs (Tushman, 1979; Macdonald and Williams, 1992). However, different ICTs are characterized by different degrees of information richness (IR) (Daft and Lengel, 1986) which more recent research has concluded is to some extent context dependent (Lee, 1997; Ngwenyama and Lee, 1997). Thus making particular ICTs more or less useful or applicable for particular types of interaction within specific organizational contexts. The aim of this research, then, was to explore and analyze the way two particular groupware technologies, e-mail and Lotus Notes were used as means of supporting knowledge articulation, creation and distribution during and outside of project work at Universal Consultancy. We conclude that the adaptation of groupware technologies for knowledge-intensive work within Universal Consultancy – a firm characterized by an internal market for

---

knowledge, was a case of survival of the leanest insofar that e-mail usage was extensive and crucial for project working despite its relatively lean characteristics.

In the following section the methodological approach that was used to conduct the longitudinal case study is explained. Section 3 provides an introduction to Universal Consulting. Section 4 discusses the use of ICTs for knowledge work. Section 5 presents and analyses the case of groupware adaptation at Universal Consultancy. Section 6 discusses the findings and Section 7 concludes the paper.

## 2. Methodology

Universal Consultancy participated in a longitudinal research study that commenced at the beginning of 1996 and was completed in spring 1998. The study focused on the way in which knowledge-creation processes were sustained over time within this particular organizational context. An interpretive case-study approach was employed and the main methodological approach adopted was a combination of non-participant observation and semi-structured interviews (Yin, 1989; Walsham, 1993; Alvesson, 1995; Denzin and Lincoln, 1998; Stake, 1998). A stratified sample of organizational members were formally interviewed ( $N=15$ ) across the firm and several individuals were interviewed twice over the period of the research. The firm was loosely structured according to scientific discipline and consultants were allocated to non-hierarchical divisions according to their particular scientific or technological expertise. The sample, therefore, included consultants from all seven divisions within the firm together with senior management including the founder, chairman, human resource and IT manager. Interviews were of between one and a half and two hours duration and all interviews were taped and transcribed.

Interviews focused on the way in which consultants interacted during project working both during the period of the research and historically. Content analysis of interviews was then conducted focusing on the structural (reward systems, level of formalization, availability of resources – including IT, etc.), cultural and social (trust, power relations) conditions which either facilitated or constrained processes of knowledge creation. This paper reports primarily on the role of structural conditions (in particular, groupware) in processes of knowledge creation and distribution.

E-mail and Lotus Notes were established as being the groupware technologies available to consultants at Universal during this period of time. Hence, questions sought to establish the individual's usage patterns of these groupware and what were considered to be the advantages and disadvantages of these groupware for project working. There is clearly some reliance when interviewing, on the subjective beliefs and attitudes of both the interviewee and the researcher, which will inevitably be situation bound. The majority of interviewees, however, were remarkably candid when describing what it was like to work at Universal Consultancy and the nature of project working

and this is reflected in their comments in this paper. While inevitably contradictions and inconsistencies emerged, there was considerable consensus regarding the use (and abuse) of groupware technology across the entire interview sample. In addition, triangulation techniques were used which are outlined below to corroborate individual consultants' comments and observations that were made during interviews.

One of the authors was invited to observe consultant/client interaction throughout the duration of one complete project. This involved attendance at seven project meetings over a four-month period, early in 1997. Access was also provided to all of the discussion databases generated from another project where Lotus Notes had been used during project work. In addition, this researcher spent approximately one day every two weeks on site, over a four-month period in mid-1996. This period of non-participant observation provided further insights into project working and informal access to a further ten to 15 consultants, who were prepared to engage in informal conversation. Access to secondary sources of data, such as internal management reports, was negotiated, as too was attendance at various company meetings (including a board meeting) through 1996 and early 1997.

In spring 1998, two final interviews were conducted, one with a consultant from the original sample and one with the IT manager, in order to establish what technologies (groupware or otherwise), were in use at this time for project working and to consider what changes, if any, had occurred regarding project working over the previous 12 months. Thus the interpretive case-study design was characterized by the use of multiple, qualitative methods and sources in support of the outcomes reported here. Table I highlights the various sources of data that were used in this case study.

### 3. Universal Consultancy

Universal Consultancy was founded in 1986 and is based in the south-east of England. Universal develops completely new ideas (inventions), which it markets to clients as intellectual property rights (IPR), and also develops innovative solutions to organizational problems, using existing concepts, ideas

Characteristics of the firm	Universal
Founded	1986
Numbers employed	Approximately 140
Location	Cambridge, UK
Main type of service	New products
Number of interviews	18
Average length of interview	1-2 hours
Meetings attended	6
Site visits (non-participant observation)	20 days
Access to company data	Open
Access to information systems	Open
Access to client documentation	None
Access to project documentation	Open

**Table I.**  
Summary characteristics of the firm and data sources

---

and technologies in new ways. The firm has been responsible for the invention of major technological developments including, for example, the electronic security tag which, since its invention, has been manufactured and marketed in many forms by the Swedish firm, Esselte – a client of Universal Consulting. Inter-disciplinary team working, where scientists and technologists from different disciplines contribute to projects, characterizes the nature of the majority of the work carried out at Universal. The reputations of the senior organizational members are internationally acknowledged within the scientific, engineering and communication communities.

Over time, the organization has grown substantially, from a “handful” of scientists who were predominantly specialist engineers and communications experts and expanded into other scientific disciplines. In 1998, it employed 137 people directly, of whom 116 were expert consultants with doctorates in the sciences, representing 19 different nationalities. It also employed a further 110 people on an associate basis in the USA, Japan and Europe. Despite organizational growth, the founder of the organization had attempted to maintain an organizational configuration which is referred to in the literature as an “adhocracy” (Mintzberg, 1983). The adhocracy is an organizational structure characterized as organic, flexible, non-hierarchical and highly informal and is considered to be one which promotes innovation. Self-formed and managed project teams is the dominant mode of organizing within an adhocracy and characterized the nature of work at Universal. During the period of the research and in line with structural conditions which were characteristic of an adhocracy, it was evident that considerable efforts were made to avoid the introduction or imposition of any formal protocols, systems or procedures upon consultants or project working.

#### **4. Knowledge work and the use of ICTs**

This paper uses existing theoretical frameworks of knowledge creation and communication to analyze the way in which knowledge was managed in order to facilitate knowledge creation in Universal Consulting (Huber, 1991; Nonaka, 1994; Spender, 1996). These frameworks offer rich conceptual understandings when analyzing processes of knowledge creation and communication but do not specifically assess the role of information technology within processes of knowledge creation. In addition, therefore, research that has been conducted on the use of groupware technology as a media for communication and co-ordination (Huber, 1991; Lee, 1997; Ngwenyama and Lee, 1997; Straub and Karahanna, 1998) will also be used to analyze and explain the way in which these technologies facilitated knowledge creation within Universal Consulting. This paper attempts, then, to extend this earlier work, by providing an empirically-based analysis of the role of particular groupware (e.g. e-mail and Lotus Notes), in processes of knowledge articulation, coordination and creation within a KIF.

Nonaka (1994) and Spender (1996) have both developed frameworks that aim to highlight the role of different knowledge types in processes of knowledge creation. Nonaka (1994) identifies four mechanisms for knowledge creation:

- (1) socialization, whereby one individual shares tacit knowledge with another;
- (2) combination, whereby one piece of explicit knowledge is combined with another;
- (3) externalization, whereby tacit knowledge is made explicit; and
- (4) internalization, where explicit knowledge is converted into tacit.

The emphasis in this framework is on the interplay between tacit and explicit knowledge (i.e. internalization and externalization) at the individual level, as the basis for knowledge creation and learning within organizations. Spender, however, argues for a four-fold pluralist epistemology that recognizes both individual and social knowledge, as well as implicit (tacit) and explicit knowledge in processes of knowledge creation. Thus he identifies four types of organizational knowledge:

- (1) conscious, which is an individual's explicit knowledge;
- (2) automatic, which is an individual's implicit knowledge;
- (3) objectified, which is explicit, social knowledge; and
- (4) collective, which is implicit, social knowledge.

Spender (1996) suggests that collective knowledge, rather than individual knowledge, is the most strategically useful knowledge within the firm, in processes of knowledge creation and that this develops at a social level from the dynamic interplay between explicit and implicit (tacit) forms of knowledge.

While these models may differ with regard to the level at which knowledge creation occurs, they suggest that for KIFs to maintain competitive advantage, it is important to manage this interplay between tacit (implicit) and explicit forms of knowledge and also the involvement (or exclusion) of individual experts. The major issue addressed here, then, is the impact of groupware on these processes of internalization and externalization (Nonaka, 1994), or using Spender's (1996) framework, the development of collective knowledge, within Universal.

IR theory (Daft and Lengel, 1986) suggests that the choice of communication media is heavily dependent upon the fit between task and medium. Different media can be characterized by the degree of media or IR they possess. This is defined as:

... a determinant of the extent to which information is given common meaning by the sender and receiver of a message (Daft and Lengel, 1986, p. 103; Huber, 1991).

There are two aspects to IR, the variety of cues the medium can convey and the speed of feedback that the medium can provide. IR theory suggests, therefore, that highly complex or equivocal tasks, such as project working for knowledge creation require information-rich media, primarily face-to-face communication, which is considered to be the richest media for communication because it provides a variety of social cues.

---

Adopting this theoretical perspective, groupware technology is considered a fairly lean media, insofar as the medium provides a channel for asynchronous interaction but is limited to the written word. According to IR theory then, this medium is potentially useful for the exchange of explicit information and knowledge across time and space but inappropriate and problematic for the communication and exchange of more complex, tacit knowledge. This suggests that in the context of project working where the emphasis is on knowledge creation, groupware technology may be useful for the exchange, co-ordination and articulation of low-level information and explicit knowledge, particularly if team members are geographically dispersed. However, given the complexity of project work in this particular context, based on IR theory, it is expected that the majority of work and tasks performed may require face-to-face communication. IR theory tends, however, towards positivism when explaining choice of communication media. It is somewhat deterministic suggesting that particular types of task demand particular types of communication media regardless of context. More recent research has highlighted context does need to be considered and that social factors may also affect choice of communication media, particularly between knowledge workers and professionals (Lee, 1997; Ngwenyama and Lee, 1997).

Recent research, then, has indicated that aspects of the social environment are also a determinant of the choice of media for communication and interaction, particularly in the case of knowledge workers (Straub and Karahanna, 1998). Two dimensions of the social environment have been shown to influence the choice of communication media for knowledge workers. The first is the presence of a critical mass of users and the second is the temporal availability of the recipient. This research suggests that knowledge workers will only spend time learning and using groupware technology, such as e-mail, if they are reasonably confident that most others within the firm are prepared to use this medium and if the tasks to be performed are not particularly complex (requiring high social presence). Again, where the task in hand was complex, knowledge workers still preferred to use media that was information rich, e.g. face-to-face communication, rather than attempting to use e-mail to convey complex information or knowledge. Straub and Karahanna's (1998) research, while again routed in positivist research traditions, and highly deterministic, suggests that knowledge workers carefully consider the potential payback associated with time spent acquiring the new skills required to use particular technology, before deciding to use this media for communication. Assessment is also made of the potential for face-to-face communication, prior to choosing to use a technological media for communication. This research does therefore suggest that particular social, contextual conditions do mediate the choice of communication media, particularly between knowledge workers.

Other research on the choice and use of particular media for communication (Lee, 1997; Ngwenyama and Lee, 1997) has rejected the idea that particular communication media will be chosen for their objective rich or lean properties alone. This research suggests a more complex interaction between individuals,

---

technology and organizational context, which requires an interpretive approach rather than the positivist approach adopted in IR theory. This more recent work has sought to understand why several empirical studies have identified serious conceptual weaknesses in IR theory (Markus, 1992; Orlikowski, 1992; Yates and Orlikowski, 1992; Schultze and Vandenbosch, 1998). For example, Markus's research found that managers' actual media use was inconsistent with IR theory, as they used e-mail far more intensively than IR theory would predict. This research highlighted "that managers who received e-mail were not simply passive recipients of data, but active producers of meaning" (Markus, 1992, p. 154). The richness afforded to a particular medium, therefore, depends on more than just the objective features of the medium it is also highly dependent on organizational context. For example, Lee asserts that the most appropriate communication medium will depend on individuals' familiarity and skills with different media and their willingness, opportunities and resources available (e.g. time) to support learning of the capabilities of particular media, innovating uses for it, etc. In the context of a KIF, for example, consultants who are often faced with a significant degree of dispersed work activity and a significant pace of work, may have discovered innovative ways of using relatively "lean" media for rich communication.

This more recent research focusing on choice of communication media does suggest that within KIFs, the availability of ICT may be a useful resource in project team working, particularly where team members are temporally unavailable and geographically dispersed. However, its level of utility cannot be estimated without detailed empirical investigation. While, the complexity of the majority of tasks consultants engage in during project team working may require information-rich media, consultants may have developed ways of using relatively lean media, innovatively, in order to overcome problems of temporal and geographical dispersion. This research has also shown that knowledge workers are only motivated to spend time learning how to use IT for communication and interaction if a sufficient number of others are also prepared to use the same media. In the following analysis a qualitative, interpretive approach will be used to assess the degree of media richness afforded to different groupware within this particular organizational context and to what extent different communication media facilitated knowledge creation processes. The existing literature in this field suggests that its role is highly situated and context dependent. In the next section we consider the use of groupware within Universal Consultancy.

## **5. The use of groupware at Universal Consultancy**

### *5.1 E-mail*

E-mail was adopted and implemented within Universal in late 1991, by which time over 100 consultants worked within the firm. Prior to this, knowledge had been managed and created purely through tacit exchange (socialization) and externalization during inter-disciplinary project team working. Hard copy project documentation was generated which, in conjunction with socially

---

located knowledge, served to generate collective knowledge over time regarding the skills and expertise that existed throughout the firm. Until this point in time, consultants had been allocated in a fairly arbitrary fashion to two broad skill groupings – engineering or communications. Consultants could choose which projects they worked on, across the skill groupings in an environment that was characterized as highly autonomous and egalitarian by all interviewees.

In late 1991 however, in response to a worsening financial situation, and in order to provide better accountability, consultants were organized into five divisions, subject to specific expertise, e.g. physicists were allocated to applied science innovation division, bio-chemists to life sciences division, etc. A financial control system was then introduced to monitor the revenue generated by each division and by each consultant. At this time an e-mail system was also implemented to facilitate communication across divisions and to help support inter-disciplinary team working.

Within the financial control system all consultants were allocated the same personal revenue target to be achieved each month (indicative of the egalitarian environment), and personal revenue subsequently contributed to divisional revenue targets. Thus, by default, the larger divisions had the highest divisional revenue targets to achieve. In order to accrue personal revenue it was in the consultants' interests to be involved in as many projects as was feasible at any given time. However, involvement in projects would only occur when consultants could demonstrate that they had the required knowledge and expertise to contribute to a particular project. The e-mail system that had been introduced at this time began to be used specifically for this purpose in the following manner.

In the initial stages of negotiation with clients, project leaders used e-mail, primarily as a technology for knowledge acquisition, to conduct a focused search for knowledge that would be relevant to the project proposal. Consultants responded quickly and effectively to requests for information from project leaders, so that inclusion in projects could be secured. It was not necessary, at this proposal stage, to share expert tacit knowledge. Consultants were only required to provide low level explicit information regarding their capabilities and areas of expertise. The e-mail system was considered to be a highly-efficient groupware technology for managing processes of externalization and generating collective knowledge across the firm regarding individuals' knowledge and expertise within the firm.

This can be explained in part by considering the degree of media richness provided by e-mail. Media richness has two underlying dimensions – the variety of cues that the medium can convey and the rapidity of feedback that the medium can provide (Huber, 1991). Initially, the project leader required only fundamental information but it was required quickly. The e-mail system provided the necessary degree of media richness for this type of knowledge acquisition; the variety of cues was limited to the written word but the rapidity

---

of feedback was potentially immediate. In this way, e-mail articulated and coordinated low-level information transfer.

When a project was secured, consultants who had demonstrated their potential usefulness and contribution at the project proposal stage, negotiated their percentage of the project fee, with the project leader premised on their expected contribution to the project. This then contributed to their personal revenue. In this way, a free market for expertise was created at Universal and E-mail became a tendering tool within the financial control system. The information provided *via* e-mail was explicit and, therefore, consultants had on record, their contribution to the successful negotiation of a project (Ljungberg and Sørensen, 2000). This would not have occurred if project leaders and consultants had relied only on the tacit exchange of this knowledge. By considering the context of application then e-mail could be considered a particularly rich media within the highly-informal tendering system for knowledge and expertise, reflecting the innovative use made of this particular groupware. While only low-level information regarding consultants' particular knowledge and expertise was made explicit using e-mail, project leaders interpreted the information that had been provided (applied their tacit knowledge) and imbued these messages with meaning in order to develop a financial estimate of the potential use that could be made of the knowledge and expertise that was being offered.

Other than for project tendering, however, the e-mail system was considered to have become a communication medium of hegemonic proportions by the time the research commenced. Since its introduction, the use of e-mail had grown significantly. Any subject matter, regardless of how important, sensitive or trivial, was communicated via e-mail. While it was recognized that e-mail was a useful and efficient tool for communicating to significant numbers of people across divisions, e-mail had become increasingly used within divisions and even between individuals sitting next to one another.

As one consultant stated:

I couldn't believe it when I saw people sitting next to one another sending e-mails . . . I think it suits some of the introvert personality types working here.

Divisional managers received on average between 150 and 200 e-mails each day and other consultants only slightly less. There was no effective classification system used to categorize the type of message sent and this constrained the management of this high level of communication flow. Messages rarely had a header that related to the content of the message and only two classifications were used for messages. The SOC prefix was used to imply a social message and the INNOV prefix was used to imply a message relating to project working.

The INNOV category was therefore used not only by project leaders during project tendering, but also to promote discussion more generally around new ideas. Thus in principle, e-mail was a potential medium for the articulation and creation of knowledge. However, in reality, the manner in which consultants

---

were free to respond and send e-mails, meant that this occurred in only a very limited way. For example, some identifiable consultants always responded to requests for information and knowledge, regardless of whether their contribution could be considered useful or relevant. Arbitrary and unconnected responses then allowed other consultants to digress on “flights of fancy”, which subsequently contributed very little information and knowledge to the topic or new idea originally under consideration.

This example of the way in which INNOV mails were treated, highlighted the chaotic manner in which the e-mail system was used outside of project tendering. The highly-informal organizational context at Universal was such that consultants were not subject to any mail protocols and hence were free to introduce bad practice and effectively abuse the system, if they chose to do so.

The majority of e-mails were also sent to everyone and replies also went to everyone. How and when this bad practice began, no one was sure, but this approach was the “norm” at the time of the research. One consultant stated:

There is no sort of consensus that e-mails below a certain threshold of interest don't get sent to everyone. So you go away for two days and come back and you will have 200 e-mails. And you don't get discipline where people will copy to the whole of Universal some silly little remark about some other silly remark people have made. About once every four months there will be a conversation (on e-mail!) along the lines of “do you realize that having sent out that message to everyone you have wasted two hours of company time”. Nothing generally happens though, it goes on every three to four months.

Everyone acknowledged that they were overloaded with e-mail communication but, as another consultant pointed out:

It's quite wasteful but again, there's a kind of cultural thing about it's better to allow people to waste time than make people feel constrained about not talking to people.

This quote highlighted the emphasis that was placed on individual autonomy at Universal, which the founder attempted to promote and which was perceived to be a major facilitator of knowledge creation within the organization. It is evident then that while e-mail was introduced to facilitate communication across divisions, over time, information overload had developed across the whole organization as a result of the manner in which the e-mail system was used (Hiltz and Turoff, 1985; Carstensen and Sørensen, 1996; Ljungberg and Sørensen, 1998, 2000). Attempts to use this groupware for processes of knowledge articulation and creation were thus constrained, paradoxically by the culture and work norms that had developed which in themselves were considered to promote individual autonomy and facilitate processes of organizational innovation.

### *5.2 Lotus Notes*

Project team working at Universal was a process of information and knowledge distribution and group interpretation, leading to knowledge creation. Until 1994, this had occurred mainly on site at Universal, through direct face-to-face communication and the exchange of tacit knowledge. For example, at the start

---

of a project, team members would spend whole days together, “brainstorming” and recording relevant ideas and suggestions put forward. Using Nonaka’s (1994) framework, through a process of socialization, individual knowledge was externalized so that the tacit was made explicit.

However, during 1994, two projects were undertaken that required some highly-specialized knowledge that could only be found outside of the organization, in the USA and Japan. Scientists in these countries agreed to work on these projects as “associates” (experts employed on a sub-contract basis), but a technology had to be found that would allow project work to be conducted across international boundaries. Lotus Notes discussion databases were implemented to facilitate project working and overcome the temporal and spatial obstacles created by the dispersion of project team members. Notes were used successfully to coordinate project work across countries and both projects were successfully completed using this groupware. A valuable by-product of using Notes were the databases created, which served as high-quality project documentation. These provided a form of organizational memory that could be stored for future use.

Despite the successful use made of Notes by these two projects, by the time the research commenced in 1996, usage of Notes was only limited and partial. By the time the research ended, Notes usage had diminished further and the IT manager was no longer prepared to support the software. It was evident then that project teams still preferred and relied primarily upon the verbal exchange of knowledge as the medium for knowledge creation, when team members were all based in the UK. Since it had been first implemented in the firm to support the two projects mentioned, there had been no concerted effort by either divisional managers or project leaders to raise consultants’ awareness of Notes as a medium for project working despite its successful use on two major projects. This, we suggest, relates to two of the firm’s structural properties; culture and work norms, and the financial control system.

Orlikowski (1992) suggests that individual cognition about technology and work, combined with structural properties of the organization, influence the effective utilization of groupware. As mentioned previously, consultants at Universal worked within a highly informal, autonomous environment. While they were therefore made aware of Lotus Notes and its successful use on two major projects, divisional managers remained ambivalent regarding its widespread diffusion across the organization, allowing project leaders completely free choice regarding its adoption, characteristic of the importance attached to maintaining individual autonomy within the firm.

Untypical, perhaps, within consultancy firms, a competitive, yet strongly co-operative culture existed at Universal, driven by the demands of the financial control system. Individual consultants had always shared their knowledge and expertise with others, both inside and outside of project working. Knowledge sharing freely occurred in order to complete the work required and, perhaps more importantly, to enhance the visibility, or make explicit, individuals’ tacit knowledge within the free market for expertise, created by the financial control

---

system. e-mail was used to communicate low-level information regarding the potential use that project leaders could make of particular expertise or tacit knowledge. However, it was the face-to-face interaction during project team working and, more generally, with its significant level of media richness that adequately conveyed the extent and breadth of an individual consultants' tacit and explicit knowledge base. Face-to-face communication generated collective knowledge across the firm from which new knowledge emerged in the form of new products or processes.

Consultants' perceptions of Notes was that the technology did not provide comparable degrees of media richness in which this particular form of collective knowledge could be developed. This particular groupware was not therefore an appropriate technology for knowledge creation within this context. Notes is a suitable medium for the communication of explicit knowledge. However, as Nonaka (1994) states:

Organizational learning derives from combination knowledge and in project working, knowledge creation occurs when the tacit is made explicit through processes of socialization and externalization.

Lotus Notes, in many instances, lacks the media richness to support these processes. For example, consultants who had worked on projects using Lotus Notes, suggested that while the databases provided relevant knowledge in a timely fashion often clarification would be required on particular complex information that was communicated in this way. Clarification would be sought generally *via* telephone conversations, as consultants attempted to make their tacit knowledge explicit, in order to provide the necessary clarifications that were sought. As face-to-face communication was impossible, telephone conversations were considered to be the next best (richest) medium for these processes of externalization. This analysis, highlighting the limited and diminishing use made of Notes, also supports the research by Straub and Karahanna (1998), which suggests that there needs to be a critical mass of users for knowledge workers to invest time and effort in learning and using new forms of communication media.

## 6. Discussion

The way in which groupware technology was used within Universal Consultancy, highlights the limited attention of IR theory to context and the context-dependency of knowledge creation processes. Thus the analysis of the case highlights the need to consider media richness as a subjective (possibly even an inter-subjective) and contextually-dependent phenomena rather than as an objective characteristic of the technology (Lee, 1997; Ngwenyama and Lee, 1997). Rogers (1983) similarly notes that the characteristics of an innovation that encourages its diffusion and adoption are necessarily perceived characteristics. These then depend on how the innovation is communicated and understood by potential users. One way of explaining the relative success of E-mail within the informal tendering system, then, is to take into account media

---

richness, but in context, i.e. in the context of incentive systems. Consultants had to market their expertise in order to meet revenue targets. However, a lack of formal structures and processes for recording contribution to projects meant that e-mail was the only mechanism by which consultants could make themselves visible and have their potential contributions to project work recognized and recorded. Thus within this particular context, e-mail was considered a relatively rich media for the communication of individuals' explicit knowledge base and tacit expertise. Over time with extensive use of e-mail for this purpose, collective knowledge was also generated regarding the knowledge and expertise of consultants throughout the firm.

The limited use made of Lotus Notes can also be explained in terms of both the structural characteristics of the organization (context) and the lack of media richness provided by the groupware, which supports many of the arguments made by Orlikowski (1992) but within a different organizational context. While Orlikowski's (1992) research was also conducted in a consultancy firm, the structural characteristics were very different across the two firms. For example, Universal does not have a partnership structure which, in Orlikowski's (1992) study, was found to significantly inhibit knowledge sharing as individuals competed for partnership positions. Instead, Universal maintains a flat organizational structure of expert consultants of equal standing. It is the financial control system, rather than a recognition and promotion system, which serves as the major control and incentive mechanism encouraging and motivating consultants to freely exchange information and knowledge. Thus the main source of conflict generated by the partnership system in terms of Lotus Notes diffusion, reported by Orlikowski (1992), did not exist at Universal. The structural arrangements at Universal did, however, encourage experimentation and thus emphasized creation of knowledge at the point of application through face-to-face contact and so the systematic documentation of projects via Lotus Notes became of limited value. It was also the imperative to make visible individuals' tacit (expert) knowledge, generated by the free market for expertise, which inhibited individuals from using this medium as, in terms of IR theory, it is particularly difficult to convey tacit knowledge and expertise through such a lean medium.

Ciborra and Patriotta (1996) investigated how the visibility of work activities and subsequent possibilities for surveillance in a hierarchical configured system inhibited Lotus Notes adoption. At Universal the adhocracy configurational arrangements and internal market for expertise did not present such a hindrance. In fact, Ciborra and Patriotta's (1996) point that the use of the groupware technology should be aligned to the existing organizational structure was valid at Universal. The flat organizational structure emphasizing casual formation of projects based on open negotiation of skills fundamentally matches the underlying assumptions of Lotus Notes discussion databases quite well. Karsten's (1995) argument that different perceptions of what the underlying capabilities of Lotus Notes was not in fact a significant inhibiting factor in the case study here. At Universal, the knowledge

---

workers demonstrated significant technological flair, and Lotus Notes was indeed successfully used in two geographically distributed projects.

Thus, while e-mail served as an effective tool for the articulation and coordination of low-level knowledge, this study suggests that verbal communication, social interaction and hard copy project documentation are more effective mechanisms for knowledge creation – a conclusion also drawn in Kraut and Streeter's (1995) study of knowledge work in software engineering projects. These can provide a level of media richness, which is simply not found in groupware such as Lotus Notes.

The e-mail system as a project tendering tool recording the negotiations that took place can be viewed as a means for securing textual traces of human activities (Sørensen *et al.*, 2000). This mode of operation has been studied in other knowledge-intensive work settings as a means of managing interaction (Ljungberg and Sørensen, 1998, 2000). Here, knowledge workers would produce written logs of telephone conversations or even tape-recordings to ensure consistent records of important decisions, although these traces potentially would increase the interaction overload experienced (Ljungberg and Sørensen, 1998, 2000). Applying information-filtering techniques to textual traces of human activities can support the navigation of these traces. This can potentially play an important role, as the organization develops, given that the individual knowledge workers' e-mail directory represented the "knowledge base" (Fagrell and Sørensen, 1999; Sørensen *et al.*, 2001). The lack of proper indexing and search facilities, however, prohibited full usage of these "knowledge bases" (Oard, 1997).

The misuse of the two categories, INNOV and SOC, as well as the general use of e-mail for threaded discussions, suggest a need for increased formalization of the support for communication and collaboration at Universal (Malone *et al.*, 1987; Carstensen and Sørensen, 1996; Schmidt and Simone, 1996). If the number of participants in these discussions were to increase dramatically, it is more than likely that the knowledge workers would experience interaction overload. This would demand the subsequent adoption of various means (formal or otherwise) for moving some of the complexity of coordinating work activities into organizational or technological arrangements (Carstensen and Sørensen, 1996). In fact, although not substantiated in this case study, the two existing categories can be viewed as a first attempt to manage the complexity of the interaction through simple categorization (Malone *et al.*, 1987; Karsten, 1995; Carstensen and Sørensen, 1996; Bowker and Star, 1999; Karsten, 2000). The misuse of categories, along with the sheer number of messages, made the technology appropriate for managing weak ties, whereas the face-to-face project working clearly facilitated the maintenance of strong ties (Granovetter, 1973). Assuming that interactive knowledge-creating processes rely on strong ties, the interesting question for further research is to what extent, in such knowledge-intensive settings, does the management of a wealth of weak ties actually inhibit the maintenance of strong ties.

---

## 7. Conclusion

This discussion has highlighted the importance of considering choice of communication media for processes of knowledge creation, not only in terms of IR theory, but also in terms of context. Several commentators on knowledge creation (cf. Nonaka, 1994; Spender, 1996; Blackler, 1995) emphasize the highly-contextual nature of the process, yet very few empirical accounts of the process have been documented and published. Using both IR theory and research that has focused on the importance of considering the interaction of people, technology and the nature of work processes, this paper has highlighted the highly situated and novel use made of ICTs for processes of knowledge creation.

Considering Universal Consultancy as a case of the diffusion of technological innovations in support of the management of knowledge, the question is how to innovate the innovators? Ciborra (1996) argues that, because of the highly informal nature of group work, organizations must adopt and show hospitality towards groupware technology in order for it to succeed. At Universal, the pace of work, extreme low levels of formalization and the relative ephemeral interdependencies among expert consultants constituted a very hostile rather than hospitable environment. The value placed on an individual's knowledge and expertise was constantly being re-negotiated among peers and was basically expressed *via* membership in projects. A consultant was required to constantly market their skills to others in the organization. Using groupware to support work is, therefore, a question of, if not supporting this process, then at least not disrupting it. Basically the adopters were, in this case, highly-motivated, intelligent and technologically-proficient people who could not be forced to adopt a particular technology.

As expressed by Blackler (1995), it is difficult to manage knowledge workers and the technology they choose to adopt must help them communicate and interact. Technology cannot be seen to be a hindrance for project work. Given this user-driven technology adoption strategy, if a technology imposes problems for the users, it will not be adopted, and even in the event that it is adopted, there may be heterogeneous diffusion patterns across the organization. The dilemma here becomes one of the technology as a tool versus becoming an information infrastructure. If both the adoption and the use of a particular groupware technology is managed using a *laissez-faire* approach, the adoption pattern may be heterogeneous across the organization, and the full potential of the technology may not be achieved (Mathiassen and Sprensen, 1997).

Alternatively, if the technology becomes widely adopted in the organization this may in turn create other problems. A user group that is technologically proficient and demanding suggests that they will only adopt technologies, which serves their goals, and subsequently push the use of these technologies to (and sometimes beyond) the limit.

The chaotic use and abuse of e-mail during project working (as opposed to project tendering) highlights this point, reflecting the considerable personal

autonomy that existed within the firm. This final point again reinforces the need to focus on context when studying the use of ICTs for processes of knowledge creation.

### References

- Alvesson, M. (1995), *Management of Knowledge-Intensive Companies*, Walter de Gruyter, Berlin.
- Alvesson, M. (1999), "Social identity and the problem of loyalty in knowledge-intensive companies", in Blackler, F., Courpasson, D. and Elkjaer, B. (Eds), *Knowledge Work, Organizations and Expertise: European Perspectives*, Routledge, London.
- Blackler, F. (1995), "Knowledge, knowledge work and organizations: an overview and interpretation", *Organization Studies*, Vol. 16, pp. 1021-46.
- Bowker, G. and Star, S.L. (1999), *Sorting Things Out: Classification and its Consequences*, MIT Press, Cambridge, MA.
- Carstensen, P. and Sørensen, C. (1996), "From the social to the systematic: mechanisms supporting coordination in design", *Computer Supported Cooperative Work: Journal of Collaborative Computing*, Vol. 5 No. 4, December, pp. 387-413.
- Ciborra, C. (1996), "What does groupware mean for the organizations hosting it?", in Ciborra, C. (Ed.), *Groupware and Teamwork*, John Wiley and Sons, Chichester, pp. 1-19.
- Ciborra, C. and Patriotta, G. (1996), "Groupware and teamwork in new product development: the case of consumer goods multinational", in Ciborra, C. (Ed.), *Groupware and Teamwork*, John Wiley and Sons, Chichester, pp. 121-42.
- Daft, R.L. and Lengel, R.H. (1986), "Organizational information requirements, media richness and structural design", *Management Science*, Vol. 32 No. 5, pp. 554-71.
- Denzin, N.K. and Lincoln, Y.S. (1998), "Entering the field of qualitative research", in Denzin, N. and Lincoln, Y. (Eds), *Strategies For Qualitative Inquiry*, Sage, London, pp. 1-34.
- Ellis, C.A., Gibbs, S.J. and Rein, G.L. (1991), "Groupware: some issues and experiences", *Communications of the ACM*, Vol. 34 No. 1, pp. 38-58.
- Fagrell, H. and Sørensen, C. (1999), "Surveying the World Wide Web", *Scandinavian Journal of Information Systems*, Vol. 11 No. 1, pp. 25-50.
- Granovetter, M.S. (1973), "The strength of weak ties", *American Journal of Sociology*, Vol. 78 No. 6, pp. 1360-80.
- Hiltz, S.R. and Turoff, M. (1985), "Structuring computer-mediated communication systems to avoid information overload", *Communications of the ACM*, Vol. 28 No. 7, pp. 680-9.
- Huber, G.P. (1991), "Organizational learning: the contributing process and the literatures", *Organization Science*, Vol. 2 No. 1, pp. 88-115.
- Karsten, H. (1995), "'It's like everyone working around the same desk': organisational readings of Lotus Notes", *Scandinavian Journal of Information Systems*, Vol. 7 No. 1, pp. 3-32.
- Karsten, H. (2000), "Constructing interdependencies with collaborative information technology", in Baskerville, R., Stage, J. and DeGross, J.I. (Eds), *Organizational and Social Perspectives On Information Technology, IFIP TC8 WG8.2 International Working Conference, Aalborg, Denmark*, Kluwer Academic Publishers, Dordrecht, pp. 429-52.
- Kraut, R.E. and Streeter, L.A. (1995), "Coordination in software development", *Communications of the ACM*, Vol. 38 No. 3, pp. 69-81.
- Lee, A.S. (1997), "Electronic mail as a medium for rich communication: an empirical investigation using hermeneutic interpretation", *MIS Quarterly*, Vol. 18 No. 2, pp. 143-57.
- Ljungberg, F. and Sørensen, C. (1998), "Are you 'pulling the plug' or 'pushing up the daisies'?", in Nunamaker, J.F., Turoff, M. and Rana, A. (Eds), *Thirty-First Hawaii International*

- 
- Conference on System Sciences (HICSS-31): Collaboration Technology – Theory and Methodology*, IEEE, Minitrack, Big Island, HI.
- Ljungberg, F. and Sørensen, C. (2000), "Overload: from transaction to interaction", in Braa, K., Sørensen, C. and Dahlbom, B. (Eds), *Planet Internet*, Studentlitteratur, Lund.
- Macdonald, S. and Williams, C. (1992), "The information network in an age of advanced telecommunications", *Human Systems Management*, Vol. 11, pp. 77-87.
- Malone, T.W., Grant, K.R., Lai, K.-Y., Rao, R. and Rosenblitt, D. (1987), "Semistructured messages are surprisingly useful for computer-supported coordination", *TOIS*, Vol. 5 No. 2, pp. 115-31.
- Markus, L. (1992), "Electronic mail as the medium of managerial choice", *Organization Science*, Vol. 5 No. 4, pp. 502-27.
- Mathiassen, L. and Sørensen, C. (1997), "A guide to manage new software engineering tools", in McMaster, T. and Wastell, D. (Eds), *Second IFIP WG8.6 Working Conference: Diffusion, Transfer and Implementation of Information Technology, 25-27 June, 1997, Low Wood Hotel, Ambleside, Lake Windermere, UK*, Chapman and Hall, London.
- Mintzberg, H. (1983), *Structure in Fives: Designing Effective Organizations*, Prentice-Hall, Englewood Cliffs, NJ.
- Ngwenyama, O.K. and Lee, A.S. (1997), "Communication richness in electronic mail: critical theory and the contextuality of meaning", *MIS Quarterly*, Vol. 21 No. 2, pp. 147-67.
- Nonaka, I. (1994), "A dynamic theory of organizational knowledge creation", *Organization Science*, Vol. 5 No. 1, pp. 14-37.
- Oard, D.W. (1997), "The state of the art in text filtering", *User Modeling and User-Adapted Interaction: An International Journal*, Vol. 7 No. 3, pp. 141-78.
- Orlikowski, W.J. (1992), "Learning from Notes: organizational issues in groupware implementation", in Turner, J. and Kraut, R. (Eds), *CSCW '92. Proceedings of the Conference on Computer-Supported Cooperative Work, Toronto, Canada, October 31 to November 4, 1992*, ACM Press, New York, NY, pp. 362-9.
- Prusak, L. (1997), *Knowledge in Organizations*, Butterworth-Heinemann, Oxford.
- Rogers, E.M. (1983), *Diffusion of Innovations*, 3rd ed., The Free Press, New York, NY.
- Scarborough, H., Swan, J. and Preston, J. (1999), "Knowledge management: a literature review", *Issues in People Management*, Institute of Personnel and Development, London.
- Schmidt, K. and Bannon, L. (1992), "Taking CSCW seriously: supporting articulation work", *CSCW*, Vol. 1 No. 1-2, pp. 7-40.
- Schmidt, K. and Simone, C. (1996), "Coordination mechanisms: an approach to CSCW systems design", *Computer Supported Cooperative Work: An International Journal*, Vol. 5 No. 2-3, pp. 155-200.
- Schultze, U. and Vandenbosch, B. (1998), "Information overload in a groupware environment: now you see it, now you don't", *Journal of Organizational Computing and Electronic Commerce*, Vol. 8 No. 2, pp. 127-48.
- Sørensen, C. and Kakihara, M. (2001), "Knowledge discourses and interaction technology", in Carter, C., Scarborough, H. and Swan, J. (Eds), *Managing Knowledge: Controversies and Critiques. International Conference*, 10-11 April, Leicester University, Leicester.
- Sørensen, C. and Snis, U. (2001), "Innovation through knowledge codification", *Journal of Information Technology*, Vol. 16 No. 2.
- Sørensen, C., Fagrell, H. and Ljungstrand, P. (2000), "Traces: from order to chaos", in Braa, K., Sørensen, C. and Dahlbom, B. (Eds), *Planet Internet*, Studentlitteratur, Lund, pp. 113-36.
- Sørensen, C., Macklin, D. and Beaumont, T. (2001), "Navigating the World Wide Web: bookmark maintenance architectures", *Interacting With Computers*, Vol. 13 No. 3, pp. 375-400.

- Spender, J. (1996), "Organizational knowledge, learning and memory: three concepts in search of a theory", *Journal of Organizational Change*, Vol. 9 No. 1, pp. 63-78.
- Stake, R. (1998), "Case studies", in Denzin, N. and Lincoln, Y. (Eds), *Strategies For Qualitative Inquiry*, Sage, London, pp. 86-109.
- Starbuck, W. (1992), "Learning by knowledge-intensive firms", *Journal of Management Studies*, Vol. 29, pp. 713-40.
- Straub, D. and Karahanna, E. (1998), "Knowledge worker communications and recipient availability: toward a task closure explanation of media choice", *Organization Science*, Vol. 9 No. 5, pp. 160-75.
- Swan, J., Newell, S., Scarbrough, H. and Hislop, D. (1999), "Knowledge management and innovation: networks and networking", *Journal of Knowledge Management*, Vol. 3 No. 3, pp. 262-75.
- Swan, J., Robertson, M. and Newell, S. (2000), "Knowledge management: when will people enter the debate", in Sprague, R.H. Jr (Ed.), *Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS-33)*, Maui, HI.
- Tushman, M.L. (1979), "Managing communication networks in R&D laboratories", *Sloan Management Review*, pp. 37-49.
- Walsham, G. (1993), *Interpreting Information Systems in Organizations*, Wiley, London.
- Yates, J. and Orlikowski, W. (1992). "Genres of organizational communication: a structural approach to studying communication and media", *Academy of Management Review*, Vol. 17 No. 2, pp. 299-326.
- Yin, R. (1989), "Case study research", *Design and Methods*, Sage, London.