

Case study

Knowledge work and telework: an exploratory study

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Abstract

Describes a case research study into how knowledge workers adopt telework as an alternative work arrangement. It reports how knowledge workers in two New Zealand organisations organise their workload to take advantage of the information and Internet technology available to them in their work and home environments. The findings of the study indicate that knowledge workers are inclined to use home-based teleworking as an adjunct to the work done during normal business hours. Their preference is still to work at the office for most of their work time. Discusses the implications of the findings for practice and research.

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Introduction

Picture an organisation where the workers own the means of production, their knowledge. The organisation is in a service industry producing a product that is intangible. Moreover, the organisation's knowledge, its "capacity for action" (Senge, 1997), is not the sum of the knowledge of the individuals within. Therefore, the organisation must find ways of multiplying the knowledge of the individual in order to expand and create new knowledge in a form that the client or the end user requires.

Organisations can achieve this by fostering a dynamic, stimulating and supportive environment conducive to knowledge sharing. Access to information and Internet technology is one way, providing the means to interact and collaborate with colleagues is another (e.g. the use of intranets, extranets and Internet-based videoconferencing systems). Additionally, different physical environments for different work processes, or different mediums for communicating what is known, might be necessary.

This study examines the question of how knowledge workers adopt telework as an alternative work arrangement. The study was conducted in the city of Wellington, New Zealand. Wellington is a service-oriented city with an abundance of organisations staffed with people whose knowledge is their currency. This study examines ten such knowledge workers from two organisations in the business of providing analysis, advice and technical expertise. Each worker has access to information and Internet technology in an alternative work environment, in this case their home, linking them to their work environment[1]. The study examines how these knowledge workers have used home-based teleworking.

The first section of this paper provides a review of literature on knowledge work and home-based telework. The second section describes the research method. The next section presents the findings and describes selected aspects of these findings. The final section discusses implications for future research and human resource management policy.

Literature review

The literature review focuses on the two major areas of interest in this study, namely, the nature of knowledge work and home-based teleworking.

Knowledge work and knowledge workers

Senge (1997) suggests that while information is knowing “about” things, and is received and passed on, knowledge is knowing “how”, thereby giving people the capacity for effective action. Davenport *et al.* (1996) define knowledge work as “the acquisition, creation, packaging, or application of knowledge. Characterised by variety and exception rather than routine, it is performed by professional or technical workers with a high level of skill and expertise . . . ” (p. 2).

Sulek and Marucheck (1994) expand the definition of knowledge work by referring to cognitive skills such as planning, problem solving and decision making, and the knowledge worker as having high levels of education, experience and organisational status. The sense of knowledge workers constantly renewing, replenishing, expanding and creating more knowledge as part of the production process so that in the end they produce a unique solution, needs also to be conveyed. The authors studied the impact of information technology on knowledge workers and explored the relationship between the technology and the individual characteristics of knowledge workers with respect to observable changes in the allocation of work time to various task categories. The results indicate support for the existence of both deskilling[2] and intellectual specialisation effects on the part of knowledge workers.

Davenport *et al.* (1996) present the findings of a study of 30 organisations looking at the ways appropriate for improving knowledge work processes. They concluded that organisations should probably choose an approach that reflects the type of knowledge, the organisational culture and the actual business requirements.

Home-based teleworking

Many authors acknowledge the role of communications and information technology in

creating the ability for individuals, including knowledge workers, to work anywhere, anytime, anyplace, thereby changing the way they and the organisation operates (Staples, 1996; Handy, 1995; Lucas and Baroudi, 1994).

Stanworth (1998) identifies three main groupings of home-based teleworkers:

- (1) employees who work at home for part of their working time;
- (2) totally home-based; and
- (3) freelance tele-homeworkers.

Gray *et al.* (1993) refer briefly to one important area of research given scant consideration, and that is the “tacit” or informal teleworking that occurs occasionally. This type of teleworking encompasses what the authors refer to as “the multitude of managers who take work home for the occasional day to finish a report in peace and quiet, for example, or to work in the evening or weekend” (p. 3). These “occasional homeworkers” work at home on an entirely informal basis, in many cases unbeknown to the employer. The authors attribute the increase in tacit teleworking to the growth in computers for the home, and see the trend accelerating rapidly in organisations where keyboard skills and communications equipment skills are automatically expected of all employees.

Knowledge work and home-based telework

Mazzi (1996) explores the issue of status as it applies to alternative office structures for telecommuting. She interviewed telecommuters who considered themselves as part of their office group. The office, not the home, was their primary workspace. Home was an alternative workspace better suited to high-concentration, individually-based tasks that were best done without interruption. Mazzi also found that the nature of the job had an impact on the level of telecommuting. Knowledge workers, she found, could afford to be out of the office for part of the week, but they had to be in the office for the interactive purposes of group projects and meetings, including meetings with clients. Administrative or management employees also interact considerably with others in the office so need to be both visible and accessible. The conclusions drawn were that the home office is only an extension of the office environment, not a

substitute. As such it should be viewed as an alternative workspace, one that may not be suitable for all types of office activities.

Duxbury *et al.* (1992) identify a work arrangement where “job-relevant” work is done at home on a computer outside regular office hours. Their study looked at how after-hours telecommuting affects an individual’s ability to balance work and family demands. The study found knowledge workers with computers at home worked significantly more hours per week and a greater number of hours of overtime at home than do individuals without computers. However, the authors found there was increased work-family conflict that was not offset by the increased work role flexibility.

Rognes (1996) questions the commonly-stated advantages and disadvantages of telecommuting by introducing some paradoxes and also some contradictions. For example, increased personal flexibility leading to decreased flexibility for group co-ordination, and a less disruptive home-office environment contradicting the desire to always be reachable, highlight what the author calls the two parallel aspects of information work, one solitary and one social and communicative. The findings lead to the conclusion that telecommuting is “made to measure”, and that it is difficult to predict how its introduction will affect the organisation.

Method

The purpose of a case study is to shed light on a phenomenon (process, event, person or object of interest) and has been noted for three purposes; to produce detailed descriptions of a phenomenon, develop possible explanations of it, or evaluate the phenomenon (Leedy, 1997). Case research method is considered useful when a natural setting is needed and when the study is exploring a contemporary event, where control of subjects or events is not necessary and where there is not already an established theoretical base (Benbasat *et al.*, 1987). The case research approach is considered an appropriate research method for organisational studies because of the way it uses direct observation and systematic interviewing to gather data, and in particular when “how” or

“why” questions are being posed (Yin, 1989; Cresswell, 1994).

The greatest concern in case research is the lack of rigour, uncertain evidence and biased view. Furthermore, case studies provide little basis for generalisation, especially if designed as a single case (Yin, 1989). In contrast, quantitative research accounts for questions of validity and reliability at the start. The design stage of qualitative research must also address the same issues of validity and reliability of data. Similarly, theory development prior to the collection of any case study data is considered an essential step, except where there is little existing knowledge as would occur in a true exploratory study (Yin, 1989). It was decided that as this was to be an exploratory study, it satisfied all the requirements of a case study approach.

Planning the study

Because this was an exploratory study, the literature review was used first to read about knowledge workers and the nature of their work and then about teleworking itself. This helped form the research questions which, although unstructured, could serve as reminders or prompts when gathering the data, while staying focused on the topic. Because of the small sample population, it was decided to study two organisations, not one. The first step was to identify two organisations of similar size, both in the knowledge-worker service sector and at a similar stage of technology (see Tables I and II). Chosen was one organisation from the private sector and one from the public sector, signalling ownership differences. Both were producers of legal, economic or financial advice, although each had a different client/stakeholder base. The variable was deliberately chosen to see if knowledge workers in the private sector organisation use telework to support their workload any differently to those in a public sector organisation.

Data collection and analysis

Selection of participants was carried out with the help of information services and human resource personnel in both organisations. In the first organisation this was done by identifying the five people who already had a computer at home linked up to the office network

Table I A brief profile of the two organisations

Organisational features	Organisation A	Organisation B
Industry	Private sector – professional services	Public sector – government department
Number of employees	170 in the office where the case study was carried out. This includes professional legal, management and administration staff	300 includes policy analysts, managers and corporate services
Physical location	Wellington, New Zealand	Wellington, New Zealand
Type of business	Legal services	Policy advice to Government
Age of organisation	Over 100 years	Over 100 years
Size of client base	Approx. 5,000 – global	One major client – the NZ government
Organisational structure	Chief executive and board of management teams headed by team leaders	Chief executive and five deputies
Major divisions	Three teams – financial, business and litigation	Four policy advice divisions and one corporate

Table II Technological infrastructure of the two organisations

Technological features	Organisation A	Organisation B
Platforms	Win98, ISDN and dial-up modems	Win98, MS dial-up networking via RAS
Desktop tools	Microsoft Office products, e-mail client, Internet browser, and virus checking software	Microsoft Office products, e-mail client, Internet browser, and virus checking software
Communications, collaborations and document sharing tools	Routers to bridge home network to office network so that home applications “looked” identical to office environment, and were automatically connected	Intranet, e-mail and shared network drives
Shared databases and online transactional applications	Yes, same as above	Limited access to some databases via Intranet
Emerging technologies	Web-based products, remote computing using a Terminal Server, access to higher bandwidth through ADSL lines	Thin client supporting digital certificates for login and database access validation. Also, applications to support video conferencing and workgroup collaborations

(participants in an informal pilot project), and in the second by inviting five recipients of that organisation’s home computer subsidy to participate in the study.

Four methods of data collection were used: semi-structured interviews with the participants; personal observation in the workplace; interviewing key personnel[3]; and reading supporting documents to obtain an overview.

Each interview took about one hour. They were recorded on audio-tapes, and immediately

transcribed so that key points could be noted and themes and ideas teased out prior to the next interview. When interviewing was completed, the transcriptions were returned to the participants for checking and validation. The first author did not receive any comment to suggest inaccuracies in the transcriptions. The initial findings from the first organisational setting were put into a diagrammatic form, so that the descriptive framework became the vehicle for examining the second organisation.

Research findings

In this study each participating knowledge worker was a member of the organisation – as an owner and/or an employee and/or a manager/supervisor – and each possessed specialist knowledge as their “means of production” or “tools of trade”. With the specialist knowledge gained over a period of time came power and status. This in turn gave them the authority to request entrée to the technology to enable them to organise facilities for working from home. The work was found to be non-routine, highly demand driven and with tight time-frames. The end product produced by the organisation has to be of high quality and on time. These findings are consistent with the definition of a knowledge worker given by Davenport *et al.* (1996) and Sulek and Marucheck (1994). Both definitions emphasise that knowledge workers have a high level of skill and expertise, with Sulek and Marucheck (1994) also including high levels of education, experience and organisational status.

Aspects of knowledge work

Two aspects of knowledge work were found: knowledge workers carrying out their own work, and knowledge workers helping others do their work

Knowledge workers carrying out their own work

In this section the nature of after-hours work and its implications for home-based teleworking will be discussed.

The participants in this study are producers of work in their own right. That is, they possess the specialist knowledge required to help produce the end product for the organisation. Any supervisory role is additional to the requirement to meet a set number of productive hours. The most important thing to emerge from the data is that this is not routine work where the mind switches off at 5 p.m. as workers walk out the door. Work is an integral part of their life.

Some of the participants have their own client bases to maintain and because they are in a service industry it is considered important to provide the type of service the client seeks. For example, two of the participants have international clients and have to provide a

service to them outside the normal 9-5 p.m., five days a week. They have found being able to send documents and communicate by e-mail means they do not have to take into account international time zones, and can provide a better service by taking advantage of their off-site workalike facilities.

Other participants noted a change in end-user expectations. Some clients and colleagues want contact at all hours in case an important issue arose, because in many instances the end-user has to make decisions based upon the advice received. Other clients, they suggested, were driving the push for communication by electronic means, depending on their own comfort zone with technology.

However to do their own work, they must have access to others' prior work, such as research databases and precedents, and also to the knowledge of others in the organisation. Large service organisations tend to cover a wide range and have specialists in particular areas of expertise. Therefore, knowing where to go for information and how to obtain it, being able to “bounce off” ideas, work through issues, seek expert opinion in unfamiliar areas, or seek guidance from their supervisors or colleagues is considered vital to the production of the work.

Knowledge workers helping others do their own work

The managers in this study have the opportunity to be remote workers who supervise other workers that are located in a central office or in other remote sites. However, all but one of the participants in a supervisory role did not wish to telework during the standard work day as it might lose control over what was happening back at the office. This is what one supervisor had to say:

People [clients] ring me. They don't expect me to know the answers to everything but they do expect me to know what is going on. So I need to be in constant contact. There are two elements to that, one is when they [staff] want to talk to you face to face and the other is just the whole synergies of the team where you do need to stick your head around the door and say “How is it going?”

Staples (1996) discusses the concept of remote management which is defined as “managing employees who work in physically separate location from their managers” (p. 665). His study has found that higher trust building and

increased communication between managers and remote employees have led to higher employee job satisfaction and organisational commitment.

One participant in this study found that higher trust and increased communication with her team have contributed to the effective supervision of team members. As this manager found, supervising by e-mail and following up by meetings when she was in the office was a very satisfactory method of control, especially as it gave subordinates increased responsibility to keep things running smoothly in her absence. This contradictory nature of the supervisory role can be explained as the perceived lack of control from not having all members of the team in close proximity balanced against the need to have a more proactive and goal-oriented management style (Rognes, 1996).

One of the central themes emerging from the data was the need to interact with others informally or collaborate on particular projects, both to get one's own work done, as previously mentioned, and also to help others do their work. One participant explained how it works:

It really is an information exchange ... you specify what is required and they go away and organise how they deliver ... that works both ways ... they knock on my door and say I've got a problem here and come and talk it through [too].

Having to maintain opportunities for interacting implies always being visible or at least available to others in the organisation. Evidence suggests this requirement reflects the culture of the organisation, and implies workers cannot act entirely in their own interests even if they want to. Each of the two organisations in the study has a culture of long working hours and pressure to perform. For example, one participant mentioned the tradition of working above and beyond the call of duty, and that there is a corresponding sense that if you are going to do that you might as well be visible. There is a perception, too, that that is what the organisation values and therefore wants.

The expectation of availability is an issue not only for the participants who have a supervisory role, but also for their colleagues in the team. One of the participants felt that if the culture of the firm supports an open-door policy, then "walk-by" habits where people just "pop in" to colleagues' offices, mean there is an expectation

that those colleagues are going to be there when needed, which could be at any time of the day.

The same interviewee described the reaction of his colleagues the first few times he worked from home. Their view, he said, seemed to be that you would have to be sick, or a member of the family would be sick, or you would be taking the afternoon off. They did not see what he was doing as a conscious choice to work from home. However, being available in circumstances where face to face contact is not expected, for example to clients and colleagues outside the building, does not appear to be an issue. For example, said one interviewee:

I've been at home and just the same messages from people trying to contact me come through the e-mail, so I can get a call from someone and I can contact them [from home] in much the same way as if I am out and there is message here [at the office].

Rognes (1996) explains the distinction between being reachable and being accessible. Being reachable, he states, is using various channels of communication to create opportunities for contact whereas "being at the office can be interpreted as always being accessible for interaction" (p. 8).

Managing knowledge work time

The study found the productive work time of knowledge workers consists of:

- Knowledge sharing time (drawing in information).
- Thinking/quiet time (reflective time).
- Research/writing time (manipulating information).
- Operational/functional time (getting it down ready for communication). This can be delegated in office time.

Knowledge sharing time

The individual knowledge of the workers becomes collective knowledge when they share with others what they learn through experience. It is more than just passing on information, it is about offering opinion, interpreting analytically, and generating new ideas. They share their knowledge by electronic communications, written communication, or face to face.

Thinking/quiet time and research/writing time

All participants mentioned writing, reviewing, preparing and planning as work for which they

need quiet uninterrupted time. The home environment could be very well suited to this kind of work. Rognes (1996) discussed the concept of creativity, not specifically among knowledge workers, but in relation to research and development work. His point was that although telecommuters might become less creative, because they do not have the input of their colleagues, the undisturbed environment at home could be more conducive to generation of new ideas or an innovative approach to a problem.

Operational/functional time

Participants were questioned about their use of secretarial/administrative support. They tend to use this support while in the office and take home those tasks that do not require secretarial assistance. Said one interviewee:

I tend to actually more and more be taking home the work that I can use on the system as opposed to taking work home where I could just be sitting at the kitchen table and doing it.

All the participants are computer literate and use teleworking not, as one said, “to type a 100 page document” but for the research writing and editing aspects of their jobs, leaving the support staff to format the result in the style of the organisation, and thereby ensure quality control of the finished product. However they rely on the support to keep them informed of what is going on in the office, and to field calls in much the same way as if they are out of contact because of meetings, or out of the office but not at home.

Where the work is done

The knowledge workers in this study do their work at two locations: in the office and at home.

In the office

For the participants, working from home is one alternative available to them, the other is working after-hours at the office. Instead of working from home they may regularly come into the office well before anyone else gets in to get a “solid” couple of hours in before the rest of the workforce arrives and interruptions start, or alternatively they may stay on into the evening. All the participants had home offices well set up. However, when asked if they could envisage teleworking becoming more widespread for their team, several could

remember times in their past where their living arrangements would not have been so conducive to a teleworking situation, for example, when they were young adults sharing a house or apartment. In those circumstances they would most likely work extended hours at the office.

The propensity to consider the office and not their home to be their primary workspace is supported by the work of Mazzi (1996) and Gray *et al.* (1996). Mazzi (1996) reported similar findings from interviews she conducted with telecommuters. When projects at the office became too intense, teleworking was abandoned. Workers considered the office and not the home to be their primary workspace and telecommute days were mainly used to do work that would be interrupted at the office. She found that telecommuters in her survey enjoyed working at home, although they could not envisage doing so on a daily basis.

At home

Replicating the work environment beyond the office was considered by the participants as the most important aspect of setting up a workalike environment at home. Because so much of their work day is spent at the computer for e-mailing, diary organisation and reference, and access to databases, in order to work from another work space they need near identical arrangements. Speed and reliability of technology in the home environment was considered essential for teleworking on a regular basis, and where this was lacking it affected the decision about where the work was done.

Once the participants set up an office at home to assist them in their work, the ability to telecommute gave them the opportunity to explore better ways to combine parenting with work obligations. They saw it as an opportunity to be accessible to family in the evening and weekends while still fulfilling work obligations, through having the choice of two environments in which to work. In some cases that meant doing personal things like taking a child to music or riding lessons during the day, and then coming into the office for the afternoon or working from home later in the day and evening.

However, it was found that, even if the work itself was conducive to telework, the

home office is not always the most suitable venue to work, especially when there are other members of the household to consider. For example, some participants have to take account of other family members being home during the day, which limited their worktime to the evening or weekends. One interviewee said:

I am a morning person and mornings suit me better working at home, but it doesn't fit in with the need to be in the office at that time of day. My secretary works in the mornings and the children get home just after 3 p.m. so it doesn't gel in a practical sense

For another, having a partner and toddler and new baby at home meant that he could not successfully work at home in the afternoon, as he had been doing previously, but by the same token he saw great benefit in being able to be at home in the late afternoon, or early evening to share the parenting and then to carry on the day's work in the evening after the children were in bed. Even evening or weekend work beyond the office had to be at a time when they were not required to participate in other household activities.

Even though working from home is an opportunity to combine work and family duties, it can create its own pressures and impact on other family members (Habib and Cornford, 1996; Belanger and Collins, 1996; Duxbury *et al.*, 1992).

Summary of findings

Table III is a matrix of the findings (including the suitability each finding has for teleworking)

To summarise, most of the participants considered the teleworking they did was an adjunct to the work done during normal business hours. While they acknowledged the home environment was, for the most part, conducive to quiet time without disturbances, the nature of their work meant that their choices about where they worked were limited. However, having an alternative workalike environment from which they could telework, meant that they at least had the means of arranging their workload in the best possible way for them depending on their particular circumstances.

Therefore we can state that:

- the general nature of the work of a knowledge worker prevents the flexibility and choice associated with teleworking;
- individuals still prefer to do most of their work at the office and consider work done at home to be an adjunct to work done during normal business hours;
- teleworking is mainly an after-hours' activity and thereby extends the normal working day; and
- the only exception is when an individual negotiates a special arrangement for a defined period.

Implications for human resources management

When beginning to look at the implications for human resource (HR) management policy, one is immediately struck by the lack of literature. There are few instances reported in the literature, where telecommuting has been introduced as a result of strategic planning by the organisation, and where human resource managers have been involved in the planning process from the outset. Snell (1994) noted the requirement for human resource managers to align the needs of the individual with those of the organisation. Becker *et al.* (1994) examined the processes underlying the implementation of non-territorial workplace strategies comparing business-driven versus cost-driven approaches and concluded that the business-driven approach is more likely to consider an integrated approach, supported by appropriate human resource policies.

Human resource issues such as equal employment opportunities, family friendly policies and paid parental leave are relevant to the responsibility to be a good employer and provide equal employment opportunities to employees. HR policies have to develop practices that facilitate the circumstances for people to decide how they work best. Three policy areas are discussed:

- (1) *Retention of staff during child-bearing and child-rearing years.* One of the main reasons for adopting a workplace strategy that includes a higher incidence of teleworking would be a desire on the part of the

Table III Knowledge work and telework

	Knowledge sharing time	Thinking/quiet time	Research/writing time	Operational/functional time
Knowledge workers doing their own work	Being available longer (+) Contact with international clients (+) Matching end user expectations (+) Gathering information to proceed (-) Collaborating with others on the project (-)	Preparing and planning work (+) Intellectual reflective time on course of action (+) Time with the family (-)	Writing, drafting or editing a written communication (+) Researching national and international databases (+) Time with the family (-)	Ability to produce a finished product from start to finish (+) Frustrations if not computer literate or had adequate training (-) Time doing mechanical routine functions such as presentation of finished work (-) Time with the family (-)
Knowledge workers helping others do their work	Controlling the work through face to face supervision (-) Interacting and collaborating with colleagues in their work (-) Attending work group meetings (-)	Not available without interruptions (-)	Not available without interruptions (-)	Not available without interruptions (-)

Notes: (+) denotes this aspect of knowledge work is conducive to teleworking; (-) denotes this aspect of knowledge work is a barrier to teleworking as an option for supporting workload

organisation to retain valuable employees, in whom they may have invested considerable money to enhance their skills. Flexible workplace strategies which allow a mix between the home and work environment would be a good negotiating tool to attract individuals who might only be able to work part-time, but who could increase those hours if they could work part of the time from home.

- (2) *Quality of life issues.* Also at stake is what to offer high-quality knowledge workers who wish to take early retirement or to work part-time in order to pursue other opportunities. Their status in the community is high and they still have much to offer the organisation in terms of sharing of knowledge. Teleworking offers the perfect opportunity to enable special arrangements to be made to accommodate these people, while still retaining their specialist knowledge and experience.
- (3) *Acknowledgement of the status quo.* It may be that the organisation will decide that the current mix of workplace strategies is the best for work effectiveness, in which case HR management may be required to do no more than monitor what is actually happening in practice. There is a danger

that a pattern of an increasing number of *ad hoc* arrangements between individuals and their supervisors for occasional teleworking may go unnoticed by management, resulting in an unplanned change in organisational culture, and a reactive HR policy environment.

Implications for practice

This section examines the “distribution” of relevant information and knowledge between knowledge workers in a home-based telework environment and how recent advances in Internet-based applications may enhance the work of the knowledge workers.

Schwartz *et al.* (2000) describe the Acquire-Organize-Distribute (AOD) model for personal and team knowledge management strategies in the Internet age. Essentially, acquisition refers to the process of collecting knowledge from internal (e.g. team or other organisational members) or external sources (e.g. consultants or clients) and storing them for future uses. Organization refers to how the company “structures”, “indexes” and “formats”, the acquired knowledge so that it can be easily located when required by individuals or team

members. Finally, distribution refers to the ability to get the relevant knowledge to an individual, possibly via the Internet, in an easy and timely manner.

While doing their work from home, knowledge workers are often required to distribute and access documents between themselves and their clients or colleagues. As well as using their e-mail for this purpose, knowledge workers should consider the use of the intranets or extranets as alternative approaches, especially if access to organisational databases is required. For example, Jennex (2000) has found these two Internet-based applications to be acceptable and effective means of sharing knowledge between members of a Y2K virtual project team. To enhance the distribution or sharing of knowledge in these Internet-based telework environments, knowledge workers need to be aware that certain useful knowledge exists within the organisation. They also have to make sure that the knowledge is relevant and deliverable to where it can be applied to the issue at hand (Schwartz *et al.*, 2000). Gonzalez (1998, cited in Burn and Ash, 2000) describes this phenomenon as the “pull” factor in successful Internet development. In other words, knowledge workers will “pull” the content to their desktop because the relevant documents are easily located and distributed.

The use of Internet-based conferencing systems is another potential application for home-based knowledge workers as they are required to communicate and collaborate with their clients and colleagues who are based in local or global locations. One such emerging technology is the Internet-based desktop videoconferencing system which combines personal computing with audio, video and communications technologies to provide real time, one-to-one or one-to-many interactions between groups of people (Hughes, 1995; Allen, 1998). Textual and graphical images of documents can also be exchanged, as well as sharing an online whiteboard. With this technology, knowledge workers are now able to write online policy or legal documents involving other team members and in real time. However, knowledge workers who formulate commercially or politically sensitive documents are not likely to adopt these Internet-based conferencing systems unless they are assured of the security and reliability of the Internet connections.

Implications for research

This has been an exploratory study at a very early phase of research, focusing on the individual as the driver of change. Research opportunities abound. One suggestion is to replicate the study in different locations in order to generate hypotheses for testing (Benbasat *et al.*, 1987). A further study could be to follow the controlled implementation of a teleworking pilot project within the same organisations and monitor and evaluate the impact on productivity or the effect on some other aspect of the organisation, such as support services. Another study could be conducted in other organisations with other categories of workers besides knowledge workers, focusing on the nature of their work. One example could be the nature of the work of managers/supervisors. Other studies could look at a typical work day of a knowledge worker, considering variables such as the number of hours worked, the tasks performed, productive versus non-productive time, and the nature of their “adjunct” work in a quest to find a more effective way of working. Finally, further investigation into the effect extending the working day has on the demarcation between home and work, the temptation to work excessive hours and stress.

Limitations of the study

Because the outcomes of this study are based only on a sample of two organisations, it can only be considered a basic exploratory case study. The small number of people in each organisation who had teleworking facilities also limited the study. At the first site, the authors had access to all people from the local office, participating in the home computer pilot project. All five were interviewed. They represented a cross-section of roles within the organisation and had varying reasons for being involved in the pilot project.

At the second site, the human resource department invited interested people, from a list of people who had received a subsidy, to have a home computer installed to respond to a request to be interviewed. It is likely that only those with an interest in the research and who had the time responded. There was no way of

knowing whether those interviewed were representative of the whole, nor whether the number of people interviewed was a reasonable sample. There did however appear to be a reasonable cross-section of employees. The consequence of working with a small number of participants is that generalisations are limited.

Notes

- 1 The ten participants in this study have limited access from their homes to office documents via organisational Intranets, some databases and workgroup tools (see Table II).
- 2 Deskilling is defined as the tendency of non-managerial professionals to spend much of their time performing support level work instead of specialising in the performance of intellectually challenging work (Sulek and Maruchek, 1994).
- 3 Key personnel included a representative from senior management in one organisation, and the human resource manager and information technology manager in both organisations.

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