2. NETWORK-CENTRIC WORK - IMPLICATIONS TO PROFESSIONAL IT EDUCATION

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ABSTRACT

Telework, telelearning and telecommuting are current buzzwords in the modern information society. Information and communication technology (ICT) gives us many options and challenges to transform work and learning processes being independent of time and place. However, some findings indicate that people are still moving to city centres despite teleworking and telelearning opportunities. Division of tasks and processes, support of management, technological problems, location of telework sites and acceptance of new technology are some of the inhibitors. The following study focuses on three research areas. First, it examines the quality and level of ICT used in households of Finnish business people; secondly, the current state and growth of networking in office and at home; and thirdly, the related service and financial issues hindering the implementation of network-centric technology and processes. The sample represents the views of Finnish small and medium size enterprises' managers which actually may gain the most from telework and telelearning. Results indicate that the emerging network technology should fit with the current technology used in households and with no major barriers, either technical or social. On the other hand, the services and content of network-centric working and learning should be clear and visible.

Keywords
Higher education, professional development, implications, organisations, open learning, visions

1.   Introduction

New technology-intensive ways of working and learning offer a flexible way to arrange work and learning processes in the information society. On the other hand it puts pressure in providing technology and applications which fit with the work and learning routines, workplace and household facilities and furthermore, with management procedures. This new way should be independent of time and place and includes normally a high intensity of information and communications technology (ICT) use.

ICT involves use of computers, facsimiles and other teleoperator network services. The advertised benefits of telework or telelearning are related to decreasing load of traffic, environmental issues, quality of life, flexible control and improved reward systems for employees. Especially in the European Union area telework projects are favoured while it provides possibility to balance regional equality.

In this report first results of diffusion drivers in the Finnish small and medium size enterprise (SME) environment are reported based on a large survey of telework technology at households. SMEs provide a great potential to be flexible in their operations and joint processes, while larger organizations seem to be monolithic and also heavily tied to the traditional office buildings. SMEs can gain some competitive advantage from designing their work and training in a more flexible and virtually effective way. The results give an excellent view to evaluate the role of education in the forthcoming work and learning process environment.

2.   Theoretical background and concepts

2.1   Definition of telework

Telework is difficult to define while it is a evolving concept. However, one of the best definitions and also a complex one is from Gray et al. (1993): "teleworking is a flexible way of working which covers a wide range of work activities, all of which entail working remotely for an employer, or from a traditional place or work, for a significant proportion of work time. Teleworking may be on either a full-time or part-time basis, the work often involves electronic processing of information, and always involves using telecommunications to keep the remote employer and employee in contact with each other." A more simpler definition is "a form of 'flexible' work which involves distance work, remote work or telecommuting which is dependent upon the use of information and communication technologies" (Moon & Stanworth, 1997).

2.2   *Innovation diffusion theory and telework*

In Finland, in the country of highest percentage of Internet access and well-developed telecommunications infrastructure (Goodman et al., 1995), telework is not very well dispersed and the latest surveys on labour movements from rural area to attractive city areas seem to be contradictory to objectives of telework objectives (Talouselama 30/97). Although our analogical telephone networks are almost 100% converted to digital ones, a faster Integrated Digital Service Network (ISDN) is not well diffused in Finland. Previous surveys indicate that 3-5 % of households have an ISDN access to the telephone network. This might be due to many factors such as pricing of ISDN services, learning potential of users or technological compatibility. Innovation diffusion theory is suggested to fit well in this research while adoption of telework practice is mostly voluntary-based innovation. Needs to invest in ICT equipment at home or correspondent remote office are mostly evaluated from the perspective of personal or family use.

The innovation diffusion theory (Rogers, 1983) assumes that a potential adopter engages in mental evaluation of the innovation, and that the likelihood of an adoption decision increases when the innovation promises to have a strong relative advantage over alternatives (relative advantage), is highly compatible with existing practices (comprehensiveness), is not too complex, (complexity), can be tried out (trialability), and the results of the innovation can be observed (visibility).

A new technology-based innovation such as telework demands redesign of routines and activities from the user community. Users need to learn the new system innovation and upgrade or transform their knowledge on using the system in the context of their work. Normally when teleworkers (or telelearners) need to buy the technology by themselves, costs of the new innovation are a major inhibitor of diffusion (relative advantage). If the voluntary user needs to put more money to get seemingly similar services from this new innovation (such as an email service) he or she will not probably adopt the innovation. It might also be that the telework technology is too complex and difficult to implement and use (comprehensiveness, complexity). In the same time management procedures need to support new work design and arrangements in order to foster the change process (trialability, visibility) It is clear that telework needs to be based on trust and not on control. Reward and performance evaluation systems need to converted to fit in this new situation.

3.   The Research Process

A mail survey was executed in collaboration with a major Finnish teleoperator company Helsingin Puhelin (which belongs to a major Finnish teleoperator pool FINNET Group), a communications systems company Teleste Communications Ltd (later on called Miratel Ltd) and a business people association the Junior Chamber of Commerce Finland which was the sample group of the survey. The mail survey was sent on December 1996/January 1997 and replied questionnaires were analyzed during Summer 1997.

From 4500 sent questionnaires 875 people replied i.e. the reply rate was 19,4%. The reply rate is acceptable and reasonably high considering the obvious time restrictions of the respondent group.

The objectives of the study were exploratory i.e. we observed the group's opportunities and willingness to apply telework, use of information networks and their intensity of use. Especially we were interested in the level of technology investments in households (computers, network devices and access services), the needs for information society services and sensitivity to acquire new technology to this purpose.

3.1   Sample

The age of the respondents varied between 30 and 40 (a biased sample due to the association's rules). The study follows the principles of convinience sample due to the nature of the study. Although the sample is biased by age its quality is excellent involving respondents from business organizations. Educational level was relatively high, mainly respondents with a university degree. Despite this fact the sample involves a large amount of SME entrepreneurs. Organizational position was either in manager or executive level, work tasks or functions were usually related to either administration, marketing or sales.

Most of the respondents' companies belonged to the SME group which means an organization with a turnover of less than 40 Meuro (about 45 Million USD) and balance sheet total of less than 27 Meuro or employees less than 250. The sample is very unique while it is usually difficult to find business people oriented studies where respondents represent highest decision making level (i.e. managers or executives).

3.2   Preliminary results of the study

Due to the space limits and the on-going research programme the first set of descriptive statistics is reported in this paper

3.2.1   Technological environment.   The first set of questions examined the amount and quality of ICT technology in households and the level of experience in using ICT. This related to comprehensiveness and complexity to adopt an innovation. The respondents described themselves as experienced or at least having a good fundamental knowledge on ICT. They use computers daily in their work. We can conclude that these people are qualified to evaluate the benefits of telework and ICT technology.

One of the most interesting findings was that almost 80% informed to have and use computer at their homes. This is a very high figure while the average of home computer penetration in Finland is near 35 percent according to the latest surveys for all households. The computers were quite new while most of them were either Pentium or Intel 486 processor-based computers. Survey participants informed that almost all family members are using the home computer. About 31% replied that their computer is used by three of more of the family members.

This might have far-reaching implications to organize telework and learning activities at homes. We may ask do the families need several computers or even a home network with a server and clients with multiple access to the network? This might put challenges to ICT home sales and consultation, teleoperator and network service providers and digital media services.

3.2.2   Organizational support. The second set of questions dealt with organizational support for applying telework as one part of work practice (relative advantage, partly trialability and visibility). According to survey results, companies support telework quite actively, almost 50% of the respondents informed that their employers support telework arrangements. However, we must be careful in interpreting the results while the whole concept of telework is very fuzzy. Most of the organizations doing already telework were SMEs. Most of the previous studies do not indicate that companies are favouring telework arrangements, vice versa, rather being skeptical and wanting to keep control.

3.2.3   Telecommunications facilities and usage level. The third set of questions was about telecommunications facilities. Half of the home computers involved also a telecommunications device (a modem or equivalent). Most of the devices were high-speed modems (over 28 000 bps, but only 3% of them with an ISDN access device). Most of the respondents replied their telecommunications device to be slow or moderate when asked about their view of data transfer speed. Less than 25% indicated that the speed is satisfactory.

We must note that most of the teleconnections were typically done couple of times per week and lasting in average not more than 15 minutes. This means obviously that home computer systems are used for reading and replying email messages and/or doing remote banking which is a very common practice in Finland (about 400 000 active users of the population of 5 million people). We can say that the level of using extensively network services is still waiting, this might be mainly due to slow supply of digital contents in the network.

3.2.4   The use of Internet network in office and at home. The use of Internet network services for work and business activities was surprisingly low remembering the highly advertised image of Finnish Internet diffusion. Less than half of the participants used Internet in their offices and at homes less than 20%. Outside the work tasks in office about 30% of the people indicated to use Internet. Although there is a high interest to find something from the Internet, the research group also identified a group which has never used Internet and is reluctant to use it in future. This is very surprising while the object group had a very good facilities to do networking. It might mean that the relative advantage of doing telework or other activities such as learning and education is in its embryonic phase.

4.   Educational implications

This survey indicates a number of paths for developing learning and education activities for network-centric organizations. The next analysis is based on the

earlier study on opportunities and limitations of IT-induced learning and education (Ruohonen, 1998).

4.1   Learners and other stakeholders in the network-centric context

Telelearning, teleteaching and other equivalent approaches face the problem of user abilities. New ways of working and learning are not just related to high level investments in computers and networks. Personal experiences of the author suggest that if educational processes need to change also learning processes need to be transformed. A typical learner say, in a university or a vocational institute, is used to follow certain standard flow of education.When this flow is changed radically by using networks, interactive chat channels and email groups in addition to digital document supply centers the learners need to change their learning processes, too. Other stakeholders of the whole process such as teachers, administrators, digital contents providers, telecommunication services and publishers need to be aware of the emerging community's way of learning. In terms of innovation diffusion, we might say that people need to see the relative advantage of teleactivities before changing their daily practices.

4.2   Interactive technology as a tool for network-centric education

Much of the technology provided nowadays is far too sophisticated and expensive. Transmission of "a talking head" to another city or even a country does not much raise the quality of education but it surely raises the costs of it. Naturally, if this is the only way to deliver something (i.e. teaching resources are scarce and/or not available with some other way), it works well. However, surprisingly often the latest interactive technology needs also support personnel while teachers and students can not cope with these new ICT applications. New technology might be difficult to use both for teachers and students or it is far too complex and managed only by "teaching support engineers". Therefore it is very important to evaluate the level of teaching and learning tasks and use "fit" technology to execute them. Very often just an email or World Wide Web access and maybe some simple videoconferencing through workstations may do the same as a hard-core teleteaching studio with an optical fiber network, video servers, digital documents and multiple camera systems (see for an example, Newman, 1998).

4.3   Mastering the subject knowledge for network-centric education

The type of material covered during teaching sessions can be factual, procedural, conceptual or exploratory in nature. Leidner and Jarvenpaa (1993) have noted that procedural and exploratory knowledge contents dominated computer-based education sessions more that conceptual or factual knowledge which were more typical in traditional lecturing. It is obvious that, for example, computer algoritm

education and many of the engineering education topics fit well with the network-centric education ideology. However, how do we teleteach strategic management through networks or handicraft design? This type of knowledge might demand several channels of knowledge transfer and it puts pressure to analyze the nature of courses in the network-centric context.

4.4   Prevailing education strategies and rules

Transformation processes can be ruined by administrative policies or standards of doing things "in the good, old way". For example, telelearning and remote evaluation may put more extra work and costs to traditional schools and training institutes. Some administrative rules might inhibit, for example, remote examination or arrangements in contradiction with the master teaching plan of organizations. It starts from the educational policy level where you put your grand objectives for information society. The most dangerous is sectorial thinking in the age of networks, both social and technical networks. We should remember that teleteaching and similar arrangement may exist just for decreasing unit costs i.e. to copy the same standard lecture to multiple sites and having that way cheaper education per student. If we are looking added value from these experiments we need to redesign our educational processes and structures which makes the education game political.

4.5   The nature of learning communities

In the global context we are facing a new challenge which is related to multi-cultural communities both in our own institute or country and across the borders. In the current and future working life people need to collaborate and run teams which are very diverse by home country, religion, culture and habits. It means that already in our educational system we need to practice these diverse contexts. This is very well boosted by network technology and global virtual teams which can learn and work globally (Knoll and Jarvenpaa, 1995). However, it also demands networking of teachers, professional communities and even institutes to set up these learning and education networks. This is beyond just technical issues while people networks must work, too. Communities of practice, business or some other interest areas seem to be the key for teleteaching and telelearning activities.

4.6   Networked, open learning environments

The traditional way of sharing duties or workload is changing dramatically. In the management of education you need to analyze carefully which phases of the whole process belong to your core competencies. This differs when comparing different educational levels, primary, secondary and tertiary. It is, however, clear that outsourcing and insourcing effects are evident also in the field of education. You might need to plan your course in collaboration with some foreign institution to face the challenge of unification of education. You might also co-operate in allocating time or place of teaching and also financial resources put to your joint

course or program. Finally you need to evaluate probably with same standards. In addition to that all the supporting processes can be re-evaluated such as examination procedures, case and exercise control, teaching/learning material production, students services, add-on course supply, industry projects and connections, job search and research & development projects. This makes also educational cluster more competitive, via networks virtual institutions and companies can compete about the same audience and customers.

5.   Discussion

Based on the survey to Finnish business people and previous work on IT-induced learning and education implications for network-centric learning and education were discussed. Much of the technical problems have been solved at least in developed countries, however, it seems that many social and cultural issues are more complicated.

In the network-centric context of education educationalists, teachers and all other stakeholders need to evaluate the situation holistically. Technological determinism is not viable option while many of the transformation processes are not related to technology as your survey also indicates. The use of telecommunications for work and other activities was at a reasonably low level despite the good level of ICT equipment in use.

Learning and education in network-centric environment is, however, a very challenging and potential area for training business people which are normally unable to participate in educational activities during office hours. On the other hand it seems that markets are open for those players which can provide good quality education via networks.

6.   References

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7.   Biography

Mikko Ruohonen is a Professor at the University of Tampere, Department of Computer Science and a Docent of Information Systems Science at the Turku School of Economics and Business Administration. Dr Ruohonen's interest areas are business strategy and information management, management participation in strategic information planning, knowledge management and IT/IS education. He has published three textbooks, two chapters in international textbooks and more than 90 articles in informations systems research field. He is a Full Member and a Vice Chair of the IFIP Working Group 3.4.