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Track 5 - New Forms of Work and Employment

Generation of tacit knowledge in virtual environment

Introduction

Generating explicit and tacit knowledge is crucial at work. The backbone of knowledge is tacit knowledge in which explicit knowledge is mixed with individual experiences. It is common to argue that it is not possible to mediate tacit knowledge through electronic network or print, because tacit knowledge is not coded. This leads to the conclusions that it is impossible to generate, use and transform tacit knowledge when doing telework because teleworkers are dependent on information networks and physically isolated from co-workers. Thus telework should be, by definition, inefficient. In the virtual environment the crucial point is in the relation between socio-technical system and the generation of knowledge. It is possible to study elements of tacit and explicit knowledge among teleworkers by analysing their working practices and the use of information systems.

The paper is based on empirical case studies in two multinational frontline it-companies where advanced information systems and telework were used. The findings of the study rest on empirical analysis of two theoretical dimensions and their interaction. The dimensions are used to break down social and technical structure of information systems. The empirical findings highlight 14 elements in which the information system compensates or mediates tacit knowledge and where the use of information system is based on tacit knowledge.

1.Research question

In today's worklife we are increasingly connected to other people via information networks. Our co-workers belong to various organisations, since we deal with customers and the customers of our customers. Work is organised up to a degree in flexible networks consisted of people or stakeholders with common interests. The value added chain around our work may be wide, even global. The traditional office is not the only environment for work. The physical element at work has got new competitors: interfaces to information networks; intranets and extranets and other virtual environments. (See figure 2.)

The long debate about telework or ework gives rise to one crucial question in particular: if we are not working in the same physical place at the same time and if we do not have face to face contacts, are we able to generate tacit knowledge? By definition it would be ineffective and socially destructive. Should we take another look at telework or ework as work in information systems in relation to tacit knowledge? Are the face-to-face contacts really the crucial precondition for tacit knowledge? Is it possible that the new virtual environment generates tacit knowledge that has new characteristic? In order to answer the question we should go to basic elements of human action, that is, time, space, actions, tools and mind.

2. Tacit knowledge

According to Polanyi the nature of tacit knowledge is the (not coded) understanding, which is linked to the skills and processes among individuals and groups. Tacit knowledge consists of cognitive and operational elements. One form of tacit knowledge may be a mental model based on practical experiences and explicit knowledge.

Tacit knowledge is important and valuable in working cultures, but transmitting it from people to people or to someone outside the working place has been regarded as a challenge. In the working life research the discussion concerning tacit knowledge relates to the distinction between formal and informal organisations. It is not wise and sometimes even impossible, to try to manage a work organisation only by explicit, written or formal rules. If we try to do so, the workplace ends up in a stagnant situation and most of the initiative among the personnel will be lost.

Wage earners have professional skills that further refine in the process of learning by doing. A crucial question of efficiency is how the work organisation is able to utilise this kind of knowledge and how the organisation pushes its staff to create and transmit informal skills. In modern work organisations workplace practices are continuously and flexibly developed by combining the tacit knowledge and the explicit knowledge. In some theories the process is called double-loop-learning. (Cf. Argyris and Schön 1978, Senge 2000.)

The goal of this paper is to analyse if the generation of tacit knowledge is possible in the –new- virtual environment, where we are able to organise work more freely in space and time. Face-to-face contacts disappear or get thinner. Does tacit knowledge disappear as a result of these changes? Do some new types of tacit knowledge emerge?

3 Traditional and new working environments

Human beings act in dimensions of time and space. Traditionally it is thought that our work "takes place" in some 3-dimensional location. That is correct. When we take a closer look, we notice that the working environment is up to high degree social with various structures and processes. In this respect our working "place" is a mental one. It is individual and private but also shared with others. Our individual work is a public story about us.

Spatial and social structures should support our work and the generation of ideas. In addition we have a virtual environment created by computers and information systems. This environment maintains the traditional and creates new kind of social contacts. The function of the virtual working environment is the same as the physical and social environments have: to support the generation of ideas. In other words, we operate in physical space, virtual space and social space in order to support our thinking and express the outcomes of our thoughts again in these environments.

The virtual working environment is an extension of the physical and social environment. In the virtual environment there are actors, structures, rules and elements to support human intelligence like in the social and physical environment. The main difference lies in the fact that in the virtual environment it is possible to overcome timely constrains and select proper time mode for joint work. It is possible to connect computers and human minds together in a generative manner and organise work and knowledge generating networks even globally on the base of interest.

4. Social sphere and tacit knowledge in the virtual environment

The virtual environment has been regarded as a negation of the physical environment according to Joinson (2006, 22.). Computer-mediated communication CMC was studied analysing "what has been lost" in terms of visual signs or feedback. CMC was regarded as formal and task oriented behaviour which lacks the richness of real time interaction. However, according Joinson, the loss of visual signs does not lead to the loss of social elements in the same scale. Even the "non

personal" communication via telegraph can be sensitive and familiar. The absence of visual signs leads CMC towards higher sociality, which is characterised by more sensitive rules compared to face-to-face interaction (Joinson 2006.).

Is the social nature of CMC enough for the creation of tacit knowledge? Looking at the web, there are projects and policies in which tacit knowledge is stored and mediated in virtual environments and cases where weak signals are searched and generated in the internet:

Talouselämä 18.12.2003: Before planners and buyers of fashion travelled to Paris and Milano to find latest trends. Internet has spoiled this exclusivity. In the net there are pages dedicated to demonstrate show windows and boutiques. Anyone is able to see the trends of tomorrow. Planners try to get themselves in contact even with more weak signals in order to gain the status of visionary for the mselves.
http://www.talouselama.fi/docview.do?f_id=532810

UMP-Kymmene video in the net stores tacit knowledge: When employees retire, saving the knowledge and transferring it to new generations is a challenge. The policy is to make a video when some occasional task is done in order to save and transmit models to act. The policy uses pictures, voice and literal instructions.
http://www.learningbusiness.fi/portal/news/article_of_the_month/previous_articles/?id=9293 '

One argument for the opportunity for transmission of tacit knowledge only in the physical sphere is the concept of "body as an instrument". One may argue that there is no other option as the presence and contact is based in deep manner, in addition of emotion and consciousness, in body as an instrument. (Hautamäki; http://myy.helia.fi/~kalei/semin/itk98.html)

Companies use information networks and technical tools to store and transmit tacit knowledge and to search tacit knowledge or weak signals. If it is possible to store tacit knowledge in making a video about a work task, one can argue that in the representation of the video tacit knowledge appears in visible or understandable form. This may lead to the conclusion, that the transmission of tacit knowledge was done by technical means and at least with some independence of real time physical environment.

5. Information system as a social and virtual environment

Basically information systems are about material technology. They are a tool, but by content, they are an environment for human actions. The crucial question in the generation of knowledge and tacit knowledge is, will information systems offer basis for mental and social actions alike the physical environment? Could there be some, even better, properties for creating and transmitting both forms of knowledge? Obviously, the crucial question remains: is the creation of knowledge possible as a social and interactive act when parties are at the same time in various physical places or the interaction is asynchronous by nature?

	Same Time	**Different Time**
Same place	"Face to face" Interaction	Asynchronous interaction
Different place	Synchronous and dispersed Interaction	Asynchronous and dispersed interaction

Figure 1. Information technology / Groupware / Time and Place

6. The sphere of creating knowledge

How can we describe the environment and processes of knowledge generation in a more detailed manner? Nonaka and Toyama call the sphere where knowledge is created “Ba”. Ba is an environment shared by those who interact and who are related to Ba in interaction. Ba is a context which itself boosts the creation of knowledge. According Nonaka & Toyama the nature of Ba may be:
-Physical space (office)
-Virtual space (email)
-Human relations among those who share common goals
-Mental spaces, which are characterised by common experiences, ideas and ideals. (Nonaka & Toyama; 2000.) Elements of “good Ba” support the maintenance of cohesion and interaction by allowing creativeness, emergence of new thoughts and synergies in practice.

When organising work, internally and with customers, the crucial element in relation to time and place is the information network. This can be regarded:

A In relation to communication and co-operation (see: Ståhle & Grönroos; 1999.) as a functional element, in a sense of the improvement of the performances or as qualitative change in generating knowledge.

B From Intellectual Capital (see: Sveiby; 1998.) point of view information systems can be regarded structurally as the thing binding the elements of intellectual capital together in a productive and synergic manner.

C It can also be regarded pragmatically as a sphere where the processes of knowledge generation take place. (See: Nonaka & Toyama; 2000.)

Nonaka & Toyama (2000) state that the physical environment is needed as a precondition for the creation of knowledge. Participation is a crucial element. Metamorphosing information to knowledge will occur when a human being is interpreting information in the context of beliefs and responsibilities. (Nonaka; no printing year.) Context is about action. Interpretation is possible in the interactive process where meaning is given. Knowledge will not emerge only in the consciousness but also in action. When we try to understand the process of generation knowledge, we have to understand the contextuality, action and interaction. (Nonaka & Toyama; 2000.)

7. Empirical evidence: Work and information systems in ICL Invia Oyj

ICL-Invia is a company offering customized and holistic information system services. The company was a target of the empirical longitudinal study addressed especially to telework policies and forms of work organisation. Information is based mainly on interviews and statistical data. The findings presented later on concerning the use of information network and tacit knowledge are empirical results based on daily practices in the company. (Pekkola; 2002.).

“when I go to work then the world...is in machine there... when I go at work it is not that I step in the room but instead when I go to work it mean that I join information systems... This is the real work place. Otherwise there is nothing. If there is no information system or if there is no electricity in pc, one is not at work...” (Expert statement in interview, ICL Invia, 1999.)

The core business of ICL Invia is to support information systems of the clients and develop their operations. Between the company and the clients there are various connections and the company has the authority to metaoperate in the client’s network. The information system is divided functionally to operative elements and developmental environments and it allows the work from various accession points. Employees work within the teams of their own organisation as well as with the teams of the customer. (Figure 2.) People have the technical equipment and opportunity to select their working place and working time. The information systems speed and intensify the work.

This means for instance that teams work at the same time on the same issue staying in various places. In the year 1999 it was possible to estimate, that the staff used a minimum of 10-15% of their working hours being connected to information systems outside of their "common" office. In addition people are connected to information systems when staying in their offices.

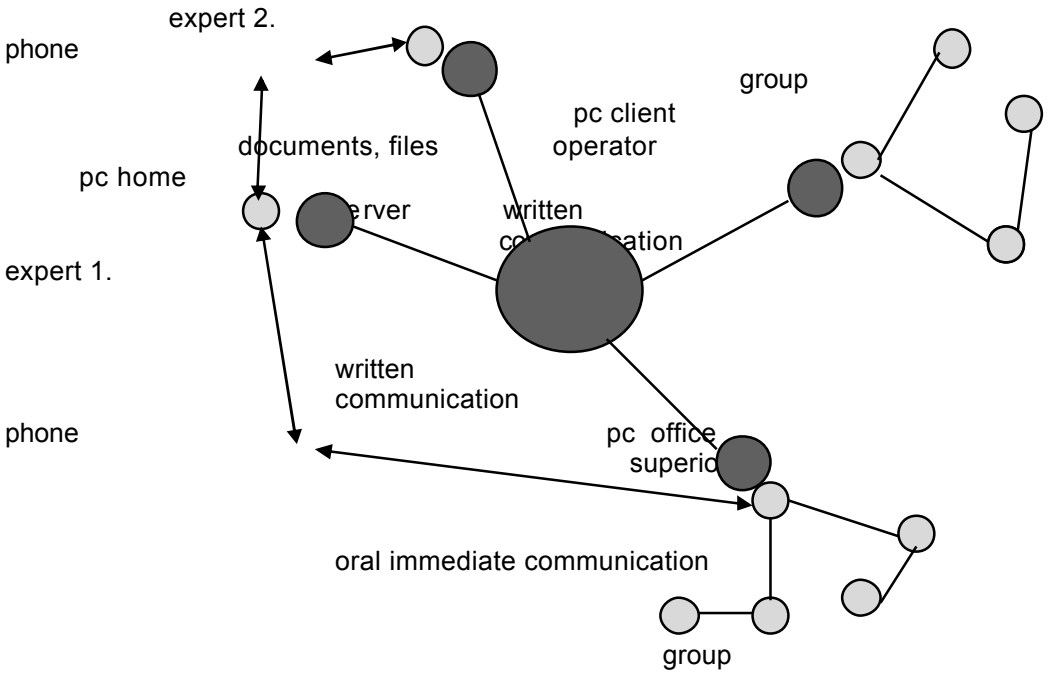

Figure 2. A typical way to organise custom oriented work in spatial terms.

8. Information systems, telework and generation of knowledge

A crucial element in estimating the creation of tacit knowledge is its relation to the techno-social system. Tacit knowledge can be defined according Raivola & Vuorensyrjä (1998, 22-23.) as follows:

The backbone of knowledge is tacit knowledge in which explicit knowledge is mixed with individual experiences. Knowledge has two dimensions: targeted knowledge and knowledge as a tool for dealing with that knowledge (knowing). The dimensions support each other and are context related.

I Tacit knowledge emerges often as non cognitive rules and norms which support other targeted knowledge
II Tacit knowledge is transformative and like a filter element for knowledge. New experiences are melted as understanding with the concepts one possesses and what he/she has got from others who use the language.
III Tacit knowledge is a typical form in craftsmanship but in addition beliefs and interpretations form part of social reality. Shared cultural connection is a background for communication.
IV Tacit knowledge lies deep in social reality. Understanding and learning tacit knowledge is easiest in practical interaction or dialogue.
V The modes to possess tacit knowledge are up to high degree learning by following models: follow up, identification and learning by doing.

Raivola & Vuorensyrjä also think that tacit knowledge cannot be transmitted via electronic network, because tacit knowledge is not coded. When coding tacit knowledge the richness of nuances of meanings disappear. The work of teleworkers will be poor in a social sense if other connections are not organised. (Raivola & Vuorensyrjä; 1998, 26-27.) According to Ståhle & Grönroos (1999, 91.) tacit knowledge cannot be transmitted via technologic channels, but instead only in social

context, speech and interaction. Smeds (2000, 33-34.) thinks that technology can support exchange of information and coordination but it will not help in creating the “feeling of joint experiences”.

Should we really accept these arguments? In information networks it is possible to transmit visualisations, speech, and picture in real time. Shared working environments may contain shared tools. In addition, work in information networks is real work – if any. People have a lot of technical and social opportunities for transmitting and creating tacit knowledge. It is obvious that working in the net will lead to the emergence of a specific kind of tacit knowledge. Work in information systems that are in virtual environments increases and it takes place more and more often and sometimes solely in the net. Face to face contacts may be marginal or non existent. The elements of efficiency in teleworking / virtual working can be various (Pekkola 2002, 232.238.) According to empirical study tacit knowledge is generated: technically supported when information network compensate local tacit knowledge, socially when information systems intermediate tacit knowledge and when virtual co-operation is based on existing tacit knowledge:

Work in the information networks makes the use of explicit knowledge and the generation of it more efficient. This can happen:
By accumulating explicit knowledge rapidly.
Collecting more vide explicit knowledge in a value added manner.
Only option to do it in cost effective manner
Information network and –system can compensate local tacit knowledge
By building technical standards and concepts in order to produce general understanding
By supporting cultural contacts with technical means and by giving technical structure to it
The system supports creation of social reality
Human action and technical appearance of work emerge in the information network
Information network and – system can intermediate tacit knowledge
Rules and norms emerge and formulate in discussion
The system support social experiences. Discussion is done inside the system
The system can produce new and transmit former beliefs and interpretations
The system supports interaction and learning
It is possible to make actions and learning possible by observation of others work
Co-operation is based on existing tacit knowledge or tacit knowledge possessed by the participants
The system can organise dispersed knowledge
It is possible to increase the amount of dispersed knowledge indirectly
Organisation of shared culture
Building social reality
Identification and increased dispersed knowledge (See Figure 3.)

9. Conclusions

Professor Heinonen (1998) uses the concept of “virtual presence”. This means participating work processes for instance in asynchronical and dispersed manner. The scope of influence and the number of processes involved are relevant issues in being virtually present. Virtual presence is related to the Ba-concept, where synergic interaction is of importance.

When we analyse the elements of efficiency at telework, we can notice among other things, that work via information systems does not mean the end of the generation of tacit knowledge but instead continuing this process and doing it in new formats. Cognitive processes are not solely tied to physical places. Human beings generate tacit knowledge in social contexts both when acting in physical and virtual environments. The technical information system and the virtual environment can maintain and support parts of social structures already existing in the physical environment. Information systems can support ongoing interaction and learning as well as observations on co-workers performance. Virtual presence at work can support mental and social presence up to such degree, that tacit knowledge is generated and transmitted.

Technical and social nature of information networks in ICL Invia Oyj	**Information network and – system compensate local tacit knowledge - Technical nature of the system**	**Information network and – system intermediate tacit knowledge - Social nature of the system**	**Co-operation is based on existing tacit knowledge**
The nature of tacit knowledge (Raivola & Vuorensyrjä 1998.)			
Tacit knowledge emerges often as non cognitive rules and norms which support other targeted knowledge		h Rules and norms emerge and formulate in discussion	m The system can organise dispersed knowledge
Tacit knowledge is transformative and it is like a filter element for knowledge. New experiences are melted as understanding with the concepts one possess and what he/she has got from others who use the language	d Building technical standards and concepts in order to produce general understanding	i The system support social experiences. Discussion is done inside the system – rapidly	n It is possible to increase the amount of dispersed knowledge indirectly
Tacit knowledge is typical form in craftsmanship but in addition beliefs and interpretations form part of social reality. Shared cultural connection is a background for communication	e Supporting cultural contacts with technical means and by giving technical structure to it	j The system can produce new and transmit former beliefs and interpretations	o Organisation of shared culture
Tacit knowledge lies deep in social reality. Understanding and learning tacit knowledge is easiest in practical interaction or dialogue	f The system support creation of social reality	k The system support interaction and learning	p Building social reality
Tacit knowledge lies deep in social reality. Understanding and learning tacit knowledge is easiest in practical interaction or dialogue	g Human action and technical appearance of work emerge in the information network	l It is possible to make actions and learning possible by observation of others work	q Identification and increased dispersed knowledge

Figure 3. Generation of tacit knowledge in virtual environment at telework in ICL Invia Oyj

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