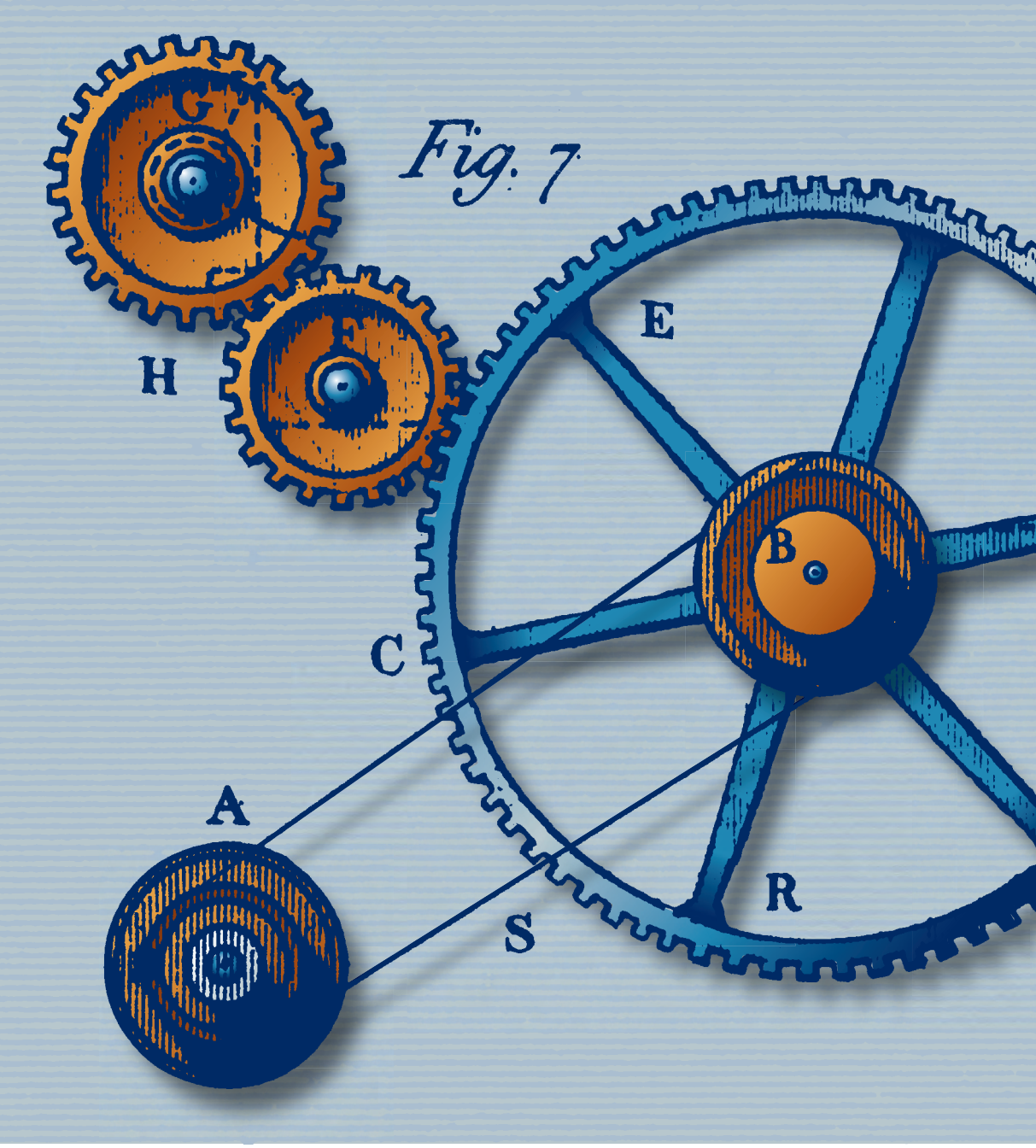

Distributed and Mobile Work

Places, People and Technology

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Satu Koivisto · Petri Mannonen
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OTATIETO

Distributed and Mobile Work contributes to the understanding and the improvement of an emerging new kind of multi-locational work, i.e. mobile virtual work (MVW). The starting point is knowledge work as practice – the ways in which work is actually done in different situations and contexts – as the base for design and development of workplaces, i.e. physical, virtual and social workspaces.

The distribution and mobilization of activities in organizations has increased dramatically over the last decade and will continue to do so as these organizations seek to reduce costs, get closer to their customers, ally themselves with other companies and engage the best talent wherever it may be. This book explores the present and likely future developments of the nature of work. The aim is to introduce the concepts of "distributed", "mobile" and "multi-locational" work (dWork) and suggest the product and service needs based on the introduction of these flexible forms of work.

Distributed and Mobile Work explores and shows many of the challenges and needs that new work creates to the employees. The book is done as collaboration of HUT and MIT researchers and sponsored by Tekes and three spearhead companies: Nokia, Nordea and Senate Properties.

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This book is based on the joint dWork Project of
the Helsinki University of Technology and
the Massachusetts Institute of Technology.

Sponsored by

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DISTRIBUTED AND MOBILE WORK
places, people and technology

Helsinki University of Technology
BIT Research Centre

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Preface

In the Spring of 2004, teams from the Helsinki University of Technology and the Massachusetts Institute of Technology launched a joint project to explore how enterprises can best support distributed work. We explored the nature and implications of a new paradigm about the workplace, one that shifts from the notion of single place for face-to-dace interaction to a system of support that enables people to work in an anytime-, anyplace-network of electronically connected places. Our work led to frameworks for thinking about 'distributed work' and to planning processes and analytic tools to create the necessary infrastructure.

Our findings are reported in two complementary volumes. Distributed Mobile Work – Places, People and Technologies, prepared by the Helsinki University of Technology team, draws upon empirical case studies in our three sponsoring organizations. This book explores and shows many of the challenges and needs that new work creates. The HUT report includes extensive bibliographies. The MIT report, Enabling Work Practice, reflects about the challenges and practices faced by these sponsoring organizations as well as the authors' experience with other firms in the United States, Asia and Europe. The MIT report considers the specifics of work practice – the ways in which work is actually done in different situations – as the base for designing 'work enabling platforms' consisting of places, electronic connections, social rules and deals, and management policies. Both reports provide suggestions about how enterprises can improve their capability to plan for and manage this increasingly prevalent work pattern of 21st century organizations.

Our research was sponsored by Tekes, the Finnish organization for applied and industrial research and development, Nokia, Nordea Bank, and Senate Properties. We thank the many people in these and other organizations who cooperated with our research by contributing their time and thoughts. MIT's work also received support from the Cambridge-MIT Institute (CMI). We are particularly appreciative of those who guided our case work and reflected with us about what we learned: Satu Haaparanta and Reijo Kangas from Tekes; Bethany Davis, Marja Kauttu, Eeva Ventä and Outi Vuorio from Nokia; Juha Olkinuora, Ari

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Summary

Multi-Locational Work

The chapter *Distributed and Mobile Workplaces* explores the present and future developments in work from the societal and organisational perspectives. The concepts "distributed", "mobile" and "multi-locational" work (dWork) are introduced to the real estate and IT industries, while product and service needs are suggested according to the nature of these flexible forms of work. It is shown that the number of new types of knowledge workers is rapidly growing, and that the challenge of multi-locality is a reality that now has to be recognised.

- The distribution of work, in one form or another, is one overarching characteristic of all aspects of knowledge work. In addition to multi-tasking, knowledge workers are multi-locational. As location becomes less relevant, the quality of the places where work is performed becomes more critical.
- The job content of knowledge workers is demanding both cognitively and socially. Around 50 per cent of the work includes thinking and creativity demands. Around 40 per cent of total working time is solo work and involves tasks requiring concentration. The social network of employees is wide, consisting of tens of people.
- Multi-locational employees collaborate from afar with each other. This creates distributed and virtual organizations. Mobility is an additional, dynamic feature of a distributed organization. It has been calculated that around half of the workforce is collaborating from afar with their work mates, in other words, they are doing distributed virtual work.
- To design and develop workplaces for increasingly virtual and mobile employees and to support their work, it is necessary to know in more detail about their work activities and requirements. This is not generally recognised in companies.
- Joint activities take place in shared contexts, which are layered and imbedded. The physical space, such as office space, the virtual space, such as e-mail, and the mental or social space, such as common experiences, ideas, values, and ideals shared by people with common goals, forms the shared working context.

- Physical spaces or physical environments that employees use for working can be divided into as many as five categories: (1) home, (2) the main workplace ("the office"), (3) moving places, such as cars, trains, planes, and ships, (4) a customer's or partner's premises or own company's other premises, and (5) hotels and cafés etc. An employee may use, and members of a team may be distributed to, all these places.
- Collaboration from distributed places is only possible via virtual spaces, i.e. in electrical collaboration environments. Their internal integration, as well as their integration into work activities, is still meagre.
- Managing and leading a distributed workforce is a challenge for human resources management and design. Employees tend to share ideas, goals, values, and joint procedures locally, though they should think and act globally.
- The work of a knowledge worker is characterised by a continuous double-binded search for places to concentrate and to share and socialise. Work in offices is often interrupted, causing losses in productivity. While the collaboration technologies are developing greater versatility and the level of tool and device integration grows, harmful interruptions may effectively reach the other workplaces where knowledge workers have, until now, sought the privacy they need to concentrate on some of their tasks.
- The work of knowledge workers is a continuous process and a mixture of solo work, asynchronous and synchronous communication and face-to-face meetings. In large meetings, employees often turn to the mode of solo working. They start to concentrate on their own tasks and work asynchronously: reading and sending e-mails and SMS, chatting, reading documents and writing them.
- It seems to be possible to combine a company's economical benefit with employee work-life balance and satisfaction. There are many good examples now of long-lasting and expanding company policies and practices aimed at supporting mobile virtual work and collaboration. This requires flexibility strategies and well-defined policies on the part of the company. The integration of space, ICT and human resources management is a necessity.

Distributed Work Environments

The chapter *How Work Takes Place – Notes on Distributed Work Environments* discusses knowledge workers' use of space in distributed organiza-

tions and their spatial requirements in terms of productivity and effective management of work processes.

- Premises management sees office space as a powerful managerial tool, but the ideology subscribed to in office design and procurement is based on a traditional idea of work with fixed, team-based collaboration relationships and conventional interaction methods in collocated work settings. This is contradictory to the specific nature of distributed knowledge work where the contribution of an individual expert is crucial and the organizational context – membership in several co-existent projects and teams – is never stable, but constantly changing.
- From the viewpoint of an individual worker, the contemporary work environment manifests itself as a mosaic of places and people: the workplace is a holistic individual experience. The case studies show that working in a distributed manner in a multitude of places involving knowledge sharing, communication, and intensive knowledge production in silence is commonplace. People prefer to work according to their individual work styles, to manage their own work processes, and to make their own choices as to the most suitable workplace according to the task in hand. However, unfortunately the organizational targets such as the organization's business profile, economic restraints, the need to control, and managerial challenges seem to take precedence over the functional needs of individual workers. The aspect of user-centred office design with participatory design methods is usually neglected.

Organizing Distributed Work and Collaboration

The chapter *Organizing Distributed Work and Collaboration* offers a fresh view of the challenges in organizing collaboration and workplace making in distributed settings. The analysis and recommendations are based on scrutiny of the data from the viewpoint of organizational psychology.

- The analysis of the collaboration of distributed and mobile groups depicts distributed employees as lonely experts striving to achieve their sub-goals. Gains of smoothly cooperating groups were undermined due to group members' local identities, task independence, task and role unclarity, as well as shallow leadership in the groups. Collaboration can be improved by coupling the tasks, by agreeing upon work practices, and by empowering the leaders to support and steer their groups.

- The key to supporting distributed and mobile work successfully lies in a profound understanding of the work people do. Participative design practices are needed to discover the real needs of the distributed and mobile personnel. Nevertheless, profound work analysis and participation were found to be rare in case organizations. Work analysis and participation are, however, not as painful as our case companies seemed to think.
- Moreover, workplace making seemed to be a business and technology-driven process and the focus was often on the unit-level cost savings with little consideration of human factors. This narrow view often inhibited the vital collaboration between different organizational units (HR, ICT, CRE) and their clients. This collaboration should be enhanced in order to obtain a holistic view of the workplace – the key to successfully organizing distributed collaboration and workplace making.

Technology in Distributed and Mobile Work

The chapter *Technology in Distributed Mobile Work* presents a comprehensive picture of the technology-influenced life of today's knowledge workers. The underlying reasoning is derived from the viewpoint of those who use tools. The features of the tools used are often overly influenced by the product development and engineering process that produced them.

- Knowledge workers in general, but especially distributed and mobile knowledge workers in particular, rely heavily on technology in their everyday tasks. Execution continuity is often interrupted because the overall understanding of distributed and mobile work is fragmented among many parties. The workers may perform tasks without any knowledge of the underlying reasoning; likewise, the tools used and IT solutions may force unnecessary, or even incorrect, procedures. The required deeper understanding of an individual worker's tasks is often neglected and the tools used are based on generic solutions developed for much wider audiences. Thus, it may be said that the problems are caused by friction between the non-compatible goals of the social and economic drivers of the actors.
- The tasks of the workers need to be understood in more detail when developing or introducing new tools. The tools and practices of the workers must be allowed to reflect this contextual knowledge as it assimilates the never-ending change in both the tools and the work tasks.

Distributed and Mobile Workplaces

Matti Vartiainen

The distribution and mobilization of activities in the corporate value chain have increased dramatically over the last decade and will continue to do so as these organizations seek to reduce costs, get closer to their customers, ally themselves with other companies and engage the best talent wherever it may be. This chapter explores the present and likely future developments of the nature of work. The aim is to introduce the concepts of "distributed", "mobile" and "multi-locational" work (dWork) to the real estate and information technology industries and suggest the product and service needs based on the introduction of these flexible forms of work. Put simply, the purpose is to convince the reader that the challenge of multi-locality is real and worthy of recognition.

It is strongly suggested that distribution and mobility of work and employees will increase still more from now on and have a strong influence on workplace design and management. Working in multiple locations, rather than staying in the "main office", will increase. One does not need to be a fortune-teller to forecast changes in the job content of workplace designers and managers also. Luckily for them, work in the future will also be conducted in physical settings, though digitalized virtual environments will be merged with these settings. New types of work are challenges for workplace designers, premises and facilities management in companies, as well as for those who provide services for them, such as workplace consultants, not to mention employees themselves, who have to change their mindsets to adapt and participate in the change. Helping corporations to gain the competence to design the infrastructure to support and enable this distributed mobile work is at the core of helping them to be productive and agile. As Joroff, Porter, Feinberg and Kukla (2003, 293) noted: "Alignment of work, space, and information technology (IT) has, in fact, become a practical necessity for all organizations." This requires operational agility, i.e. the ability over time to respond quickly and effectively to rapid change and great uncertainty. Do companies have this capability?

1. Working in Multiple Places

1.1 Challenge of Multi-Locational Workplace

The challenge itself is not new; some spearhead companies faced up to it early and changed their workplace strategies and policies, as shown in later sections. Enterprises have been dealing with issues of distribution and mobility for decades, many effectively. But organizations face many challenges as they move ahead, and the majority is still grappling with how to deal with this increasing phenomenon. The range of questions of interest to companies is illustrated by the long list generated at a dWork workshop with participating companies at the beginning of the project in 2004. The following issues emerged: distributed work as a challenge, its implementation and influence on businesses, how to lead and manage distributed and mobile work, how ICT tools and new spaces support dWork, and what the future challenges are. These issues are of immediate concern for those responsible for day-to-day operations and strategic planning.

1.1.1 Distribution of Activities

As work becomes more geographically distributed, strains develop that reveal latent and often unexamined dimensions of collaboration. Management typically has to rely more upon results than upon the supervision and direct control of behaviour typical of traditional organisations. Motivation of employees and social bonding, two of the major benefits of face-to-face communication, has to be at least partly accomplished in other ways. With increased dependence upon communications, communication and collaboration tools substitute for person-based information. The increased autonomy of the individual requires more explicit articulation of the formal and informal contracts[1] that bind him or her to the purposes of the organisation. The roles and practices of participating employees must necessarily shift in order to maximize the benefits

1 A psychological contract represents the mutual beliefs, perceptions, and informal obligations between an *employer* and an *employee*. It sets the dynamics for the relationship and defines the detailed practicality of the work to be done. It is distinguishable from the formal written *contract* of *employment*, which, for the most part, only identifies mutual duties and responsibilities in a generalised form.

from the new situation of distributed work. Good team members know how to exploit the skills and expertise of others, but the mutual understanding that enables such behaviour is more difficult to achieve with greater dispersion of team members. There is a loss of subtlety in communication from not being able to see facial expressions, bodily gestures, and from not being able to share informal moments between substantive exchanges. Moreover, when relationships with other team members become restricted to formal occasions having strictly to do with project purposes, there is a loss of opportunity for further communication that can arise in informal situations.

A complicating factor in the equation is the fact that much of the activity of an enterprise may be "distributed" in a number of ways, compounding the challenges required to manage them. One form of distribution is that people involved are multi-tasking, doing multiple tasks with many others, while, in another form, activities may be distributed in the sense that they are conducted by people located in different divisions within the organization or different firms, often in distant environments and different time zones. Other work may be distributed in the sense that some or many of the people involved are mobile, moving from place to place, with multiple teams, which are themselves distributed in a variety of patterns. Yet other work may be distributed in the sense that the "value created" by the work may be achieved in virtual space, through information and communication technologies (ICT), where the physical location of the involved parties is of little, or no, consequence.

1.1.2 Mobility and Multi-locality

Mobility is an additional dynamic feature of a distributed organization. The concept itself is rather slippery. Many things in work can be "mobile". It helps to try to think of work as a system consisting of several interrelated components: subjects, tools and objects. When we consider work as a work system, we find that mobility is related to other components of the system in addition to actors (Vartiainen, 2006). Mobility of a person and a team is shown as physical mobility, i.e. using different locations in work and moving between them. From the perspectives of tools, team members may also be mobile virtually and mentally, meaning that they work together in virtual workspaces, exchanging thoughts and ideas electrically in digital format and externalising them as products, e.g. documents and drawings. The object of work moves as well, or is transported from one place to another in physical (material) form or is transformed into electronic (immaterial, digitalised, "virtual") form. In addition,

concrete tools, i.e. technologies such as the means of production and communication, e.g. mobile phones, are moved.

The physical mobility of employees is realised at least at two levels: individuals move alone as a members of a distributed team or organisation, and teams and projects move as a part of a dispersed organization or network using different sites. Moving employees establish their "instant office" by adapting to the environment at hand, and do so again as quickly. If collaboration with distant workmates is needed, this is possible with mobile, wireless ICT technologies. Mobile employees travel, using ICT for communicating and collaborating with others from different locations[2]. Therefore, mobile work is also telework in its traditional meaning of being performed out of the main office.

In practice, several professions (Andriessen & Vartiainen, 2007) are based on continuously changing locations. Salesmen, auditors, consultants, patrolling police, truck drivers, ambulance staff, on-site customer service and repair and maintenance groups are some of the most common examples of mobile workers. In addition, many other professions have a strong mobile element in their work.

Mobile work involves alternative arrangements, changing the definition of the traditional office – often dissolving the boundary between home and workplace, and, furthermore, sometimes totally ignoring the restrictions of the built environment. Usually, these arrangements include spatial solutions of the regular office, e.g. team spaces, shared offices, hoteling, etc., and those applied to space outside the regular office, e.g. home offices, telework centres and mobile offices. As location is becoming more irrelevant, the quality of the place where work is done becomes critical. One of the important features of the future workplace is also the quality and functionality of technological infrastructure and tools, because these provide the platform that can be used for collaboration in a distributed workplace.

1.2 Prevalence of Multi-Locational Work and Teams

Next, a short review of the definitions and the prevalence of emerging new types of work is presented. The terminology is still fuzzy and overlapping

2 'Mobile teleworkers are those who work at least ten hours per week away from home and from their main place of work, e.g. on business trips, in the field, travelling or on customers' premises and use online computer connections when doing so. See. *Collaboration@Work* The 2003 report on new working environments and practices. *http://europa.eu.int/information_society/topics/ework/information/*

when different terms are provided and used to refer to a variety of practices. Distribution and mobility manifest themselves at the individual, organizational and societal levels. At the individual level, "telework" or "remote work" (Olson & Primps, 1984) are the traditional terms referring to all kinds of work and work arrangements carried out outside a main office but related to it. "eWork" is increasingly used in Europe to describe the variety in it. Mobile work is a sub-category of eWork. At the team and organisational levels, distributed "virtual teams" and organisations are used to denote groups of people who work interdependently with a shared purpose across space and time, using technology to communicate and collaborate. In a fully virtual organisation, all the communication and collaboration takes place through ICT in virtual workspaces.

1.2.1 Individual eWork

On the individual level, the term "eWork[3]" refers to all those "work practices making use of information and communication technologies to increase efficiency, flexibility (in time and place), and sustainability of resource use" (Commission of the European Communities 2003). It is evident that most of the employees in Europe are using information technologies in their work. eWork, however, includes specific types of work (ECATT, 2000, 8–11).

(1) *Home-based telework* is the most widely recognised and best-known type of eWork. The majority of teleworkers divide their time between the home[4] and the office, and they are therefore called "alternating teleworkers". Individuals who spend more than 90 per cent of their working time at home are called "permanent teleworkers". "Supplementary teleworkers" are those who spend less than one full day per week teleworking from home. They are also called "occasional teleworkers" to distinguish them from regular teleworkers.

(2) *Self-employed teleworkers in SOHOs* (Small Office Home Office) are private entrepreneurs, such as consultants or plumbers, working and

3 In the traditional terminology, 'telecommuting' means the substitution of physical travel by work. Telecommuting is a special case of a more common 'remote work', which refers to work performed away from a central work site (Olson & Primps, 1984, 98).

4 For example, Olson and Primps (1984, 99–100) categorised work at home into the following categories: after-hour work at home, i.e. employees working overtime at home; self-employed work at home, i.e. a consultant combining work and living space; occational work at home, i.e. escaping the interruptions of the office and working now and then at home; and regular work at home, i.e. working regularly and formally from one to five days a week at home.

communicating with their contractors, partners, and clients by means of new technologies. The critical difference of teleworkers in SOHOs from home-based teleworkers is their market position as self-employed.

(3) *Mobile workers* are those who "spend some *paid* working time away from their home and away from their main place of work, e.g. on business trips, in the field, travelling, or on a customer's premises" at least once per month. *High-intensity mobile workers* are those who do so for 10 hours or more per week. In both cases, commuting to work is not included. *Mobile eWork* is defined as high-intensity mobile work in the course of which an online connection to the internet and/or to company computer systems is being used.

Studies show that the prevalence of new types of work has increased. For example, Gareis, Lilischkis and Mentrup (2006, see also Gareis, Kordey & Müller, 2004) show that telework, including home-based telework (at least one day/week), supplementary home-based work, mobile eWork, and freelance telework in SOHOs increased from six per cent in 1999 to 13 per cent in 2002 in Europe. In Britain, the number of people using their home in order to work in a variety of places, i.e. the number of mobile workers, has more than tripled over the last two decades. This accounted for around 2.1 million people in the UK in 2002 (Felstead, Jewson & Walters, 2005, 59).

Types of Individual Physical Mobility · To evaluate the needs of mobile employees, it is first necessary to identify such employees. For the identification of physically mobile employees, a topology based on the two dimensions of space and time is enough (Figure 1). Space criteria (Lilischkis, 2003) are: the number of locations, recurrence of locations, whether there are headquarters to return to, whether work takes place while moving or at a destination, whether work can take place at fixed locations without changing it, whether there is a limitation of the work area, and the distance between locations. Time criteria are: frequency of changing location, the time spent moving between work locations, and the time spent at a certain work location if not moving. Each type of mobile work has its constitutive criterion: "On-site movers" work in a limited work area, "Yo-yos" return back to a main office, "Pendulums" have two recurrent work locations, "Nomads" work in more than two places, and "Carriers" cannot do their work at a fixed location while moving.

The categories of micro- (desk-based), multi- (campus) and total mobility are fruitful as well (Niitamo, 2006; Schaffers et al., 2006). The micro-mobility of an employee, i.e. in-house and on-site mobility, increases primarily due to the implementation of the open office "Flexi-

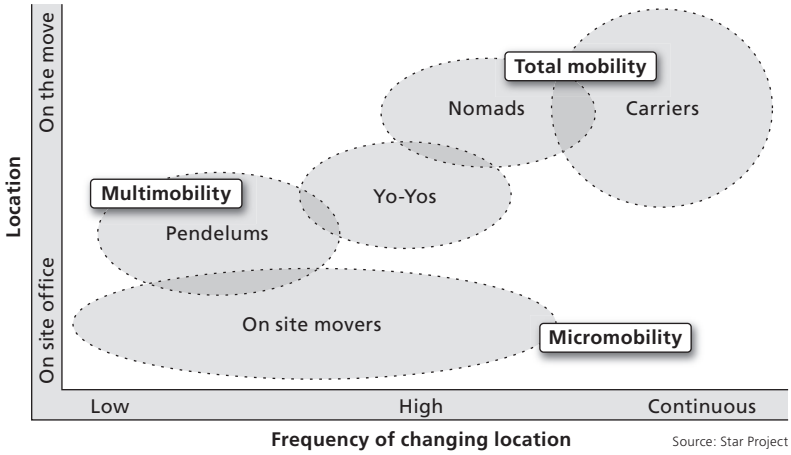

Figure 1. Types of physically mobile employees (Lilischkis, 2003; Schaffers et al., 2006).

space" concept. Flexi-space is a generic, adaptable space that can be used for a wide range of activities. Campus mobility, i.e. city-level mobility, grows from the need for multiple face-to-face meetings with colleagues, clients, subcontractors and partners in different nearby places. The use of individual wireless tools increases the possibilities of work in different places. Employees use visitors' working places at other sites of the company in the district, and work at home as well. Together with flexible working hours, this may also enable a better work-life balance and result in savings regarding total transportation times and distances. Fully mobile employees are nomadic, moving all the time, e.g. journalists, multi-site managers and global sales persons.

Multiple Workplaces · Gareis et al. (2006) suggest that to categorise teleworkers as either "home-based" or "mobile" distracts from the fact that many teleworkers spend their working time at a number of different locations, among which the home is only one option (Table 1). This trend has obviously been enabled by mobile technologies, which have liberated work from being bound to a particular space and time. For this phenomenon, Gareis et al. (2004) propose the term "multi-locational telework" (see also CEC 2003). It implies that people work wherever it suits their work tasks, business schedule, and/or lifestyle.

Table 1 shows the share of those teleworking from one of locations (columns) who also do telework at each of the other locations (rows). For example, of persons teleworking from the home (a), 11.5 per cent also

Table 1. People work increasingly in many places. Multi-locational telework – working locations (Gareis, Kordey & Müller, 2004, 25).

Base	(a) at home or the same grounds	(b) on another site of employer	(c) at customers/ clients	(d) at a hotel/ meeting venue	(e) on the move
at home or the same grounds	100.0	40.4	42.2	39.1	42.5
on another site of employer	11.5	100.0	52.5	57.4	55.6
at customers/ clients	17.4	76.0	100.0	64.6	71.9
at a hotel/ meeting venue	9.2	47.4	36.9	100.0	50.1
on the move	14.2	65.2	58.3	71.0	100.0

Base: all multi-locational workers. Data source: BISER RPS 2003, weighted.

work at another location of their employer and use online connections to stay in contact when doing so. Another example: 42.5 per cent of those who telework on move (e) also spend time teleworking from home.

Other sources confirm the observations of multi-locality. For example, ITAC, the Telework Advisory Group for WorldatWork (2005), reports that millions of Americans are working in a variety of different locations outside of their employer's office[5]. The survey asked respondents to check up to 13 different locations where they may have conducted work in the past month. The survey found that, out of 135.4 million American workers, 45.1 million worked from home, 24.3 million people worked at the client's or customer's place of business, 20.6 million in their car, 16.3 million while on vacation, 15.1 million at a park or outdoor location, and 7.8 million while on a train or aeroplane. Among the 45.1 million Americans working from home, the average number of locations they work from is 3.4. The ability of people to work from anywhere is attributed, in part, to the increasing availability of portable computers and high-speed communication connections. The use of broadband in the home by teleworkers increased by over 60 per cent during the former year; this meant that there were 25.6 million home-based teleworkers with high-speed access. The survey also showed a 30 per cent increase during the past year in employee telecommuters, while self-employed telecommuters decreased by

5 This result is based on research conducted for ITAC by The Dieringer Research Group as part of Dieringer's 2005 American Interactive Consumer Survey. The survey was conducted from August 15 – September 1, 2005.

two per cent. Overall, there were 26.1 million people who worked from home at least one day a month and 22.2 million at least once a week.

Among the Finnish workforce, the number of those who agreed officially with their employer to work at least some hours from home utilising information technology has remained at a steady 10 per cent level during 1997–2003 (Lehto & Sutela, 2005). In the 2003 survey, seven per cent of men and four per cent of women, or six per cent of all employees, reported that they factually teleworked. Many employees, however, work at home without any official agreement with an employer. Antila (2005) shows that one third of employees work at home occasionally, i.e. for two hours per week on average, but only one per cent work solely at home. His data was based on two surveys collected in 2003 (n=1538, response rate 49.5%) and in 2004 (n=2856, response rate 53%). Another study (Uhmavaara et al., 2005) explored the variety of places where employees work. Respondents in the survey (n=1177 from 106 offices in 2004) were asked to select where they had performed their main job during last week. It was shown that, at one time or another, 40 per cent of employees worked either from home, on business trips, at the customer's place or at different locations of the same business. In detail, the working places were: only the main office, 55 per cent of respondents; other places plus meeting and training rooms, 29 per cent; home, 25 per cent; at the customers' site, 15 per cent; domestic trips, 12 per cent; train, bus, and aeroplane, 8 per cent; parties and lunch, five per cent; trips abroad, three per cent; at relatives' site, two per cent and summer house, one per cent.

1.2.3 Distributed Collaboration

Types of Distributed Collaboration · As shown above, work and employees as individuals are often multi-locational. The nature of the workplace turns out to be even more versatile when we examine it from the viewpoint of collaboration. People mostly work together for a joint objective. In knowledge work, tasks are often so complicated that it is not possible to do them alone; employees have and want to collaborate from afar. This creates distributed, virtual organizations. The term "virtual organisation" dates back to two sources. One source is the groupware technology of the '80s (Baecker, 1993; Oravec, 1996), which made working apart possible by providing support tools for group members' collaboration and communication. Another source is the early vision of the virtual corporation (Davidow & Malone, 1992; Byrne, 1993), which provided a model for networks of enterprises to operate in a global context. Davidow and

Malone remarked that "the Virtual Corporation will … for the first time tie all of these diverse innovations, i.e. just-in-time supply, work teams, flexible manufacturing, reusable engineering, worker empowerment, organisational streamlining, computer-aided design, total quality, mass customisation, etc., together into a single cohesive vision of the corporation in the twenty-first century." There is literature that uses the concept of "virtual enterprise" to refer to a network of legally independent companies that acts as one organisation vis-a-vis a client (e.g. Goranson, 1999). Thus, virtual organisational structures can be classified into levels such as networks, companies, projects, teams, and dyads (Jackson, 1999; Hyötyläinen, 2000).

The definition of a distributed virtual organisation states that it consists of employees or teams working apart but towards a joint goal, mainly collaborating via information and communication technologies. The main criterion of "virtuality" is the pure communication and collaboration through electrical media. In a fully virtual organisation, all the communication and collaboration takes place through ICT in the mental and virtual workspaces. "Mental workspace" refers to cognitive constructs, thoughts, beliefs, ideas, and mental states that employees share or could share. Relative to the traditional organisation, relationships in the virtual organisation are more geographically distributed, more asynchronous, more multicultural, and more likely to extend outside the firm.

Whatever the organisational structure, groups and teams are its basic units. Virtual teams are groups of people who work interdependently with a shared purpose across space and time, using technology to communicate and collaborate (Jarvenpaa and Laidner, 1998; Lipnack and Stamps, 2000). In fact, being virtual is a matter of degree. Virtuality is a team characteristic referring to the degree to which collaboration technologies are used; the degree to which these technologies are used is usually related to the degree of geographical distribution. There is quite a consensus of what virtual teams are. Martins et al. (2004) conclude in their comparison of virtual team definitions that the majority of definitions are founded on the condition that teams rely on technology-mediated communication while crossing different boundaries like those of geography, time, and organisation. *Geographical distance* refers to different locations of employees, *time* to working asynchronously in different time zones, and *team* to team members who often come from different organisations or organisational units.

Virtual teams can have many forms, because they operate in a variety of environments having different purposes and internal regulative processes to adapt to their environments. This variety of goals, tasks, contexts

and processes needed for internal regulation "produces" different types of teams (e.g. Bell and Kozlowski, 2002). Common goals and tasks vary according to their complexity, i.e. tasks are routine or creative, and they are less or more interdependent from each other. Working contexts may vary in six characteristics (Vartiainen 2006, 30): location, e.g. the geographical distance of employees working in a group; mobility, e.g. the distance employees travel and the number of times they change their working locations; time, e.g. synchronous or asynchronous employee collaboration in different time zones; temporariness, e.g. employees working temporarily in projects or in a permanent team; diversity, e.g. the composition of a team, and the mode of interaction, e.g. team members sometimes meet face-to-face. The task content and the context characteristics of a team creates needs to organise intra-group processes and social support in such a manner that the team can survive. Next, the differences between different team types are explored in detail by using task and contextual complexities as differentiating factors.

Conventional, Distributed, Virtual and Mobile Teams · Conventional teams comprise members who work together in the same location and communicate face-to-face. Other terms that have been used as synonyms include "traditional teams", "face-to-face teams" and "co-located teams" (Powell et al., 2004).

The task complexity itself does not differentiate distributed teams from conventional teams; the variation of task demands from simple to complex and their interdependence may be the same in both. Conventional team members solve jointly demanding problems and perform creative tasks as distributed teams.

When studying the differences from the viewpoint of contextual complexity, members of conventional teams as well as of distributed teams are often multi-tasking and divide their efforts and time between several groups or projects, they work only temporarily in a team, and are diverse in terms of their members' backgrounds and personal characteristics. The remaining three characteristics of the contextual complexity, however, make the difference from conventional teams more clearly visible. These are: *geographical distance*, i.e. crossing spatial boundaries, *mode of interaction*, i.e. the way information, data and personal communication are exchanged (Bell and Kozlowski 2003, 21–22), and *physical mobility* of team members. Conventional teams are co-located, communicate face to face and stay in fixed locations.

Distributed groups and teams vary as well. At one end of the scale, there are distributed teams that possess multiple characteristics of con-

ventional work groups, such as all members are working in fixed places, though they are distributed. At the other end, there are the "ideal types" or prototypical global, highly mobile virtual teams and projects, such as management, marketing and sales teams and new product design teams whose members may constantly move and may never meet each other face-to-face.

In practice, teams and projects are only seldom fully distributed and "virtual" in the sense of being at the extreme ends of the six characteristics: all members, different in terms of their backgrounds, move and work temporarily and asynchronously together over large distances using only ICT for their communication. The six characteristics of contextual complexity are closely related to and dependent on each other: a change in one of them results in changes in some or all of the others. Two examples: the larger the distance of distributed employees, the greater is the use of ICT for collaboration, and the greater the physical mobility of an employee is, the more likely (s)he is to meet and collaborate with people from diverse backgrounds.

In addition to variation in spatial distance, media use and mobility of team members, distributed virtual teams may also vary in the three other characteristics of contextual complexity: time asynchronicity, temporariness and diversity. The combinations of these characteristics yield many possible types of distributed teams, only one of them being a fully virtual team.

Summarising, it can be seen that groups and teams are complex entities, because their purposes, tasks, working environments and resulting intra-group processes vary a lot. All these factors are interlinked so that a change in one of them influences others. Therefore, only rough categories of team types can be presented (Figure 2). Conventional groups and teams differ from distributed, virtual and mobile teams especially in three characteristics: geographical distance of their members, mode of interaction and physical mobility. Conventional groups and teams are co-located, communicating face-to-face and working towards a joint goal here and now.

Based on the argumentation above, the main types of non-conventional teams are: (1) distributed, (2) virtual and (3) mobile virtual teams. Team members working in different locations and their geographical distance from each other make a distributed team. A team becomes virtual when group members communicate and collaborate with each other from different locations via electrical media. Physical mobility of group members adds a new feature to distributed work. Mobile, virtual teams are always distributed, but not all distributed, virtual teams are

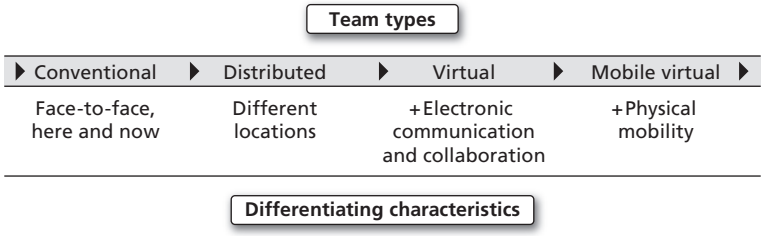

Figure 2. Types of groups and teams by increasing contextual complexity.

mobile. Virtuality as the use of ICT for communication and collaboration makes a team into a distributed virtual team or mobile virtual team. In conclusion it can be said that mobile virtual teams are the most complex type of teams to lead and manage.

Prevalence of Distributed Teams · It can also be concluded from the reasoning stated above that measuring the prevalence of distributed work is somewhat fuzzy and also difficult. However, efforts have been made to increase our understanding of this topic. Gareis, Lilischkis and Mentrup (2006) estimated the extent to which the EU labour force is involved in distributed, i.e. virtual teamwork. For this, a very basic definition was used that included everybody who regularly uses e-mail or the internet to communicate with work contacts located at other business sites, either in other organisations or at other sites of the same organisation. It was operationalised for survey research as "communicating with external business contacts via e-mail, video-conferencing or electronic data transfer". For further explanation, external persons were described as "customers, clients, suppliers, other business contacts, but also colleagues working at other locations of the same company". More than every third worker in the EU15 appeared to be involved in regular tele-cooperation, if defined in that way – about three times as many as there are multi-locational workers (Figure 3).

Hertel et al. (2005) report a survey among 376 business managers in Germany that reveals that about 20 per cent of the managers worked predominantly as members of virtual teams, and about 40 per cent worked at least temporarily in virtual teams. Their findings confirm that distributed virtual teams are used widely in the European Union. This is equivalent to the prevalence in North America as shown in Martins' et al. (2004) summary: more than half of the companies with more than 5000 employees use virtual teams and 60 per cent of professional employees work in them.

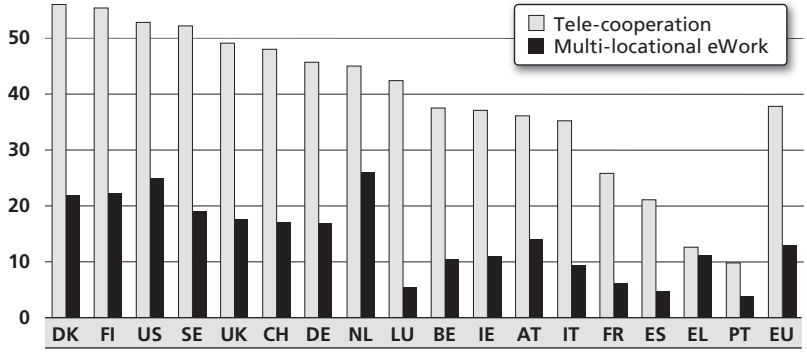

Figure 3. Multi-locational eWork and tele-cooperation in EU15 countries and USA in 2002 (in % of total employment) (Gareis, 2006, 32).

The figures above show that people are increasingly working in many places during their working days and weeks. However, little is known as to the extent the spaces they use really support employees in their work. This is the topic of the next chapter.

2. Experiences of Mobility and Multi-Locality

The reader is hopefully now convinced that distributed, virtual and mobile teams are real, and that multi-locational work is a challenge to workplace design and management. In the chapter below, it is shown that this has already been acknowledged and known for over a decade – since the early 90s, in fact. Some spearhead companies had by then already successfully changed their workplace strategies and policies to fit in with the needs of new work, and are still working along these lines. Some references from then are used to show this and are also compared to newer observations from our own project. First, however, a frame to describe the workplaces and contexts is proposed. It is provided to help readers in the identification of the real usage of different locations. In the frames, the workplace is seen as an integration of physical, virtual and mental spaces where work and communicative actions take place. Second, the frames are used in an analysis of the literature to review benefits and drawbacks to work in different locations both from the respective viewpoints of companies and employees. Third, the results of two case studies of a mobile group are shown. The purpose is to illustrate the everyday life in practice of mobile employees from the viewpoint of the activities in work environment. In addition, two examples of developed workplace policies are presented to show that supporting multi-locational work is possible and may benefit both employers and employees.

2.1 Frames to Analyse and Describe Multi-Locational Work

2.1.1 Work as a System

From the practical point of view, it may sound a bit lofty to view work as a system. The systemic view adapted in this chapter was already preliminary handled in the chapter 1.1.2 when discussing on mobility. The systemic view has, however, helped the writer of this chapter to create a pattern, "Gestalt", of the relevant system components to focus further on. This pattern on its behalf has helped in finding critical factors in work that can be changed and developed. A specific system theory, the activity system approach is used as the methodological guideline for

the analysis and description of multi-locational work[6]. In the approach, work is studied as a system consisting of a subject[7] using tools to process objects of work in a working context. This leads to analyse work from four perspectives: what (assignment, tasks, objects, tasks) is done, by whom, how (work and communicative actions and practices), and where and when (spaces and time)?

Activity systems in working contexts are goal- and interest-driven entities, which aim at fulfilling given or self-set tasks and assignments. Work is realised through purposeful object-oriented and/or communicative actions often in collaboration with others. Subjects, as actors, are social and cultural entities such as individuals, pairs, groups, organisations, and networks. They use both concrete and mental tools to work on their objects in their respective environment, which can be characterised by its degree of complexity (the six characteristics). The objects of work are manifested as self-set and given assignments, tasks, and goals related to them. In addition to goals, a driving force can be an interest without any exact goal, but one, which does, however, create joint actions. Because of the systemic nature of work and working, the concepts like "virtuality" and "mobility" are just aspects of activity systems. The tripartite entity "subject-tool-object" is the basic functional unit of mobile virtual work, which is carried out as actions in different working contexts or spaces. Next, the working contexts as spaces are discussed in more detail. The spaces are the starting point to study multi-locational work.

2.1.2 Imbedded Spaces

What are the working contexts where actions take place? They can be outlined both from the individual and collective perspectives. From the *individual point of view*, each individual exists in a psychological field of forces that determines and limits his or her behaviour. This implies and underlines the meaning of personal perceptions and interpretations of the contexts-in-use. Lewin (1972) called this psychological field the "life space". It is a highly subjective "space" dealing with the world as the individual sees it. "Life space" is, however, imbedded in the objective elements of physical and social fields. As "life space" describes individual contexts, the concept of "ba" (Nonaka et al., 2000, see also Nenonen,

6 This approach is described in more detail in Vartiainen (2006) and Vartiainen, Hakonen & Kokko (2006).

7 It is underlined that although 'subject' is used in singular, it refers to both individual and collective actors that share their interest, goals and volitions.

2005)[8] focuses on *shared contexts*, which is useful for differentiating various spaces in collaborative work. *Ba* refers to a shared context in which knowledge is created, shared and utilised by those who interact and communicate there as often happens in knowledge work. *Ba* does not just mean a physical space, but a specific time and space that integrates layers of spaces. *Ba* unifies the *physical space*, such as an office space, the *virtual space*, such as e-mail, and the *mental or social space*, such as common experiences, ideas, values, and ideals shared by people with common goals as a working context. Physical, virtual and mental or social *places* are particular areas or positions in spaces in relation to others where individual workers and groups of people collaborate. The workplaces that virtual mobile employees use are analysed in the following sections by using these shared space-categories.

Physical spaces The physical environments that employees use for working are divided in this chapter into five categories: (1) home, (2) the main workplace ("Main office"), (3) moving places, such as cars, trains, planes, and ships, (4) a customer's and partner's premises or own company's other premises ("other workplaces"), and (5) hotels and cafés etc. ("third workplaces"). In fact, because they all can be used for work purposes, they are all referred to by the general term "offices". So, the "office" is a place where work takes place. For example, van Meel (2000, see Harrison et al., 2004, 24) distinguishes locations that knowledge workers use for their work into:

- Central office, i.e. a building where the workplaces of the employees from the same office or department are located.
- Telework office, i.e. a workplace that is physically disconnected from the central office.
- Satellite office, i.e. a telework office facilitated by the employer.
- Business office, i.e. a telework office facilitated by a commercial provider.
- Guest office, i.e. an office located in the building of a principal or client organization.
- Home office, i.e. a workplace located in the residence of an employee.

8 'Ba' roughly means 'place'. The concept was originally proposed by the Japanese philosopher Kitaro Nishida (Nishida, K. An Inquiry into the Good, 1921) and further developed by Shimizu (Shimizu, H. 1995, Ba-principle: new logic for real-time emergence of information, Holonics, 5, 1, 67–79.) (See Nonaka et al., 2000, 14).

- Instant office, i.e. a workplace instantly created by the user in a place that is not primarily designed for office work (e.g. airport lounge, train).

The use of physical places can be described by different indicators, such as their distance from each other (near – far), their number (one – many), and the frequency with which they change (seldom – often). The indicators are then used in modelling various types of distributed and mobile work units. A physical place itself can move, for example, a car, a train, or an aeroplane. This type of working in many places is called multi-locational work (Lilischkis, 2003).

A *virtual space* refers to an electronic working environment or virtual workspace or collaborative working environments. The internet and intranet provide a platform for working places for both simple communication tools, such as e-mail, and complex ones, such as collaborative working environments, which integrate different tools like e-mail, audioconferencing, videoconferencing, group calendar, chat, document management and presence awareness tools. The use of virtual workspaces can be analysed and described by focussing on connections, devices and services and on their purposes, functionality and usability.

The combination of physical work settings and virtual space has been called a "*workscape*" (Harrison et al., 2004). The term "workscape"[9] refers to the "layers of where we work", i.e. the constellation of (1) real and virtual work settings, i.e. furniture + IT, within (2) particular spaces, i.e. meeting rooms, project areas, cafés etc., that are, again, (3) located in a specific environment, i.e. office building, city district, street, home, airport, bus etc. They together form a hybrid work environment.

A *mental/social space* refers to cognitive constructs, thoughts, beliefs, ideas, and mental states that employees share. Creating and forming joint mental spaces requires communication and collaboration, such as exchanging ideas in face-to-face or virtual dialogues. Mental/social spaces are usually studied by collecting individual perceptions, attitudes and conceptions, and then analysing their contents. Network analysis is also used to show the relationships of individual members like "liking" and "not liking" or "helping" or "not helping".

As a summary, the working contexts of individuals and groups are today combinations of physical, virtual, mental/social, and cultural working spaces, especially in collaborative work (Figure 4). The use of

9 The concept of a workscape was initially developed by Franklin Becker and Fritz Steele in their book Workplace by Design (see Harrison et al., 2004, 56).

Physical Spaces Settings Arenas Environments Tasks	**Home**	**Main workplace(s)** 'Office'	**Moving places,** i.e. trains, airplanes, ships,	**Other workplaces** e.g. clients' and suppliers' places	**Third workplaces** e.g. hotel, cafe, congress venue
Virtual Spaces Connections Devices Services Purposes Functionality	PC, phone, Internet, broadband, wlanPC, phone, Internet, broadband, wlan	Intranet, communication and collaboration systems Intranet, communication and collaboration systems	Mobile devices	Intra- and extranet, Internet	Laptop, intranet
Mental and Social Spaces G&O and HRM issues	Tranquility, well-being **family**	Shared goals and values, 'stress', **peers**	Change and solitude, **strangers**	Trust, **partners**	Interruptions, mostly **strangers**

Figure 4. Types of workspaces in multi-locational and virtual work.

various spaces varies, depending on the type of work and interdependence of tasks to be done. Individual telework in solitude at home without virtual connections to others is an extreme and rather rare case. Usually home-based teleworkers sporadically communicate with superiors and colleagues face-to-face by commuting to the main office. When employees are working in multiple locations, the combination and emphasis of their spaces are different from co-located employees, just because of the greater number of physical places they rotate and use. Still they need not communicate virtually. The significance of virtual spaces grows when members of a distributed team communicate and collaborate from different locations with each other. They are not only distributed in physical places but simultaneously use virtual places (videoconference and documents shared on the intranet), and also are related to other team members who must share common goals (social space) to be able to reach the aim, and possibly also share common ideas, beliefs and values (mental space).

2.2 Working in Multiple Workplaces

Working from multiple places seems to mean two things. First, an individual employee uses successively many places to work. Second, members of a distributed team work from different places, and are not necessarily moving at all. A glance backwards in time shows that the variety of workplaces used either by solo working employees or team members collaborating from afar has steadily diversified during the past few decades from

home and telework centres to full virtual offices with multiple supporting technologies in each location and, finally, to a "mobile office" or "instant office" where work actions are enabled in multiple places by the support of wireless and mobile technologies for short time periods. It is increasingly usual that team members use and work in different locations and that the only common platform of work is a virtual electrical collaboration environment.

What might be the reasons to favour multi-locational work from a company's viewpoint? There are a number of reasons to implement flexible work locations and workplace strategies as early workplace researchers report (Becker, Quinn, Rappaport & Sims, 1993a). Some are using teleworking or remote working as a way of avoiding transportation problems and adapting to environmental legislation. Others want to increase the size of their labour pool by including people that would not otherwise be able to work, such as disabled workers. Still other organizations have even a more human-centric view and want to reduce employee stress from commuting, and balancing home and work life. The most common goal and the crucial driver is, however, the desire to reduce real estate costs. Some other authors are more critical, claiming that organizing work in multiple places in effective ways just offers an additional way of intensifying work (Felstead, Jewson & Walters, 2005). The reason may be just the economical surplus. We can, however, also ask if it is possible that new flexible ways of working and the implementation of a new workplace strategy are a win-win situation both for companies and employees. It seems that employees look for more autonomy and control over their work as well as a better balance between work, family life and leisure. Therefore, in the next review, benefits and drawbacks to work in different physical places are summarized from the viewpoints of both companies and employees.

2.2.1 Home as Workplace

Working at and from home is not a new topic, since it was quite common in the pre-industrial area when family-life and work were neatly intermingled in farming and stock raising as well as among craftsmen in cities. Whole families in several generations worked and lived together in the same physical premises. Most people could go on foot to their work. The industrialization broke this tradition down by gathering large numbers of people to work in the same places. This was to make possible the processes of monitoring, observing and carrying out surveillance of the workforce. Most people had to travel to their job. Increasing commuting times,

traffic hazards and air pollution raised the topic of working at home back in the 70s, and the discussion of telework and technologies supporting communication and collaboration from afar started (Toffler, 1980). The basic dilemma in the discussion from the very start was that, on the one hand, telework at home was seen to reinforce the individual's autonomy and self-control over the work, and on the other, non-work related issues, e.g. those relating to the family, were seen as factors interfering with, and constraining, working at home (Olson & Primps, 1984). In addition, the geographical distance from colleagues, co-workers and managers was seen as a challenge (Felstead et al., 2005). Working at home seems to generate some uncertainty and unpredictability between, on the one hand, a worker and other family members and, on the other, employees and their managers.

One of the first studies (Olson & Primps, 1984) on work at home concerned the effects of regular work at home on the relationship between employee and employer, the connection between work and non-work domains, and gender issues. Olsen and Primps found that, depending on the extent to which the organization views the employee as an irreplaceable resource, work at home can either result in increased autonomy and freedom, or it can decrease autonomy through more formal control procedures, the loss of promotion opportunities, and a change in compensation or work status. Male professionals without responsibility for child-care reported that relationships with their children improved. Working at home reduced stress because it reduced interruptions, avoided office politics and eliminated commuting. Positive impacts on leisure were also reported because of improvements in time for leisure activities. Employees who had child-care responsibilities, all of them women, reported negative impacts on job status and work content, the lack of separation between work and family allowing only little time for leisure. They also reported stress associated with work at home. In a recent Finnish study (Antila, 2005), over half of the home-based workers were either very or rather satisfied with working at home. Observations gained from various studies summarise the main benefits and drawbacks of working at home (Table 2).

Homes as "workscapes" vary a lot. As Harrison et al. (2004) note, blurring boundaries between working life and private life lead to the temporary use of primary working spaces for private purposes and vice versa. Sometimes there are named and specified real and virtual settings for working, sometimes the work takes place in a kitchen or sleeping room. Felstead et al. (2005, 110–111) summarise two approaches to organising working space in the home. The first approach establishes a clear sepa-

Table 2. Benefits and drawbacks of working at home (Olson & Primps, 1984; Becker et al., 1993a; Becker, Quinn & Callantine, 1995; Greengard ,1994; Felstead et al., 2005; Uhmavaara et al., 2005)

Benefits	Drawbacks
From the viewpoint of companies	**From the viewpoint of companies**
• Reduction of office space and the associated costs • Reduction of transportation • Ability to attract and retain certain highly valued employees • Broadening the workforce pool by including people that would otherwise be unable to work • Reduction of traffic congestion and air pollution	• Enlarging responsibilities based on legislation • Insurance liabilities • Challenges to compensation • Low commitment of employees to organisation • Loss of control over work performance • Decreased visibility of employees • Costs to build up home-office, e.g. furniture, equipment, rent, additional media lines
From viewpoint of employees	**From the viewpoint of employees**
• Higher quality of personal life • Freedom to choose when to work and when to have personal time • Ability to avoid interruptions at the office • Increased autonomy and self-control over time • Increased amount of time in use because of no commuting • More effective work	• No leisure time if small children • Work spilling into family life • Interruptions at home • Deterioration of relationship with supervisors • Reduced staff interaction, lack of social contacts • Isolation from the flow of information, support and help • Role conflicts and social control • Deteriorated prospects for promotion • Aggravated "Workaholism" • Need for separate costly workplace, inadequate workspace

ration between the spaces designed as domestic and those allocated to working at home. The second approach is characterised by integration of sites of domestic and working activities by blurring the boundaries between work and non-work locations. They identify five types of ways to organise spaces of work within the home along the continuum from separation to integration (Felstead et al., 2005, 111–119):

- "Detachment": clear and precise physical and aesthetic divisions between working spaces and domestic spaces, e.g. a strictly separated working room.
- "Juxtaposition": work activities are clearly demarcated from the rest of the house but in which they are in close proximity to, and within touch, sight and sound of, one another, e.g. a permanent workstation in the corner of a bedroom.

- "Assimilation": the aesthetic and ambience of the home swallows up or obscures that of work, e.g. working temporarily in the dining room.
- "Collision": domestic and work activities compete for the same space, e.g. working in a place used simultaneously for family games and piano practice.
- "Synthesis": combining and blending working and housing areas without boundaries.

2.2.2 Main Office as Workplace

The main office is the nerve centre of an organization. The power and main resources are traditionally located there. It is a place to return to and meet workmates, though many time studies show that employees seem to use their desks only for a small proportion of their working time. Becker and Sims (2000) described the development of offices during the past 100 years as a dialectical development of *being a social setting* or *a place to concentrate* full time on task execution. According to them, it was only in the late 1950s and early 1960s that widespread implementation and use of private environments was seen. Enclosure and office size became associated less with the key activities to be performed and more with status and rank. The focus also shifted from groups of people working together to focus on individual productivity and performance. This was, however, challenged during the 1990s, when a large-scale move to using teams emerged. Becker and Sims claim that interaction and communication once again became the primary purposes for coming together in a place called "the office". At the beginning of the 2000s, Becker and Sims (2000) suggested that the "office's primary (not only) value is as a place for face-to-face interaction: a place to meet co-workers and managers, to inspire, coach, be motivated, share information, debate goals and objectives, socialize, make friends, and so on." The increase of multi-locational mobile employees and teams and their flexible working times have changed the main office itself again. The desks are not any more – if they ever were – in full use.

This has created the need to develop flexible-to-use workplaces in offices and led to widespread moves from the closed cubicle offices to open-area, shared-office environments and task-specific spaces in them. Becker and Sims (2001) also question the juxtaposition of closed and open types of offices. The reasons to prefer one of them over the other vary from personal preferences to cost reductions and flexibility. The question itself is wrong, they say; both closed and open can serve useful purposes. Finding the right balance of closed and open offices requires understanding the purpose of the office and the nature of the work being done.

Solutions in non-territorial offices vary: employees may have their permanent working desks or they may have to find a place for a shorter period of time ("hoteling"). In the open-area office, only a handful of employees, working with confidential information, usually retain their private workspaces. Becker, Simms and Davis (1991, 49) described the forms of shared offices to include: "'Shared assigned offices', in which two or more people are assigned to the same office or desk, and non-assigned offices, in which a group of people use available workspace on a first-come, first-serve basis." From the economic point of view, a workspace shared on a first-come, first-serve basis is the most beneficial one, and one that maximizes the use of unassigned space and minimizes the costs of workstations and office constructions (Greengard, 1994). In shared-office environments, the users outnumber the workstations provided. The main reasons to implement an open-area office is the fact that many employees no longer use their desks fulltime, but flexibly use other locations to perform their work. Some benefits and drawbacks of open-area offices are shown in Table 3.

There are many possibilities of realizing the physical layout of offices on the basis of the need to disconnect or collocate employees. For example, van Meel (see Harrison et al., 2004, 24) distinguishes the following types of offices: cellular office, i.e. an enclosed space designed to accommodate 1–3 workplaces; group office, i.e. an enclosed space of 4–12 workplaces; open-plan-office, i.e. an enclose space for 13 or more workplaces, and combi-office, i.e. a cellular office situated in an open space designed to accommodate common facilities and group work. Another topic relates to the partly unanswered question of when increasing density becomes counterproductive. What is the "tipping point" where adding another drop of water makes the glass overflow? According to Becker and Sims (2001), very little is known when increased density intersects with reduced performance or higher turnover.

A Case: Interruptions in Open Office Space · In knowledge work, time to think, concentrate and reflect is needed, as well as time to communicate, share information and socialize with others. The major attraction of the closed office is the possibility of controlling unwanted interruptions to work in open office space.

Studies on interruptions at work show that they often interfere with the workflow of knowledge workers in offices and elsewhere. For example, Mark, Gonzalez and Harris (2005) observed day-to-day activities of twenty-four information workers over a period of three days. They were software developers, financial analysts and managers. For knowledge

Table 3. Benefits and drawbacks to work in an open-area office (Becker et al., 1991; Becker & Sims, 2000; Greengard, 1994; Felstead et al., 2005).

Benefits	Drawbacks
From the viewpoint of companies	**From the viewpoint of companies**
• Cutting costs of office space when compared to cubicle office	• Employees may be reluctant to give up their own space
• Better use of space by increased headcount per desk	• Too high density may become counterproductive
• More interaction between managers and their teams (if that is valuable)	• Size of teams may create space shortage
• Enhanced flexibility and satisfaction of employees when implemented carefully and effectively	• Managing turnover of spaces between users
• Quicker decisions because of enhanced communication	• Scheduling conflicts
	• Investments in equipment and training
From the viewpoint of employees	**From the viewpoint of employees**
• Encourages interaction	• Feelings of lost privacy
• Fluent communication	• Uncontrolled noise and interruptions (uninvited chatting and asking questions) in work
• Social support from colleagues	• Disturbances created by meetings within the space > difficulties in concentrating
• Explicit and tacit learning	• Overhearing co-workers
• Feedback	• Two people trying to use same desk, not finding a place to work
• Rich communication	• Losing "sense of space" in the organization
• Business is performed in a spontaneous, informal and flexible manner	• Storage can be problematic

workers, it is common to be engaged in multiple activities; they are multi-tasking because of an increased amount of work and projects to be done. Working spheres observed in the study were coded into two categories: the working sphere was central when a person had the main responsibility for it, and it was peripheral when she was not accountable for it. In addition, the category "other" was used. Researchers focused on two components in work fragmentation: length of time spent in an activity, and frequency of interruptions. Work fragmentation was examined along three dimensions: effect of collocation, type of interruption, and resumption of work. Basically, interruptions may be beneficial or detrimental, depending on their context. Interruptions that help an employee to think about his or her tasks can be called *interactions*, whereas interruptions that lead to a switch of working sphere are *disruptions*.

The researchers found that multi-tasking was very common; knowledge workers worked in an average of 11.7 different working spheres during a day. Work was highly fragmented: 57 per cent of their working spheres were interrupted. The average length of time that the informants

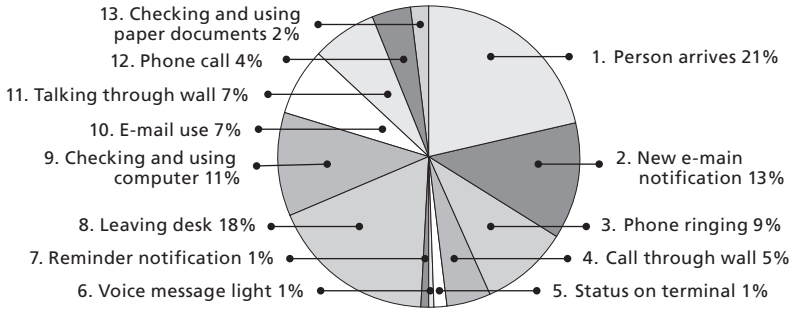

Figure 5 Average number (%) and types of interruptions (external: 1.–7., internal: 8.–13.) per day based on observations of 14 people (retrieved from Gonzalez & Mark, 2005, 118).

spent in central and peripheral working spheres was about 11 minutes. Collocated people worked longer before switching than distributed employees who worked physically separated from their workmates, e.g. in other building, but had more interruptions.

Interruptions were divided into internal and external, as was also the case in another study (Gonzáles & Mark, 2004) (Figure 5). Internal interruptions are due to personal work, e.g. an employee stops a task on his own volition, whereas most external interruptions, e.g. phone ringing or a colleague entering a worksite, are due to the work they are responsible for. There was a significant difference between internal and external interruptions and work role (Mark et al., 2005). Managers were more likely to experience external than internal interruptions, whereas analysts and developers experienced internal and external interruptions equally. Informants said that interruptions are most disruptive when they lead them to shift working spheres. Interruptions were not nearly as bad if they were related to the project a person was already working on. Being forced to leave one working sphere and enter another was highly disruptive.

Though 77 per cent of interrupted work is resumed on the same day, typically it takes an average of 25 minutes and more than two intervening activities to occur before it is resumed. Interrupted central working spheres were about twice as likely to be resumed on the same day compared to peripheral working spheres. Distributed workers were most likely to resume work.

How to work in Open Office Space · The study suggested three main directions for supporting multi-tasking behaviour (Mark et al., 2005, 328): (1) interruptions ideally should match the current working sphere in order to provide benefits instead of disruptions, (2) one should be able to easily

and seamlessly switch between tasks, and (3) interrupted tasks should be easily recoverable by presenting the state of task when it was interrupted and by providing cues to reorienting to the task.

In the main office, employees are often micro-mobile moving in its different places. Many employees who cannot do their work at their own working desk, often because of various interruptions, will find a different place elsewhere in the building to work, such as a library and an empty meeting room. This, of course, is possible only if such places are available. Flexible working places include a variety of places like food areas within the work area, quiet zones or rooms, small group meetings areas and rooms, and different types of informal interaction and socializing areas.

A new etiquette of office behaviour is also needed. Others should know what project you are working on at any given time. Broadcasting to colleagues what the working sphere is can help them estimate the costs of an interruption.

All this raises the question if it is possible at all in an open office to balance conversation and other kinds of interactions allowing concentration. One possibility is to attach jointly valued and negotiated meanings to all the cues that a rich social environment provides. For example, Becker and Sims (2001, 23) list the following implications of visual access:

- Allows an individual to time the initiation of conversation better, in order to reduce disruptive interactions
- Enables a person to see actual work occurring in other business units or departments, facilitating a greater transfer of information both within and across teams
- Enables a person to assess a situation before fully committing to an interaction
- Reduces the likelihood that someone is left out of an interaction in which he or she should be a part.

Zoning of activities and functions is one more option for dealing with different needs and preferences for concentration that Becker and Sims suggest. An example of zoning is putting human resources people near other human resources people. Another is to use protocols or planned etiquettes, for example, by creating "quiet areas". A third one is to define the workplace as consisting of other places like home in addition to the main office. There are also individual differences in the ability to work in open spaces; some are more socially oriented than others. The internal work motivation or the expected rewards may also play a part in the adaptation.

2.2.3 Moving Places

It is a sort of a paradox that people are today moving even more in their work than before, although new collaborative working environments allow working from "anywhere" – including working permanently from one fixed place. This section concentrates on working in moving places. Temporary stopping places like hotels and airport lounges are discussed in the section "third workplaces".

Work-related moving can be divided into commuting, i.e. travelling between a place of residence and a place of work, and travelling for work. In both cases, cars, trains, taxis, trams, aeroplanes, ships, bicycles and other vehicles are used for moving – and sometimes as moving workplaces. Typically places used for working on the move are the legal property of neither employer nor worker (Felstead et al., 2005). Most of the moving places are public and therefore shared by others. As Felstead et al. remark, the main question relates to how people learn to cope with "transitional spaces", i.e. spaces that are occupied temporarily whilst travelling.

A study made in eight European countries (De La Fuente Layos, 2005) shows that, on average, people aged 20 to 74 spent between one hour and 90 minutes per day travelling. With regard to trip purposes, from nearly one third in Hungary to almost half of total travel time in Finland is linked to free-time activities[10]. Gainful work and study, as well as domestic activities, justify the remaining time spent travelling, both kinds of activities globally accounting for similar proportions in all the countries (from approximately 25% to 40%). According to the data from SIBIS (see Gareis et al., 2006), 28 per cent of EU15 workers spent some paid working time doing physically mobile work in 2002.

In Finland, 134 hours are used for commuting each year according to a national survey[11] (Työmatkat 2004–2005). During one day, Finns commute 7.4 kilometres in an average of 22 minutes, and, in working time, 3.9 kilometres in an average of 35 minutes, within the country.

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10 Free time: All other kinds of activities are included here, e. g. volunteer work and meetings, helping other households, socialising and entertainment, sports and outdoor activities, hobbies and games, reading, watching television, resting or doing nothing, as well as unspecified time use.

Gainful work and study: Time spent on main and second jobs and related activities, breaks during working hours, and job seeking. The time spent on study at school and during free time is combined with gainful work.

Domestic work: Housework, child and adult care, gardening and pet care, construction and repairs, shopping and services, and household management.

11 Data was collected 2004–2005 by telephone interview from 13 386 respondents in all (response rate 67%).

Thirteen per cent of the distance travelled is on international trips. In commuting, a car or other private vehicle is used most (83%), in addition to bus (7%), bicycle (3%), metro and tram (1%). One per cent of work trips are made by foot. During a working day, trips are also made most often by car (83%), in addition to aeroplane (6%), bus (3%), taxi and ferry (1%). Another survey (Uhmavaara et al., 2005) in Finland showed that 11 per cent of respondents had worked during trips in their home country for, on average, one hour per week, and two per cent had worked on trips abroad.

In the USA, more than 100 hours are used for commuting to work each year, according to American Community Survey (ACS) data complied by the U.S. Census Bureau (Offutt, 2005). ITAC, the Telework Advisory Group for WorldatWork (2005) reported that, in the past month, 20.6 million Americans had worked in their car and 7.8 million while on a train or aeroplane.

Table 4 shows some of the benefits and drawbacks of working while on the move. The main challenge is the need to adapt to changing environments again and again. What is possible in one space is not possible in another. There also seems to be some differences between working in public places like trains and working in a private car. As Felstead et al. (2005) note, public transport throws large numbers of strangers together in enclosed spaces under observation of each other. The car allows drivers more choice as to the type of social encounters. Felstead et al. (2005, 139) name different ways to use the private space of the car. First, it can be used to extend private time; that is, time outside the view of others that is used to think, to reflect, to talk aloud or to express emotions. The second use is to promote varying levels of intimacy between friends and colleagues. The time used in the car is used in committed social interaction, which otherwise would not be possible. The third use is to connect to the outside world via communication devices.

Felstead et al. (2005) claim that contrary to the advertising campaigns' slogan that technology allows working effectively at any time, in any place, mobile workers have to give thought to planning how to compensate for the deficiencies of their physical and virtual working spaces while on the move. They make places work and allocate work to places.

2.2.4 Other Workplaces

After travelling, mobile workers *land* somewhere. One type of landing space is "other workplaces". Other workplaces include a multitude of premises such as a company's own offices at different sites, and telework

Table 4. Benefits and drawbacks to work while on the move (Greengard, 1994; Harrison et al., 2004; Felstead et al., 2005).

Benefits	Drawbacks
From the viewpoint of companies	**From the viewpoint of companies**
• Cutting costs of office space • More responsiveness to customers	• Costs of communication and collaboration technologies • No direct control • Tracking where employees are; "telepresence"
From the viewpoint of employees	**From the viewpoint of employees**
• Possibility of interacting with interesting strangers • Possibilities of reaching interesting and exotic places to work • Possibilities of being alone, think and reflect • Possibilities of concentrating on reading, writing, using a mobile phone and consulting documents	• Missing privacy in public transportation • Limited time in use • Unwanted interaction with strangers • Diminished spatial isolation and temporal freedom from work • Continuous need to adapt into new environments • Unexpected tasks and unforeseen demands • Carrying numerous devices to communicate and collaborate • Missing power sockets

and satellite offices, business offices provided by a commercial provider and guest offices in partners' and clients' premises (e.g. Harrison et al., 2004). Often these places are transitional places where employees work only temporarily, though sometimes for longer periods.

In large companies, it is usual to have several premises around the district. "Office swapping" (Becker et al., 1993a, 58) occurs when organizations with multiple offices allow employees who live in one location and work in a more distant office to use a dedicated space in the office closest to them, rather than commuting to their regular office.

"Telework centres", "Satellite work centres", "satellite offices" or "telecottages" are remote from the main office and possibly close to employees' homes. The first of them were built up at the beginning of 1970s in the USA (Nilles, Carlson, Gray & Hannemann, 1976; see Jaeger & Bieri, 1989) and later in other industrial countries. They were considered alternatives to work at home and aimed at avoiding the harmful mixture of work, family and leisure there and, at the same time, unnecessary time-consuming commuting to the main office. Based on studies of ten telework centres and two resort offices in USA, Canada and Japan, Becker, Rappaport, Quinn and Sims (1992) grouped into two categories the driving forces that led to telework centres being established. The primary drivers

Table 5. Benefits and drawbacks of working in transitional fixed places (Jaeger & Bieri, 1989; Becker et al., 1992; Becker, Quinn, Rappaport & Sims, 1993; Greengard 1994).

Benefits	Drawbacks
From the viewpoint of companies	**From the viewpoint of companies**
• Lowers rentable costs per square meter	• Costs of communication and collaboration technologies
• Availability of skilled personnel	• Missing indicators to measure performance
• Reduction of traffic congestion, energy consumption, air pollution and number of commutes	• Remote management is a challenge
• Demonstration and promotion of new telecommunication products and services	• Difficulties in team activities and coordination
	• Missing guidelines
	• Challenges to protect company secrets
From the viewpoint of employees	**From the viewpoint of employees**
• Helps to avoiding the harmful mixture of work and family life	• The amount of work and salary paid
• More and better quality time with family	• Technological limitations: missing power sockets and wireless connections
• Decreasing commuting time to and from the main office	• Feelings of disconnectedness from the organisation
• Reducing employee stress related to commuting	• Unexpected tasks and unforeseen demands
• Social contacts, preserved professional identity	• Maintaining privacy and personal space
• Enhancing productivity	• Difficulties in self-management
	• May impede inter-office communication

include transportation issues, economic development and marketing. The secondary drivers include quality of life, cost reduction, better ways of working and disaster recovery. The last one came out of the terrorist bombings in London and New York in 1993! The same discussion continued again after September 11th 2001. From the viewpoint of companies, reasons for using them are also a shortage and cost of office space and a shortage of skilled personnel (Olson & Primps, 1984). Other benefits and drawbacks of transitional other places are shown in Table 5.

As Jaeger and Bieri (1989) point out, satellite offices where a group of people work can be used for several purposes, such as doing a joint project for an employer or individual assignments for different employers. Also they can be used as offices of one company, serving several companies with the same products or services, or as a joint physical setting for a group of independent private entrepreneurs.

In the 90s, the number of furnished and unfurnished offices for companies grew permanently and started to appear at airports and a variety of other locations (Greengard, 1994). Jaeger and Bieri (1989, 6) offered satellite offices as places to solve the problems of isolation and missing social contacts that easily arise from working alone at home: "Professional contacts mediate self-respect, more or less clear-cut professional

identity". In the early phase, the main limitations in adapting satellite offices were technological ones: the capacity of lines and usability of tools. Technologies such as videoconferencing for communication and other video systems for observing work in distant places were, however, tested.

The more staff work at clients' premises, the less they need room at the company's premises. Simultaneously they maximize billable hours.

2.2.5 Third Workplaces

Third workplaces are also for short-term transitional stops. Usually they are used only temporarily, for hours or, maximally, some days. They include hotels, cafes and conference venues, as well as public areas and lounges at airports, and motorway service stations. They are the places where a mobile worker stops for awhile and maybe does something related to work. Felstead et al. (2005) refer to these places as in-between transitional spaces, as they are often visited only briefly. Harrison et al. (2004, 24) refer to workplaces that are instantly created by the user in an airport lounge or a train as "instant offices".

Table 6 shows some benefits and drawbacks of the third places. In addition to an employer and employee, there is a third party involved, i.e. the owner of the third place.

A Case: A Hotel as a Workplace · Hotels, for example, have a long tradition as places of lunch meetings. Becker and Tennessen (1995a) studied a hotel as a temporary workplace for a sales team, altogether twenty-one persons, during its sales campaign to sell advertising space in the "yellow pages" of business telephone directories. The team members worked and lived (except commuters) at the hotel during the campaign. They used two of the hotel's conference rooms to serve as campaign space for managers and support staff and for commuting sales representatives. Most of the sales persons and managers worked and lived from suites. Work hours, communication and interaction, work versus home life, space and design, technologies and cost implications of the work arrangements were studied by interviews, questionnaires, observations during visits, and using background documents. The key findings were as follows (Becker & Tennessen, 1995a, IX-XI):

- Some sales representatives felt that they worked more hours than before.
- Spontaneous daily interactions were minimized with the removal of the workstations from the campaign office. Sales representatives met

Table 6. Benefits and drawbacks to work in third places (Becker and Tennessen, 1995a; Felstead et al., 2005).

Benefits	Drawbacks
From the viewpoint of companies	**From the viewpoint of companies**
• Cutting costs of office space	• Low public image
• More working hours	• Challenge to protect confidential information
• Tailored work environment	
• Quick availability and access	
From the viewpoint of the "third place"	**From the viewpoint of the "third place"**
• More customers	• Costs of tools and services for mobile customers
• A customer may return	
• New customers with similar needs	
From the viewpoint of the employees	**From the viewpoint of the employees**
• Freedom and control of time and schedule	• Reduced ability to separate work from personal life
• Improved concentration in privacy	• Missing privacy and personal space, interruptions
• Easy access	• "Looking good and sounding right"
	• Decreased social interaction with co-workers
	• Unexpected tasks and unforeseen demands
	• Loss of opportunity to learn from others
	• Limited time in use
	• Missing technological infrastructure and devices

informally during evenings more and more often over the course of the campaign. Only certain people participated.

- Work and "home" lives were blurred: feelings of inability to separate from work due to having one's office in the "home"; feelings of personal time being violated when accidentally encountering co-workers in the evenings; feelings maintaining personal time was difficult because team expectations were of socializing with colleagues; feelings of one's entire life happening in the same place.
- Employees were generally happy with working out of their own suites. They liked the control of their own work and believed to be more productive because of fewer interruptions and easier concentration. The managers believed that enclosed offices were necessary. The sales representatives felt that combining offices and living accommodations required separate areas for living and working. The hotel complex layout was appreciated because it limited unplanned interactions with co-workers. The hotel lobby became an informal gathering

place playing a key role in bringing the group together. Many team members were concerned about the image presented to customer of having their office located within a hotel.
- The campaign resulted in savings over the traditional arrangements, although wiring and equipping hotel suites added to costs.

2.3 Working in Multiple Locations and Workplace Policies

Working in multiple places has its benefits and drawbacks both to an employer and an employee, as shown above. In this chapter, two cases and two examples are presented. The first case is about a group of mobile employees, i.e. case E in the dWork project, and how distribution and mobility were apparent in their work. It tells of the work content of mobile knowledge workers' time. The other case and two examples relate to the spearhead companies, which as first reshaped their workplace policies according to the need for multi-locational work and employees. The second case is a now classic study of Becker, Quinn and Callentine (1995) on the implementation of a new workplace strategy "the Midwest Mobility Program" at IBM in 1992–93. Digital Equipment Corporation is an example of the early adapters. Also, the well-known case of Sun Microsystem, which is still considered a success today (Offutt, 2005), is briefly described. Although the time difference between the oldest and newest cases is almost fifteen years, the old examples and their follow-ups show well the lasting challenges and outcomes of mobile, multi-locational work and collaboration.

2.3.1 Case I: Working Spaces of a Mobile Team

Research Questions and Methods · This case study is aimed at deepening the understanding of mobile and distributed work. The main precondition of a distributed team's work is collaborative communication. Therefore, it was critical to find out to what degree physical, virtual and mental/social spaces support full communication and collaboration in a network of people doing project work that requires problem-defining and -solving abilities, as well as creativity. The research questions of the study were:

- For what purpose (task), how (mode of communication and collaboration) and where (place) and with whom (network) do mobile employees act and communicate?

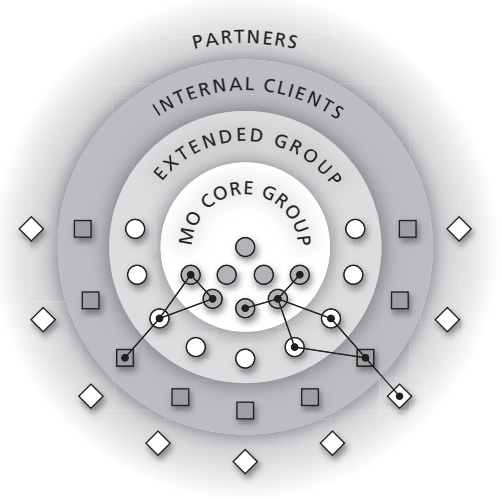

Figure 6. The MO Team and a sketch of its network.

- How do physical, virtual and mental/social spaces support, or how should they support, the team in its work?

Object of Analysis The core group of mobile employees (Mobility Office Team, MO) consists of people employed to promote the mobilization of the Nokia businesses (Lattanzi, Korhonen & Gopalakrishnan, 2006). MO has its extended group, people with whom they are working for their internal clients (Figure 6).

At the beginning of the dWork project in 2004, the MO team consisted of eight persons. Later, some changes took place, as, for example, some people left the team and the leader of the team changed, and new people came in. This case description is a part of the second stage of the dWork project and focuses on the data collected from four MO members plus an external collaborator.

Collection of Data. The data was collected in three phases during autumn 2005 and early 2006 (see Appendix A for details): first, each member filled a self-observation diary for seven days, second, each employee was interviewed individually, and, third, a workshop was organized to validate the observations and to create ideas for the development of work. The main data was received from the self-observation diary. The purpose was to identify the content of workdays from morning till evening when working was in solitude and in asynchronous and synchronous collaboration. The time when tasks were performed was to be described in terms of the blurriness of workdays. The place where team

members communicate and collaborate was to be described in terms of the used spaces and their suitability for specific work tasks. The media that was used to transfer different kinds of information between different actors was to be descriptive of the used media and its suitability to the work of mobile employees. In addition, each participant was asked to save the messages sent and received by the different media used over the period of seven days. Finally, a workshop was organised to validate the results of the study.

Analysis of Data. First, the overall view of a working day and a week was formed by analysing the diary data at the individual and day levels. The results are shown as the structure of a week and a day. Second, the task contents and the forms of asynchronous communication while working in solitude were analysed. The task contents were grouped following the generic knowledge task categories presented by Harrison et al. (2004, 54–55). In addition, the complexity of tasks, i.e. their cognitive requirements, was described by categorizing them from "routine tasks" to "creative tasks" based on Hacker (2005, 239). The frequencies of different forms of asynchronous work-related communication, i.e. e-mails, SMS, MMS and communication chains, e.g. one-to-one chat, were counted and the purposes of their use described. Third, the frequencies of synchronous meetings and their purposes were categorised by using the list of generic co-operative tasks (Andriessen, 2003, 84; Short, Williams & Christie, 1976; Rice 1987). The reasons for the experiences of the most satisfactory and unsatisfactory meetings during the period are also described. Fourth, the physical spaces in use during the working week were analysed by using five categories: home, the main workplace ("Office"), company's other places, moving places, a customer's or partner's premises ("other workplaces"), and hotels, cafés etc. ("third workplaces"). Time used in each place was counted, and the route during the working week was described. Fifth, the information and communication (ICT) tools used were first listed by person and then summed up to describe the whole tool set of MO members.

Knowledge Work in "Blurred" Working Days · This section shows how employees worked and what they did during the observed week.

Working in "Blurred" Structure of Work. In all, employees worked in physical solitude, on average, for 21 hours and 45 minutes of the average total weekly working time of 51 hours and 34 minutes. Working days were "blurred", meaning that when working in solitude as well as when working with others employees were often interrupted by virtual collaborative and communicative actions. Team members worked many times

a day in solitude for some hours in all, especially at the beginning of the week and on Fridays. Other events like official and ad hoc face-to-face meetings, lunch and coffee breaks, moving from one place to another and family affairs interrupted the day's run.

The following example of an employee's single work day describes well the blurred nature of work days (see also Figure 7): the work day includes several kinds of tasks and does not end when the person leaves the office building.

> This day an employee stayed at the office without any trips to other sites. The day started in the office at 7:45 by working alone and reading and sending e-mails, and ended by trashing e-mails at 22:11 at home. Between the day's start and end many actions were carried out. An employee worked in physical solitude eight times, four hours and ten minutes altogether. During the day, 23 work-related e-mails were received, 16 were sent and 25 trashed; three calls were made and six answered; six SMSs were received and four sent. There were two one-to-one virtual meetings using presence awareness, instant messaging and Web conferencing, one for four persons, and one for six team members. In addition, the employee had eight face-to-face meetings during the day, mostly small one-to-one meetings.

The workday of employees is seen as a series of work and communicative actions as episodes taking place in hybrid workspaces that are imbedded mixtures of physical, virtual and social settings. The settings are, in practice, intermingled and change dynamically as an employee during the day flexibly moves from one episode to another working some time physically alone in solitude and then with many others face-to-face. Working in solitude does not mean just "working alone in privacy", because working is affected either by self-initiated virtual outgoing contacts with others by phone and online chat, or externally by an incoming flow of requests and questions by e-mails and text messages. This is a transitional stage between deep concentration in flow and fully social polyphonic events, which is referred to here as the stage of "pseudo-privacy". Becker and Sims (2000, 15) used "pseudo-privacy" to describe working in high-panelled cubes; the high panel was supposed to create privacy, yet one could overhear all of what cube neighbours said. While the degree of synchronous face-to-face communication increases, the degree of virtual, asynchronous communication decreases. It does not, however, vanish totally, because it was found that, at the other end, in large face-to-face gatherings, the mode of working returned to that of "working alone", e.g. writing documents and reading and sending e-mails while sitting in the meetings.

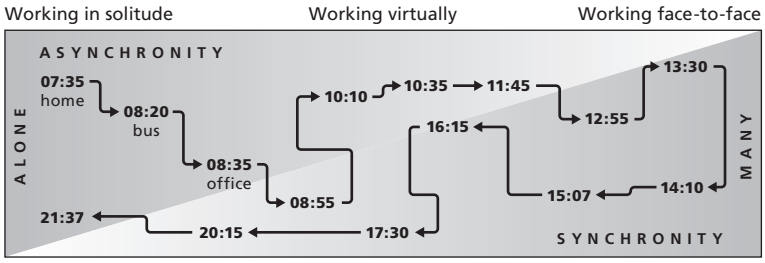

Figure 7. An illustrative example: "working solo" – "working face-to-face with many" continuum of actions and episodes: moving from one state to another.

Solo Working and Asynchronous Communication · The average daily working times in solitude during the workweek varied from almost three hours on Thursday to five hours on Monday. The interviewees considered their work as highly demanding though there were a considerable number of routines to be followed. Around 50 per cent of the work included creativity demands (Table 7). While working alone, it was possible to think, to clear thoughts, to reflect and to analyse as well as to produce material. It was possible to concentrate on the work that could not be done in collaboration with others. Some used their working time in solitude for reading and writing e-mails. It was underlined that physical solitude does not mean being alone because of virtual communication.

Forms and Contents of Asynchronous Virtual Communication. The asynchronous work-related communication while working in solitude consisted of e-mails (received, trashed, sent), SMSs, MMSs and communication chains.

E-mails were used for purposes like sending reminders to oneself, documents for comments and reworking. In all, the five respondents received, trashed and sent 1239 e-mails during the week in question. E-mails were considered to work best in exchanging information and opinions and worst in creating ideas, problem solving and getting to know each other. There were some doubts as to their usefulness for persuasion, bargaining and resolving disagreements. Disagreements were resolved to some extent by e-mails, however, it was remarked that resolving disagreements was easier to do face-to-face. Interviewees remarked that e-mails should not be used for problem solving or in urgent situations (at least with strange people). It was noted that, if e-mail is used for problem solving, it should be in one-to-one interaction. The problem of e-mails is their number. One interviewee remarked that every month around 100–

Table 7. The cognitive requirements of tasks evaluated by respondents (n=5) (cognitive levels are based on Hacker 2005, 239-).

Required level of cognitive regulation	When working alone my work consists of ….	%
Doing routine tasks	e.g. reserving tickets, organizing and booking meeting rooms, registration of working hours, doing travel bills, room reservations, reading news mails	18
Working based on familiar rules and guidelines	e.g. working on e-mails (answering simple questions), standard answers to customers like "for what we are working", classifying mails, continuing others' work	14
Applying rules and guidelines in many familiar contexts	e.g. customising based on a basic set of offerings	15
Combining familiar rules and guidelines in new contexts	e.g. identifying the mobility needs among internal customers, complex customising	31
Creating new plans and solutions	e.g. usually done in groups by brainstorming, considering new technologies that could be utilised, forecasting future, doing drafts 0.1, documents to be worked on with others	22
All together		**100**

300 e-mails remain unread just because there is no time to go through them all. Nowadays e-mail is used too much for too many things, said another. When an e-mail is sent to several people simultaneously, the problem is that people do not read the last replies in the chain properly. Thus the discussion may not continue.

In all, 121 SMSs were received and sent during the week. SMS was used for asking and answering detailed questions, exchanging information, e.g. "Where are you", "Which room we meet in?", informing, e.g. "The call is postponed due to meetings", "Budget status is…"; making agreements, e.g. "Let's meet 10 o'clock", reminding; confirming; suggesting, checking flights, getting information, e.g. "Weather forecast in Singapore". An interviewee commented that SMS is also used when other means do not work: when you cannot reach someone by other means and you have something urgent to say and need to get quick yes-no answers. SMS has been used for, for example, getting 100 000 euros funding, problem-solving, fetching information, getting approvals, starting projects, and also informing a change of a superior. It is noteworthy that the use of multimedia messages (MMS) was rare among the respondents; only two instances when MMS were used were reported. This raises the question about their role and benefit in work. It may be that they play a role in some specific situations, when sending contextual information about the workplace, for example; but this was not found to be the case in this study.

Exchanging e-mails often develops as a communication chain. An example of a *communication chain* is a draft sent by e-mail attachment to others who then add something to it, then it goes to the next recipient and so on. Communication chains are often just for creating something, said one interviewee. If so, they could be one – though slow – virtual way to enhance creativity instead of face-to-face meetings. E-mail chains may be used to analyze information together, and to develop new ideas. However, e-mails were criticized for being too often used unsatisfactorily when solving problems: someone poses a question and sends it to someone else. Then this same message is sent further and further along the path. The chain may end up consisting of 30–40 people who all disagree, and all this development of the chain may have taken several months.

Communication chains may consist purely of e-mails or they may be developed by use of several different media. For instance, in one case after a face-to-face meeting, tasks were divided and processed by two persons. Some problems, however, appeared and an additional person was involved by sending an e-mail to her. In addition, there were phone calls to identify more problems in the affair. After some chatting and meetings, a decision was made as to how to proceed. Coming to this decision, a communication chain developed to involve several people and several different media.

All kinds of communication chains are used: from very short-cycle chains where several messages are exchanged in a couple of minutes, chains lasting couple of hours, and communication chains lasting weeks and even longer. The throughput time of a matter in a chain may be even months. The mixture of media used in a chain may also vary from one media to multimedia use. For short-cycle communication chains, it is usual to use the same media, for example SMS. For example, in Figure 8, the respondent D communicates with three persons during a day by using SMS. It is, however, typical that various media are used when the chains last longer.

Forms and Contents of Synchronous Virtual Communication · Most of the working day was either working with others virtually online and face-to-face or moving from one place to other (and not working). Next, the contents of virtual synchronous working with others are described in more detail.

The data shows that, during the observed week, the most frequently used media for real-time communication were individual calls and small official and ad hoc face-to-face meetings. Most respondents also used chat and call conferences on daily bases. Most employees also had large

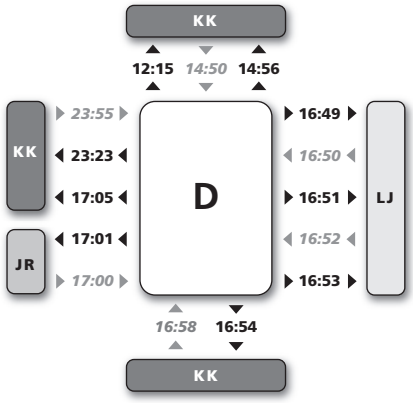

Figure 8. An example of simple ego-centric SMS message chains of the respondent D during one day (KK = mr. Karl Kirman, LJ = mr. Larry Jaatinen, and JR = mr. Jack Richman).

teleconferences during the week. No one reported having videoconferences. Synchronous virtual media were mostly used quite successfully for exchanging information and opinions. Phone calls were still the most frequently used form of communication, though their number compared to e-mails was rather small. The usefulness of teleconferences seems not to be good for creating new ideas, problem solving and resolving disagreements. It was almost unanimously said that individual teleparticipants complicate the arrangements of face-to-face meetings. It was mentioned that teleconferences work well when all participants participate virtually, but that problems occur when only part of the participants take part via telephone. Next, each type of communication is explored further.

Calls were mainly used for exchanging opinions and information, but also for negotiating, solving problems and, to some degree, for resolving disagreements. Information was exchanged during phone calls, but usually this information was pretty routine in character, like "I'm late", "Where's the meeting?" or "How can I get the home-office connection up?" and "Where should I stay in Singapore?" Exchanging information was done more by e-mail than by phone. Exchanging opinions was said to be easier face-to-face than by phone. Sometimes the content of information was more demanding, as when reporting the status of a project or listening and commenting on new project plans, and making decisions, for example, with a superior. Some planning, e.g. preparing and organising workshops, was also done by phone. Sometimes disagreements were resolved by phone – however, not always very well, as one of the respondents commented. There was some experience of using calls for getting to know somebody and generating ideas. There were many failed and

unanswered phone calls and lines breaking down. A restriction on using calls was sitting in an open-space office. Talking on the phone disturbed other employees in the same space, thus it was considered easier to send e-mails or chat than talk or make a call. If calls were made, respondents usually walked around in corridors so that they would not cause so many disturbances.

Online chatting was quite popular. It was used mostly for quick checking. It was said to suit arguing and small problem solving very well. It was also used for exchanging information and opinions, sometimes also for generating ideas. Some had also used it to get to know somebody, bargaining and persuading clients, and even resolving disagreements. Somebody said that, in personal bargaining, online chat resembles personal face-to-face meetings: you can, for example, sense whether someone agrees or not. Resolving disagreements took place so that people having differing propositions as to how to approach some task tried during the chat to reach a decision as to how to carry out the task so that all would be satisfied. Problem solving was accomplished a lot during chat: someone asks something and then people start discussing the matter. Soon they realize that it isn't a simple problem. Thus, along with problem solving, people also generate new ideas. It was said that online chat could include problem solving, information sharing and persuasion, all at the same time.

Small as well as large teleconferences were mostly used for exchanging information and opinions. Often teleconferences were supported by online chat and documents were shared and handled. The use of persuasion, bargaining, problem solving and generating ideas was rated low. In brainstorming you need to move and draw, it was said. Teleconferences do not support these requirements.

Forms and Contents of Synchronous Face-to-Face Communication · Small face-to-face meetings were usually considered to be pretty effective. The most versatile media were the official face-to-face meetings in which there were up to ten participants. Practically no negative evaluations concerning them emerged. Only large ad hoc meetings were said to be difficult to arrange. Large, i.e. with over ten participants, meetings raised some negative evaluations as well; they did not seem to function well in terms of resolving disagreements, solving problems, creating new ideas and bargaining.

Face-to-face meetings with teleparticipants were organized fairly often. Quite unanimously, interviewees remarked that meetings with many participants in the same room, but with a number of others par-

ticipating through teleconference did not work well: the best conferences were those where people were either all in the same space or all attended through call. It was said that when all take part virtually, all have the same level of knowledge as they all hear and see same things. Exchanging information can take place also when someone participates by telephone, but this kind of situation does not support creating something new.

Small face-to-face meetings were very popular and successful. They were especially used for exchanging opinions and information and for persuasion. In fact, they were used for all of the purposes categorized earlier. It was said that one-to-one meetings were for deep discussions, problem solving and creating ideas. Official meetings were often used also for getting to know somebody, exchanging information, especially with superiors, and sometimes also for discussions on specific problems and disagreements.

Larger (2–4 people) meetings were used mostly for collaboration. They seem to be best for problem solving and generating ideas. They were also thought to work well when exchanging opinions and information. Eventually they could also be used for bargaining. Small official face-to-face meetings were also sometimes used for generating ideas (meetings aimed at planning), sketching and writing. Official small meetings were used pretty rarely for problem solving. Resolving disagreements was sometimes accomplished in larger meetings; however, it was noted that these kinds of things should be attempted in quite small meetings (with only the superior and the two people that have disagreements participating). It was said that one-to–2–4 meetings were used for group working, agreeing on something, making decisions, e.g. a kick-off agenda, and producing some other end-result.

Large meetings (5–10 participants) were used for exchanging information, though it was often seen to happen one-sidedly. Usually there was no discussion in large meetings, only someone informing others. They were also for lobbying (persuasion) and sometimes getting to know others.

Really large meetings (more than 10) were mainly used for distributing information and exchanging opinions, sometimes for self-presentations of new employees. Another type is a large meeting, where something is shared, and opinion or advice is asked. In large meetings, persuasion and lobbying were also seen to occur. The larger the meeting, the more there is by way of exchanging information and opinions. The fewer the people, the greater the generation of ideas. Ideas and opinions may pop up in these kinds of meetings but working on them was considered difficult in large meetings. A kind of paradoxical thing seems to happen in large meetings: people start to work "in solitude" instead of collaborating together. In

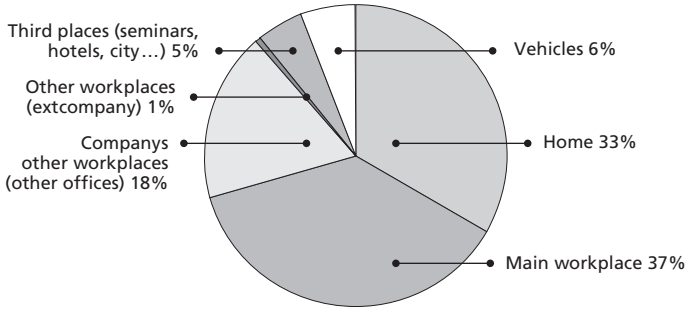

Figure 9. The average division of time (in percentage terms) used in different places during the study week by five employees.

large meetings, people start to concentrated on own tasks and work asynchronously: reading and sending e-mails and SMS, chatting, reading documents, and writing them. They are, in a way, working as if they were in solitude. An interviewee said: "In larger meetings, you can concentrate on the interesting parts, and otherwise work on your own affairs". In all, large meetings got the lowest ratings of all types of communication.

One-to-one ad hoc meetings were used for exchanging information and opinions and for problem solving. They usually started from exchanging opinions and information. They were often arranged to check the status of some project. They were said to easily change into problem solving and drift into decision-making. In official meetings, specific tasks were dealt with, but in ad hoc meetings that took place in, for example, corridors, things were taken to another level ("meta level"). In ad hoc meetings, the work seemed to have been planned, but only "in a way". Ad hoc meetings were also used for informal support of colleagues. Respondents thought that, in this kind of meeting, you could tell if you were tired of something and get social support. *Larger ad hoc meetings (3–5 participants)* were said to be more problematic. They were more difficult to arrange, as people were so busy and distributed in different places. These kinds of meetings were usually arranged by using online chat.

Multi-Locational Work and Moving Around · The employees worked in company's premises 55 per cent of their total working time (Figure 9). There were, however, large differences among the employees in their use of different places. After the main office, home was the most used place. The use of home for work varied from eight per cent to 61 per cent.

The work of the interviewees was multi-locational and mobile on several levels: interviewees travelled once in a while, for example, to

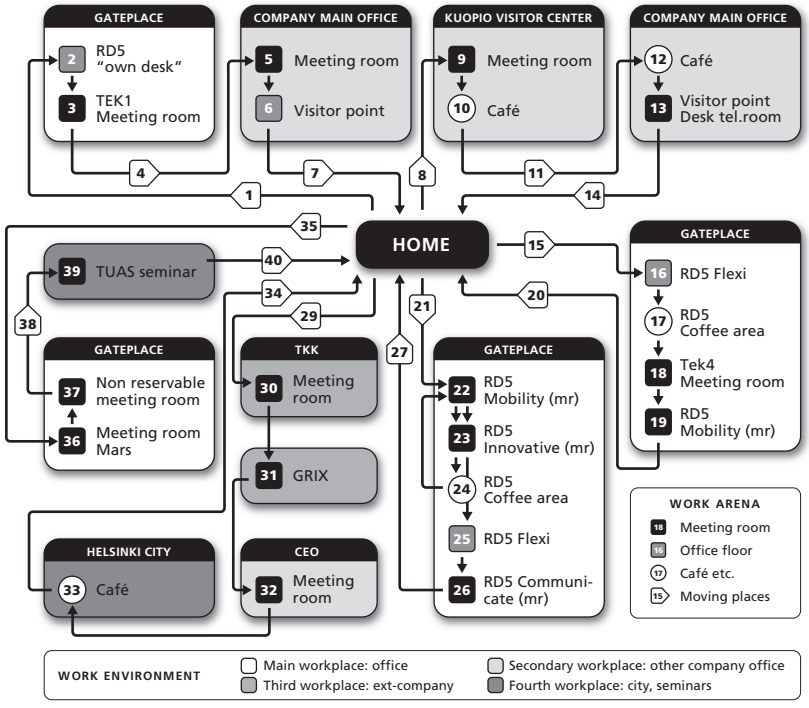

Figure 10. An example of multiple workplaces and of an employee's route between the sites in the observed week (1 = the start of the first day, 40 = the end of the final day).

Boston, Dallas and Singapore. However, most travelling took place in Finland, especially around local company premises in the metropolitan area. There was also micro-mobility in the main office's meetings rooms and corridors. In addition, airports, shops and even a doctor's waiting room were mentioned as working places. Figure 10 shows an example of the places used during the study week by an employee.

Commuting between the company's premises itself was considered rather a nuisance: necessary but pretty uncomfortable and unproductive. Travelling made workdays longer and affected work negatively. Routine travelling was considered a waste of time as that time was away from work, family and leisure. On the other hand, moving from one place to another was seen as beneficial, as during the move one could change his/her "mental model", forget work-related things, for example, and start relaxing when coming from work.

Micro-Mobility in Company Premises. Interviewees moved a lot inside the main office. "Office" was considered to be the whole main office

complex, the campus. It was the place to meet other people. Most of the meetings took place there, but also the company's main building was used a lot to meet other people. It was described as a good place to meet people as there were good cafés and meeting points that were often used for working. People were micro-mobile and used several different spaces during their workday. The study revealed that half of the time was used in meeting rooms. Auditoriums were used as places where you can sit either as one of the audience or you may participate more actively. Calls were made in flexi-spaces and corridors. Interviewees mentioned that speaking and calling in flexi-spaces were problematic because of causing interruptions to others' work. Café or tea machines, corridors, rest rooms, sofa corners and elevator fronts were used a lot. People met colleagues there, had ad hoc meetings, made phone calls, and spent time before a meeting started. Some mentioned that it often was a challenge to find a place to stay before meetings.

Working in Moving Places. There were not many comments on working in moving places. Sometimes calls were said to be made in a car, sometimes also in taxis. Phone calls in public transportation were rare because of business security reasons. Short trips in busses were utilized to read and send e-mails. Aeroplanes and airports were used too, while coming back from long journeys, for example. Interviewees mentioned that during a flight it was a relief to do some work, on documents, for example, or answering mails to send them after landing.

Home and "Third Places". There were several references to home as a workplace. As Figure 9 illustrates, interviewees worked a lot at home. Home was thought to be the place where one could concentrate on demanding tasks. The possibility of working at home was considered to be an advantage, but it was also seen to cause difficulties in separating work and family life.

"Third places" like cafés in cities, shops, and university premises were mentioned and evaluated only seldom. It seems that they are not in very general use. Some also mentioned nature as a place for thinking.

Functionality of Workplaces. When looking for the worst and best places to work, views varied a lot. People mentioned that "The starting point is the mindset and spirit", i.e. mental space. "There is no one best place, as different places support different tasks".

Some characteristics for the worst place were given:

- Few visitor points and no permit to access meeting rooms
- Rooms not with enough wall sockets
- Open space office, because you just cannot concentrate on your tasks

- Having a role of a visitor in the company's other premises. You have to use the visitors-door and spend time at reception getting a pass. Not all the company's premises have real visitors' points.

When discussing the environmental disturbances, it was noted that mostly it is not the environment itself that causes disturbances but the equipment that does not function or missing access to the net. However, the environment was thought to be important to a certain degree as well: poor chairs disturbed working; in addition, some tasks were mentioned to require more silence than others, and some other tasks required places where you could use your voice without someone else getting disturbed. Different kinds of interruptions include voice (people talking), social (too many possibilities for interaction with surrounding people), and visual stimuli (something is moving around you all the time). The open office was seen as disturbing when one needed to concentrate. Thus the environment should adjust to different tasks that have to be done.

Some characteristics for the best place were stated as well:

- At home it is easier to do only one thing at a time and concentrate, but workplace work is more like switching between different tasks
- Routine tasks and communication are performed better at a workplace
- Places that support group work and meetings
- The main office is good because of available resources and colleagues

Different procedures had been developed to adapt to the mismatch of task requirements and environment. For example, one interviewee said that, because it was difficult to participate in teleconferences and make phone calls in his own workroom shared by another person, he just walked around the house in the corridors and talked on the phone trying to solve problems.

Meaning of Workplace Aesthetics. The question concerning the meaning of aesthetics raised only few remarks. It was noted that, even though aesthetic places are nice to have, the influence of nice colours etc. on efficiency is not clear – it was considered more important to have peace to concentrate and sufficient connections at the workplace than aesthetic design. By and large, functional things were seen as criteria that were more important than aesthetic characteristics for choosing places to work.

Ideal Working Environment. The interviewees suggested that an ideal workplace is something between home and a pub. In all, the comments were pretty controversial. When asking about the ideal working environment, for example, the following answers were received:

Table 8. Media in use, indispensable media and ideas to improve media use.

Media in use	Indispensability	Ideas to improve
• Basically the same standard tools. • Phone (calls, sms, push e-mail, chat, intranet, internet, contacts, calendar), laptop (e-mails, power point, sametime chat, teleconference, online presence, Trackview, Lotus Notes-based Teamroom for documents, intra- and internet, mindmap, hour reporting, MS Office), paper documents, PostIt, Locus magazine, Irma for showing slides with phone. • Most people have a home office connection.	• It depends on what you are doing. For making things happen, chat is the number one. Although other person is in a meeting, by using chat you can manage things. Chat is unnoticeable. Nobody waits for long answers, just quick ones. Instead of putting things into mailbox, it is good. • If PC is taken off, everything becomes paralysed. • E-mail is the best and worst media: quick, multifaceted, mobile access but used too much.	• E-mails are used too much. Instead all the material could be put to Teamroom and the e-mail would just include links. • There are too many meetings. Because e-mails are used so much, other tools are suffering. • Needs for videoconference if properly arranged. It is a hindrance to get opposite side to right place. • Centralized calendar is a problem, because you cannot know where the others are, and travelling may take some time. • Virtual meetings tools should be more flexible. • Communication tools are not problems as such; people just do not know how to communicate.

"An ideal working place would be an own place with facilities: sofa, possibility of boiling tea. This place should be quite near one's home so that it is easy to get there. The people that you work with should be there as well: This is a problem because they are distributed. F-t-f and ad hoc meetings must be possible."

"An ideal work environment would be located closer to home than the main office is now. The spontaneous move to the workplace would be easier than it is now. The workplace should not be too close either."

"An ideal working environment would be a place that is very much like home. It should be easy to disengage from work for a while and, for example, play billiards or drive an electric car race. Then there could be a living room in which people could watch movies and shows and have discussions. Somebody could even live there."

"An ideal working environment would be a place where you have a possibility of working so that you don't disturb others and others do not disturb you. On the other hand, you need to have a chance to meet others at your workplace. In a perfect workplace, there would be walls, a window would be nice, too; it should be warm and you shouldn't have to wonder all the time whether someone is being disturbed because you are talking on the phone. In the prefect workplace, there would be some social space as well and better equipment that would make a virtual way of working possible (e.g. better teleconference phones)."

Employees have differing expectations from the ideal workplace. However, some common themes could be found. For interviewees, in the ideal workplace would be possible to do the multifaceted work that requires concentrating alone as well as communicating with other people. The location of the place, the facilities in the office, and the aesthetics of the office were all mentioned to be important characteristics of the ideal workplace. Interviewees also viewed the home as quite an ideal place for work that required concentration. At home, there are fewer interruptions. In the office, there were rooms reserved for lone working, but there were always other people around, and that was experienced as disturbing. The office was suitable for collaborative work. One interviewee stated that at the perfect office there would be a workroom where you could leave things hanging on the wall.

However, even though all interviewees described their ideas of a perfect workplace, it was also mentioned that work is always task-dependent and usually not that much place-dependent. The "head" is most important and, besides that, the network, access to other people and information are important.

ICT Tools in Use · The virtual environment in use was versatile[12]. Table 8 shows the interviewees' description of their ICT tools, their usefulness and ideas as to how to improve the use. Basically, the tool set for everyone was standard. Chat, laptop and e-mail were mentioned as the most beneficial. On the other hand, it was mentioned that improving employees' competencies could develop their use.

Discussion · The job contents of the employees are demanding both cognitively and socially. Around 50 per cent of the work includes thinking and creativity demands. So, team members can be genuinely called knowledge workers. Around 40 per cent of total work time is used in solitude doing tasks requiring concentration. The social network of employees is wide, consisting of tens of people, and is shown to have a high number of various communicative actions. They are contacted virtually and face-to-face. During seven days, each person received and sent 24 SMSs, had 26 small and large face-to-face meetings, worked in solitude 35 times, received and dialled 29 calls, and received, sent and trashed 248 e-mails on the average. E-mails were considered to work best in exchanging

12 The support of information and communication technologies for distributed work and employees is handled in detail in Chapter Four.

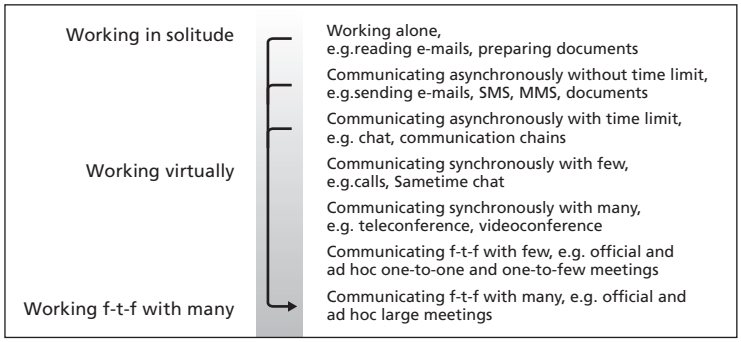

Figure 11. A workday is a mixture of working spaces.

information and opinions, and worst in creating ideas, problem solving and getting to know each other.

The study revealed that MO members' work is pretty virtual and mobile. They work in different locations and at different times. The work MO members do is not tied to any one location, nor is it tied to any specific time. Work is done at the main office, other Nokia premises, home, sometimes in public spaces, in cars, and, for instance, in the offices of clients and colleagues. Work starts early in the morning, and often the days end with some work-related tasks late in the evenings. Many work on Sundays too.

The work seems to be blurred around the day as there is no specific time or place when work starts or ends. The study also found that the work itself is blurred. People work both in solitude, asynchronously with others, virtually online and in face-to-face collaboration with others (Figure 11). All are essential for success of work, but contrary to the traditional thought that these modes of work can be separated. The results of this study suggest that it is rather difficult to separate working in solitude from collaborative work. Working in solitude might mean virtual asynchronous collaboration with others and presence in collaborative meetings may be used to write some documents in solitude. Thus the nature of work seems to have become all the more blurred at several levels.

The employees worked on the company's premises 55 per cent of their total working time. Only one of the employees worked more than 50 per cent of the time at the main workplace, and another one more than 50 per cent at home. Home was the most used place. The use of home for work varied from eight per cent to 61 per cent.

Employees are multi-locational and mobile at several levels. Some of them were mobile at the global levels, very often they were Campus

mobile, visiting different sites of the extended enterprise, and they were micro-mobile in the main office's meetings rooms and corridors. Travelling itself, especially between company's offices, was considered quite a nuisance: necessary but pretty uncomfortable and unproductive.

One of the aims of this study was to explore how spaces, ICT and human resources manage to support the contemporary work of employees. It was found that, at the moment, people doing virtual and mobile work experience challenges that these support functions could – and should – address. Open space offices did not allow people to concentrate properly, thus home had become an important place for work that demanded concentration. The spaces that enable both concentration on individual tasks as well as on collaboration are needed. It was also mentioned that virtual collaborative working environments could be further developed to better support real, virtual and mobile work. At the moment, proper videoconference facilities are not available and there are some problems having successful teleconferences, especially if some participated virtually and others face-to-face. Also, the new blurriness of work, diffusion of work into different places, different times and different networks were considered troubling at times. There was no clear difference between working time and leisure, and thus it was thought to be difficult to really relax and forget work-related issues. As work seemed to dominate the week of mobile employees, some clear guidelines for alleviating stress and managing new kinds of work were needed.

2.3.2. Case II: Ecology of the Mobile Worker

Objectives and Research Questions · This case provides a historical dimension to workplace thinking as it deals with the start of a new workplace policy in IBM. The case study was a part of Cornell University's International Workplace Studies Program (Becker et al., 1995) carried out mainly in the 90s. It was considered a test of a new workplace strategy where employees were given a choice as to where they work and how they schedule work activities, to provide more personal flexibility in work activities and closer direct contacts with the customer. Although the new strategy itself was based on the idea of multi-locational work, home as a workplace was the main concern in the study. According to Becker et al., the home had become an integral part in the workplace strategy, along with the use of non-territorial or shared offices, telework centres, and information technologies to support mobile work. In such workplace systems, work increasingly spills over into employees' family lives. A

question was the extent to which factors such as household composition, whether one is married or single, has children, and so on, as well as the nature of the home and other alternative work environments, may affect employees' response to work and their ability to work effectively in a mobile environment. This case addresses the impact of, specifically, such factors as household composition and the nature of the home workspace on employees' satisfaction, stress, and work effectiveness.

The following questions were addressed:

- What were the characteristics of the integrated workplace system referred to as the IBM's Midwest Mobility Program?
- What were the patterns of time and setting use for mobile employees?
- What were the main effects of household composition and home workspace on measures of satisfaction, stress and work effectiveness?
- What other variables, such as gender, age, and job type had a significant effect on employee satisfaction, stress and work effectiveness?

Collection of Data and its Analysis · *Object of Analysis.* At the beginning of 90s, IBM Indiana was like many other IBM offices faced with financial pressures to reduce costs and become more responsive to customers. This meant a reduction of the workforce and cutting other costs. In 1993, IBM Indiana was given a chance to save 50 positions if other costs could be reduced instead. This was achieved by implementing a new workplace strategy that stipulated employees were to be mobile and work distributed to various locations. The integrated workplace strategy was referred to as the Midwest Mobility Program. All customer-related employees in technical services, marketing, and management positions were moved out of costly real estate and into a program consisting of a variety of work locations. The motivation was to cut space costs. Employees were informed that they would no longer be provided with a personal assigned workspace at the central office. They were encouraged to create an alternative workspace at home to supplement their work areas at customer locations. The program allowed employees who spent a large portion of their time (approximately 70%) with clients to work the remainder of their time in home offices and a main office, called a Productivity Centre, using unassigned, non-territorial workstations and offices. In addition, employees were free to work in other workspaces, including IBM drop-in sites, restaurants, hotels, airports, aeroplanes, and cars.

The total population of the study was 282 employees who participated in the program. The respondent group consisted of 105 employees repre-

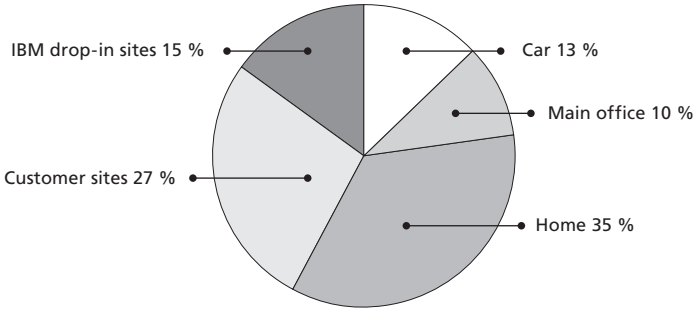

Figure 12. Hours worked per week by setting (n=102) (modified from Becker et al., 1995, 27).

senting different job categories: marketing (58%), technical services (12%) and management (30%). These employees represented a cross-section of household compositions from not married singles to adults-only; 25 per cent were females.

Collection and Analysis of Data. The data was collected by a survey (n_{sent}=282, $n_{received}$ = 105, response rate 35%); interviews ($n_{face\text{-}to\text{-}face}$=9, $n_{telephone}$=10); personal unstructured observations of work activity, patterns of interaction and occupancy rates during a two-day visit; photographs taken by survey respondents (n=9) of home working areas, main office, customer work areas and other relevant areas; and archival data, for example, on schedules and cost impacts.

Employee responses were grouped according to whether employees had pre-school children, school-age children, or no children. Home workspace was divided according to whether the employees had a dedicated room, i.e. a room specifically dedicated to work, or a dedicated area, i.e. a specific area dedicated to work located in a multi-purpose room, in their homes.

New Workplace System · The new workplace system meant reducing workspace in the main office, starting to work in other places, and supporting this with new types of workspaces and technologies. The program reduced real estate and other fixed asset costs by incrementally increasing the person-to-desk ratio from the traditional 1:1 to 4:1, and finally 8:1. The whole space reduced to 37 per cent of the space it once did, which realized significant cost savings. In all, annual cost savings were 3.2 million dollars. Purchasing laptop computers, printers, training and telecommunication charges generated some new costs.

Employees were asked to report the typical number of times they worked in a given setting each week and the typical amount of time spent

in the setting each time it was used. In all, employees worked an average of 60 hours a week, higher than previously. One of the possible reasons may be the "fight" for jobs in a tight economic situation. As shown in Figure 12, roughly 35 per cent was spent working from home and 27 per cent from customer's sites. Only 10 per cent was used in the main office. The percentual figures match quite well the times used in different locations by employees in Case 1 "Mobile Office".

The *home* workspace was used as the primary work setting. When the program started, employees were given office furniture, a computer, a high-speed modem, a multi-line phone and two phone lines to accommodate data and voice transmissions. In addition, they had some other tools like fax and printers to use. There were no significant variations as a function of household composition and nature of home workspace, or gender. However, employees with pre-school children tended to work more at home than other employees. Home was considered the best place for doing work requiring high concentration, such as planning, paper work, and telephone and teleconference calls. When asked what changes they would like to make, the most frequent answers concerned more storage, followed by printers and better furnishing.

At *customer sites*, work consisted of planned meetings, administration of projects, and taking care of customer business and socializing with customers. Customer sites varied a lot depending on the customer's furnishing the space. In some sites, a private office including office technologies was provided. On other places, IBM employees worked in windowless rooms sharing the space with different vendors.

Mobile employees were expected to spend approximately one-half to one complete day a week at the *main office*. In the office, employees had access to shared unassigned working spaces, including individual and group workstations, private group offices, conference rooms, copy/mail/fax etc. rooms. Standard technologies were provided. The main office was considered to be highly functional. It was designed for planned and videoconference meetings and other tasks requiring interaction with others. When asked what was missing, the requests concerned free parking place and better technologies.

Outcomes on Satisfaction, Performance and Well-being · *Satisfaction with Mobility Program.* Seventy-six per cent of the respondents were somewhat or very satisfied with the mobility program; 13 per cent reported being somewhat or very dissatisfied. There were no significant variations as a function of household composition and nature of home workspace. While overall satisfaction levels with the mobility program were high for both

men and women, women were more satisfied than men. Employees liked most flexibility, freedom and independence that the Mobility Program provided.

Negative issues concerned the decreased interaction and communication with co-workers, inadequate equipment and technology and spillover from work to home. These conclusions have repeatedly come out from subsequent studies as well. Communication had two components: the ability to communicate about work with co-workers (professional communication), and the ability to socialize with co-workers (social communication). Over 77 per cent of the respondents reported that professional communication at work was somewhat or much worse since the mobility program began; nine per cent rated professional communication as better or much better. Eighty-eight per cent of the mobile workers rated their ability to socialize with their co-workers as worse or much worse; three per cent said it was better or much better. There were no significant differences as a function of household composition, home workspace, or any of the other secondary variables examined in this study.

Work Effectiveness. Close to 52 per cent of the respondents reported that their overall work effectiveness was better or much better than before; 18 per cent reported that it was worse or much worse. Fifty-seven per cent of the survey respondents considered the home office to be the most productive work setting, then the main office (22%) and client site (14%). Fewer interruptions and better concentration were provided as explanations. While employees with dedicated rooms at home rated their overall work effectiveness somewhat higher than those with dedicated areas, there were no statistically significant differences as a function of household composition. Most of the respondents were also satisfied with work effectiveness at the main office.

The most productive working hours for all employees tended to be the normal working hours. However, almost 40 per cent of the respondents found non-traditional hours, i.e. before 8 a.m. and after 4 p.m., to be productive; of these, 40 per cent, employees with children, were more likely to report working non-traditional hours than employees without children.

Job Satisfaction. Sixty-two per cent of the respondents reported being somewhat or very satisfied with their jobs; 17 per cent said they were somewhat or very dissatisfied with their jobs. No significant differences occurred as a function of household composition or home workspace. While overall job satisfaction scores were high, employees who had been participating in the mobility program for more than twelve months had significantly lower scores for job satisfaction (but not low scores in an absolute sense) than did those who had been participating for less than

twelve months. Women rated job satisfaction higher than did men. In interviews, some employees said that the job was not as much fun as it used to be, and some perceived the firm less committed to employees than before.

Job Stress, Spillover and Role Conflict. Forty-seven per cent reported job stress as high or very high; 19 per cent said it was low or very low. There were no significant differences as a function of home workspace, but there were as a function of household composition. Mobile employees with no children reported significantly less stress than those with preschool children. Married or partnered couples had higher stress scores than divorced or single employees. In interviews, the most frequent comment regarding stress was about work overload. The average weekly working hours were sixty.

Forty-six per cent of the respondents reported positive or very positive spillover between work and family life as a result of the mobility program; 14 per cent reported the effect to be negative. Women reported more positive spillover than men. In interviews, positive spillover included more time for family interactions, having an enhanced family life, and finding it easier to do one's job because of the flexibility.

Conflicting somewhat with the above findings, 41 per cent of the respondents reported that the impact of the mobility program on role conflict was negative or very negative. The index for role conflict consisted of three items: (a) distinction between home and work roles, (b) difficulty to separate work and home life, and (c) increased tensions at home due to working there. Men were more negatively affected than women. There were no significant differences for the type of home workspace. In interviews, some employees complained that there was not enough space in their homes to accommodate work.

Discussion · Becker et al. (1995) considered the Midwest Mobility Program to be successful for the company. The cost savings were achieved, and the employees were mostly satisfied with the program, although they were working sixty hours per week on average. This was, however, considered as stressful. One reason for the job satisfaction might be that the data was collected only from the first year of the new workplace strategy implementation.

The study also showed that mobile employees really used multiple places for their work, although the home was the most important one. As the second issue, Becker at al. warn us to be careful about assuming that the home is a viable workplace option, which it may be less of an option for those living in smaller residences. In those cases, the design of other

workplace options like the main office or telework centres may become more important. In addition, there was the evident need to develop technologies for communication and work both at home and the main office, as well as in other places, although the quality of supporting technologies at such places was not explicitly evaluated.

The mobility program studied here provided, in principle, an unlimited choice in where and when one works. Employees considered this to increase their autonomy and control of their own work. The importance of this greater time/space freedom is underscored by the finding that almost 40 per cent of the respondents reported their most effective work time to be *outside* the traditional 8 a.m. to 4 p.m. workday. Many of them were happy with this.

Families with pre-school children reported higher levels of stress and role conflict than those with no children. While these conflicts were not sufficiently intense to undermine a high level of overall satisfaction, they were likely to be more intense for those living in smaller residences, such as apartments in urban areas. Becker et al. conclude that, at the very least, the more the home work environment must vie with living space, the more likely it is that employees will have to devote energy and imagination developing rules and protocol relating to how and when family members interact, where and when certain activities occur, and so on.

Based on the case study, a critical issue that organizations need to investigate is loss of communication, both social and professional. Without stimulating planned informal interaction and business communication, the organization may lose the collective learning and connectivity that is valuable to the long-term success of the organization.

Mobility Program Today · IBM has continued its Mobility Program until now (Offutt, 2005). Today the company employs nearly 140 000 employees in the United States and more than 315 000 employees worldwide. The U.S. Environmental Protection Agency (EPA) recognises the nation's "Best Workplace for Commuters" to support flexible work. IBM is the top performer in the list of more than 1 300 organisations. The prize is motivated by the U.S. Census Bureau's statistics showing that the average commuter spends more than 100 hours every year commuting, i.e. more than two full weeks of work. To get the status, employers must meet a National Standard of Excellence (Offutt, 2005). The company's motivation to offer commuter benefits has been to improve employee commuting, increase moral, boost retention rates and cut costs. Each worksite offers a commuter benefits package. Telework at home and proximate commutes are two of IBM's most used benefits. Most of its worksites

participate in IBM's national Mobility Program, in which employees are given equipment, such as laptops, mobile phones and printers, needed to work from home. People can also utilise "mobility centres", where employees share and reserve work spaces, averaging one desk per four employees. The company also provides telework policies and guidelines, training and responsibility agreements, and uses extensively communication technologies, such as the internet for meetings, conference calls and video conferencing.

External, independent studies are not available – at least, not as far as the author of this chapter knows – to evaluate objectively the outcomes of the IBM program. Internal studies tell about success in many aspects. In an internal study, the company found that employees who believe they have job flexibility are able to work eight more hours a week and still feel they have work-life balance. Another study in 1996 showed that teleworkers anticipated staying with the company the longest and showed the greatest job satisfaction. Eighty-seven per cent of the teleworkers felt to be "more" to "far more" productive because of telework. The telework options have helped IBM to reduce its overhead costs associated with leases and facility expenses. In total, IBM saves more than 7 500 workplaces, 2 million square feet and more than $100 US million per year in reduced real estate costs (Offutt, 2005).

2.3.3 Two Examples of Flexible Workplace Policies

Digital Equipment Corporation · The first example concerns one of the early adopters, Digital Equipment Corporation (Becker & Tennessen, 1995b). Researchers studied the effects of mobile work on professional and informal social interaction and communication by interviewing 13 employees and by using company documents. The company closed a large traditional office and its nearly 100 employees including consultants, customer service, and sales personnel became mobile workers. One of the reasons to close was that a survey result had shown that more than half of the staff spent less than 40 per cent of their time in the office. After closing, employees were expected to work from a Digital telecenter, a telecenter in a Digital selling partner office, from other Digital offices anywhere in the UK, from their customers' offices, and from their cars, hotel lobbies, and even a supermarket. This was supported by providing technologies like laptops and mobile phones.

Becker and Tennessen found that mobile workers developed a new appreciation for face-to-face contacts. They spent less time together as

mobile workers, but when they were together, they spent more time socializing. Unplanned interactions involved intense sharing and catching up with one another. Meetings, which once were considered an annoyance and not taken seriously, were now eagerly anticipated. The mobile workers actively participated in and appreciated them. Socialization was both formal, i.e. planned meetings, and informal, i.e. organizational learning, informal sharing and trust-building, and simply spending time with friends. Informal socialization declined significantly, in part because the formerly active sports and social club disintegrated in the flexible work environment. Different types of socialization occurred in different locations. Planned meetings were held in the telecenters and other Digital offices, as well as in hotel lobbies and a nearby supermarket. Informal socializing, including the discussion of work-related topics, occurred over pub lunches or in the supermarket cafeteria. Cross-functional and brainstorming communications were primarily handled face-to-face and, as a result, were less common in the flexible work environment. Communications to inform and to coordinate were more often handled using information technologies in the new environment than they had been in the past. Virtually no social communication or non-administrative or logistic work-related communication took place using electronic mail. In the flexible work environment, the close-knit family atmosphere, which had characterized the old main office evolved into a loose family with its relations extending to a wide network of distant relatives. Employees felt that the company was losing its social culture, and they were disjoined from each other and the company.

The telecenter support staff, as the only permanent staff, became the focal point of coordination and socialization activities. In many ways, their role was evolving, informally, to that of a concierge. Several employees spent more of their working and social time with other work-related contacts they met in the customer's or Digital selling partner's offices. Coping strategies also included turning to the local community, i.e. going to the local pub in the evening to get out of the house, and the development of new hobbies and recreational activities involving community groups and resources.

Employees missed the informal contact and communication of a conventional office. For most staff, technology had not yet become a viable substitute, or even complement, to the reduction in face-to-face contact. Formal and informal policies and practices to encourage social connectivity were only minimally effective. The role of support staff changed and gained importance as they became the informal social directors of the organization. A study by another independent contractor suggested

that performance, in terms of customer response, improved overtime. Employees also reported using their time more effectively, including increased time spent at customer sites, which was one of the goals of flexible work program. The findings of Becker and Tennessen underscore the importance and value employees place on formal and informal social connectivity to the work group. However, the data from this study also suggest that performance in certain areas can improve.

Sun Microsystem's Open Work Practice Program · The second example, Sun Microsystem's Open Work Practice program, has been one of the most cited examples of arrangements for flexible work (for example, Bell & Joroff, 2001; Joroff et al., 2003; Richert & Rush, 2006). The program began with the rollout of the "flexible office" in the mid–1990s for the field sales and services employees to allow them to spend more time with customers. A survey of 13 000 Sun workers revealed that, on any given day, more than a third of all employees did not enter their assigned buildings. Moreover, those working at their regular worksites did not use many of the offices' available services (Richert & Rush, 2006). "Flexible office" was grounded in a free address model that allowed employees to use office space on a shared or just-in-time basis. The program consisted of three workplace features: first, physical facilities offering a number of work settings for individual and collaborative work; second, work practices including training on "managing for results", team building, rigorous goal setting, formalised knowledge sharing, work integration and a shift in the manager's role from task master to coach, and, third, technology enablers (Bell & Joroff, 2001, 133).

Later, the program called "network of places (NOP)" was added to the "flexible office". The NOP program restructured Sun's workplace portfolio into three categories: "Hubs", i.e. strategic locations such as headquarter sites and call centres, "Satellites", i.e. telework centres that are strategically located around the periphery of Sun's major office cities, and "work from home", i.e. formal policies and procedures for partial work at home. Now the company has 127 flexible offices worldwide in approximately 50 countries (Richert & Rush, 2006). The aims of this strategy include reducing operating costs, attracting and retaining a globally and locally dispersed workforce, supporting mobile work, entering emerging markets, interacting more closely with global customers, and assuring business continuity (Bell & Joroff, 2001, 134; Richert & Rush, 2006, 25).

Today, 46 per cent of Sun employees take part in the Open Work Practice, the target being 65 per cent. According to a survey, roughly 72 per cent of those participating are happy with the arrangement (Richert

& Rush, 2006, 25). The program is not for everybody, and, based on an online assessment, the suitability of a person is evaluated before participation. Then those who want to participate can register for one of three categories: flexible (43%), home-assigned (4%) or Sun-assigned (53%). The mobile employees work mainly with customers who are the most flexible.

On the subject of savings: during the past five years, the company has saved about $319 million (USD) in overhead costs by consolidating its real estate holdings. In addition, office space and related technology for each Sun-assigned employee costs $10,000 (USD), but only $6,500 (USD) for a flexible employee and about $3,000 (USD) for a home assigned worker (Richert & Rush 2006). This has induced savings too.

3. Implications for Workplace Management

3.1 Conclusions

- The distribution of work, in one form or another, is one overarching characteristic of all aspects of knowledge work. Mobility is an additional, dynamic feature to a distributed organization. As location is becoming more irrelevant, the quality of the place where work is done is becoming critical.
- Studies show that the prevalence of new types of work has increased all over the world. For example, in Europe telework, including home-based telework (at least one day/week), supplementary home-based work, mobile eWork, and freelance telework in SOHOs increased from six per cent in 1999 to 13 per cent in 2002.
- Work is becoming "multi-locational": mobile and wireless technologies have liberated work from being bound to any particular space and time. In addition to main office, employees work from home, at client's or customer's place of business, in cars, trains and aeroplanes, at a park or outdoor location, in summer houses on vacation and in hotels and cafes.
- Multi-locational employees are increasingly collaborating from afar with each other. This creates distributed and virtual organizations. It has been calculated that around half of the workforce is collaborating from afar with their work mates, i.e. are doing distributed virtual work.
- To develop workplaces of an increasingly virtual and mobile workforce and to facilitate its work, it is necessary to know in more detail how they work and what their job requirements are.
- The methodological starting point to analyse and describe the individual and shared working contexts is to see them as imbedded layers. Each individual exists in a psychological field of forces: a highly subjective psychological "life space" is imbedded in the objective elements of physical and social fields. Shared contexts can be analysed as "ba", i.e. as the physical space, such as an office, the virtual space, such as e-mail, and the mental or social space, such as common experiences, ideas, values, and ideals shared by people with common goals as a working context.

- Physical spaces or physical environments that employees use for working are divided into five categories: (1) home, (2) the main workplace ("Office"), (3) moving places, such as cars, trains, planes, and ships, (4) a customer's and partner's premises or own company's other premises ("other workplaces"), and (5) hotels and cafés etc. ("third workplaces").
- Homes are places in which to do work that needs concentration without interruptions. From a company's point of view, working at home reduces the need for office space and associated costs. On the other hand, control is lost over work performance, and building up a home-office costs as well. From an employee's viewpoint, working at home can result in increased feelings of autonomy and freedom. The challenge is the balance between work and family life.
- Open-area offices save companies money. On the other hand, not all work can be done in an open office. The dilemma of open offices is whether they should be a social setting or a place to concentrate full time on task execution. Many studies show that work in offices is frequently interrupted, which may seriously reduce work productivity. On the other hand, offices are places of meetings and dialogues, which are necessary for creating something new and for decision-making.
- Little is known about moving workplaces. Once again, a company can save its premises costs.
- "Other workplaces" like satellite and telework offices are from the companies' viewpoint beneficial in that they usually lower costs per square meter, because of their location off the business centres. Working in them may also promote environmental protection by reducing commuting. They may also increase the availability of skilled personnel. On the individual level, drivers included better quality of life when working near home, though working far from main office may disconnect an employee from his or her work community.
- The third workplaces include hotels, cafes and conference venues, as well as the public areas and lounges of airports. Their benefits from a company's point of view once more concentrate on cost savings. In permanent use, the public image of the company may suffer. From the viewpoint a "third place", the possibility of working may attract new customers, as happens in cafes. On the other hand, investing in needed technologies is not without its costs. From an individual viewpoint, feelings of freedom and control over time and schedule may increase, but, on the other hand, it may reduce the ability to separate work from personal life.

- The working day of knowledge workers is blurred as there is no specific time or place when work starts or ends. People work both in solitude, virtually asynchronously and synchronously online and in face-to-face collaboration with others. The results of this study suggest that it is rather difficult to separate working in solitude from collaborative work. Working in solitude takes place in "pseudo-privacy" (Becker & Sims, 2000, 15), i.e. it is interrupted by numerous e-mails, chat sessions, SMSs and calls. Thus the nature of work seems to have become all the more blurred at several levels.
- Work in an open office is often interrupted, which causes irritations and losses of productivity when an employee wants to concentrate on work. While the collaboration technologies are developing more versatility and while the level of tool and device integration grows, harmful interruptions may effectively reach the other workplaces where knowledge workers have, until now, sought privacy to concentrate on some of their tasks.
- The job content of knowledge workers is demanding both cognitively and socially. Around 50 per cent of the work includes thinking and creativity demands. Around 40 per cent of total work time is used in solitude doing tasks requiring concentration. The social network of employees is wide, consisting of tens of people. The case study II showed that, during seven days, each person received and sent 24 SMSs, had 26 small and large face-to-face meetings, worked in solitude 35 times, received and dialled 29 calls, and received, sent and trashed 248 e-mails on average. E-mails were considered to work best in exchanging information and opinions and worst in creating ideas, problem solving and getting to know each other. Face-to-face meetings are mainly used for creative tasks; however, communication chains in virtual space are used as well for creating something new.
- In large meetings, employees often turn to the mode of working "in solitude". They start to concentrate on their own tasks and work asynchronously: reading and sending e-mails and SMS, chatting, reading documents, and writing them. They are, in a way, working as if they were in solitude.
- Knowledge workers are multi-locational and mobile at several levels. In the case study I, interviewees travelled once in a while, to, for example, Boston, Dallas and Singapore. However, travelling took place mostly in Finland's main cities and especially around local company premises in the metropolitan area. There was also micromobility in the main office's meetings rooms and corridors. In addition, airports, shops and even a doctor's waiting room were mentioned as

working places. The study revealed that half of the time was used in meeting rooms.

- There are many now long-lasting and still enlarging good examples of company policies and practices to successfully support mobile virtual work and collaboration. It seems to be possible to combine a company's economic benefit with work-life balance and satisfaction of employees. This requires flexibility strategies and well-defined policies from the company side.

3.2 Managing Uncertainty and Change

Policies of Mobile Virtual Offices · The main challenge of workplace designers and management is to support those employees in their organisations who work in multiple locations during their working days and weeks and collaborate therefrom. This support requires acknowledging the status of the workforce and forming the policy that integrates premises with electrical communication and collaboration environments and human resources management practices. Based on the above review of the use of the five types of physical spaces, it can be concluded that not only individual employees are multi-locational and but also members of teams and organisations collaborate synchronously from different places and use virtual team spaces as joint environments. This integration of the physical spaces with virtual spaces creates a hybrid working environment, which is called a "virtual office", when group members work distributed but stationary in different places. When all or part of the employees are physically mobile and collaborate by using mobile technologies, the office is called a "Mobile Virtual Office".

Working in multiple places is not harmless either at the individual level or at the team level. All kinds of disruptions lurk round the corner. As Felstead et al. (2005) point out, interruptions to planned sequences of space and time always take place. Even the best-laid plans go astray – cars get stuck in traffic, trains and aeroplanes are delayed, unexpected visitors pop up, and so on. Workspaces in multiple locations generate different sources of ambiguity and uncertainty. According to Felstead et al., in the shared, open-area office, uncertainty arises from the disappearance of personal space and of space capable of being personalised. The uncertainties of working at home arise from the mixture of working spaces and times with the private family life and leisure time combined with geographical remoteness from direction and support of co-workers and superiors. While moving, the uncertainty comes from trying to work

in the midst of locations that are public and more devoted to having fun than to work.

Can Physical Proximity be Replaced? · The main prerequisite for collaboration in virtual and mobile virtual offices is the quality of communication. It simply is the necessity without which it is impossible to co-work. In this, communication and collaboration technologies or virtual spaces play a crucial role. In traditional collocated groups and teams, face-to-face interaction and communication are critical for building cohesion and trust between team members. When working in distributed groups and teams, virtual spaces should help to do the same and to provide versatile media to guarantee rich communication.

It has been found consistently that the likelihood of communication and collaboration between team members decreases as their geographical distance increases. It cannot be without influence on socializing new members and learning possibilities from others. In the now classical study, Allen (1977) measured the frequency of communication of 512 individuals in seven organizations over six months. Beyond about 30 meters, the communication curve was so flat that further separation became immaterial. For example, about 25 per cent of engineers whose offices were next door to each other talked to each other about technical topics at least once a week. If their offices were 10 meters apart, this figure dropped below ten per cent. Working at a distance of 30 meters did not differ from working 3000 kilometres apart as far as the communication frequency was concerned!

Kraut, Egido and Galegher (1990) showed a similar phenomenon among psychologists collaborating in research and writing articles. They asked respondents to indicate the distance between their own offices and those of the primary co-author for each of their collaborative articles and to estimate the frequency of their communication (1 = communication multiple times per day – 7 = communication less than once a month). Physical proximity (1= office next door – 7 = in different states in USA) was strongly related to frequency of communication during both the planning stage and the writing stage of the research process. The percentages of research collaboration were: 10.3 per cent on the same corridor, 1.9 per cent on the same floor, 0.3 per cent on the different floors, and 0.4 per cent in the different buildings.

Both studies were made before the internet revolution. Therefore, we can question the impact of physical distance on the communication frequency. This does not remove the influence of physical proximity, but may diminish its influence. Often face-to-face meetings are preferred

when the task is complex and requires creativity. The need for proximity can be taken into account when people are working in the same building or campus by providing places where formal and informal communication is possible. Communication is possible in an open office, but its problem is the disturbing effect it has on others wanting to concentrate and work in privacy.

Originally Lengel (1983, see also Daft and Lengel, 1984) argued that communication media used in organizations determine the richness of information processed. It was proposed that communication media fitted on a 5-step continuum including face-to-face discussion, phone calls, letters, written documents and numeric documents. The proposed explanation was that the media differ in (1) feedback capability, (2) communication channels utilized, (3) source and (4) language. Face-to-face discussion was said to be richest because it provides immediate feedback with which understanding can be checked and interpretations corrected. This also allows the simultaneous observation of multiple cues, such as body language, facial expression and tone of voice. Information exchanged face-to-face is also of a personal nature and utilises natural language, which is high in variety. According to the model, the most effective communication is found by combining different media to meet the demands of the tasks and information quality. For example, performing a complex task, e.g. negotiating, through a simple medium such as e-mail is *ineffective*, while performing a simple task, e.g. sending simple data through a rich medium such as videoconferencing is *inefficient*.

There is, however, a danger that the model simplifies the possibilities different media have of transmitting complicated messages, as well as the capacity of individuals and teams to adapt and overcome the limits of media. The media richness model has been criticised by saying that the fit between task and medium is not a one-to-one relation but falls within quite a wide band of good fit. If the situation falls within this band, performance of the task with the indicated media is perhaps not easy, but can be achieved by increasing mental effort and adaptation processes (Andriessen, 2003, 79–80). For example, by developing netiquette, increasing competencies of people via training and education, recruiting new competent people, rotating tasks between employees, restructuring tasks, and by changing the working environment performance can be made more fluent.

Managing Uncertainties · The view of work as a goal-oriented activity system in its environments opens up the perspective of multiple requirements for workplace design and development. Since the elements of the

work system and its environments are dynamically interrelated, "uncertainty" instead of "stability" is the outcome and, at the same time, the main requirement of workplace management. Becker and Sims (2000, 7) name the main sources of uncertainty to be, in addition to technology, the nature of the workforce, i.e. number of employees needed and location of qualified staff, market conditions, i.e. timing of business opportunities and competitor behaviour, and business models and practices, i.e. mergers/acquisitions and re-structuring. They also emphasize the need for workplace developers to see the workplace as an ecological system, which fits very well with the activity-system approach in this chapter. It means that it is not possible to understand what makes a workplace intervention successful without considering the nature of the organizational culture, the times and places where work is carried out, the technology that carries the information of an organization, and the work processes that constitute the reason for the organization's existence.

At the beginning of this chapter, the main drivers of working life change and uncertainty were identified as technologies such as wireless and mobile technologies, complex knowledge-based products and services, the need to be near customers, and mobile distributed types of work (Andriessen & Vartiainen, 2006). This chapter has mainly concentrated on analysing the changes that have occurred and will gain more pertinence in the near future in the work itself. The change from "one place office", be it home or any other permanent place, to "multiple-place office", which could be called mobile virtual office for multi-locational collaborative work, is a long jump. It may increase employees' self-regulation and control, productivity and happiness, time used with clients due to reduced commute time, and reduce space and occupancy costs. At the same time, it may decrease professional and social interaction between employees and between employees and management, reducing employees' rights and connections to the organisation, and dim the balance of work and life. In addition to the multiple work settings inside and outside the office, Becker and Sims (2000, 11) describe challenges at the corporate level to be the difficulty in predicting precisely where and when an organization or an individual will need space to work and the short and unpredictable time horizon between the realised need of space and when it is needed to be occupied. Indeed, our dWork project shows that management does not exactly know the needs and work contents of their employees.

The uncertainty and the need of continuous change have implications to workplace management strategies. As Ashby's law of requisite variety says (Ashby, 1958), the greater the variety in an environment of a system,

the greater the variety that should be within the system to adapt properly to its environment. Becker, Quinn and Tennessen (1995) referred to a new strategy they called the Integrated Workplace Strategy, which combines management practices, physical settings, and technology to support a desired way of working. In this model, all components must work together to create an effective workplace. Later on, Becker and Sims (2000, 11) characterised the Integrated Portfolio Strategy as driven especially by flexibility, i.e. the ability to manage the workplace portfolio with speed and grace in the face of organizational uncertainty, in addition to traditional cost-reduction. The strategy should provide the right type and amount of space, when and where it is needed, for only as long as it is needed. The focus is not on how to reduce the amount of space needed. "Zero-time space" is space that can be procured and/or constructed and ready for use in as short a period of time as possible when space is needed. According to Becker and Sims (2000, 21), "zero-time space can be achieved: "(1) operationally, by new policies for allocating and using space; (2) physically, by new approaches to construction; and (3) organizationally, by new approaches to procurement and by exploiting information technology". Examples of policy approaches have been non-territorial offices where nobody has an own assigned workstation and "shelling". This is the policy of deliberately building space that will not initially be occupied. Mobile, modular and tensile structures are examples of "zero-time space" construction approaches. They have the common value of being transportable, relocatable, and reusable. Information technology approaches are closely linked to other "zero-time space" approaches, although it is hard to imagine that work and collaboration in multiple physical places would be possible without the support of information and communication technologies.

The change in workplace strategy and alternative officing has had great effects on the organization, human resources functions and on the required technologies. Multi-locational virtual work challenges the social functions of a traditional organization like socialising, commitment, knowledge sharing and organizational learning. The challenge is to develop a model for which alternative work options are the norm. This requires a fundamental change in thinking.

The traditional hierarchical organization based on direct control by superiors and workmates is dissolving and being replaced by flexible networked, often temporary, work connections, i.e. grouplike work. "Grouplike" means flexibly organised tasks and employees participating simultaneously in several professional and informal groups, organizations, and communities.

The contents of recruiting and training employees have to be reconsidered. Not everyone is suited to working in a mobile virtual manner, perhaps for work-family-leisure-balance reasons, for example. The integration of newcomers to a mobile work environment is a challenge because they traditionally learn "tacitly" by observing, experimenting and acquiring information from supervisors and co-workers.

Information and communication technologies are the enablers of the multi-locational work. From the technological viewpoint, the multi-locational mobile office implies employees equipped with laptop computers and smart phones with wireless access to an information network working at home and client offices, on the move and in hotels. When they sometimes come to the office to meet their colleagues and superiors, they log onto the intranet, where they can find the data bases that may not have been accessed from a distance because of security reasons. Electronic communication and collaboration can, to some degree, replace social contact, but not fully.

In all, it is the question of developing and using such a workplace strategy that aligns places, people and technologies and is able to manage change.

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How Work Takes Place

Notes on Distributed Work Environments

Anni Vartola

A properly designed office can improve productivity and job satisfaction (Szilagyi, Holland, & Oliver, 1979).

1. What Composes the Contemporary Office?

One of the most salient features of both public discussion and management research literature during the last few years has been the increasing concern for the quality of the everyday work environment. The discussion has mostly criticized today's overly hectic and stressful working life, but office architecture, and especially the open office solution so typical of our time, has not been omitted from critical reassessment either (see e.g. Brill, Keable & Fabiniak, 2000; Brennan, Chugh, & Cline, 2002; Maher, 2005 and Figure 1). At a time when the knowledge-based economy[1] is in ascendancy, when privacy has been replaced with productivity, hierarchy with teamwork, and status with mobility (Hamilton, Baker, & Vlasic, 1996), it is clear that office design is in serious need of re-examination.

This chapter discusses the dWork research project results relating to the use of office space and the requirements set for office premises when contemporary ways of working are at issue. The focus is on an individual worker who works as a member of distributed[2] collaboration networks in

1 European Union Lisbon Strategy 2010; eEurope 2005 Action Plan; http://europa.eu.int/information_society/eeurope/

2 Being a member of a distributed collaboration network means to work in work groups whose members or affiliates work for different organizations and in different, and often also changing, physical locations, and whose knowledge sharing involves the use of ICT tools. Besides the dispersed organizational setting and the nomadic and ICT-driven work styles, the concept of distributed work often also entails that the work groups are temporary, project-based, and involve short-term contacts with experts relevant to the project at hand.

Figure 1. SanomaWSOY's headquarters Sanomatalo (Sanomahouse), Helsinki; SARC Architects Ltd 1999. Sanomahouse has recently been described as the epitome of contemporary office architecture, but in which the actual office floor solutions have turned out to be partly quite unsuitable for the users. The beautiful, fully open office floors, which are of a high architectural standard and designed to fulfil the spatial requirements of a journalist community in an ideal way, clash with some of the needs of editorial work, especially when it comes to acoustics. In order to better fulfil the need for concentration, privacy, and the storage and handling of confidential documents, the office floors are now being modified by, for example, adding softer carpets, more acoustic ceiling panels, higher partition walls etc. However, these modifications are problematic, as increasing the height of the partition walls, for example, will block the original crux of the solution: the panoramic view across the Helsinki skyline. Likewise, the use of soft carpets is expected to bring about problems with dust and allergies. (Väänänen, 2005)

the field of knowledge-intensive work[3] and who is expected to be mobile, at least to the extent that successful performance entails regular face-to-face interaction with other people. The basic idea has been to explore physical spaces to see whether they support or hinder effective working

3 Knowledge-intensive work is defined as work that requires receiving, managing, or producing information in order to increase the amount or value of tradable or upgradeable knowledge. Typically, knowledge-intensive organizations employ highly qualified personnel with specialized expertise in some core competence area and who are relatively dependant on good social skills and networking abilities. In addition, knowledge-intensive work is usually performed by using information and communication technology (ICT). (Blackler, 1995; Toivonen, 2001; Webster, 2002; Kasvio, Inkinen, & Liikala, 2005)

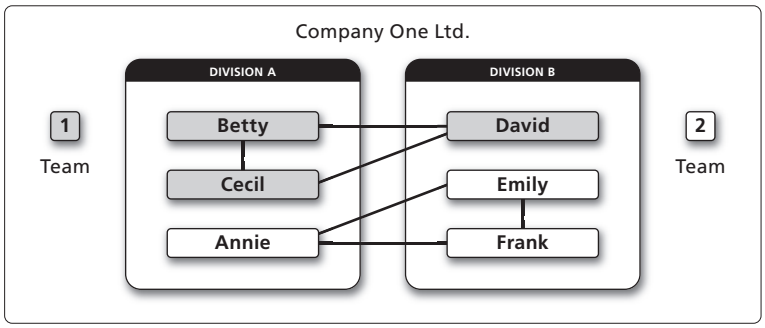

Figure 2. "Traditional" work setting. One top organization that is located in one physical location (for example, in a corporate headquarters) and whose employees are governed by the same corporate policies. Division-based office architecture was the standard approach during the first half of the 20th century: different divisions, e.g. marketing, accounting, customer services etc., were placed in different sections of the building: the top floors were usually reserved for management, and the lower floors for clerical workers. In the 1960's, and following the ideas of American economist Douglas McGregor (1960), a new invention in office design was the development of Bürolandschaft, a cross-divisional open office space "landscaped" into smaller units by means of lightweight furniture and low partition walls. Developed by German business consultancy Eberhard und Wolfgang Schnelle GmbH in 1958 (since 1965, better known as the Quickborner Team), the idea was to change the traditional organizational structure into a more flat, transparent and flexible idea of the organization. The crux was in the internal communication flow: people would be placed in the office space according to the traced communication map, and managers were to be seated close to their subordinates. Special attention was to be given to acoustic conditions, and to enhancing company spirit and wellbeing: the floors were fully carpeted; the use of electronic muzak systems created an ambient noise background; coffee corners and lounge areas were regarded essential for informal communication; and the large open office spaces were enlivened by using colours and green potted plants. In the US, the commercial equivalent to the Bürolandschaft was the furniture system called the Action Office developed by Robert Propst together with architect George Nelson (manufacturer Herman Miller Inc; first commercial installation in 1969). (Duffy, Cave, & Worthington, 1976; Duffy, 1979; Hascher, Jeska, & Klauck, 2002; Schlosser, 2006)

(Harrison, 2004, p. 121; Figure 1) and to what extent the requirements for the work environment within a traditional work setting (Figure 2) differs from those within a distributed work setting (Figure 3). The focus is on subjectively perceived productivity at work.

The decision to define the individual employee as the reference point is not intended to undermine the social dimension of contemporary knowledge work, but, on the contrary, to enhance the fundamental role

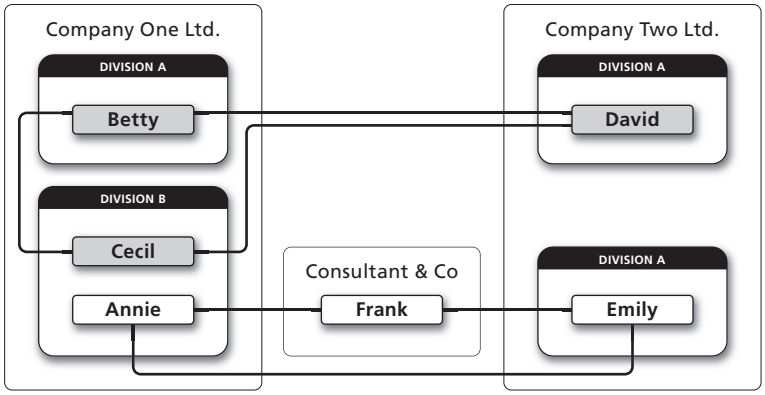

Figure 3. Distributed work setting. Members or affiliates work for different organizations that are situated in different physical locations. Their work conditions are also regulated by different policies, i.e. each organization has its own premises policy, IT policy, HR policy etc. The relationships change in time and depending on the work and task at hand (according to, for instance, the special experts required and the demands of the current project).

of communication and knowledge sharing in successful and effective work performance in today's work culture. When distributed knowledge-intensive work is at issue, it is of prime importance to acknowledge that the organizational context – the membership in several co-existent teams or work groups – is crucial: today, no work can be successfully carried out without the support of, and communication with, others. Within the scope of distributed knowledge work, however, this setting – with whom one is currently working and where – is never stable, but constantly changing.

The objective of this chapter is to provide a practical, fresh framework for viewing the theme of distributed work, and to provide some new approaches to office design thinking in order to respond better to the specific needs of distributed, mobile knowledge work. The research questions discussed are: *How does an individual employee use, perceive and experience his/her work environment? What needs does s/he have to perform his/her work-related activities as efficiently and as effectively as possible? What kind of a spatial relationship do distributed communities have? In what way could intelligent architecture and the reorientation of office thinking respond to the apparent needs of distributed knowledge work?*

The findings discussed here are based on a study of relevant architectural literature and on empirical research with four case teams (cases A,

B, C, and D; see Appendix A for case descriptions and methods). Cases A and C were observed in winter 2004–2005, and cases B and D were studied in more detail in winter 2005–2006. Section 2 deals with the issues that came forward in the context interviews and background interviews, especially those with the premises management. Then, section 3 shows the case-specific findings: sections 3.2–3.6 introduce five case examples, section 3.7 the results of the questionnaire, and section 3.8 draws up a summary. Section 4 gives an interpretation of the results together with some recommendations and points for further consideration.

2. The Office = an Envelope for The Team

In the context interviews and background interviews with the premises management and office design service providers within the explored companies, the idea of the work conducted at the offices was mostly described in terms of the business area of the client organization and its employees' organizational position. For example, certain business areas were believed to be more conservative and old-fashioned and not to have any particular needs outside normal office work. Likewise, clerical personnel working in support functions in public service organizations were believed to have only a few, or at least quite stable, professional contacts and to spend most of their time at their desks. Salespersons, IT experts and others with apparently more sophisticated or challenging work profiles were assumed to be more mobile, to demand regular interaction with teammates and external contacts, such as clients, service providers etc., and to have specific or more sophisticated spatial or IT requirements, such as the use of conference rooms, video conferencing, calendar sharing etc.

When the relationship between productivity and office design was discussed, issues such as fluent communication, flat hierarchy, and transparency of transactions were said to be crucial. The role of office design as a tool of strategic management (Duffy, Francis, & Tanis, 1993; Allen, 2001) was widely acknowledged, and office designs were explicitly assessed in terms of whether or not they improved communication and interaction. Office layouts, the visual appearance of office premises, as well as any symbolic meaning an office might carry, were heeded as relevant to the organization's behaviour; there was a recognizable willingness to exemplify how sophisticatedly the explored companies did, in fact, enhance determined workplace thinking. Workplace design was taken seriously and any office design project was said to always commence with a business case analysis. The linking of spatial solutions with particular meanings was surprisingly straightforward: at least a partly open office

solution was regarded as more suitable for a modern enterprise than a fully cellular office, because open office solutions were considered to be more flexible, more economic, less hierarchic and more supportive of interorganizational communication.[4] Office design was regarded as a task of premises management and specialized designers; HR and IT provided support services if needed.

Interestingly, design programming was highly formal, rather conservative, and quite top-down oriented. Firstly, an organization was believed to exist as a distinguishable entity that could be studied separately from its components, i.e. from the individual staff members. The focus was in the organization, its needs and objectives; it was generally believed that, in this way, the needs and objectives of the employees would also be fulfilled. Direct staff feedback, participatory design etc. was thought to service evaluation needs; as such, they were considered unnecessary, to disturb the flow of a design process, or at least make it more difficult:

> Asking for the viewpoints of all the personnel would be absolutely impossible; we would never have the time or the manpower to do that. Besides, you know what the outcome would be, don't you? No open office, no cubicles, but spacious private office rooms. That's what they always say. We need to look beyond the immediate concerns and change the resistance of individual employees and build on broader managerial targets and more general business objectives.

In all the studied cases, the most fundamental unit in workplace design appeared to be The Team, i.e. an unambiguously formed group of colleagues assumed to be working for the same organization, assumed to be contributing to same business processes, or assumingly having close and regular collaboration with one another. An optimal office space would have been one that increases the interaction and communication of such a group of people (Figure 4), and the office design should have been flexible so that any changes in the teams and projects could be easily housed. This idea was challenged in only one interview (case D) where the costs and disturbance caused by such changes (renovation, redeco-

4 It is interesting that in management research literature, this kind of symbolic meaning is attached to office solutions. For example, Brennan (2002) uses the term "traditional" to refer to private offices, i.e. a cell office type solution, and open office is regarded as a modern solution. No evidence for such a one-sided reading can be found from the history of office or administrative building, however. Both open and cellular office types were widely used already in the 16th century administrative buildings; it is regrettable that only such a limited interpretation of the history of workplace design is currently available in the discourse.

ration) were heeded in relation to the possible benefits of flexibility. The quote below exemplifies the attitude:

> Well, my starting point is that I gather information about the organization: how many people there are, their division into teams, who needs to sit besides whom, how the functions should be positioned, and how many office rooms and how much open space is needed. This information comes from the managers: the organizations know best what their needs are. After this, I start planning the floor…

Secondly, the contact with the target organization (in cases A and B, the project target, i.e. the tenant organization; in cases C and D, the business units facing a move) was highly representational. The information about the target organization was primarily gathered by interviewing the target organizations' managers; official data such as those derived from management interviews about organizational structures, team divisions, job titles etc. were unquestionably regarded as more reliable and relevant than the viewpoints and opinions of the personnel. Only in cases A and B could the company use third-party consultants[5] to gather this kind of information on the client organizations when such a specific workplace consultancy procedure was regarded as reasonable in business terms. The organization-centred approach was directly converted into both a neutral and a feasible design programme that was believed to exemplify the practical requirements and objectives of the design task in hand. The organization-centred approach becomes clear from the following section of one of the interviews:

> The starting point is always the situation at the tenant organization, but, of course, in respect of the financial constraints and long-term premises policies we have. We gain information mostly by interviewing the managers: what business objectives they have, what prospective changes their organization is likely to face in the future, what their personnel policy is, the problems, if any, they have with internal communication, public image etc. Then, later on, if the case requires, there will be more specific research done by the consultants, but, in general, the starting point is the strategic goals of the organizations.

5 Due to confidentiality reasons, the methods and results of third-party research was not available for this study.

The design concepts constituted in this way were not intentionally challenged during the process of design, and the design proposals were presented to the employees for feedback only as some kind of formal procedure for good HR policy.[6] User feedback was usually gathered afterwards by using post-occupancy evaluation or other company-specific methods; there was considerable belief in adhering to one knowledge base and one ideal way of doing things; and during the design process, there were only few checkpoints or possibilities for readjustments so that user feedback could mostly deal with practical details only. In the context and background interviews, the idea of an office was restricted to three office types: the cell office, i.e. a solution where each employee has his/her own private workroom; the open office, i.e. a large open space divided by specific systems furniture and screening partition walls into single or multi-occupancy cubicles; and the combi-office, i.e. a mixture of cell and open office areas.

Likewise, authentic work processes or space usage were not intentionally explored to supplement the descriptive data gathered from the user organizations' managers. The emphasis seemed always to be in the structure of the organization and the employees' job descriptions. As already mentioned, an exception to this policy was found only in cases A and B, where the company used third-party consultants to analyze their client organizations. This can be interpreted to indicate, for instance, that the level of distribution, the amount of mobility, the actual networks versus the assumed networks, and the actual spatial needs and patterns of usage versus the assumed spatial conventions amongst the users of the space were never fully exposed or discussed.

Conclusively, it can be argued that, in design programming and premises policy, the office was regarded as a physical envelope for a conceptually constructed entity such as the organization or the team. The organizational or corporate culture – defined as the attitudes, views, and daily behaviours of a company or a department (Zimring & Peatross, 1997) – was the major point of reference in assessing the validity of an office solution, while the target was to achieve as optimized a spatial solution as possible in terms of the organization's business profile, economic restraints, and managerial challenges. In this sense, it appears

6 An exception to this could, again, be seen in cases A and B, where the third-party consultants used by the company were said to use participatory methods with the company's clients. This approach did not come forward, however, in the premises policy of the company itself. In neither case A nor B did the employer appear to practice participatory methods with its own employees, but, rather, to use office design as an expert-driven method to improve organizational performance.

that the lessons of the role of design in workplace management discussed since the 1970's (e.g. Duffy et al., 1976; Szilagyi et al., 1979; Graf Klein, 1982; Hascher et al., 2002), the requirements of new work for management discussed since the 1980's (e.g. Duffy, Francis, & Tanis, 1993), and the role of knowledge in the changing workplace discussed since the early 1990's (e.g. Cassels, 1990; Brill, 1991; Becker, 1992; Freiman, 1994; Henderson, 1998; Lappalainen, 1998; Myerson, 1999; Allen, 2001) had been learned very well.

On the other hand, however, it can be argued that such a strong emphasis on the organizational approach to workplace making missed the possible existence of organizational subcultures or mini-organizations, the informal and semi-formal communities of practice beyond the organizational level (Ruuska & Vartiainen, 2005), the differences of behaviour between task-oriented and categorical work cultures (Zimring & Peatross, 1997, p. 199–200), and the ways in which the formal company policies were, in fact, actualized in the daily routines and behaviour of the employees. In short, the question of how and with whom the work was really done, how the organization was managed, and what elements within the physical space contributed to or disturbed the desired outcome, was not necessarily tackled in the company's workplace thinking. The mismatch between descriptive and actual work settings came especially clear when the social networks of the informants were explored (Figure 4). The team conceptions were asymmetrical, and explaining the team composition demanded a great deal of accompanying information as to, for instance, who was an essential teammate and who was only a formal figure in the picture.

Then, the end users were regarded only as scenic features within an object-world of design (Sharrock & Anderson, 1994), and not as real agents of the design process crucial to its success. The relationship between work and its physical setting was simple: people were presumed to do *"normal office work"* and to require *"normal office facilities"*, while the workplace was regarded as the fixed location used during working hours for normal office work guided by central corporate structures. The crux of the design process was not to optimize individual work processes, but to find the best possible office typology chosen from the three recognized types: the cell office, the combi-office, and the open office. What was central, was to calculate the optimal division of workstations between open office cubicles and private office rooms, and to find the most favourable aesthetic image, and the optimal seating arrangement, i.e. the positioning of workstations and the staff members, within the available space.

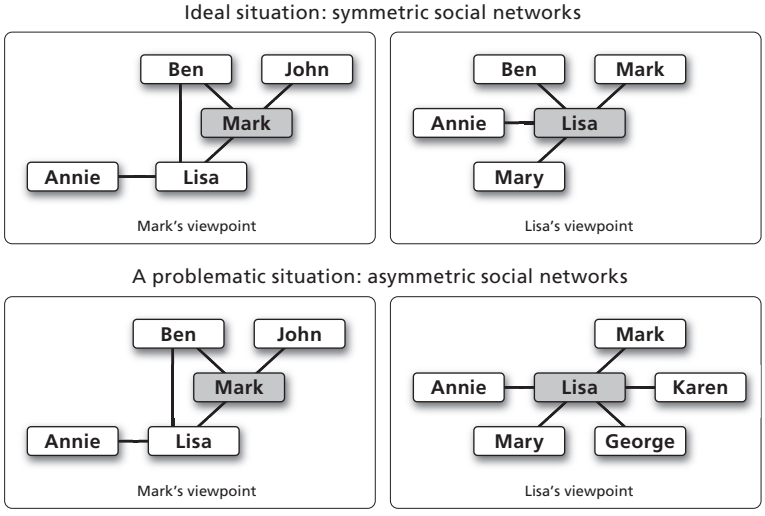

Figure 4. Results from the social network drawings. In an ideal situation, and as presumed in the context and background interviews with the premises management, the team has a consistent constellation, and all the team members see the agents and their mutual relationships in the same way. The social network drawings (see Appendix A for details) revealed considerable asymmetry: the team members did not have a shared view of the team members or their mutual interdependence. This results in a problematic situation when a team-based office layout is to be designed: who composes the team and for how long are they expected to work together?

Finally, all the investigated office premises were aesthetically very neutral, with no apparent signals about workplace ideologies advocated in the interviews or the values and business ideas of the occupants. This was quite surprising, bearing in mind the fact that the business areas of all explored companies were more or less directly concerned with consumer goods or services, or with public interest. In this sense, one of the most discussed aspects of contemporary office design, i.e. the ability of space to be generative (Kornberger & Clegg, 2004)[7] and narrative (Narrative office as brand experience in Myerson, 1999, see also Groat & Stern, 2002) and to convey the company's profile in public and to support branding appeared to be disregarded (Figures 5 and 6).

7 The concept of a generative building refers to a building that, instead of being a merely passive container for actions happening inside it, contributes positively towards an organization's capacities.

Figure 5. Example of new urban office development. The *Sony Center am Potsdamer Platz* in Berlin (Murphy/Jahn Architects 2000) provides an interesting example of brand-conscious office design combined with public interests, marketing, and urban development. The huge 135.000 m^2 complex houses the European headquarters of Sony Corporation, rentable office space, condominiums and rentable apartments, several restaurants, a German film and television museum and institution facilities (das Filmhaus), shops, an IMAX movie theatre, subway and local train stations, and an urban meeting point at the covered courtyard.

3. The Work Environment as a Mosaic of Places and People

The workscape[8] drawing assignments and the interviews (see Appendix A for details) revealed that the office strategy that the premises management seemed to subscribe to, caught only a partial view of the reality of work within the examined cases. Firstly, verbal or diagrammatic descriptions – either from the managers or the actual interviewees – did not easily expose the actual work processes. Likewise, organizational structures and the company's workplace policy were highly unreliable in predicting individual behaviour in terms of workspace usage. Neither

8 The concept of *worksphere* is sometimes also used in the same sense and it has a somewhat similar meaning, but it has its focus on the individual and refers to understanding the individual workspace as a kind of a halo, i.e. a private and personal space and the tools, furniture, equipment, etc. that define and enable interaction, see (Antonelli, 2001). In this report, the term "workstation" has also been used with this meaning.

Figure 6. Picture of a typical office interior. Although this picture is from the cutting-edge premises of a space planning firm, JFN Associates, Inc. at 77 Water Street, New York featured in *Progressive Architecture*, March 1971 (p. 74–75), the explored company premises within the dWork project did not differ greatly from this 1970's office interior.

the number of places nor the number of professional contacts used for work-related activities could have been conjectured on the basis of the interviewee's work title or job category. The full picture was revealed only when the interviewees were posed direct questions about their ways of working.

Secondly, the functions attributed to office types – an open office being more communicative and the cell office more traditional and private – did not correspond with the actual situation. Contrary to general assumptions about open office problems, there were no differences between cell office and open office users in the degree of their dependence on communication. Both cell office and open office users suffered from disturbances; both cell office and open office users shared information with their colleagues and valued effortless interaction. Mobility was more a rule than an exception, and the networks of places used for work were highly idiosyncratic.

3.1 Analysis of Drawings

The total number of workscape drawings was 20.[9] Officially for ten persons, the main workspace currently provided by the employer was an own workroom; four worked in a shared workroom, i.e. 2–5 co-workers in the same space, and one person worked in a cubicle in a fully open, large landscape office (Figure 7). In addition, there were five respondents who had non-territorial office facilities at their disposal, i.e. they did not have dedicated, permanent workplaces (hot desking, desk sharing).

Figure 8 illustrates the respondents' conceptions about the workplace experienced as "the home base", i.e. the central node, the heart of working life within the network of places with specific significance or pragmatic value for the respondent. Seven respondents did not want to identify one specific place, but treated two or more places as their home base. One respondent merged his/her workstation or office room, the office in general, and home together, while one merged home and the office together. Four respondents merged their individual workstations and the office in general together.

The place that was conceived as their home base within the mosaic of workplaces was usually the same as the main workspace. Surprisingly often, however, there was considerable hesitation about the centre of work life: the workstation at the office – assumed to be an individual's primary workspace – was experienced only as one of many possible places.

The average number of places coiled around the home base in the workscape drawings was 10.3 (median 8); the total number ranged from two to as many as 30 places. Within this network, the most important node was conceived to be the home. This is quite natural, and is presumably due also to the amount of time and energy spent on commuting and the counterbalancing role that the home increasingly plays in our work-centred life. The locations of team members and colleagues were said to be significant as often as the other premises the employer had (branch offices etc.).

Figure 9 illustrates the respondents' conceptions of the most important places that were linked to the home base illustrated in Figure 8 (see Appendix A for methodological details) and Figure 10 the least important place. It is worth noting here that, due to the highly personal manner in which the workscape drawings were drawn, both the accounted amounts

9 Out of these 20 drawings, five were drawn by participants of case E. As case E was outside the scope of the study discussed in this chapter, their drawings have been used only as a basic source of information and excluded from a more fundamental workscape analysis exemplified and discussed in the following chapters (3.2 – 3.7).

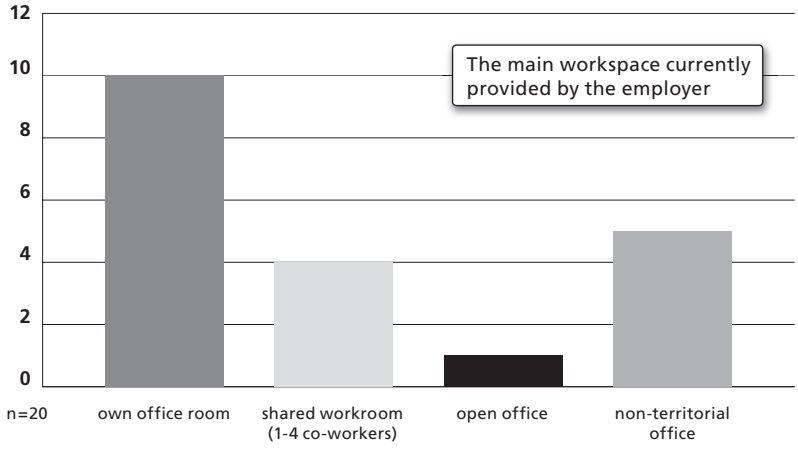

Figure 7. The respondents' main workspaces.

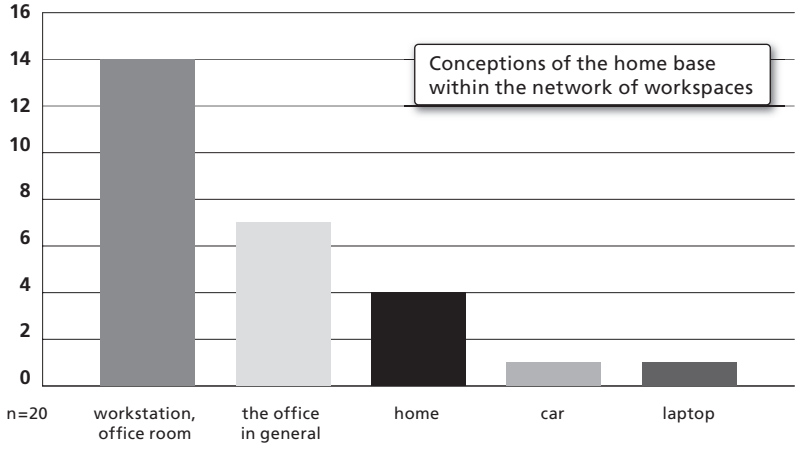

Figure 8. The respondents' interpretations of the 'home base' within the network of workplaces they mapped in the drawings.

and the interpretation of the drawings are ultimately based on the interviewer's judgment.

Finally, the place signified as the place where employees felt most productive or creative was surprisingly often the home (Figure 11). For many, the office environment was also regarded as highly supportive of productivity, however. The role of well-prepared meetings and group discussions were often mentioned as especially fruitful.

On the other hand, the interviews clearly revealed an ambiguous orientation towards the use of home for working. For many, the home was regarded as a possible, or even the most enjoyable, place for working,

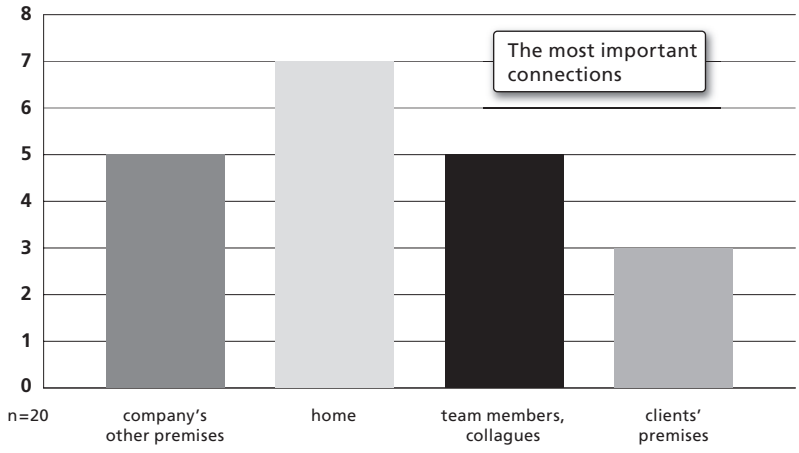

Figure 9. Links from the home base regarded as most important.

but for equally many, the home was to be kept strictly beyond the scope of professional life. This was mostly due to family reasons: the presence of small children in a small apartment often turned out to make work impossible if there was challenging teleworking to be done.

I shall next show five examples of individual workscapes that exemplify the findings in more detail.[10]

3.2 Example 1: An IT Professional

Example 1 works with IT development services (Figure 12). At the time of the interview, the interviewee was said to divide her time between projects (estimate 30 %), maintenance and detailed development (estimate 20 %), and support services (estimate 40 %). The rest is spent with other things such as reporting etc. The way time is spent varies a lot on a daily basis, weekly or even according to the season. Her work requires comprehensive knowledge of the company's IT and marketing systems, the product portfolio and processes, and some knowledge of general aspects such as national legislation etc. At the time of the interview, she had from three to four projects on her desk, of which two were quite complicated and large.

10 The examples presented here are all authentic instances of the phase 2 research results of the dWork project (see Appendix A for methodological details). The examples are chosen because they demonstrate the most common findings and cover the most typical office types, i.e. private office room, shared office room, cubicle in an open office, that the case participants were using. For the sake of confidentiality, all workscape drawings have been encrypted, and all details that might reveal the interviewee's or his/her employer's identity have been obscured or altered.

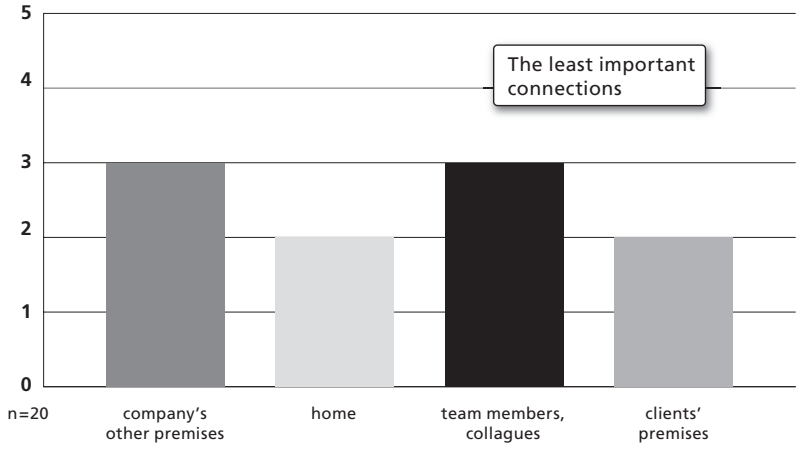

Figure 10. Links from the home base regarded as least important.

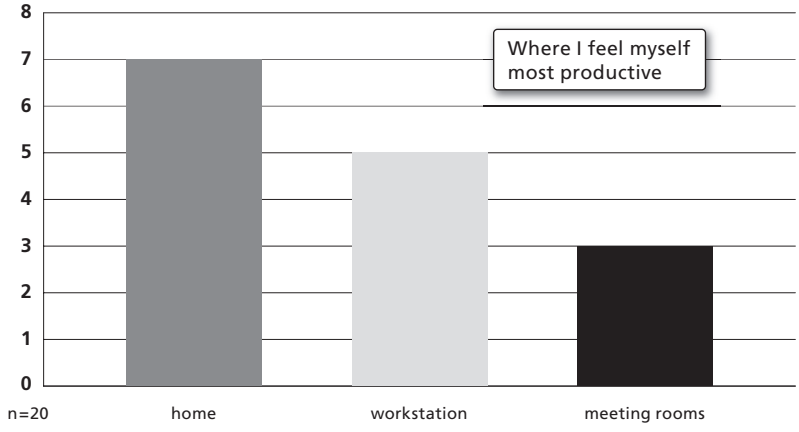

Figure 11. Places of experienced productivity.

Within the organization, her official team comprises four colleagues and two assistants. However, as each project has its own work group, the interviewee regards the number of her affiliates as very large. Nevertheless, the interviewee appreciates her substantial network of contacts and regards them as highly significant to her professional performance. The interviewee would appreciate greater control over her time, however:

> Well, I'd prefer some piece and quiet once in a while, but yet, on the other hand, it's really essential to have the opportunity for discussions with my co-workers because it is the way to gather information and to increase

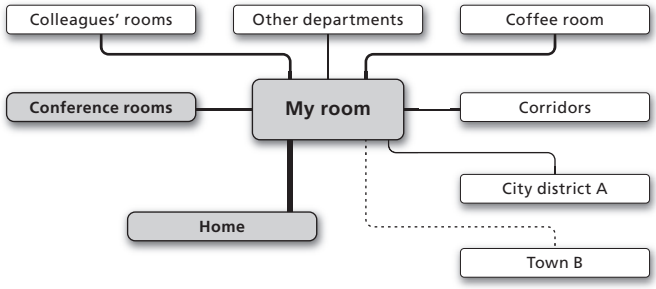

Figure 12. Workscape drawing of example 1. Main workspaces are the own office room, the conference rooms and the home; the strongest link is between the home and the office room; the weakest links are to branch offices.

> your performance. Personally, I've found the number of contacts OK, although they occasionally disturb the flow of my workday quite a bit.

The interviewee works in an own office room, but the company policy is to keep one's door open unless one deliberately wants to concentrate on something and to express the need of privacy. Despite having an own office room, the interviewee describes her workplace as generally chaotic. People walk in to ask for advice, to discuss projects, and to consult on things, so that the maximum span of work is, with luck, 30 minutes, but usually less than 20 minutes.

The interviewee coils her network of work-related places around her own office room. This is the physical centre of her professional life, but the place she describes as the most productive and most creative is home:

> …I think, well, as to where I get things really done, that is home. I try to avoid it [due to family reasons], but I've noticed that in two hours at home I can produce more than here at the office for the whole day… it is quiet there and I can concentrate, all this other fuss is gone

A third important touchstone of her work is the conference rooms:

> I think conference rooms are important to my work also. Sometimes, when I can attend a meeting fully prepared and focused, I find them really productive and rewarding. Otherwise, there are many irrelevant meetings that do nothing but waste your time.

The ideal work environment for the interviewee would have been some sort of a combination between home and office. The contacts are of para-

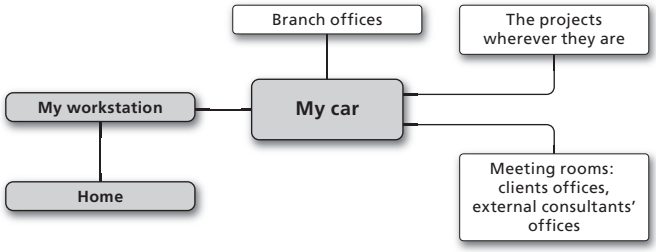

Figure 13. Workscape drawing of example 2. The car was regarded as the main workspace, and the 'real workspaces', i.e. the ones subject to premises policy and intentional office design, were only secondary to the interviewee's work performance.

mount importance, but the work environment at the 'contact centre', i.e. the interviewee's daily office environment, does not provide the required opportunity for concentration and giving fully focused attention to the task at hand. Despite the interviewee's own private office room and other facilities, which are all well designed and well equipped, her office environment does not include a space that would let her *"shut the rest off"* from her mindset.

3.3 Example 2: A Project Manager

Example 2 is a project manager who works with several simultaneous projects, each of which has its own network of affiliates and each of which is highly location-specific, requiring the interviewee's regular on-site attendance (Figure 13). The interviewee describes that his main workplace is the car. He says he spends 50% of his workday on the road and 50% at the workstation.

The official office environment of the interviewee is a comfortably furnished, but no-nonsense office room. It as a larger room divided into spacious single-occupancy workstations with partition walls and systems furniture shared by two co-workers. At the time of the interview, the interviewee had only one project shared with his roommates; other than this, the interviewee said he had very little in common with his co-workers.

The number of contacts relevant to his work is very large: these are always quite project-specific and involve people not just from this location of the company's office network, but from other divisions and locations as well. Because of the interviewee's family situation (father of small children), the interviewee avoids taking work home or staying late

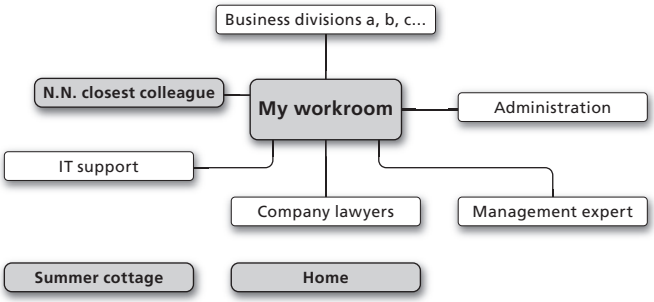

Figure 14. The workscape of example 3. The interviewee has a typically clerical work profile, but yet she seems to work in distributed work groups and in several locations. She is always on call, and uses her laptop in case she is not at the office premises, e.g. at the summer cottage and at home.

at work in the evenings. Yet, this is sometimes compulsory, as, according to the interviewee, the work environment is very restless:

> Well, I try to cope. I like my colleagues here, they're all really nice, but it's just that I need to get things done and can't just go around with a coffee mug in my hand and participate in the trivia. I don't oppose that, but I just don't have the time. Well, at least I won't get bored, will I… hah hah…

Basically, the interviewee always uses the office in-between meetings, either on the way to the project site, or coming from a project meeting on site, or in the project affiliates' premises, or to attend a meeting at his own office. Time is limited, and the things to be done at the office when he finally gets there – reading and responding to e-mails, archiving project material that has been stored into his laptop, and writing memos, documents and other company material for administrative purposes – require concentration. The interviewee's apparently purely functional relationship to his work environment can be read from his desk: the workstation resembles more a document storage than an inspiring single-occupancy workplace. It is completely impersonalized and full of binders, papers, CDs and IT equipment waiting to be taken to their final destination.

> This is something that I guess is called some kind of an open office. This is what we get these days, it's about improving communication, you know... I've never even thought of making this more personal or to bring in family pictures or suchlike. This is just a workplace, not my home.

3.4 Example 3: An Executive Secretary

The third example is an executive secretary responsible for the managing director's time management and other secretarial duties (Figure 14). She assists the managing director in all practical matters and provides him with all the material needed in his presentations. Besides that, she also works in various projects that may need coordination between top management and the rest of the company. For instance, she keeps records of the latest business figures for the use of the PR division, and informs the managing director about the topics of the company everyday.

The interviewee has her own workroom and says to be *"always here"*. Yet, in the interview, it soon becomes evident that besides the office room, she also works at home, at the summer cottage, at the different divisions of the company and with different colleagues depending on the task at hand. Her competence seems to be essential to the managing director and it is also highly valued, so, as her personal situation does not set any obstacles to such a commitment, she is always voluntarily available and within reach of a phone during her holidays:

> I have my own workroom in which I work all day… Today, here at our current office, we have a really good atmosphere. Although almost everyone works in a private office room, we meet each other at the coffee room and at the corridors and we really exchange information and ideas a lot and still everyone has his or her own peace and quiet. So in that sense, I'd say that my current working environment is really optimal.

The interviewee maintains that the quality of the place in itself is not crucial, although she values her private office room as she handles a considerable amount of confidential information that is held or discussed at her desk. The most important thing for her is easy access to company information. She works as much as possible without excessive papers or printouts, but stores documents in an electronic format to her laptop. This, together with fast access to the company database and the privacy needed for handling confidential information, is basically all she needs:

> Well, basically, if you store the files to the laptop, you can work everywhere; it functions in the same way wherever you are…

> Personally, I don't find any particular place more suitable or more supportive of what I do, nor do I find that the environment affects my efficiency, creativity, problem solving ability and so forth. It is not really up to the environment. But I do remember once to have been sitting in a kind

> of an open office solution next to the coffee corner with another secretary in my cubicle and some sales people nearby. The exchange of information was sometimes really useful, but then, on the other hand, it was also quite annoying there, in fact. People dropped by when they were on their way for a cup of coffee and we all had really loud voices and we talked a lot, so when the telephone ran, you could hardly hear what was said at the other end. And then, also, sometimes people could just start poking at the papers on your desk and ask: what's this, then? That sometimes resulted in awkward situations. We all worked for the same company, but still, there was and there still is a lot of information at my desk that shouldn't be exposed to anyone but my superiors and myself. I could manage there all right, but sometimes it was a bit of a noisy hassle in there.

The interviewee does not use meeting rooms, nor does she have any specific needs besides access to information and an opportunity to collaborate with colleagues when needed. For her, good traffic connections are important and also an uncomplicated and straightforward company atmosphere so that communication is easy and effortless. Despite the esteemed quality of her current work environment, the interviewee wishes, however, to have more opportunities for teleworking:

> Well, because, you see, in the morning, one never knows what kind of a day is ahead. And somehow, it seems that at home I get so much more done. It's because here there are so many disturbances: people drop by and come to talk to me etc. etc. So I'm somehow more effective at home. But, of course, I need to be here and to take care of the social side of work and all that.

3.5 Example 4: A Senior Expert

Example 4 is a senior expert who is responsible for the mathematical modelling, profitability calculations, and programming that are required for the preparation of the business ventures of her company (Figure 15). The interviewee considers her job a real dream-come-true where she can combine her education and her personal interests in a most rewarding manner.

According to the interviewee, approximately 70% of her time is spent at the computer doing the main tasks mentioned above. The rest, approximately 30%, is spent in meetings where the interviewee gathers feedback, discusses the progress of current projects, and reports the results. Her work requires some travelling abroad and also regular contacts with the company associates. Otherwise, the interviewee describes her work as

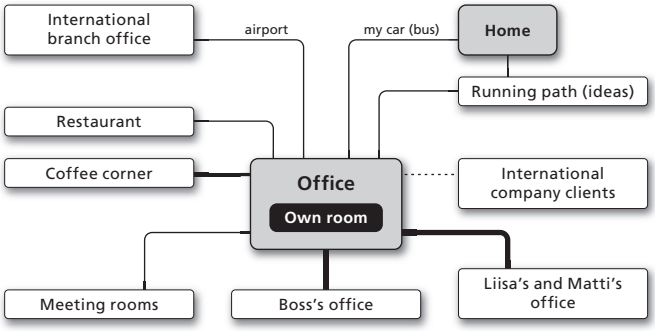

Figure 15. Workscape drawing of example 4. The main workplace is the interviewee's own office room, but the interviewee also works in several other places. The interviewee's professional network is substantial, but yet, the interviewee describes the work as solitary and unsuitable for group work. Typically, the best ideas come off-duty: *"my head keeps working despite my not being at the office; I often get the best ideas when I'm jogging…"*

solitary and requiring extremely focused thinking and concentration. In this sense, she says that her current work environment is optimal: she has her own office room and, if necessary, she can always close the door if the colleagues get too noisy.

While travelling, the interviewee does not perform any of her basic duties except for attending the meetings at the destination. She uses only her company mobile phone on the road; her laptop is not regularly with her as it lacks network connections. She would like to have a fast network access because she would consider teleworking from home a feasible alternative to her current work environment. At home, there is always the required peace and quiet, and, for her, the unofficial social life at the workplace does not seem to be at the top of her list of priorities. This is not to say that colleagues are irrelevant to her work, but on the contrary, she has very important and regular communication with her colleagues, the most important of which are two of her co-workers. With them, the contacts are usually maintained by popping into their rooms next to hers. With the internal clients, for whom the interviewee partly does her work, the contacts are mostly based on e-mail exchange. Otherwise, the interviewee works alone and exchanges information by regular face-to-face meetings:

> I don't think that the work environment, as such, affects the way I work. The content of my work is nevertheless always the same, so I can't see that there would be any other way to do it. It's not group work by nature, but solitary toiling…

> Perhaps one thing that could be different [in a different office type] is that the amount of conversation with my colleagues could increase. I could exchange information with them a bit faster, more effortlessly. But that is not really important in my work; it is not that hectic, but rather peaceful contemplation of what we do. At the moment, things are just fine in that respect. We discuss a lot and I meet and see my colleagues and co-workers at lunch and during coffee breaks and I visit their rooms when necessary, so there's no problem.

3.6 Example 5: A Special Advisor

Our final example works as a special advisor within a core business area of his company (Figure 16). His duties entail project preparation, project management and supervision, acquisition of clients, contracting third-party consultants when needed, and developing his company's expertise on the specific field in question.

The interviewee has a single-occupancy workstation in a large open office. He describes his work environment as composed of three basic sectors: 1) the office *("which is for interaction");* 2) the home *("in which I do all the stuff I can't get done at the office");* and 3) the clients' and business partners' premises *("the interaction with whom is very fundamental to my work").* In addition to the basic triad, the interviewee mentions his work environments as also including the company's branch offices and the trips to them, the 2–4 business trips abroad per year, the company's annual field trips and other happenings, and the circles of personal life, i.e. summer house, weekend trips, concerts, parties etc. *"I work everywhere"* says the interviewee in describing his relationship to work and his work-life balance.

In the main office environment, the interviewee's workstation comprises a desk, i.e. a table sized approximately 180 x 80 cm, two storage cabinets, and a small drawer. The surface area of the workstation is small and separate, as are all the workstations on the floor with low partition walls (height approximately 120 cm). He calls his "home base" his organizational unit, yet he also has frequent interaction with other units, especially on the same floor. According to the interviewee, an open office plan works very well in these situations; it makes it easy to approach colleagues and also to see who is available for an informal conference.

At the office, the interviewee says he uses all spaces for work-related activities. The elevator is a good place to approach colleagues; the toilet is a good place to share information; the company canteen is a good place to discuss things over lunch, and so forth. At home, the interviewee counts

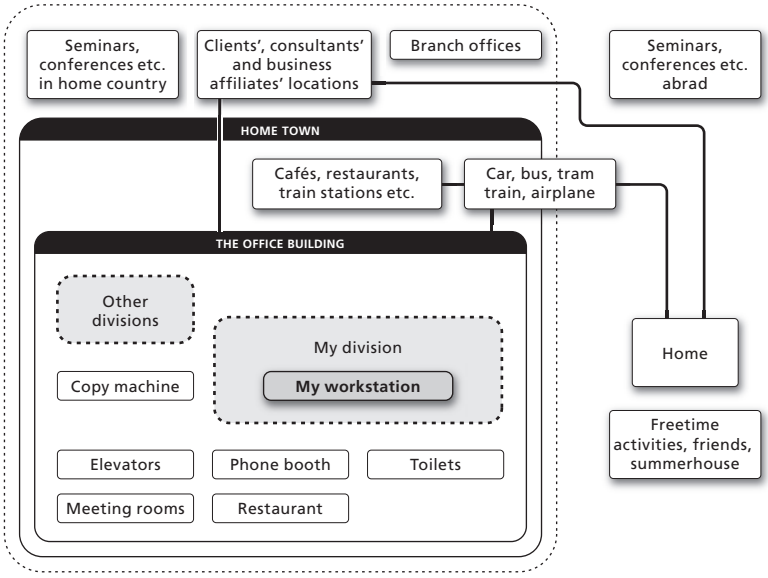

Figure 16. The workscape of example 5. A fully open office environment with plenty of interaction. The interviewee has a mobile and work-oriented lifestyle and uses all kinds of environments for working. The heaviest traffic takes place between the office building, business partners' premises, and home.

all the rooms in his work environment; he has no dedicated workplace at home. The only limitation is the number of data connections, because there's only one connection line available; otherwise all rooms are used flexibly to accommodate various work-related activities. He is not easily disturbed, but if the office day is too hectic, he can also stay at the office later in the evening:

> If necessary, I take the stuff that needs concentration home with me and look at it in the evenings. I don't specifically like to do that, or at least, it has become a bit annoying regarding my private life, but I have no choice: my employer doesn't provide me with a disturbance-free space that can be at my disposal whenever I need it during the workday, so what can I do… Sometimes, I come a bit earlier or stay here later. In the early evening hours, after people have left for home, it's really dead silent here and I get a lot of work done.

According to the interviewee, the number of meeting rooms is very small and most of the meetings take place within the open office area, e.g. in the coffee corners at the ends of the floor or in the few meeting points

that exist on the floor. The meetings that involve people outside of the company take place in the formal conference rooms available on other floors, but these have to be booked well in advance with the aid of the secretaries, who also take care of the conference catering. The interviewee regards this as a laborious process and describes the formal conference rooms also aesthetically somewhat unpleasant and gloomy.

One aspect that contributes greatly to the quality of the interviewee's workplace is the orthodoxy of openness in the office design. There are no private office rooms; everyone – including the CEO – has just a desk in a cubicle within the shared office space. The size of the desk, and, accordingly, the size of personal space, is determined according to one's work profile. According to the interviewee, these have been assessed only recently, so that workstation design follows the work specifications of four basic categories. Company announcements etc. are always on the intranet, so, in that sense, traditional bulletin boards have been found unnecessary. However, the interviewee recognizes two disadvantages: 1) in spite of the open office concept that basically displays everyone's presence, the interviewee says that s/he would benefit from a personnel schedule board that would visualize who's in and who's out and when the colleagues would be available; 2) in the meetings, people often use flipcharts, but, at present, there is no place to store the large papers except on a roll in somebody's drawer.

The interviewee is satisfied with the office furniture and office equipment available. He has two half-empty storage units at his disposal, where he mainly stores an extra pair of shoes and some reference material. The interviewee says he has *"trained himself in the digital lifestyle"* so that almost everything is on his computer. The workstation has almost no indicators of the occupant's personality; besides the colourful coffee mug, there's just one funny cartoon pinned on the small steel grid stand.

3.7 Results of the Questionnaire

On the basis of the drawings, it appears that traditional workplace thinking, which focuses on developing one ideal workplace solution localized within a particular office building and composed of the required number of workstations for a known network of employees, can only have a partial, although not insignificant, influence on the overall work environment. The inevitable deficiency of contemporary workplace thinking is that the total work environment seems to be a much broader concept than expected: the use of the optimized workstation in the perfect office is only occasional, and sometimes being at the office is even regarded as

stressful, frustrating, hardly necessary or even detrimental to what you are supposed to be doing.

This argument gains unambiguous support from the supplementary questionnaire that was completed as part of the second phase of the dWork study (the target group was cases B and D; see Appendix A for more details). The number of respondents was 42, out of which there were 21 men and 21 women. Their average age was 40.5 years (age variation from 24 to 57); the average time of employment with their current employer was 17.5 years (ranging from six months to 34 years of service).

The most common office type at the respondents' disposal was the private office (65%)[11]; 33% of all the respondents had a workstation either in an open office or in a shared workroom, while only 2% worked in non-territorial workstations (Figure 17).

Keeping in mind the target group of the research, it is interesting that 43% of respondents said they did not to regularly do any work-related tasks within their normal working hours outside their normal office environment, while 74% said they did occasionally work elsewhere in the evenings, for instance, or during the weekends. Fifty-seven percent of the respondents said they did not do regular telework, while 26% said they did not do even occasional telework (Figure 18). The most common secondary workplace was *the home* (29% regularly; 62% occasionally), which can be interpreted as proof of the commitment and flexibility of contemporary knowledge workers, but also as a worrying signal of the increasing penetration of work into our private lives.

Within those who regularly used other workplaces besides their prime workstation, the second most popular working places were: *the car* (17% of the respondents; all answer options were available), *public vehicles* such as buses, trains and airplanes (14%), and *public places* such as railway stations, cafés, business lounges etc. (14%). In occasional teleworking, however, the second most commonly used working place was *free time environment* (21%): for Finns, the summer cottage appears to be a convenient and appealing place to leaf through the latest quarterly report during the weekend.

In general, the respondents replied that they were fairly satisfied with their productivity and the qualities of their current work environment. The most common default in the office location was *poor access by collective traffic;* 71% of the respondents regarded this aspect as affecting a little

11 The large percentage of cell offices here cannot be treated as a typical situation in Finnish companies. The figures are simply a result of a coincidental and rather exceptional situation within the studied cases.

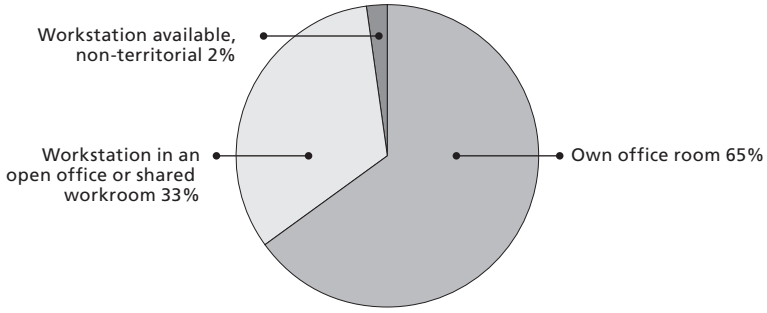

Figure 17. Office types primarily used by questionnaire respondents.

or very negatively their working day (all answer options were available). Amongst the general qualities of the office premises, the most common problem (79%) was *improper indoor air temperature* (too hot or cold), whereas *problems with tidiness,* such as dirtiness or messiness, were regarded as the least disturbing (52%).

As to the qualities of the actual workplace, the quality having the most negative effect (69% of the respondents; all answer options were available) was the poor quality of the *IT equipment*, e.g. processor power being inadequate. *The amount of storage space, the possibility for occasional meetings, the workstation's location, and the adjustability of lighting, and the usability of security systems* were all rated to be fairly reasonable, whereas *ergonomics* (55%), *the provision of billboards* (52%), and the *ability to adjust heating* (67%) were said to affect negatively the respondents' working day. In general, our contemporary offices clearly have *an inadequate number of spaces for work that needs concentration* (67% said that affected negatively their working day), *poorly adjustable air conditioning* (57%), and *too few meeting rooms* (55%) and *inadequately equipped meeting rooms,* e.g. with no beamer, no access to the network etc., (55%). On the other hand, our offices seem to have good facilities for *keeping personal belongings* (71% did not regard this as affecting negatively their working day); and well-equipped *common areas* (69%).

As to the question of what aspects were fruitful with respect to the respondents' own innovativeness, i.e. creativity, problem solving ability, mental performance etc., 86% of the respondents (all answer options were available) regarded *spontaneous conversations* with the members of the work community useful to their work, and 76% thought that *reading literature related to their profession* kept up their interest in the field. *Group work situations* relating to the respondent's work, i.e. brainstorming, workshops etc. and *informal conversations* with people outside

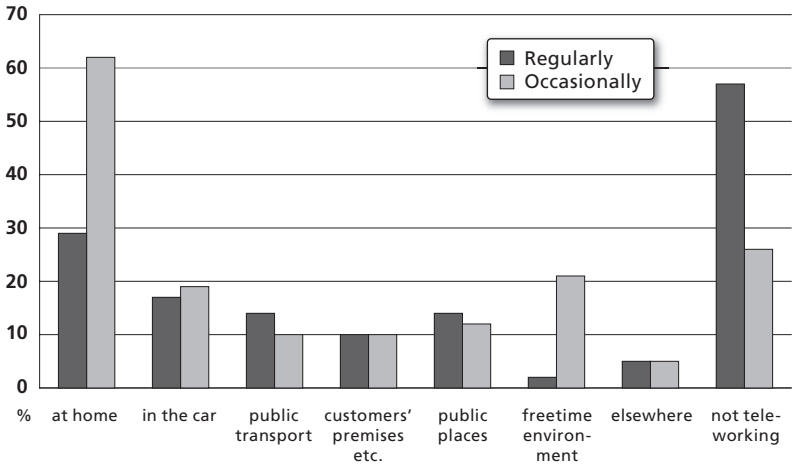

Figure 18. The use of secondary workplaces amongst the questionnaire respondents who teleworked either regularly or occasionally; all answer options were available.

the respondents' work community, were highly esteemed: three out of four regarded them important or very important to their innovativeness. Interestingly enough, *meetings booked in advance, organized training sessions* such as seminars, lectures etc., *processing documents relating to one's work,* i.e. reading memos etc., and *free time activities in natural surroundings,* i.e. gardening, summer cottage, hiking, boating etc., were both equally relevant (62% regarded them useful).

Despite the high percentage of private office room users, the respondents agreed that they *know their colleagues* (98%; all answer options were available), are able to *get help and assistance* to perform their work if needed (88%), often have *useful spontaneous co-operation* (81%) and are *free of any obstacles* to communication within their work community (81%). On the other hand, only 38% thought that their premises were so *flexible* that new spatial arrangements required by new projects and work groups could easily be achieved, while only 45% thought that there were no *status symbols* present at their workplace. Most strikingly, only 14% thought that the quality of their *office location* fits in well with the image of their company. Seventy-four percent did not agree that their premises were *more elegant* than other premises they knew, and 71% did not agree with the statement that their premises were of *top quality*.

For architects and designers, it may nevertheless be quite comforting to know that 63% of the respondents thought that the spatial arrangements of their *current premises were just right* for their use (all answer

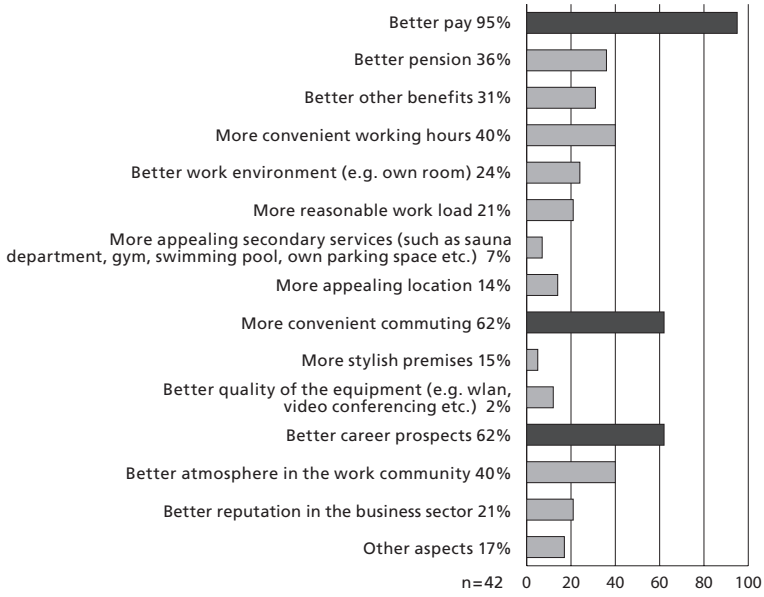

Figure 19. The decisive factors in employer change.

options were available). In fact, 43% considered the appearance of their premises rather insignificant, when it came to changing one's employer, then *better pay* (95%), *more convenient commuting* (62%), and *better career prospects* (62%) were considerably more important than a *more appealing location* (14%), *better equipment* (12%), or *more stylish premises* (5%). As to the contemporary curse of cost-saving, 74% would start by economizing on *interior decoration,* then on official *entertainment* (71%), and then on *travelling* (60%) and on *lease expenses* (60%). Only 2% would be willing to agree to *downsizing* and only 5% to compromise on *salaries* or *pension benefits* or to raise the number of weekly *working hours* (Figure 19).

As to the premises management's target of increasing productivity and efficiency by means of office procurement and premises policy (see above, Chapter 2), however, the overall functional quality and the suitability of the contemporary office for contemporary knowledge work turned out to be alarming. Here, as in so many other recent office studies, (e.g. Leaman, 1990; Trickett, 1991; ASID, 1998; Fisk, 2000; ASID, 2001; Spath & Kern, 2003; van der Voordt, 2003; Seppänen et al., 2004; Webb, 2004; Mark, Gonzalez, & Harris, 2005), the number one enemy of knowledge work was *uncontrollable sensory stimuli,* and the effects of experiencing a disturbance of any kind seemed to have a direct impact on the

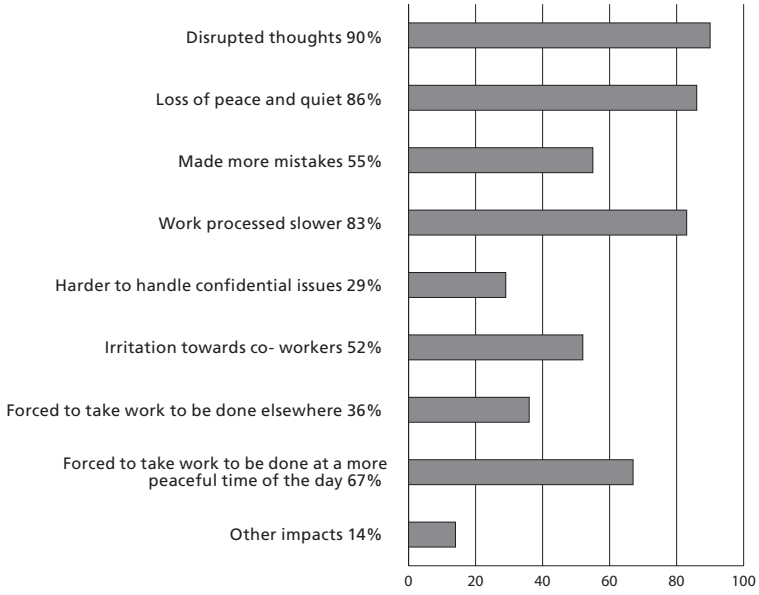

Figure 20. Experienced impacts of disturbance (of any kind; the source of disturbance was not specified in the questionnaire).

correspondents' working (Figure 20). Despite the fact that 65% of the respondents had their own workroom (see above), only a rough half of the respondents mentioned to be able to communicate their colleagues if they do not want to be disturbed. 90% of the respondents mentioned that disturbance *disrupted their thinking,* and 86% had experienced an overall *loss of peace and quiet* required for their work. 83% thought to proceed with their *work slower* under the influence of disturbance, and 67% was forced to *take work to be done at a more peaceful time of the day.*

3.8 Workplace as a Holistic Individual Experience

To sum up, the informants appeared to be using a larger number and a greater variety of places for working than could at first be expected. Working in a distributed manner involving knowledge sharing, communication, and intensive knowledge production in silence entailed flexibility and mobility: people worked according to their individual work styles and, if the main workspace was for some reason unsuitable for the work they were doing, they chose another workplace according to the task at hand. Distributed work seems, in other words, to be commonplace and not a futuristic schema to be prepared for. Our current ways of working and, accordingly, our spatial requirements for office environments, are

hence different from the office-work concept on which our contemporary office design is based.

The interviewees' level of distribution defined in terms of the number of places mentioned in the drawing or in the interview could not be predicted on the basis of preliminary information of the interviewee's job title or organizational position. More essentially, the office type, i.e. private office rooms, shared office rooms, or open office, had little to do with the number of interfaces or the meaningfulness of communication in their work.

The interviewees' and respondents' attitudes towards their work environment was highly idiosyncratic and depended a great deal on the nature of their work, their work processes, the task at hand, current workload, job satisfaction, and their personal situation in work and in their private lives. The office environment was seen as a conventional arena for working and for using office machinery not available at home or on the move, but there also appeared to be a considerable number of hidden social factors present in the office. Such reasons included social control, the formality of the office environment that it was thought to support, e.g. client meetings, the enforced sense of belonging in a community that a shared space created, and the explicit or implicit company policies that expected uniform behaviour or inhibited the use of alternative workplace solutions such as teleworking. In addition, earlier positive or negative experiences of different work environments and the willingness to experiment with various ways of working appeared to contribute greatly to the sensitivity of individuals to the changing conditions in the work environment.

Contrary to the belief of the team is the basic unit around which the office design was expected to be composed, in the reality of distributed work, the affiliations were intense, but irregular. Individual employees were simultaneously involved with several teams and work groups (multi-project environment, multi-tasking; see also Figure 4). As the performance of each and every member had, due to cost efficiency and reductions in excessive personnel, become directly relational to the performance of the group and, thereby, of the whole organization, any disturbance that caused delay or unwanted work fragmentation was considered a frustrating nuisance. If the physical work environment was regarded as unsatisfactory, the interviewees thought to be wasting their competence, energy, and time, which again had a direct impact on their contentment with their social and physical work environment. Work fragmentation due to external interruptions (Mark et al., 2005) – either experienced as a result of a disturbing noise level at the workplace or as a result of disturbing interaction on the part of colleagues – was not taken

seriously in office design, however. The halting workflow, the decreased quality of work, and the unnecessarily long hours were not accounted for in the premises budget, but included in the general price tag of contemporary office work.

Despite the acknowledgement of the relationship between office design and performance, on the level of the individual employee, the explored workplaces were architecturally mediocre and, according to both the interviews and the questionnaire, deprived users of the stimuli-free spaces they unanimously required. All the explored premises looked basically the same. They all subscribed to the same, communication-enhancing office ideology; there were no specific innovativeness or experimentalism in design; there were hardly any company-specific differences in the visual, spatial, or functional composition of the premises; and one could not infer from the interior in what business the leaseholder was or what values the leaseholder subscribed to.

It may be conclusively stated that, when distributed and mobile work is at issue, the limits of traditional workplace thinking and office design are evident. The office has become an archaic convention of time and space (Laing, 1991). It has become a place in which we are expected to perform our work-related activities during the hours regulated by the necessary evil of our contract of employment. Despite its modern and transparent new appearance, the office is still designed, managed, and used in ways intended to reinforce hierarchical status and rigid patterns of work. As the tailored office no longer encompasses everything within our work environment, it follows that contemporary office design policies are impotent. To attempt to improve management, heed occupational health standards, promote knowledge sharing, job satisfaction, company spirit, and productivity, to maintain control, save costs, and fulfil the requirements of knowledge work all in one go and without renewing our idea of the relationship between a contemporary knowledge worker and his/her work environment is simply a mission impossible.

4. Discussion

> The best place to get new ideas, you ask? Well, I can tell you that if I ever get any new ideas, I will definitely not go and expose them to others, because that will mean that I'll be assigned to yet another 'Development Group' and flown for a whole day to and from the headquarters for a one-hour meeting. No, I've stopped being creative; it's enough to get my work done within the schedules. And that's really a pity, isn't it?

On the basis of the research findings described above, it becomes evident that the objectives of office design for distributed organizations need to be adjusted to a more comprehensive and holistic level. Our aim should be towards total quality of the workplace: the recognition of the differences between people; and the provision of work environments that fulfil functional needs, provision for what people really do and for allowing them individual control over their immediate work environment (Trickett, 1991).

A fruitful starting point would be to get back to the ideas of scientific management that once formed the ideological basis of the 20th century office and define the office as a production plant – a workshop – for the manufacture and development of immaterial capital. The primary interest in office design, or, as this is usually called today, workplace development, for distributed organizations of the 21st century should hence be in the productivity, efficiency of work, and well-being of the organization's basic unit of production: its individual member. Maintaining the indisputably self-evident role of communication and knowledge sharing in knowledge work, organizational performance – today the focal point of interest – should hence be regarded as a by-product of the performance of its individual members, not the guiding principle that now seems to overrule crucial functional needs and individual work styles.

With this in mind, the fundamental questions would be: *What does this individual need in order to perform his/her duties as efficiently and effectively as possible? What is needed so that these individuals can work together as productively as possible?*

Firstly, an office environment for distributed communities should acknowledge the crucial role of concentration in knowledge work, the *avoidance of disturbances,* and the avoidance of any spatial solutions that hinder users in their work or inhibit the efficient use of their time (Stone & Luchetti, 1985). The ample research literature that demonstrates the effects of unwanted communication and disturbance on stress, job satisfaction, and productivity should finally be taken seriously. This claim should not be seen as contradictory to the self-evident needs of communication in knowledge work, but as an elementary requirement for efficient, productive, and well-managed workflow.

Secondly, such an office should entail a *larger scope, integrated decision-making, and enforced competence of premises management* so that the overall work environment composed of all the various premises used by the personnel and traffic in-between these locations, including commuting, should be taken under careful functional and economic scrutiny. Our target should be in an *integrated workplace development* that would simultaneously examine design, technology, economy, organizational

values, human resource management, and business strategies within the network of physical settings where work actually takes place (Vanecko, Hillier, Leiserowitz, Ferguson, & Loftnness, 2001; Groat & Stern, 2002; Joroff, Porter, Feinberg, & Kukla, 2003).

Thirdly, such an office would entail *reconsideration of the functional needs of office space* and the development of alternative office concepts and virtual collaboration tools that aim at responding to the specific features of knowledge work. This would require the search for solutions that enforce motivation for working, nourish employee commitment to the employer, the current team and the task at hand, and provide the space that is needed at the time and location it is needed (Allard & Barber, 2001; Laing, 1991; Chadwick, 1993; Leonard, 1998; Henderson, 1998; Lappalainen, 1998; Horgen, 1999; Myerson, 1999; Marmot & Eley, 2000; ASID, 2001; Earle, 2003; Spath & Kern, 2003; Harrison, 2004).

This chapter will conclude with a brief Office Maker's Toolbox – s/he may be a designer, a developer, or a workplace activist – with some practical points for developing a workplace for a distributed community.

Office Maker's Toolbox

1 Make the right definition. Is your goal to improve your organization's performance, to save costs, to increase productivity, to increase wellbeing, or to improve the premises' quality? Different targets need different weapons; there are no easy and fast bypasses. If you want to tackle several problems in one go, find the best methods for each problem – separately.

For instance, if you're about to put up a competence centre, it does not necessarily mean that you need to place people physically together, but to filter out the most competent players and make them work faultlessly, seamlessly, and enthusiastically together. What would the members of your dream team thereby benefit from? An economical workstation at the business park near the airport in the team leader's hometown, or a comfortable den in their home neighbourhood (wherever it may be), excellent network connections, or a well-designed digital platform for virtual collaboration?

2 Plan your work. Any project needs to be planned, budgeted, and prepared. In projects concerning office making, planning ahead is even more important, as you are about to spend a large sum of money and to make changes in the ways people are doing their work. Making an office is not just about ordering the right number of partition walls and systems furniture, but about putting up a knowledge factory where the place of the machinery has been taken by real people with ideas, affections, and habits. The smoother the production line, the lesser the waste.

In design research, a recommended starting point is to divide the project in phases, to set clear goals for each phase, and to proceed in sequence focusing on one phase at a time. In this way, you'll be able to adjust your goals along with the process and according to the feedback, and to keep both your mind and the project set-up open for any new ideas or problems that will occur during the process. The first step is to make plans about how and when to inform people about the forthcoming changes and to establish support functions for change management.

3 Well planned is halfway done. To design means to prepare for a change. Besides planning your work (see #2), you need to plan your project's execution as well. The greater the investment, the more central are the roles of preliminary design and programming.

For instance, if you're about to move into a new building, the architectural plans and the order form for the removal vans are not enough. You'll also need plans for the physical move process (phones, computers, packing, cleaning…), for the new security systems (access passes, security zones…), for the new traffic arrangements (commuting, car parking, taxi services…), for the new policy adjustments (more flexible working hours, teleworking options…), and for any consequences that the changes and their interlocking may have. A move is never just a change in the postal address. The more changes you make, the more plans and the more multidisciplinary a design team you need, the roles of which should also be carefully planned prior to their commissioning. Remember that it's always cheaper to take time and experiment on paper than on your clients who sit at your perfect new office and realize that it sucks…

4 People make the organization. An organization chart is an administrative presentation, not a design brief. As already said in #2, you're about to make changes in peoples lives so don't be too presumptuous about your own processional excellence. You may know everything about your company's premises policy or about cutting-edge office architecture, but you know nothing about the contents or processes of your clients' work.

So, get on the shop floor, talk to people, go and take a look at what they do and how they do it. Ask direct questions and respect the replies you're getting. Look for similarities; pay attention to differences. Classify who move about a lot, who are dependant on absolute silence, and who benefit from close and intensive group work. Are these permanent conditions or does your staff have changing work situations? Don't waste people's time in wishy-washy staff briefings with bad power point slides, tiny layout handouts, a tight schedule, cold coffee and cheap biscuits, unless you explicitly want to let them know that this is just a formality and you really couldn't care less. Even in the most dynamic team, its contribution remains only as strong as its weakest link. Offer a variety of workspaces so that people can choose where to do their work according to the task, the

situation and their personal energy level. Optimize on the individual level instead of compromising on the organizational level: there are only badly fitting one-size-fits-all workspace solutions.

5 Take measures and do research. What is the situation before the change; what is it after the change? Get facts, operate with facts, and publish your facts. You won't need suppositions and coffee room polls, but data.

For instance, if you're about make changes in the work environment because you need to save on premises costs, then you need facts about the costs now, the current cost structure, the cost history, and the short-term and long-term cost prognosis based on known variables and sound calculations. Remember to undertake comparative analysis: How does the situation look in other organizations? Is it likely that a change in premises costs will have any impact on other costs such as HR costs or increased turnover of workers? Once you have this information, publish them openly to anyone your project might concern, because – assuming that it still is the premises costs that we're talking about – these figures should underlie the decisions to be taken.

6 Turn the battlefield into a dialogue of shared expertise. Participatory design does not mean giving up your expertise; it means making use of all available information. So, keep the project in track, keep in charge, let your star shine, and stay behind your decisions, but take advantage of the knowledge your co-workers and clients have. Start by building up a solid sense of your client: what is expected from you; what are the priorities; with whom are you dealing. Start by creating a shared understanding of the situation and a shared language. Treat others like you'd like to be treated: you wouldn't like to be treated as a subject to the Almighty Organization any more than they do.

In practice, successful design participation means to open up all the phases of a design process for an honest dialogue that involves the end users, the designers, the decision makers, the financers, and any other agents that the process directly affects or experts who could assist in finding the best possible solution. Asking about what everybody wants, or whether this or that detail is liked or disliked, is not design participation, but the focus of discourse should remain in the

performance of the organization, its problems, and the ways in which the qualities of the work environment could support better performance. In such a setting, qualities of the workspace, technical systems, work processes, IT solutions, HR issues, and organizational targets would be dealt as one natural whole. Language is crucial, so don't let anyone hide behind professional jargon or flashy visualizations that blur the focus points: productive performance and its requirements.

7 The amount of knowledge does not substitute for the quality of knowledge. It's so convenient to fix up a meeting with the managers when you need information about your client organization. You get reliable information, but remember that it's the managerial point of view only. Check items #4, #5, and #6 and pay attention to the quality of your design information. Do you have an abundance of descriptive information, or do you have genuine – both qualitative and quantitative – data of the real work situations, work processes, and the positive and negative qualities of the current workspace?

8 Keep your mind open. Is there more to office architecture than an anonymous glass box with bleak open offices? Benchmark your project: how do your global competitors house their premises? Get a consultant to do it, if you don't know what kind of solutions there are in the world.

Most essentially, open up your mind for new office concepts. Making an office is not to choose between the open office and the cell office; it's not about subscribing to some specific 'workplace thinking' or going for the trendiest workplace ideology; it's about forming an optimized setting for work. So, enquire whether someone in your client organization might benefit from conveniently located hot desks (desk sharing) around town; find out if someone might occasionally make use of a silent library-like environment instead of a permanent sentence to a cell office; check if somebody's workflow could be improved simply by giving him/her a better laptop and network connections.

9 Test before decisions. Build a test room, a test workstation; recruit a test group. A good theory is not necessarily a good solution, so it's better to experiment before rushing into the furni-

ture store. Check if objections are just due to ignorance and prejudice. Report and discuss the results of your test: what was good, what was fatal, and why. And then make decisions.

10 Search for pragmatic solutions to pragmatic problems. If the information flow is jammed in your organization, don't knock down the walls, because that will only remove all sound insulation, and since when have the words 'sound' and 'information' been synonyms? Focus on making a distinction between problems of space and problems of corporate culture. Make room for joint discussions, create opportunities for casual conversations; force people to come together; excite and inspire exchange of opinions. Check the number of billboards and visual display systems and check if the messaging policy should be updated. Begin with yourself: distribute openly and clearly any information available about your office project.

For instance, office pathways design has proved to be an excellent means to improve casual get-together. A welcoming lobby with personnel schedule boards and the all-knowing receptionist is a classic, but corridors converging at a magnetically enchanting but soundproof nerve centre, such as a library-coffee room-copy centre-relaxation area, in the best place on the floor should work equally well.

11 Keep the coefficient of friction low. Don't let people take root in their corners. Make small changes all the time; make small adjustments constantly. If Mr. Smith has nursed his cactus in his corner office for 15 years, it is highly unlikely that he will vote for your excellent idea of hot desking the whole organization. Personal upset is poison to a progressive and encouraging organizational culture, and your Mr. Smith will most probably do everything in his power to shoot you down. Proceed slowly, cut the roots gently, and treat all Mr. Smiths of the world with kid gloves if you can't afford sacrificing the high spirits of whole enterprise.

12 Make use of all our senses. Recently, the focus has been on aural information: overheard conversations have been said to increase the amount of shared knowledge, but, vice versa, exposure to uncontrollable aural stimuli has been demonstrated to cause stress and distraction. Use other sense organs besides ears: visu-

alize your clients, your products, and your services; create acoustically and visually distinctive areas within the office floor; use different colours and materials to signal a change in function. Knowledge work is abstract, so make it more concrete. Build up a project wall, a client gallery, a company phone book with photos; a "Topical this week"-site on the intranet. Put up a coffee table with "the book of the week", "the article of the day", and "the case of the month". Provide stimuli for knowledge exchange and casual conversations. Use the methods of office humour for professional awareness.

13 Keep track of the moves of your community members. People make the community and people make knowledge work. So, if somebody needs a helping hand, show where everyone is and what everyone's currently working on; don't rely on browsing the desks in the open office. Make use of the intranet and shared calendars.

14 Take possession of your space. Your predecessors have probably invested in movable furniture, so move them. Make changes and let people make changes in their work environment if necessary.

15 Give stick and carrot. It appears in your case that private office rooms would be just excellent, but you can't afford the space and can't take the risk of isolating people in their cells? No problem, just make the office room the smallest, simplest possible den of glass in the midst of beautiful, luxurious open spaces and make it available by booking only. Divide a large open space into smaller units and turn one of the resulting open offices into a library-like dead-silent reading room, and another into a loudly beating workshop with bright lights and background music. Supplement that with a row of small private dens available by booking, meeting zones, and a soundproof nerve centre, and then make people move about and to choose their optimal workspace.

16 God is in the details. Don't overlook the meaning of small amenities: fresh flowers in the lobby; fruit baskets in the coffee corners; artworks in the corridors; company logos on the carpet; company traditions. Make room and create spaces for demonstrating your company values – all it really costs is the effort.

17 Build for knowledge work, not for office work. Change from either-or to both-and thinking. Make a distinction between knowledge sharing and knowledge production, and give room to all kinds of tasks that knowledge work entails. Forget about landscape office design and function-based analysis; leave 'marketing', 'secretarial functions', and the 'IT sector' into the organization diagram. Instead, create an imaginary worker for each type of work (see #4 above) and go through the whole process: Where will s/he do silent work? Where will s/he do routine work? What if s/he gets stuck with his/her work and needs simulation and relaxation? Does s/he need a permanent workstation, or could s/he manage better with a private workroom available by booking? Does s/he handle confidential material and where should that be stored? How can s/he see where his/her teammates are and whether they're available and willing for a quick chat? Where would that take place? What effects will his/her ways of working and moving about have on other workers? Focus on housing various work processes instead of teams or other organizational sub-groups.

18 Avoid myopia. One of the main arguments of this dWork research project is that the golden days in the functional silos are over. Premises, technology, financial issues, corporate policies, business strategies, human resources, time consumption, occupancy rates, individual work processes and work styles, and preferred organizational behaviour must be treated as equally important components of a complex whole called the work environment. Build your design team accordingly and make the office together.

19 Dispute! There's no such thing as the absolute truth. Your organization's target is to be the market leader, the number one service provider, or at least better than the rivals. Why on earth do you want to look and act just like everyone else in the premises market? Let your specific competence show in the difference.

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Organizing Distributed Work and Collaboration

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At present, work takes place in multiple locations. It is not tied to only a single place, but can be conducted almost anywhere with the help of advanced information and communication technology. As previous chapters characterize, this picture has become all the more true also in the case organizations of the dWork project. This chapter adds to the previous chapters, aiming to view the mobile and distributed work from the perspective of groups and organizations. We provide a glance at one central component of the workplace: its organizational structure and dynamics. O*ur contribution will be an analysis of the organizational dimension from the viewpoint of work and organizational psychology and based firmly on our empirical case study findings*[1]. Thus, this chapter aims at contributing to the first and sixth research questions presented in the introduction[2]. The chapter provides workplace planners with a view that has often been overlooked before in the process of workplace making: The importance of analysis of the work people do, the challenges of collaboration between distributed employees, and the significance of the view of personnel involved in workplace making are highlighted in this chapter. The chapter also introduces new ideas and concepts to workplace makers and draws attention to the need of synthesizing the different views and knowledge that corporate real estate (CRE), human resources (HR), information technology (IT) departments and personnel (their clients) have developed during the process of workplace making.

1 The methods of our studies are reported in Appendix A for the interested reader.

2 dWork project aims: (1) To provide a fresh framework for viewing the themes of distribution and mobility and to provide insights that allow infrastructure managers to support the needs of their business unit clients, and communicate effectively with them. (6) To introduce the concepts of distributed and mobile work into the real estate and IT industries and highlight related product and service needs.

Firstly, our attention focuses on groups, since four of our five case studies concern groups with rather similar challenges. These challenges strongly affect the challenges workplace making meets and thus it is critical to view them in detail. All of the groups worked for some core business objective in their companies. Our aim is to show some tendencies in distributed cooperation and group work and, in this way, provide workplace makers a view of the actual work of distributed and mobile employees. We shed light on the group dynamics on the basis of real-life research of four groups in order to provide a look at a typical organizational form of distributed work and workplaces[3]. This view is expected to help organizations and workplace makers to better consider the nature of the work and working modes of distributed and mobile employees.

Secondly, we focus on the organizational settings of workplace making – in our case companies. We explore especially the organizational changes in them. By analyzing the critical elements of the empirically observed organizational change processes, we aim at pointing out the challenges posed by organization to workplace making. We also study the relationship between the workplace makers and the core business they are serving. In the final chapter, we present some conclusions and recommendations based on our analysis.

1. Challenge of Cooperation in Distributed Groups

Our results are based on a careful analysis of five different cases from three companies (see Appendix A for more detailed case descriptions). Four of the case groups (A, B, C, & E) were introduced to the researchers either as permanent or temporary distributed or virtual teams, that is, *groups of people who worked interdependently with a shared purpose across space, communicating mainly via ICT* (definition adapted from Lipnack & Stamps, 2000). Thus it seemed that the companies wanted to organize the distributed and mobile employees' work into teams and in this way achieve group gains such as better cooperation between distributed individuals and subgroups. Chosen team members were to collaborate together and strive for a common goal that was supposed to be more than the sum of subgoals of all team members.

Taken very generally, distributed groups or virtual teams, as they are often called in the literature, consist essentially of subgroups of individuals working in different places. The members of distributed groups have

3 The workplace is viewed here to consist of spatial, technological, and organizational dimensions.

many affiliations. Besides their distributed group membership, they are members of other work groups, networks, line and matrix organizations, as well as of the whole company. The literature suggests that these affiliations are often closer and affect the daily work of the team members more than their membership in a distributed group whose members easily remain rather distant (e.g. Fiol & O'Connor, 2005). This was also found to be the case in the four teams we studied. In many instances, individuals seemed to cooperate and interact more with the people near them and had some trouble in finding time and a shared understanding to cooperate with the distant members of the distributed group (e.g. Brown, 1988; Hogg & Terry, 2000). Like the majority of the research regarding intergroup dynamics would predict, out of sight was often out of mind. In the following chapters, we first conceptualize this finding in terms of social categorization and social identity, since these prominent theoretical approaches (Hogg & Abrams, 1988) provide us with an understanding of the phenomena we found in our case groups. After that, we present some reasons and consequences of our cross-case findings. An understanding of the challenges we found in relation to collaborative work in distributed and mobile settings is vital for successful workplace making, as the work and its inherent characteristics should be carefully considered when designing and implementing new workplaces. Also, workplace makers should be cognizant of the new challenges of distributed and mobile work. Only by recognizing these challenges is it possible to affect them.

1.1 Local Identities

The social identity approach (e.g. Hogg & Abrams, 1988; Turner, 1999) provides a convenient theoretical approach to the analysis of the group identification of distributed group members. The basic idea of this approach is that a self-inclusive social category, a work group, for example, or an organization, provides a self-definition that constitutes an element of a person's self-concept. This category is represented in an individual's mind as a social identity, that is, a sense of belongingness with a group (Ashforth & Mael, 1989). It is suggested that social identity leads to specific group processes. For instance, it has been noted that people who identify strongly with their in-group work harder on behalf of the group, want to remain in the group, and are more satisfied with the work group (see Riketta, 2005, for a review).

The growing literature on distributed work in general stresses the importance of shared identity as a prerequisite of fluent cooperation and other group gains in distributed settings (e.g. Hinds & Kiesler, 2002;

Fiol & O'Connor, 2005). The underlying assumption is that working in multiple locations challenges cross-site cooperation because the distributed subgroups tend to categorize themselves on the basis of more salient local boundaries and affiliations than on the membership in the wider distributed team. Consequently, these local categorizations create separate local identities, which, in turn, often lead to prejudices and negative biases towards the "others", that is, the remote subgroups. This notion has led the authors to stress the importance of shared identity in distributed collaboration.

Our analysis revealed that identities of subgroups or individuals were often rather local and separate from each other. Thus, the highly skilled experts forming distributed groups remained isolated in their local subgroups and networks and the gains of group work and cooperation remained unused potentials. In most cases, the location boundary was essentially the same as the identification boundary. The subgroups and individuals had their local networks and cooperated smoothly with their local co-workers, but their cooperation with distant group members was sporadic and poorly structured. Thus, the knowledge and ideas gained from local networks and local co-workers were poorly shared with the distributed group and consequently to the multi-site organization. The local identities were especially salient in the example case below:

> The country-based subgroups developed different technologies for the same purpose due to the national differences in conventions and legislations. Thus, when the team members were asked to describe "their group" they usually named their local colleagues and local networks instead of the multi-site team. They were, however, the top specialists of their technological area of expertise in the company. Team members exchanged ideas in regular e-meetings, but there was no reason to cooperate intensively as long as the country-based technological solutions remained different.

1.2 Task Interdependence

One of the most plausible explanations of the problem of local identities is related to the nature of the group tasks. Firstly, the tasks were usually organized in very independent ways. The individuals or the subgroups had little need for communication and mutual cooperation. It often seemed that the individuals and the subgroups in the team collaborated more with different stakeholders outside the team and had little natural interdependence together. Many times, individuals felt that they did not

know how collaboration with other team members would help them in reaching their own goals. Hence, some described their work as if it resembled private entrepreneurship and their group more as a community of practice than a working team.

> The goal of one of our case teams was distributed to team members so that each member was responsible for a part of a goal. The sum of the subgoals was supposed to lead to the achievement of the total goal. However, in reality, this did not happen: the team members did not see the interconnectedness between the subgoals and thus did not know how and with whom in the team to collaborate. Team members worked actively with people with whom they were interdependent in accomplishing their own tasks. These people were mostly outside the team – the other team members were rarely contacted. Because of the low level of interdependence of the tasks, the case team did not function as a real team; instead, team members worked like private entrepreneurs with large collaboration networks.

In the cases where the fluent cooperation of distributed subgroups clearly would have been beneficial, the locally based identities often hampered the group work in anticipated ways, that is, the subgroups scapegoated each other with respect to perceived problems.

> In one case, the problems and misunderstandings were often related to the new element brought into the renovation process. The headquarters introduced the new element that was used in the planning phase of the project, but the rest of the project, in two towns remote from the headquarters, had the major responsibility of finishing the project. The regional members did not know clearly what the new element was and they considered it as an extra burden and yet another headquarter fad. The experts at the headquarters were frustrated and could not understand why regions resisted their innovation. Neither the team members from headquarters nor members from the regions had enough resources to see and discuss how the new element could help the work of the whole team. They simply perceived their tasks to be independent from one another.

Task interdependence is one of the first prerequisites and incentives for collaboration between individuals and subgroups. It has even been proposed that structuring the tasks in an interdependent way could be a management principle for distributed groups. The more the tasks are interdependent, the more the whole group is forced to coordinate and

communicate. This, in turn, should enhance cooperation and performance (Hertel, Konradt, & Orlikowski, 2004).

> The problems in collaboration in one case were partly caused by the fact that team members were not able to see the interconnectedness between each other. They all hoped that the interdependencies between the team members would be clarified. Team members thought that they could benefit from collaborative teamwork if they knew the interdependencies between members. Active managerial work in clarifying the interdependencies was needed as, without teamwork, the team was seen to have valuable, but unused, potentials.

The reasons for independent tasks varied a lot. In some cases, it seemed that the company managers drawing the organizational charts did not fully see the ultimately local nature of the work. In other cases, the groups were just nominated or they were formed on the basis of the acute needs of distributed skills, but no one took care to organize them in a way conducive of functioning cooperation and knowledge sharing.

1.3 Task and Role Unclarity

Partly due to a low level of task interdependence, the tasks and roles of the other group members were often poorly understood. Many interviewees suggested that real cooperation needs face-to-face kick-off meetings and informal gatherings to create a shared understanding of the other group members' tasks, as well as to establish a group-level identity. The task and role unclarity often led to misunderstandings and even to conflicts when the expectations were contradictory or ambiguous. In the worst cases, some key tasks were never executed, since everyone expected that someone else in the group would take care of them, as in the following case example:

> The key client contact person of a group didn't know that a major client intervention was ongoing and was consequently caught in an embarrassing encounter with the client boss who asked if he would join a meeting regarding the intervention. This occurred because the member responsible for the intervention had never met the client contact person (they were in the same team) and assumed that this person had nothing to do with these kinds of client activities. There had not been any kick-off meeting or explication of the team members' roles and responsibilities. Thus, the information was supposed to be given on the basis of earlier knowledge which, in

the case of these two members, did not exist. The problem was probably partially due to the small amount of work the team members were able to invest in any particular project.

1.4 Where is the Leader?

Related to the general task and role unclarity, we found that, in many groups, the leadership was weak or even non-existent. Leading a dispersed team is often considered to be even more challenging than leading a collocated team (Kayworth & Leidner, 2002). It is thought that the nature of virtual teams creates challenges: when the leader has to lead from a distance, it is harder to control the work and group processes. It is also more difficult to try to build team-level identity and to motivate team members.

> In one case, we found that the team members had different views as to who should be leading the team during the ongoing early planning process. The company had formal guidelines for the projects but they were considered rather ambiguous in the early planning phase. The different expectations and limited communication within the team led to the situation where no one clearly had the leadership. This, in turn, complicated cooperation and led to stressful feelings by some team members who found themselves in the middle of conflicting and ambiguous expectations from different colleagues.

In some teams, especially when the work was not linear and well defined, the group simply had no clear leader. In other cases, the leadership seemed to change in a rather unanticipated manner, causing group members to wish for stronger leadership. In distributed work, where degrees of complexity are almost always higher than in co-located work, absent or weak leadership obviously leads to a problematic situation. The leader, at least, should be the one who unifies the group and clarifies tasks and goals. However, teams, and especially distributed teams, are often perceived as non-hierarchical organizational forms (Lipnack & Stamps, 2000). This may lead to the misunderstanding that leadership and control are not needed because they are difficult. Without leadership, the distributed experts have to internalize the full control of their work. This may sound liberating, but in the vein of earlier research (Barker, 1993), the internalized control can be described as the ultimate control, which even threatens the well-being of the experts.

> In one of our case teams, the leadership was considered to be pretty shallow. The team leader encouraged members to participate and make their own decisions, but, according to team members, insufficient attention was given to team-level processes. Team members hoped that the leader would bring people together, develop team spirit and clarify the roles of each team member. The leader was also expected to bring routine procedures to group work and punctuate the work with sufficiently near deadlines. This kind of active leadership was expected to help the team in managing the difficulties caused by the virtuality and mobility of team members.

Accounts of good distributed team leadership were also found. The good virtual team leader was characterized as a listener who gathers the signals, impulses and ideas of the group and spreads them to upper management. The position requires sensitive, respectful and participative orientation. The good leader of a distributed group is not so much a substance specialist than an enabler and unifier of the experts' work.

1.5 Need for Shared Understanding

The above-mentioned ambiguities threaten ultimately the shared understanding of the common goals in a group. Teamwork faced severe challenges when team members had problems in understanding how they, together as a team, could reach the ultimate goal. Even though at a general level most case groups agreed upon their higher-level objectives, it was often unclear how the subgroup or individual goals were intertwined so that effective goal setting and achievement would be assured. When team members were not aware of each other's roles, they often reported difficulties in perceiving how collaboration with the particular people in the team could lead to achievement of their goals. This kind of shared understanding is especially highlighted in distributed work (Hinds & Kiesler, 2002), as people lack many traditional ways of communicating, questioning, and sharing the goal-related ideas and information informally and frequently.

1.6 Summary – Distributed Group Members as Private Entrepreneurs

The analysis of the case groups depicts mobile and distributed workers as pretty lonely experts striving for their subgoals. Even though organizationally these individuals were organized into teams, the teams remained only nominal. The real collaboration took place more often with people

other than fellow team members or with a subgroup within a team. Distributed workers had their own networks of people that they actively collaborated with. They worked independently and as kinds of resembled private entrepreneurs in their work: they, as individuals, had some freedom to make decisions, but, even more importantly, they had all the responsibility of the success of their work within their often-separate networks.

The responsibility of an individual was enormous when distributed and mobile workers lacked support from the team and its leader. Without support from the whole group or active leadership, individuals had the responsibility of controlling the progress of their work, the amount of work, as well as the ways of doing the work. Individuals had the whole responsibility of their own working hours and well-being. This massive responsibility was given to individuals with rather poor support from the organization. However, the need for the supporting ground rules and tools was visible. Mobile workers wished for some guidelines that would help them to, for example, draw a line between working time and leisure. They wished that the organization would offer practical support and concrete help in the situation, by involving, for example, colleagues, managers and human resources personnel.

There may be three separate explanations for the fact that the mobile and distributed teams did not function in the organizations as expected. One explanation accentuates the generally known difficulties in working virtually. Several studies (e.g. Anders, 2002; Cascio, 2000; Kirkman, Rosen, Gibson, Tesluk, McPherson, 2002) suggest that distributed teams often face difficulties that threaten successful cooperation and teamwork. Presumably, when distributed workers are also mobile, the challenges for success increase even further. Thus, without active leadership and support for teamwork, cooperation across geographical boundaries is easily eroded.

The two other explanations for the lack of functioning distributed teams are more structural. For one, it may be that the work of the distributed group members was not suitable for collaborative teamwork. As discussed earlier, if the work of team members does not have any interdependence and if there is no need for collaboration between team members, a team as a way of organizing work is not meaningful. When organizing teams, companies should carefully clarify the work people really do and consider what kind of advantages certain people can offer one another if their work is organized as teamwork.

The third possible explanation for the lack of distributed cooperation points out the possible new paradigm of work. It might be that team-

based work is not as suitable for new distributed and mobile work as it used to be in collocated settings. It might be that contemporary work needs such large networks of people to succeed that the groups and teams as a way of organizing it do not manage to support it sufficiently. The work is scattered in different places as well as with different people. In order to meet one's goals, one needs several people in the large network. Thus it may be that teamwork is an old fad that has to step aside as the new paradigm of work becomes more prevalent. Maybe the fact that teams were not working well and their internal cooperation was problematic can be explained by the new kind of work-related demands.

Whatever the reason for the lack of team-like collaboration, the problems caused by the situation still remain. These problems are the ones that workplace makers should address. According to our analysis, the distributed and mobile workers need support from the organization. Even if they cannot be organized in teams, they need some kind of supporting system for their work. They need general policies for mobile work and working hours, they need support for their well-being and they need some kind of leadership. Arrangements at the organization level seem to become all the more important if team-level work does not function well. Thus organizations should strive to discover individual ways to support mobile and distributed workers. Workplace makers should also find new ways to support the distributed and mobile employees in this new kind of situation. The next chapter goes into organizational arrangements and ways of implementing new supporting solutions in greater detail. It also offers more practical observations to workplace makers designing and implementing new workplace solutions for distributed and mobile employees.

2. Work and Workplace Making in Changing Organizations

Organizations need to find ways to support the work of distributed workers. When implemented, organization-level decisions and ideas can, at best, create synergistic collaboration, and even the teamwork that was found to be missing in many cases. Nevertheless, at worst, organization-level decisions can destroy the collaboration of people that would benefit from it.

When deciding on the actions that support work, organizations may need to implement some changes. Many of the organizations we studied had already introduced some major changes and innovations at the organizational level. The changes discussed here either affected the case organizations in a major way or were introduced by the workplace makers

in order to serve their clients. However, these attempts were usually introduced for reasons other than supporting the work of distributed employees, mostly to save costs and to improve efficiency. Consequently, the changes were not always successful in supporting the work of distributed and mobile employees, that is, the clients of the workplace makers.

2.1 Organizational Changes and the Need for Work Analysis

The changes affect the work people do. Thus when deciding upon the actions to support the work of distributed and mobile employees, the analysis of the work and work environment is extremely important. The work that people do should be carefully taken into account so that changes really succeed in supporting the demands of work. If the real needs of work are not considered, well-intended supporting actions can have a reverse effect and appear to increase the strains of distributed employees.

Our findings across the case organizations imply that changes were too often implemented without or with too little understanding of the day-to-day work of those affected by the change. The implemented innovations had mostly to do with developing the work environment of distributed and mobile employees, as the following case example illustrates:

> The company had decided that employees would have no permanent desk for themselves. Employees were offered desks in open-space offices, meeting rooms for quiet working and meetings, and visitors' points at most of the company's sites. Employees faced different kinds of problems due to the working places that they used. They complained that open-space offices supported neither silent working nor communication sufficiently. It was said that, in open-space offices, one could not concentrate properly due to constant distractions, and that communication in these places was difficult because the distractions interrupted others' work. In addition, it was mentioned that there were too few meeting rooms for silent working and thus the rooms were often occupied, and that the visitors' points often weren't very usable in many of the sites employees had to visit. Often the employees decided to stay at home so that they would be able to do their work properly, without being interrupted or interrupting others. Employees mentioned that they felt the real needs of their work were not really taken into consideration when designing and implementing new workplace solutions. They thought that the spaces that were implemented should have supported the nature of their work better: their working time could not be clearly divided between silent working in solitude and communicating with others, as workplace makers seemed to

expect. It was considered that the workplaces should enable them to do both concentrative work tasks as well as collaborate with others.

In some cases, massive, resource consuming efforts and studies were carried out to fit the needs of the clients and the premise owners or workplace makers. These efforts included participatory practices that too often proved to be somewhat superficial in informing the workplace makers of the real state of the client organizations. Since these studies were outsourced, the typical problem was that the consultants considered the study results to be ultimately their business secrets and the premise owners and workplace makers buying the study got only a limited view of the results. In many cases, the analysis of the clients' work and needs were restricted in scope. Workplace making came down to square meters, locations of tables and spacing of workstations into physical space. In general, workplace making seemed to be a business- and technology-driven process, rather than a work- and human-driven process. Consequently, the workplace was not viewed as a holistic architectural, technical and organizational system that included human factors.

In one case, the company had a plan to move from a traditional cell office to an open-plan office. The study revealed that different units of the company (CRE, HR, employees and managers) had different perspectives and aims concerning the forthcoming move. An open-plan solution was chosen on the basis of the CRE strategy to save premises costs. Managers of the CRE unit made a decision that the case company had to move. However, the employees of the case company did not agree with that decision and its reasons and were not motivated to move. The managers and employees were satisfied with their cell office and did not see the open-plan office as a meaningful solution for their work. The employees thought that their work requirements were not considered and their needs were not heard in the planning process. The employees could not accept the layout of the open plan office, because it was considered insufficient for their daily work. Therefore, the planning process became long, complicated and inefficient.

The above case describes our common finding that collaboration between different organizational units is limited and unsystematic. Instead, different organizational units seem to have different aims, perspectives and own ways of working. Lack of collaboration is one cause of the ineffective, as well as long, planning and implementation processes of the new innovation and organizational solutions. It is also worth questioning why one

support function (CRE) seemed so often to dominate the business units, that is, their internal clients, with little knowledge of the work activity of the client organization and its employees. The design and management of workplaces seem largely to neglect the real tasks of employees. However, our analysis indicates that the work analysis and work requirements of the client unit and employees' viewpoint should be the starting point for new organizational solutions and their implementation.

2.2 Who Listens to the Employees?

The analysis of the cases brought forward that when attempting to support the demands of mobile and distributed workers, organizations should pay attention to a procedure when a change is implemented. One procedural problem was the low level of (client) employee participation, which, in turn, affected the quality of analysis of daily work.

> In one case, the attempt towards organizational unity led to the geographically centred solution in a situation where the work was actually conducted in many locations and the requirements of the work were fundamentally different in the different locations. The company, distributed in four countries, piloted a competence centre, which was located in Finland. The team members called it a "bossing centre", since the only advantage they perceived was that decision making was enhanced because most of the managers were collocated. However, the one-place centre of fundamentally distributed competencies was found to reverse the intended effect. Organizational unity was not achieved. On the contrary, team members remained in their countries and the team leader also lacked the power to send the distributed experts away from their home location, even when their skills were needed, perhaps only temporarily, elsewhere. In addition, this organizational change cut down the career opportunities of the team members outside the centre and many of them expressed an intention to leave the company. All this happened largely due to poor analysis of the actual work of distributed experts – they were not asked what they did and needed.
>
> In another case, a new element was introduced to an extremely busy and time-constrained work environment. In this case, the headquarters-driven change was introduced with limited resources and caused problems in a situation where the headquarters and regional identities and modes of thinking were polarized. The experts of the new component were too busy to train the regional team members and the organization left them rather alone with their work. Since the implementation of the new compo-

nent was aimed to be routine in the future, one would have expected the upper management to inform, encourage, and participate the case team members and the whole organization actively in the change. However, in the absence of the knowledge and participation of the experts from regional sites in the change process, the new component was perceived as another fad and a separate part of the normal project process.

In both the cases described above, the organizational change or innovation was implemented in a fairly straightforward, top-down, fashion. This finding is somewhat surprising considering that the case organizations were all at least originally Nordic-based companies and that in Nordic countries the tradition of democratic dialogue and participative working life development are deeply rooted (e.g. Naschold, 1993).

The organizational changes were also often resisted among the employees. The analysis of implemented organizational changes disclosed that the resistance was due to the weak participation of the people whom the change would concern and to the poor analysis of work that the change would affect. This was clearly illustrated in the case described below:

The company made a decision to move from the old office building to a new building in another place. However, the majority of the employees did not want to move, because the distance and time spent between home and workplace would become much longer and managing work-life balance would become difficult. The employees had only two options: to move or to leave their job. Some of the employees reacted very negatively and resisted the move. As a result, several employees started to look for a new job, and the company faced the risk of losing 10 % of its experienced employees.

As in the previously described case, if the employees consider that the participatory arrangements are just formal legitimating efforts without any real wish to hear their voices, usually a strong frustration and resistance for change are expected. Thus, it is understandable that we found that the employees resisted the top-down implemented changes, and the organization struggled with strains and problems. The literature strongly suggests that the dynamics behind the beneficial outcomes of participation relate to the perceptions of fair decision-making processes (Greenberg & Folger, 1983). When people affected by a decision or change are allowed to express their opinions and their views are taken seriously, they perceive that the process is fair, and are even inclined to accept outcomes that may be uncomfortable for themselves.

From the psychological point of view, at the root of participation lies the general need for people to interact effectively with their environment (Wilpert, 1998). Participation means, in general terms, a process that allows employees to exert some influence over their work and the conditions under which they work (Strauss, 1998). Employees are given power to influence both planning processes and outcomes in order to achieve desirable goals from all points of view (Wilson & Haines, 1997). Some authors emphasize participation as a group process; others stress delegation, the process by which the individual employee is given freedom to make decisions.

Organizational studies (e.g. Strauss, 1998; Wilson & Haines, 1997; Wilpert, 1998) refer to several significant benefits of employee participation. Firstly, employees with shared knowledge and experience of work can provide a clearer understanding of both types of problems being encountered and the solutions that will be appropriate. Therefore, participation may result in better decisions. Secondly, involving employees in analysis, development and the implementation of change generates greater feelings of solution ownership and thus may breed a greater commitment to changes being implemented. People may be more likely to implement decisions they make themselves than decisions imposed on them. Thirdly, participation may improve communication and co-operation. For example, joint participation by employees and management to solve problems may improve their relations. Fourthly, employees may learn new skills and their job-related competencies may be enhanced through participation. Further still, with the dissemination of experience, participation may facilitate organizational learning. Finally, a high degree of participation with real decision making power is one central success factor in managing organizational change (Salminen, 2000).

2.3 Summary – Analysis of Work and Employee Participation in Workplace Making

The reasons for limited participation and superficial analysis of clients' work can often be attributed to limited resources or the limited use of them. The case organizations and their workplace-making units seemed not to have developed the capability of analyzing their own or their clients' work from multiple perspectives. Too often, the analysis of work was filtered by the notion of physical dimensions and artefacts. Cost savings tended to dictate the workplace making and to blur the holistic and more realistic analysis of the work in place.

The presumption of the dWork project was that spaces, ICT and organizations should support each other. Thus, it was a surprise to find that

the case companies implemented organizational changes and the workplace-making units provided spatial arrangements with a rather poor understanding of the real work processes. In most of the researched cases, the collaboration between CRE, HR and ICT seemed to be shallow and in some cases it was totally missing. However, according to our observations and analysis, the collaboration between HR, ICT and CRE would be relevant for the success of workplace making and thus strongly needed in the future. One reason for this and for the deficient analysis of clients' work was probably the cost calculation logics of some companies. The CRE function was interested in saving money from their own budget. The possible double costs for the clients caused by the implemented changes and space savings were not considered. This policy was not questioned by CRE since the budgets were viewed separately by the top management of the companies.

In sum, participation of personnel and analysis of their day-to-day work requirements have remained very limited in designing workplaces and implementing ICT. Instead, the personnel are expected to adapt to changes and new working conditions. In the long term, this strategy will be problematic from the viewpoint of human well-being and productivity of work. In the future, the involvement of a fourth party – personnel who have the best practical knowledge and experience of real requirements of work – will be needed in addition to the CRE, ICT and HR.

On the other hand, however, it must be realized that, in practice, the culture of expertise is still strong. Participatory projects are not always easy to implement or to support. One of the main obstacles is people's unwillingness to get involved. For example, management might see participation as a threat to their right to manage, and employees may lack sufficient motivation, time, and energy or they may be suspicious of the management's motives for involving them. Other problems also may be associated with the process of participation. For example, planning and developing new systems in a participatory manner may be slower, more complex and require greater effort than non-participatory approaches (Wilson & Haines, 1997).

3. Managerial Implications

Distributed and mobile work has some specific characteristics and challenges that organizations should recognize from various perspectives. In the dWork study, we aimed at viewing these challenges and special characteristics from the point of view of different teams, units, and support functions in the organizations. We found that the cooperation in our

cases was problematic, largely due to organizational factors such as a low level of task interdependence, role unclarity and lack of leadership. This analysis and information is crucial to workplace makers whose clients strive for better cooperation. In the contemporary world, cooperation and sharing knowledge are the keys to success in any field of knowledge-intensive work. The success of, for instance, e-business, IT-industry, tax administration or innovative CRE is not predominantly based on heroic acts of individuals, but on fluent cooperation of distributed and/or mobile experts. That is why distributed cooperation and the organizational dimension of the *workplace* are so crucial for good performance in the fields of dWork study. Consequently, the understanding the basics in group dynamics and in organizing the distributed and mobile cooperation constitute one basic element of the knowledge for CRE and their clients.

Our analysis also revealed that workplace making would be improved by adopting a more holistic view of the workplace. It was discovered that the effective collaboration of CRE, HR and IT and other units – or at least the effective combination of the different views and knowledge these branches have to offer – would be required in successful workplace making. The workplace is more than just square meters, desks or chairs – it also includes the social and organizational aspects and human factors that are too often left aside.

Our research indicates that social and organizational aspects are vital in successful implementation and design of a new workplace. It seems that the key to supporting distributed and mobile work successfully seems to lie in the profound understanding of the work people do. When organizing distributed work, companies must ask their employees what they really do and what they need to perform their tasks successfully. Participative design practices are needed to discover the real needs of mobile personnel. After the employee-level information is gathered, it is not very hard to make the distributed groups and possible new organizational settings flourish.

Below we provide some suggestions for overcoming the problems outlined above. Following the structure of this chapter, we divide the recommendations into two parts:

1. Recommendations for Cooperation in Distributed Groups · If benefits from collaboration by teamwork are to be expected, the work tasks should be organized in an interdependent fashion so that the remote subgroups and individuals are forced to share their ideas and cooperate. However, teamwork is not a solution for all work. If the work, for example, is fun-

damentally local, there is no reason to form distributed teams on the organization charts. They will never work as such no matter what. This also applies to the collaboration of CRE, HR, and IT units.

A kick-off meeting of team members would be extremely beneficial at the starting phase of working and collaborating. In the kick-off meeting, the distributed team members have a chance to meet each other face-to-face, set the ground rules for their work and create shared understanding of, for example, tasks, communication patterns, roles and responsibilities, and leadership. Also enabling tools and methods, such as the Teamwork Game, can be utilized in kick-off meetings. For using the Teamwork Game, see details in the Organizer's Toolbox after the references of this chapter.

A distributed team needs "heavy leadership". This does not mean that the leader should be the senior specialist in the team's area of expertise. Instead, a good leader in distributed settings is the one who supports team members and keeps the common goals clear. S/he must have the chance to travel and meet the remote subteams or individuals face-to-face, especially when things are not going smoothly. This kind of a participative, respectful, integrator can create a shared identity and keep the distributed team together despite the many local pressures.

2. Recommendations for Workplace Making in a Distributed Environment · The work people do should be carefully analyzed before implementation of new workplaces. This can be achieved by interviewing the people who the change affects beforehand and/or by organizing a questionnaire to which all are able to respond. It is important that employees who the change really affects are heard, not only their bosses.

It is vital that all affected by the workplace making are given an opportunity to influence the change. They should be heard beforehand and also after the implementation of the change. In reality, the ideas expressed by employees cannot always be implemented, but, even so, it is critical to state the reasons why this is the case.

Work analysis and participation are not necessarily resource consuming. Look at the existing personnel (also outside the CRE unit) who have close contacts with the client organization. These are often missed, but, if they do exist, they are very valuable, since they can form a realistic picture of the client's work and hold discussions with the client's employees as a part of their daily work. If such gatekeepers are not found, the samples of client personnel strategically chosen for the interviews or web surveys mentioned above are fairly cheap ways to grasp the real needs of the client.

Finally, the logic of the change in cost calculation requires a focus on the result and costs/gains of the whole company, instead of on the sub-optimization of saving only at the unit level. This would increase the incentive for CRE or any other function to cooperate with other units and to be really interested in the work and the future of their clients.

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Organizer's Toolbox

1. The Teamwork Game

The Teamwork Game is a pragmatic tool for teambuilding and teamwork training in organizations. It is an action-based card and board game, where players discuss together work-related issues and solve problem situations. It is meant for practicing collaboration skills and forming the team's ground rules. The game is targeted at industrial, clerical and administrative personnel that form a team such as a production or customer service team.

The aims of the Teamwork Game are to increase team members' abilities and skills to work in a team and to increase the team's functionality. The more specific aims are:

- To develop collaboration, interactive and communication skills.
- To get acquainted with group phenomena and to form common concepts.
- To practice anticipating, identifying and solving problems.
- To get to know one another better as team members.
- To lay a foundation for norms or rules of the team.

The participants are those employees who are working together as a team, including supervisors and managers if possible. A team of three to eight employees participates in the game with a trained game facilitator. Typical game facilitators are human resource developers, personnel trainers and consultants who have experience in teamwork and team training.

The content of the game is based on essential teamwork situations and typical conflicts that have emerged in practice within various organizations and presented in the literature under the following themes: communication, common goals, group cohesion, fairness, autonomy and leadership in teams. Additionally, the game includes questions regarding knowing others as team members, because in teamwork, it is necessary to understand and tolerate the diversity and individuality of team members. The various levels of teamwork are handled in the game: a team as a part of an organization, internal relationships in a team, and an individual member in a team.

Materials of the game are packed in the box including the following components: question cards (145 pieces), game board with different routes and coloured spaces, the answer cards with alternatives ("I agree", "I disagree", "I partly agree", 1, 2, 3), eight pawns of various colours, one dice, score boards, Collaboration Survey and the manual for the game facilitator. The Teamwork game includes different types of question cards. Red cards ("knowing others") are meant to practice knowing others as team members and practice self-evaluation. Green cards ("teamwork themes") present the themes of teamwork with the alternative statements on the cards. On the yellow cards ("problems"), typical problems of teamwork are illustrated as small episodes, which are used to practice identifying problems and solving them. Each game is tailored for the specific needs of the team by selecting relevant question cards.

As for length of teamwork training, a two- or three-day workshop is possible, or it could be carried out over a longer period of time. The Teamwork Game is most useful when its use is connected to the broader context of personnel training, team building and organizational development. Application is typically divided into the following stages:

Collaboration Survey and discussions before the game day (1–2 hours).

Playing the game (1/2 day). Participants proceed by casting a dice, moving on the game board, answering questions, arguing about them, solving problems, and collecting points. Different viewpoints of the players and constructive discussions are encouraged. The game facilitator helps the group processes, facilitates discussions and takes care to foster a safe atmosphere.

Debriefing discussion immediately after the game session (at least ½ hour). Participants share and reflect their experiences in the game and in the team with the help of the game facilitator. Team members select those cards of the game that need further processing when creating the team's ground rules.

Ground rule workshop for the team after the game day (1/2 day <). Participants discuss the relevant topics of the game and their own team. A game facilitator structures the discussions. The purpose is to formulate and agree on ground rules or norms of the team concerning, for example, clarifying team goals or communication procedures.

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Note: The Teamwork Game was developed at TKK by the research group V. Ruohomäki, P. Buhanist, M. Laitinen, J. Sulander, T. Tanskanen and M. Vartiainen.

2. Change Management Checklist

The following table listing the key success factors and good examples of change management was developed by Salminen (2000) on the basis of his wide empirical and theoretical study. The table is modified in order to be applied as a change management checklist in two situations. Firstly, it can be used when planning changes in your own organization or work unit. Secondly, it can used afterwards in order to evaluate your organization's state in a large-scale change management endeavour. You can use this checklist as a basis for group discussions, for example, for the management group, for the workplace makers or for the moving units of the company in order to form a common understanding of your own situation. That checklist offers a tool for continuous improvement and organizational learning from previous cases when planning forthcoming changes.

Simply write a brief description of your status in each of the eleven topics/success factors listed in the left-hand column and compare your situation to the good examples listed in the mid column. The list is, naturally, rather general and should be applied concerning the situational and contextual factors affecting each individual change process.

Success factor	Good example	Situation of your organization
Leadership	Enthusiastic leader who shows the way and motivates as a result of his or her own behaviour.	
Management support	Top managers believe in the importance of change and ensure allocation of resources.	
Need for change	A shared feeling for necessity of change is created.	
Participation	Everyone involved has an opportunity to affect the solutions.	
Defining roles	Responsibilities are clearly defined. Everyone knows his/her role.	
Planning	Detailed planning: work breakdown structures, resource allocation, budget and schedule.	
Goal setting	Clear and shared overall vision of the desired state, as well as measurable performance goals.	
Control	The execution is systematically monitored, coordinated and controlled.	
Training	All people get sufficient training on new concepts and their implementation. Training is practical and timely.	
Communication	All issues are communicated to everyone at every stage of the change. Discussion is free and open.	
Motivation	Commitment is assured by making the goals desirable and actively promoting the importance of the change.	

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3. The Context Inquiry in the Analysis of Client's Work

In Appendix A, a research method including key informant interviews and documentation analysis is described. This kind of *context inquiry* could also be used by workplace makers when analyzing the work of their clients. It is a rather light-weight procedure, but potentially gives a lot of information about the work, interfaces, environment and other aspects relevant to workplace making.

If the client is internal, HR presumably has gained lots of information about the moving unit via normal internal questionnaires and interventions. In these cases, CRE should first *consult HR* in order to get a holistic picture of the client's work. In the case of an external client, CRE has much the same challenges as we had as researchers. Nevertheless, the client personnel must perceive that the ones analyzing them are not biased and do not have any hidden agenda. This is the key to the success of any change process. For example, if CRE unit makes the analysis and it is considered to have just spatial cost savings in mind, true or not, subsequent resistance is almost inevitable. Other actors in the key position to carry out a context inquiry are the ones with close contact with the client in question.

Naturally, the procedure of context inquiry varies, depending on the base level of knowledge of the client's work. However, as our study revealed, usually the workplace makers tend to assume their level of understanding of the client's day-to-day work to have much wider coverage than it really does. Thus a certain rigor and openness to contra-prejudice and surprising evidence is essential.

The process often starts with *client management interviews*. However, the workplace makers should keep in mind that managers are often overburdened by their administrative work and, as one interviewed manager said, they might "have no clue whatsoever of the daily work". Managers, though, can often present the "big picture" of the operations and provide documentation. The next step is to *take a small snowball sample of the employees*. That is, on the basis of the discussions with the management and scrutiny of the company documentation, one or two employees who seem to represent key areas in the client's work are interviewed. The topics have to be tailored to the unique situation, but essentially the *areas of inquiry* are: the respondent's tasks, his or her daily work and work processes, key interfaces and stakeholders both inside and outside the organization – in essence, what that person does during a normal

workday or week. If these first respondents seem to give a too biased picture of the client organization's work, they and the management can be asked to name one or two other respondents. However, our experience is that the essential information can be gathered by no more than a few interviews. In order to get a more comprehensive picture, discussions can be held with the *key external stakeholders* named by the respondents. A view from outside usually enriches the picture of a unit or an organization.

The outcome of this process is a *preliminary model of the client's work and its networks and working environment*. This can be reported, as we did, in a form of a *short story or graphic illustration,* which is then *briefly discussed and validated with key informants* of the client organization and adjusted to form a basis for a shared understanding of the client's work in its context. At best, this kind of procedure discloses the essentials any outsourced workplace consultant will reveal or, rather, is willing to reveal. However, the workplace makers should keep in mind that a context inquiry is just the start of a change process. A *broader participation of the client personnel* is always necessary for a successful change, such as a move. A context inquiry is one option for starting a dialogue between workplace makers and their client in a long process ending to the careful follow-up of the results of a move.

Technology in Distributed and Mobile Work

Mika P. Nieminen and Petri Mannonen

1 Introduction

Tools and devices enabling mobility, and information and communication (ICT) systems supporting distributed collaboration have became more and more common during recent years. Practically all companies consider new ICT solutions as a means of enhancing productivity and cut down costs. At the same time, the effects of introducing new tools and methods to ongoing processes and projects are hard to understand or predict. The difficulties in understanding the dynamics of change grow even larger when we speak about knowledge work and rapidly developing technologies. Knowledge work is characteristically non-opaque, i.e. it is difficult to understand the nature of a task from outside, for instance by observing the workers (Orr, 1996). The rapid and ever accelerating pace of developing new ICT systems makes the situation even more complicated. All stakeholders envision the enormous potential within the new ICT solutions, but many difficulties lie in actually materializing the promises and expectations.

This chapter aims to tackle the problem space in distributed and mobile work from the viewpoint of workers as users of tools and work-related systems. It discusses how mobile technology enables flexible distributed working in company-specific multi-site situations.

The use of ICT is addressed from two distinct viewpoints: the workers and the IT department. This comparison is unbalanced as, by definition, the workers use the solutions provided by the IT departments. Traditionally, the IT department is responsible for obtaining or manufacturing the tools and services for the company. The chapter starts with descriptions of the current state of the art in ICT and the traditional ICT viewpoints towards mobility, distributedness and use of the ICT solutions. Then, the

current practices in case companies are described. The current practices and solutions are reflected both from the workers' and the IT departments' points of view. After describing the current practices, we dig deeper into upcoming challenges regarding the ICT in mobile and distributed work, and then close the chapter with suggestions for strategies to overcome current and future challenges.

The research viewpoint of the technology part of the dWork project has been that of a designer or an engineer. The methodology has been heavily influenced by usability engineering and user-centred design (UCD). In user-centred design, the motivation behind the research actions is to develop new constructs that describe the studied phenomena from fresh viewpoints useful to workplace design. In this chapter, we hope to give practical ideas and models to all readers interested in, or supporting, modern distributed and mobile work.

2 Technology

dWork research has studied the collaboration of mobile and distributed workers. So it is understandable that the focus rests heavily on the networked and communicative aspects of technology. IT, ICT, ICTS and IS[1] are all terms that give identity to the industry that produces information and communication products and services. They have their origin in financial and political debate. OECD countries defined the ICT industry in 1998 in the following way (Nordic Council of Ministers, 2005):

- In the ICT manufacturing industry, the products must be designed to fulfil the function of information processing and communication, including transmission and display. The product must use electronic processing to detect, measure and/or record physical phenomena or control a physical process.
- In the ICT service industry, the products must be intended to enable the function of information processing and communication by electronic means.

In computer science and engineering, interest usually focuses on specific technologies and methods inside the ICT definition.

ICT is frequently over complicated within everyday work. The goals of the new systems and solutions are easily lost when the semi-technical

1 IT = Information Technology, ICT=Information and communication technology, ICTS=Information and communication technology system, IS=Information system

Table 1. Two different toolsets of mobile workers.

Person A – "traditional"	Person B – "extremely mobile"
• Laptop computer	• Laptop computer
• Mobile phone	• Mobile phone
• Hands free	• Hands free
• Briefcase for laptop computer and papers	• Battery charger for laptop computer
• Battery charger for the laptop computer	• Battery charger for mobile phone
• Battery charger for the mobile phone	• Battery charger for Hands free
• Notebook	• Post-it notes
• Almanac	• A pen
• A couple of pens	• Small briefcase
• Printed documents (2–5 most relevant + 2–5 older ones forgotten in the briefcase)	• Encryption card
• Manual for the mobile phone	
• USB memory stick	
• Encryption card	
• Newspapers, books (for free time at the airport etc.)	

features and details are highlighted by the producers and sellers of the products. In essence, ICT is just enabling infrastructure (Nordic Council of Ministers, 2005). The effect the infrastructure has had on our everyday life is possibly the main reason for frequently putting golden frames on ICT. The digital revolution has so dramatically increased the number of ways in which we can use and collect information that even political authorities have been forced to comment and commit to it.

Castells (2000) has defined ICT through a vision of the new order of things, what he refers to as a post-digital revolution paradigm. He envisions information technology defined to include the following characteristics:

- Information is the raw material. The technologies act on information. Before, information acted on technology.
- Since information is also an integral part of human activity, all our processes (individual and collective) are directly shaped by the new technological medium.
- Information technology systems or sets of relationships have built-in networking logic. The network as a structure seems to be morphologically well adapted to the increasing complexity of interaction and patterns arising from that interaction.
- Everything is flexible. The processes, organizations and institutions can be modified and even reversed by rearranging their components.

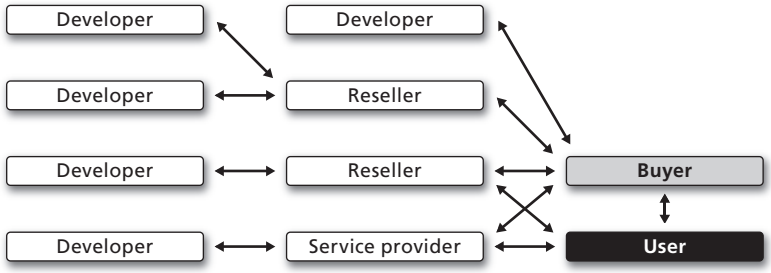

Figure 1. ICT actors from IT department's perspective.

- There is a growing convergence of specific technologies into highly integrated systems. During this convergence, old separate technologies become indistinguishable.

In this chapter, where ICT refers to the devices and solutions that the ICT industry has and will produce, the focus is on the users of technology.

2.1 Distributed and Mobile Work

Distributedness and mobility are in many ways two sides of the same coin. They are mostly found to coexist and reinforce each other. Distributedness is usually seen as a quality of a group of people and its main characteristics are physical or temporal distance between co-workers, reliance on ICTs, and interactions between workers (e.g. Cramton, 2002; Sarker & Sahay, 2003; Evaristo, Scudder, Desouza & Sato, 2004). Mobility describes the ability to move and is thus a quality of a single person or object. The main driver of mobility is the need to meet other people face-to-face (Perry, O'Hara, Sellen, Brown & Harper, 2001) or visit certain places or immovable objects, e.g. elevators or large machinery (Riihiaho, 2003). Consequently, distributed work means in many cases that the workers are also mobile. One may of course envision border cases where they become unrelated, such as

- a five person maintenance crew jointly inspecting a paper mill (very mobile, but not distributed), or
- a person working at a helpdesk from her own home without any other work premises (very distributed, but not mobile)

From the point of view of technology, the tools and devices of distributed and mobile work contribute only to the contexts in which the workers

operate, and not to defining the work itself. Distributedness or mobility are not tasks or work functions themselves. Thus, there are no specific additional functional requirements for tools and systems when they are used in distributed or mobile work compared to traditional work.

2.2 Human Factors and Usability

Introducing technology, i.e. new tools and solutions, to the daily tasks of workers can result in many problems. These fall into the field of human factors and usability, or human-computer interaction (HCI). Usability in part describes the usefulness of a product and is often quoted to include specific attributes such as learnability, efficiency, memorability, [lack of] error and user satisfaction (Nielsen, 1993). On the other hand, it can be seen as something dependant on the usage situation and environment, i.e. context (International Organization for Standardization, 1998). Developing products with high usability usually relies on taking the users into account in all stages of the development with abundant evaluations in an iterative manner (International Organization for Standardization, 1999), emphasizing the fluent interaction between the user and the system or device.

Many problems arise when distributed work is considered from the HCI point of view of interactions in a specific context. Complex collaborations between people are easily over simplified into separated interactions between singular users and a system. The problem has been recognized in the HCI field (e.g. Beyer, & Holtzblatt, 1998; Hackos & Redisch, 1998) but the product development and design methods still seem to aim at developing a new product to answer the needs of the user, instead of developing products that support the needs of groups of people working in collaboration.

A good example of problems rising from the single user point of view is the annoyance of the rapidly expanding flow of e-mails observed in each of the participating companies. The e-mail client applications (e.g. Microsoft Outlook™, Mozilla Thunderbird and the like) are extremely efficient when simple interactions between single users and the software are considered. Sending an e-mail message is easy after the initial setting has been configured and so efficient that the content of the message can almost be forgotten. Receiving an e-mail is also easy and understandable. However, after this simple and usable tool is introduced to vast numbers of people, the true nature of the solutions will emerge. Handling tens or hundreds of messages daily is slow and cumbersome. The users are burdened with non-work related tasks such as cleaning their inboxes of junk mail and emptying trash mail folders.

E-mail systems do not easily support grouping messages according to their content. Some e-mail clients can link together conversations when the title of the messages remains the same, but there is no way of definitively grouping, for instance, messages relating to a certain project or task – not to mention linking one message to two or more projects or tasks.

The computer supported collaborative work (CSCW) research field emerged from the aim of shifting the focus from single users to groups of people. As the name suggests, CSCW has been focused on supporting the collaboration tasks of people with new products. In practice, this has meant the development of collaboration and meeting systems and equipping them with ever-richer communication media. The actual tasks and actions of the users have, however, been put into the background. Modern videoconferencing systems, and even free desktop conferencing systems such as Skype, can mediate sound, video and even the content of the collaborators' computer screens. However, the use of richer media does not imply use of more usable tools. Richer communication media seem to improve the actual communication task, but often disturb or confuse the actual work task.

In the dWork project, the studied mobile and distributed team members were typical knowledge workers. Knowledge work is characterized by including analytical problem solving and reasoning in order to create new knowledge from available information. Available tools, devices and solutions enable knowledge workers to efficiently collect, create, edit, manage and communicate information and thus (interactively) produce knowledge.

3 Tools and Solutions in Use

ICT tools and solutions play a major role in modern knowledge work. During the dWork project, the opinions and interpretations of the current state of ICT in the participating companies differed greatly between different stakeholders. At the general level, the goal of corporate ICT was agreed, but, down in the trenches, the workers and IT departments had many difficulties in their communication and in many cases unresolved issues created unnecessary friction within the companies.

In this chapter, the basic set of tools of a mobile and distributed worker is described. The stakeholder perspectives mentioned before, i.e. those of the workers and IT departments, are discussed and their respective strengths and weaknesses listed as enablers and disablers. Finalizing this chapter, a context model of distributed work, which takes in account the complex nature of distributed knowledge work and the previously identi-

fied different viewpoints within the participating companies, is defined. The context model includes many attributes used in analyzing the current and future challenges and possibilities of ICT in the following chapters.

3.1 The Basic Set of Tools

The knowledge worker's basic set of tools is more a company-wide policy than a specially tailored toolset for any one particular type of work. All the companies studied in the dWork project had more or less the same general policy. Hence, the core toolset of the knowledge workers, and also of the mobile workers, consisted of a laptop computer and a mobile phone. Table 1 depicts two examples of actual collections of carry-on items belonging to mobile workers. Though the laptop computer and mobile phone form the backbone of the tools, there are substantial differences between different workers. The different utilization of tools seemed to result more from the personal differences in working habits than actual requirements caused by work tasks. While one person might have the habit of printing every document longer than ½ a sheet for reading, another might try to minimize the amount of paper carried with her and try to survive with a couple of post-it notes and with no printed documents.

The carry-on items listed above define the personal workstation of a mobile worker. When necessary, a mobile worker reassembles her office, i.e. finds a desk on which to lay down her tools, connects electricity and network (if available), and checks e-mails. Reassembling is done quite routinely and is only attempted if prior experience suggests it possible in a given situation. Additionally, company practices such as having visitor points and co-worker advice facilities reveal good spots to begin building-up the temporary office. During the study, the workers expressed a need for more support and training concerning the different working contexts they encounter almost daily, while the companies were found to mainly offer general training regarding used (mainly) software tools and solutions.

In every company, there were a couple of different laptop and mobile phone models for workers to choose from, depending on their tasks and needs. In all cases, the selection and ordering of tools was done with the worker's superior. The main difference was the laptop's performance (in some cases a priority need for software developers) and the ability of the mobile phones to send and receive e-mails. All the offered solutions, even those several years old, were, in principal, adequate for completing the work tasks.

However, the big picture was not as sunny as it might seem. Since the companies had outsourced most of their ICT provisioning and support, or at least departmentalized it, the actual tools generally chosen by the internal IT department were in several cases too outdated to run the outsourced and rapidly developing solutions and services. The latest security measures and more advanced applications are often too demanding to run on the workers' computers. The new solutions could in many cases be used with the older hardware, but the performance was disturbingly slow and unstable. One worker stated that she did not want to use her laptop when commuting, because it was so old and slow that it took longer for the computer to start than for her to reach the office.

3.2 IT Department's Point of View

The IT department thrives on giving workers secure and working ICT tools and solutions and maintaining the company's ICT infrastructure. At the moment, security issues are the main challenge from the IT department's point of view, followed by storage and infrastructure issues. The most influential trend in ICT is acceleration of change both technologically and socially. The current phenomena can be described as enablers and disablers of mobility and distributedness.

Changing ICT-world · From the IT department's point of view, the change in product development and its business structures is the most influential aspect of the transformation. The traditional division between users and developer(s) has grown into a complex network of various actors. Figure 1 portrays the ICT business domain from the IT department's point of view.

Nowadays the main duties of the IT department include the selection of both the most suitable ICT tools and services (technologies based on their potential) for use in the company, and the best solution providers to tailor and implement the solutions to fulfil the company's needs, shown as "Buyer" in Figure 1. Thus, in order to acquire the best possible services, the IT department must understand the possibilities that the technologies offered by the developers provide and the actual functional requirements in order to select the right reseller or service provider to bring the solutions to life.

In the past, the IT departments themselves developed or tailored most of the tools and solutions needed to fulfil the company's needs, shown as "Developer" and "Service provider" in Figure 1. This practice is diminishing and a new role of buying compliant multi-vendor solutions to fulfil

the needs of the actual workers of the company is emerging. The following tasks relating to this change can be identified in the ICT business:

- Obtaining compliant multi-vendor ICT systems, device and service combinations
  - evaluating and researching different solutions
  - testing different combinations
  - bargaining
- Specifying the requirements for tailoring the ICT systems, devices and services
  - selecting the functionality of the solutions (options)
  - specifying the information structures
  - mediating user feedback to the developers and service providers
  - IT department is easily cut out of the user - solution-provider dialogue, but, in order to succeed in securing the best possible tools for the company and its workers, the IT department needs to understand the work it is supporting and the problems in current solutions.

Enablers · From the ICT point of view, the task of supporting distributed and mobile work can be straightforwardly simplified as supporting the remote use of company information and communication resources, as most of the work is information processing using a generic tool within variable contexts. Of course, more advanced and context-sensitive systems, such as location or positioning-based solutions, exceed the services available to 'fixed' users and provide additional functionality only available to the mobile users.

At the general level, the toolset for distributed or mobile workers is quite good. The technical pieces of equipment are numerous and quite high in quality. New laptops are powerful enough to run all the software used in the companies, and the mobile phones support teleconferencing and other more sophisticated services at least as well as traditional phones.

A closer look does not change this situation. In all the studied companies, the technical interoperability between different devices and systems was considered important and a lot of effort was put into ensuring smooth co-operation. As a result, if deemed necessary, the workers could, for instance, utilize their mobile phones to securely connect to their company's intranet with their laptops or use it for e-mail services. The workers could also use the infrastructural ICT-services while stopping at dedicated visitor points during visits to their company's other premises.

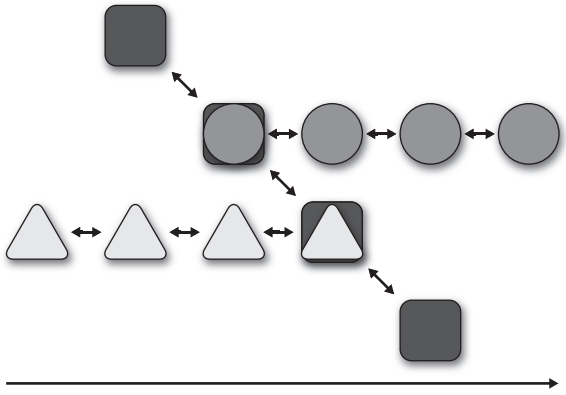

Figure 2. Hierarchy of projects and collaboration events.

Disablers · Technology develops rapidly, and computers and other high-tech equipment becomes obsolete as quickly. For instance, a laptop computer just a couple of years old may not have an internal wireless network card (WLAN), a feature commonly available nowadays, forcing the IT department to provide external WLAN cards to the owners of old laptops. From the IT support point of view, this obscures their product offering and increases the amount of support needing parts and devices that can potentially break.

In addition, the fast changes in technology also increase the need for training. Workers need practical information on the available ICT solutions, such as how to read e-mails in a hotel room, or whether a certain meeting room has a wireless network. Lack of information and training sometimes causes people not to use or even try the services the IT department has produced for them. Two out of three interviewed IT departments reported difficulties in communicating the availability of their wireless networks to their mobility-enabled laptop users.

3.3. Workers' Point of View

Mobility or distributedness are characteristics of a task, not the task itself. The tools and solutions enable mobilization of the workers and the distribution of tasks geographically, and even adapt the time of task execution accordingly.

From the ICT department's point of view, the biggest challenges, such as security, managing the IT infrastructure, and the development of new services, are not necessarily relevant to every mobile worker. To most workers, the security solutions are perceived as just annoying obstacles

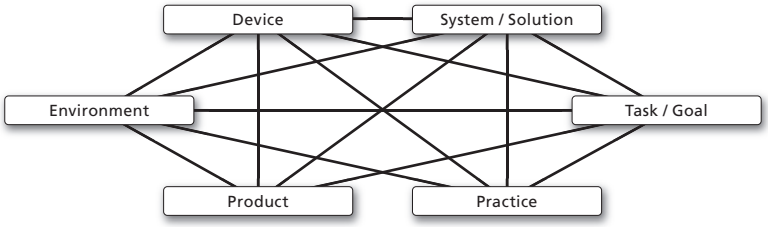

Figure 3. ICT context of use for mobile and distributed workers.

between the workers and their tasks that must be endured despite the delays they cause. However, mobile and distributed workers are conscious of existing security threats at a general level and are willing to accept the set procedures.

The current technical solutions have either enabling or disabling roles in the mobile workers' lives. Also, the fast technical development is an influential trend in their daily tasks.

Changing ICT-world · From the workers' point of view, the rapid development of technology is visible in various ways. The most concrete manifestation of change are the new tools and service infiltrating everyday tasks. In all of the participating companies, there were some sort of change processes going on with phone, e-mail or document management systems.

In the worst scenario, the change remains invisible to the workers. Modern knowledge work tools are mostly software and can be easily upgraded without any physical changes. In many cases, the announcements posted in the company intranet or e-mails were ignored. Some were never seen, some were categorized as not involving oneself, and some were misunderstood due to their technical nature. For instance, a few workers reported that whenever they visit the company intranet, it looks and works differently.

This rapid change also disables the best and most used support channel – workmates. As a rule, the workers tried to solve their immediate problems by asking the "guy next door" or "call Mike, he knows". Within the continuous change, this path ceases to work as colleagues may have different versions of the same tools, even though IT departments thrive to homogenize their portfolios and can have quite different problems of their own. An example of this could be the use of a wireless printer at a visitor point. A visiting worker cannot print to the public Bluetooth printer due to older software in her PDA, while the assisting

colleague has the same PDA and does the exact same task successfully. Thus, inconsistencies in the tool and service offering prevents the organic propagation of good work practices.

Another growing trend is rearranging the IT support. In all but one case in our study, the support was fully outsourced so that all new tools and their support came from other companies. Even the support calls were directed to outsourced companies.

From the company perspective, outsourcing may be a reasonable and cost-effective solution, but, from the workers' perspective, it creates a complicated network of ICT support providers. Workers are often confused, as they themselves need to figure out who to contact for a certain problem. Workers would like their company to act as a single point of contact for providing them with the necessary tools and for helping to use them. As an example, a worker contacted her PC support about an e-mail problem, and was annoyed to hear that e-mail services were not handled there and that the (outsourced) PC support did not know who could help her.

You can delegate authority, but not RESPONSIBILITY
- Stephen W. Comiskey

Enablers · When ICT devices and solutions function as they should, they enable the mobile workers to use company information systems and services remotely from almost any place or situation. The tools also give the workers the ability to organize their work, responsibilities and tasks into manageable and transportable entities, e.g. outlook calendars for organizing appointments and e-mails for delivering important information and documents. Several workers said that they only needed "a laptop and a working network connection" to perform their tasks.

Communication services and tools are another category of mobility and distributedness enablers. In all the companies, all workers who considered themselves mobile had mobile phones and laptops. Minimizing the ICT offering, in many cases the "non-mobile" workers also had mobile phones and laptop computers in use. All companies used teleconferencing. In our study, we observed that, if the service was offered in a straightforward manner as an always-available self-service, and if the required teleconferencing phones were available in meeting rooms, the teleconferencing was widely used in the teams. In all the participating companies, videoconferencing facilities were available for the workers. Only very few admitted to ever using them and none seemed to be satisfied with the collaboration events using a videoconferencing system. The main reason for not using the videoconferencing systems was a general

lack of confidence towards them, specifically because of difficulties in setting up a connection.

E-mail was considered a technically more mature solution (reliability, availability and speed) and, interestingly, it was also considered more suitable for accomplishing the necessary work tasks. Appreciated features included the automatic recording of the conversations as threads of e-mail messages, making it fairly easy to check afterwards what exactly was agreed or discussed or to continue earlier conversations.

In addition to technical support, the clear division of responsibilities and liberties is a major enabler of distributed work. The technological enablers must be augmented with social acceptance of various, sometimes self-induced, work practices. The combination of these practices and the ICT-services enabled the workers to genuinely work in a mobile and distributed fashion. Observed examples of these included: Explicitly encouraging people to participate in meetings remotely, providing mobile workers the comforts of a steady office, i.e. secretarial services, coffee etc. at visitor points or enabling working remotely from home with access to corporate network services. Some companies promoted a "remote-Friday", a day when all workers in a team worked remotely.

Disablers · Main obstacles for remote collaboration or working in remote locations are contradictions between the goals and tasks of the workers and the tools and services available to the worker. Evidently service and application development outruns the device circulation, as in many cases the security solutions or business applications used were too consuming for the "elderly" computers.

Based on our observations, this led to several different responses:

- the computer/tool was abandoned,
- the security solutions were disabled, removed or circumvented,
- a new computer was ordered or
- nothing was done, workers performance was degraded with the slow down caused by the equipment used.

Some of the problems can be solved with training, e.g. how to read e-mails with a mobile phone, but some should not be added to the workers' responsibilities, for instance, understanding how backup and security solutions work.

4 Distributed and Mobile Context

As mentioned earlier, mobility and distributedness are strongly linked to the participants and surroundings, or to the context, of each work task. In this chapter, the context of use for mobile and distributed workers is discussed using a six-part categorization. This partition arose from the data collected from the partner companies during the dWork project. The categorization describes the context in which ICT tools are used from the perspective of technology, and does not, as such, aim to reflect the way the workers perceive their work situation.

In this context analysis, the smallest unit for observation and analysis was an event. Within this chapter, an event refers to an individual act of communication or collaboration, these events were found meaningful as the workers were observed to base their work on the events that included other parties.

From the point of view of the project, the events are sequential and form a hierarchy; these are illustrated in Figure 2 as paths with different forms. From the workers' point of view, the events are a part of a certain project, but can share events with other projects depicted as crossing paths. It is noteworthy that the hierarchies and sequences are not necessarily the same from different workers' points of view. Participants of a meeting can have, and, based on this study, frequently do have, different goals and motivations regarding the meeting. As a consequence, the events seem to form a large network of which projects and workers see different snapshots and partial projections.

The context of use of the mobile and distributed workers, illustrated in Figure 3, was constructed on the basis of the technology-mediated communication and collaboration events to include:

- Physical environment
- Technological environment or present ICT environment
  - Devices
  - Systems and solutions
- Task and goals
- Practices and methods
- Products or concrete results of the work

The categories are closely linked, but their emphasis differs between events. Figure 3 depicts the context framework and connections between the categories discussed in the following chapters.

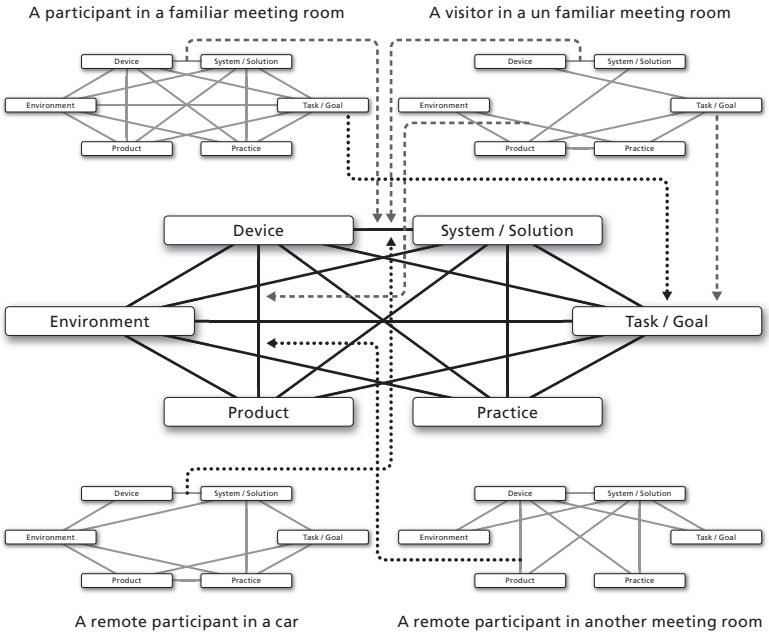

Figure 4. Comparing participants' context models can suggest ways to improve the collaboration event.

4.1 Physical Environment

The physical environment consists of the physical surroundings of workers at the time of the event. The most common environment was found to be a meeting room, but remote participants used various environments such as homes, cars, hotel rooms or even a grocery store.

Naturally, different environments set different restrictions for communications. In public places, it is not advisable to discuss confidential projects, although a person can listen to the conversations of others in meetings via a mobile phone and even participate in non-audible ways, for instance, via chat or e-mail. Another commonly used restrictive environment is the car. It is possible to participate in teleconferences using a mobile phone hands free, but it is difficult and inadvisable, not to mention illegal in many countries, to look at PowerPoint™ slides or type messages while driving.

Although advanced ICT solutions promise independency from physical constraints, the result is usually not independency, but a very strict dependency on commodities provided by the physical environments. For example, in order to work with a laptop for longer than a

couple of hours, electricity is needed, and though it might be possible to connect to the company intranet and e-mail server via GSM-data, adequate use of network services requires a broadband connection.

In general, physical environments do not usually embody modern ICT solutions. Lack of integrated power outlets is often corrected with "a chaos" of extension cords, and still many meeting rooms do not have integrated data projectors. After decades of trials, videoconferencing facilities are still few in numbers and mostly unused due to consistent technical difficulties.

The most influential factor contributing to the successful use of ICT-empowered spaces is their familiarity. In familiar environments, workers are more prone to strive to bypass emerging technical problems as they may have an idea as to who to contact or have prior experience with similar problems. When operating in strange places, a very strong will indeed is required to try to solve a malfunctioning ICT solution. More often, it is easier to change the communication medium or solution rather than try to bypass the problem with the primary solution. It was observed that, when an unfamiliar meeting room did not have a data projector, the work practice was modified to just view the slides from the laptop screen instead of leaving to find a replacement projector. Similarly, tasks requiring network connectivity were postponed when a wireless network of a hotel room did not respond immediately.

4.2 Technological Environment

The technological environment consists of both devices and systems and solutions that are used with the devices. In some cases, the binding between a device and a solution is quite strong, e.g. between a mobile phone and a text message, but this situation is changing rapidly. Nowadays, it is possible to make phone calls from a computer equipped with microphone and speakers or headset and read and write e-mails with mobile phones.

ICT devices and systems form a complex network of technological possibilities. Thus, it is up to the workers to select the most suitable combination for each task in hand. The selection requires a better than average understanding of the possibilities of interconnecting the various devices and their cooperation with the systems. Currently, the training and documentation offered seems to solely provide singular instructions separately for each tool. Even though this enables the workers to adopt good simple practices, it does not support the earlier mentioned problem solving when the situation is somehow extraordinary.

Devices · ICT devices can be divided into two categories: shared devices and personal devices. Mobile phones and personal computers are good examples of personal ICT devices. Printers, faxes, videoconferencing systems, and teleconferencing equipment are the shared equipment available in all of the participating companies. There are also some devices that fit into both categories, e.g. a digital camera was found to be both a shared device for a team or a personal tool.

The categorization gives a good indication of the availability of the devices. Personal devices are something the workers can have with them all the time, while shared devices are either fixed in a particular place or have to be fetched from, and returned to, some specific place or person. The general ICT policies in every company restrict the personalization or reconfiguration of the devices according to the personal or professional needs of the workers.

Systems and Solutions · The ICT systems and solutions can also be divided into two categories: device specific and universal systems. The toolset of the basic mobile and distributed worker has a great potential to connect to and make use of web-based services. As a consequence, the easiest way to produce universal systems and services seems to be to produce web-based solutions. The companies have already recognized this and there are web-versions of many of their information resources. On the other hand, many web-based services have been integrated or added to devices that do not have web background, e.g. many mobile phones have e-mail clients.

4.3 Tasks and Goals

Although events are parts of projects, it is not uncommon that the goals of the events are different from the goals of the projects. For example, in each project studied in this research, there were some status meetings aimed at keeping all project members informed about the current state of different parts of the project. Having differences in the goals of events and projects is not a problem as such, but problems can arise when the goals of different participants disagree. This can become critical if the differences in goals are not recognized in early phases of the event. A co-worker was deemed uncommitted when she did not actively participate in a weekly meeting; the worker in question did not even work for the project, but only came to catch up with the general project status.

Even with a shared goal, the preferred communication tool between remote collaborators can be different. This forces some of the participants to use a non-preferred tool, and thus places them in a weaker position.

At a general level, the tasks and goals are not very system or device specific and the ICT systems and devices handle tasks and other communication contents at a quite abstract level. Since the bond is loose, it would be quite easy to change the tools to better suit individual tasks. Abstracting the contents can cause problems when the workers misinterpret the capabilities of their tools. This becomes especially obvious when the content grows. For instance, finding a specific e-mail relating to a prior work task among thousands of messages in the inbox can be difficult if the only supported way is either sorting by date or sender or searching with a keyword.

4.4 Practices and Methods

Work practices have a major influence on the use of ICT devices and systems. Practices can be dependant on:

- certain tools, for instance, brainstorming ideas with SmartBoard™.
- the utilization of certain tools, allowing remote participation in meetings via tele- or videoconferencing, for instance. Or,
- the prevention of the use of certain devices and systems, for instance, having remote participants in an idea-creation workshop, so local participants cannot use post-it notes without isolating their remote colleagues.

Most of the practices seem to be of type two. Very few work practices are strictly system- or device-specific, and only few practices are restricted to the use of ICT solutions.

Though there were only a few cases where the work practice was technically ICT-solution specific, transferring a practice from one system to another was not generally an easy task.

Only a few cases of cross-device or -system use were observed, and the simultaneous usage of multiple devices or systems were afterwards remembered as great successes.

4.5 Products of Work

In this context, "the product" refers to the concrete result of worker performance. In modern knowledge work, the product is often a generic document, and as such not very restrictive towards the tool by which it has been created. Only occasionally does a product govern the selection of used solutions; this occurs mainly in highly specialized niches, such

as drawing a building plan with AutoCad or editing high-definition 3D graphics with 3D Studio Max.

ICT solutions abstract the content of the work and also the products of the work. This separates the creation of the product from the actual work tasks. Too often workers must separately document or report their tasks, even if the product is already committed to its repository and could act as a proof of a task well done.

In addition, the ICT solutions do not seem to take into account the actual products of the work. There was no integrated publishing or content-management systems to be found in the project management or other knowledge management systems in the companies. Keeping the work and the products of it separate can be a good thing from the managerial perspective, but, from the workers' viewpoint, it results in additional documentation tasks, since there is a need to document the work in a separated system.

4.6 Analyzing the Collaboration Events

The previous chapters describe the context model for analyzing the collaborative events in order to improve the technological support for them. The use of the categories allows an observer to dissect a communication event into the different parts shown with different context categorizations in Figure 4. After identifying the events' ingredients, one may single out potential discrepancies or inconsistencies. The model does not offer a deterministic way to analyze the collaboration, and in all cases one must decide which category offers most benefits if changes are made. As practitioners of user-centred design, there is no shame in admitting that adding more technology is not always the best way to go forward.

Figure 4 illustrates a communication event with four participants. Each of the participants has a different opinion about the context in which she is working. The individual context depicted in the top left corner was a common context described by people who were in a familiar meeting room that was the chosen meeting room for the event. In the familiar meeting room, the available technical and other services and tools were self-explanatory for the workers and the context was evaluated to support the tasks in hand, unless something broke or did not work as planned. Technical problems of remote participants were underestimated and often forgotten. The top right corner depicts a context of a "visitor", i.e. a person who came to an event to an unfamiliar meeting room or other premises. Visitors often could not immediately connect their personal technical devices with all the services provided by the new location.

Visitors could, however, usually bypass the problems, since there were always also persons familiar with the facility present. For example, if a visitor was not able to use the data projector or connect to the internet, the person familiar with the facility could either solve the problem or lend her computer or other device to the visitor. The third major group were remote participants. Remote participants had problems, especially with the task-environment and practice-environment axis. When driving (bottom left context picture), for example, one could connect to teleconference but not follow slides or other presented material. Remote participants in other meeting rooms (bottom right context picture) or premises suitable for looking at papers or a computer screen were naturally in a better position than participants in cars. However, all remote participants were often neglected, or dropped out on their own account, when a collaboration part of the event started.

When a collaboration event is analyzed with a context model, the individual models can be used to point out the most important characteristics of the event from the points of view of the different participants. The combined shared context (middle context in Figure 4) is a good starting point when looking for potential problems and development targets. The context model is also useful when a group is trying to share information about the context of the members and to choose tools and practices best fitting for the task at hand.

5 Current and Future Challenges

As outlined in the previous sections, ICT is overloaded with various meanings, nuances and points of views. This study has researched technology from the human-centred approach, thus focusing on the actual users of ICT solutions and the organizations providing ICT solutions for their employees. All these different viewpoints involve various challenges, some of which have already been identified and are under vigorous research as current challenges. Some are on the threshold of critical priority to be included in active discussion as short- to mid-term challenges, and some are wider new paradigms (discussed in the next chapter) that will penetrate the mobile and distributed workers' everyday tasks and tools during the next decade.

5.1 Current Challenges

Current challenges can be divided according to three main criteria: firstly, context sensitivity to accommodate the individually different work tasks

and environments; secondly, formal or implicit communication practices and policies, and, thirdly, visibility or "presence" of the work in collaboration tools.

Context Sensitivity · Both access to remote resources and monitoring the activities of remote co-workers have been identified as characteristics of mobile work (Perry et al., 2001). Together, the perceived importance of available tools and services and the accessibility of supporting colleagues suggest a need for improved context sensitivity.

In the majority of the case studies, workers expressed a need to have more and better quality information about their co-workers' status, i.e. their immediate surroundings, possible inabilities and potential capabilities. Sharing contextual information requires the workers to share, or allow their equipment to share, their own contextual data with others so that other workers may check, or be informed of, the changes in their collaborators' contexts. The main purpose for a worker to share her context was to make her availability visible for potential ad hoc communications. This kind of "busy or available" information is integrated into most collaboration and instant messaging systems, and is of low-fidelity and generated automatically, i.e. the user is either active, away or unavailable. Additional, richer, status information can be added by the workers manually. Some solutions also allow the inclusion of physical location information.

This kind of additional context information was also used for selecting the most suitable communication and collaboration medium and the appropriate tool for it. Since most of the available context information is automatic, and thus hereditarily inaccurate, the workers had adopted intricate social behaviours when instigating their communications. For instance, starting a chat session with a colleague was most often preceded by "knocking", i.e. the receiver is asked whether it is acceptable to start a chat session or not. Case studies unveiled several descriptions, or war stories, about embarrassing incidents where an informal chat messaging had appeared on screen while the recipient was giving a presentation and projecting her screen for the others to see. Mediating more accurate and timely context information could decrease these unnecessary interruptions and simplify and encourage the use of real-time systems for ad hoc meetings.

Communication and Collaboration Practices in Distributed Teams · Even if the technical solutions have evolved, people using them find themselves often in situations where earlier work practices were inefficiently

migrated to the new distributed systems. The previous chapter pointed out how the inherent inaccuracy of the automatically generated availability information has undermined its usefulness; similarly, shared calendars and the ability to easily "invite" others to meetings have degraded workers' time management and control over their own functions, not to mention the potential errors, as many of these indicators or appointments behave differently when accessing the systems remotely, with, for instance, a mobile phone.

In several instances, the collaboration situations were disturbed by the multiple communication media used within them. This means that, if a meeting consisted of a local face-to-face gathering with additional remote collaborators, for instance, via teleconference, the participants on the phone line were often forgotten, neglected or alienated during the meeting. In many cases, the situation would have been better if all the participants had attended remotely, as this would have presented all of them with an, if not ideal, at least equal, medium.

Even in the most favourable communication situations, some problems persisted. In many cases, the ICT solution used prevented the full adoption of "traditional" formal meeting practices, due to a failure to accommodate them via the digital medium. The observed teams did not use any decision support systems and structured collaboration environments, and all of the ICT solutions focused on enabling the connectivity instead of supporting the ongoing collaboration. Additionally, the availability of almost persistent connectivity caused problems, as in meetings at which the participants were often simultaneously engaged in several simultaneous virtual meetings using messaging, chat, answering telephone calls, or performing other competing tasks such as e-mailing and scheduling calendar events.

Visibility of Work · Modern knowledge work is often organized around the concept of a project. Unfortunately, in many cases, the potential gains are more managerial and administrative than actually increasing the performance or satisfaction of the workers. These problems are emphasized in the case when distributed and mobile workers want to contribute their expertise to a large number of projects as members of a distributed virtual team. Companies aim to utilize their workers' skills evermore efficiently and thus allocate them to several projects and inevitably to several teams. This creates a situation where the workers no longer have the possibility of anchoring their work tasks to the concrete fruit of their labour, or even to a joint accomplishment of (semi)permanent colleagues. Their tasks become fragmented both by location, time and social surroundings,

while the only stable work-related tasks are either trivial or purely administrative, such as keeping track of their working hours.

ICT may alleviate these symptoms by creating a specific focus on the often-random work tasks and stakeholders. As with the actual cause of the problems, it may do so from different points of view:

By creating a virtual presentation of the context or the core contributors of the project. This may be a digital discussion group or forum, or shared chat lounge for the distributed co-workers. By making sure that the contents are updated and moderated, the team can project their joint achievements to a single location and thus see the actual progress of the project.

By utilizing the physical space or work context by enabling high-performance knowledge work in unusual locations. For instance, if the team is supporting the building of new office premises and needs to be present at the site a lot, the team should be able to work efficiently, having conventional network services etc. available to them at the site, even during the renovation phase. Portable and wireless solutions are readily available, so all that is needed is to commit to provide them to given focus locations.

5.2 Short- to Mid-Term Challenges

On a slightly longer timescale, the development of distributed and mobile work emphasizes the importance of the roles of the various actors in the work context, their abilities to empower ICT for their needs and adapt to the changing requirements of future mobile knowledge work. In the following chapter, these aspects are discussed as fragmentations of data and knowledge, mobility as a personal asset, supporting expertise instead of administration, and finally the changing role of ICT and IT departments.

Fragmentations of Data and Knowledge · As mentioned in previous chapters, more and more different ICT solutions to support mobile work have become available during the previous years. Unfortunately, different vendors and solution providers have not been able or willing to integrate their systems or applications with each other. This means that, when a worker switches from one tool to another, she may need to redo much of her prior work to recreate the knowledge in the new tool. In simple generic tasks, for instance, synchronizing contact information from e-mail server to mobile devices, various products may cope with each other, but, in many cases, it is the individual worker's responsibility to enable a smooth transition. Thus, the worker herself must be aware of the limits of each tool and just use them as best she can.

Similarly, the use of several competing or parallel solutions fragments even the minimal contextual support the applications currently provide. For instance, in the case of making changes to e-mail attachments (requires a local copy of the file), the worker would use:

- a desktop computer at the office,
- a laptop computer at home and meetings, and
- a smart phone while on the move between various locations.

In practice, this would create three different versions of the document, and all knowledge of changes made and replies sent would only be available locally in each device used. This has led to the common practice of sending oneself a copy of all replies to e-mails.

Mobility as a Personal Asset · The problems experienced by mobile workers do not result solely from the lack of technological capabilities, but the lack of suitable practices with the available technology. From the ICT provider's perspective, all necessary functions can be, and in many cases already have been, delivered to the customer, i.e. the workers, but still things go awry. Potential remedies include more, and especially more personalized, training during the adoption of new tools. This may help to migrate the current open-ended problem solving, i.e. how to connect to a corporate e-mail server, towards easier selection of the best available solution to use, for instance, whether to use a faster wireless data connection and, at the same time, sacrifice maximum battery life. It is the responsibility of the ICT providers to identify the common practices needed and to guide and support the workers in bypassing any potential hindrances. The most common tasks include reading e-mails, synchronizing calendar and contact information, and using shared resources such as meeting rooms and printers.

In part, this means that the workers themselves must take the initiative and be active in committing to new ICT solutions and accepting the fact that a part of their everyday activities is to learn how to better utilize new ICT tools. The ability of workers to perform at maximum efficiency in mobile and distributed situations is linked to their ability to have enough knowledge and confidence to use the provided ICT tools and services in new combinations. This allows them to actively seek alternatives rather than fall back on conventional office environment practices. Even the most advanced mobile solutions do not enhance the work experience if they are not used or if they are used incorrectly or inefficiently.

Table 2 A categorization of eCollaboration solutions. The convergence trend can be seen in, for example, instant messaging. It is an example of a collaborative portal tool, desktop conferencing systems, peer-to-peer systems, and e-learning systems (Munkvold & Zigurs, 2005).

Category	Examples of collaborative tools included	Product examples
Collaborative product suites	E-mail, group calendar, threaded discussions, document management, workflow	Lotus Notes/Domino, Microsoft Exchange, GroupWise (Novell)
Collaborative portals	Instant messaging, presence awareness, team workplace, people finder, e-meetings, document management	IBM Websphere portal, MS Sharepoint
Desktop conferencing systems	Instant messaging/chat, audio conferencing, presence awareness, videoconferencing, application sharing, shared whiteboard, polling, voting, recording of meeting information	MSN Messenger, Interwise, Centra 7, WebEx Meeting, Microsoft Live Meeting
Web-based team/project rooms	Group calendar, contacts, notes, tasks, file sharing, e-mail, chat, pinboard, project management, document management, threaded discussion, brainstorming, voting, time sheets, telegram, evaluation, scheduler	TeamSpace, Documentum eRoom, Lotus Workplace Team collaboration
Peer-to-peer systems	Instant messaging/chat, presence awareness, threaded discussions, file sharing, project management, group calendar, group outliner, meeting management	Groove Virtual Office
Electronic meeting systems (EMS)	Agenda, brainstorming, categorization & organizing, voting & prioritizing, action planning, surveys, shared whiteboard, meeting log, chat	GroupSystems, Facilitate.com, Meetingworks
E-Learning systems	E-mail, instant messaging, presence awareness, calendar, threaded discussions, learning objects repository, course administration	Blackboard, Centra 7, Aspen, Lotus Workplace, Collaborative Learning, WebEx Training Center

Supporting Expertise Instead of Supporting Administration · Unfortunately, most of the available work support systems only support the organization of the work, but not the actual execution of work tasks. This means that the systems have taken a design shortcut, as supporting the goals of the company produces more easily visible benefits than supporting the tasks of the individual worker. The actual work efficiency is often hidden from used metrics and, just as often, wrongly attributed to the organization-level practice. For instance, from the corporate point of view, tracking the working hours of employees is important in itself, but, from the employee's point of view, the same system could provide more benefits if it helped the worker to manage her own work tasks and enable better accessibility by her colleagues.

This phenomenon is obvious when examining the corporate tools relating to project or document management systems, work time tracking and computer and network security. In all of these cases, the specialized applications are extremely dedicated to their respective domains, require medium-to-high technical skills to be used efficiently or at all, but are still forced upon practically every worker.

The Changing Role of ICT and IT Departments · As discussed in the previous chapters, the perspective towards ICT solutions vary, depending on the party in question. The role of the IT departments changes from an in-house developer of ICT solutions to a top-level provider of total work support services. This means that, on top of the technological expertise, they must also excel in a deep understanding of the needs of workers and be able to efficiently, and accurately, relay these requirements to their solution providers. They should also be included as major contributors to the specification and the acquisition process of new solutions.

Hopefully, the open-minded and active workers will be willing to expand their own work tasks to include the more demanding ICT solutions. This can be helped by introducing an open and active ICT provider. The companies need to acknowledge that cost saving does not justify outsourcing ICT tool development, provisioning and support to almost monopolized third parties that are rather more interested in providing the service with a higher sales margin than increasing worker satisfaction, variance and performance.

6 Implications

This section outlines some observed trends and new paradigms that will have an important role in the future of distributed and mobile work. After discussing the forthcoming trends, some recommendations are given on how to act upon the challenges.

6.1 Trends and New Paradigms

Based on this research and the literature about technological change, there seems to be three dominant trends affecting the lives of distributed workers especially: ubiquitous networks, technology convergence and growing dependence on technology-mediated communication and collaboration. These trends mean that new paradigms, i.e. ways to consider the work and lives of mobile and distributed workers, are needed by both the workers and parties developing ICT solutions for them.

Ubiquitous Networks · Other trends like the miniaturization of electronic components (Moore, 1965) resulting an increase in computing power, known for the passed four decades as the Moore's law, and automated assembly capabilities have made inexpensive ICT devices and networks common. Currently, almost all computing products are embedded with, or at least have an option to have, some sort of wireless technology such as Wi-Fi, Bluetooth or RFID[2]. At the same time, many management and productivity tools have migrated to the Internet and offer usage via a web browser. This de facto standard of using the web as a platform has the added benefit that the services can be used or accessed with practically any device. Together, these changes pave the way for ubiquitous networks.

From a worker's perspective, the universal unrestricted access to necessary ICT infrastructure and work-related applications is a double-edged sword. One may appreciate the freedom of choice relating to the time and place of working, but, on the other hand, it tends to obscure the border between the jobs of workers and their private lives. Similarly, the ability to collect and analyze people's habits and acquaintances always raises the fear of the Orwellian Big Brother watching our every move.

Technology Convergence · Convergence of ICT technologies is a clearly visible trend already. It is, for example, extremely hard to classify collaboration solutions according to their functionalities or features. Munkvold and Zigurs (2005) have made a categorization of eCollaboration solutions that shows clearly how the same tool can be a part of different categories (see Table 2).

Technology analysis company Gartner has forecasted fusion of different communication tools and solutions. In 2005, they forecasted a birth of a new unified communication (UC) field that would emerge from the convergence of five different communication markets, i.e. voice messaging and unified messaging, live voice, such as private branch exchanges (PBXs) – call handling, e-mail, voice, web- and videoconferencing and collaboration – and instant messaging (IM) and live-presence indicators (Elliot, Blood, & Kraus, 2005).

In addition to the convergence of ICT solutions, the physical devices are also converging with respect to their features. Laptop computers, for example, are nowadays equipped with microphones and speakers and mobile phones with large displays. With suitable software, one can make phone calls with a computer and handle documents with a mobile phone.

2 Radio Frequency Identification

Since mobility has been, and is, a driving force in technology development, the special nature of mobile work is disappearing. Mobile workers are nowadays using almost the same tools and devices in airports, cars and hotel rooms as their "non-mobile" colleagues in their workrooms. In future, everything is potentially mobile. Thus, mobility should not be regarded as a restriction but as an opportunity when work is planned and tasks executed.

Technology Mediated Communication and Collaboration · Companies are relying more and more on different technologies as mediators of communication and collaboration of their workers. Sponsoring remote collaboration is seen as a good way to reduce travel costs while taking full benefit from the existing skills within one's company. Available solutions include real-time collaboration systems supporting the use of voice, video, data and application sharing. Another option is capturing or mediating the workers' queries and knowledge for processing and collaboration at another time. Use of e-mail, document and project management systems and web portals offer an effective way to share information and also to make it available after its conception for potential reuse at a later stage.

In several of the cases in the dWork project, the need to capture and share tacit knowledge was explicitly voiced as a priority. As the roles and expertise of the workers were highly specialized, the need to consult a colleague remotely was necessary on a daily basis. Based on the evidence, it is apparent that the sharing of tacit knowledge via remote consultations and distributed teams will increase. In order to be successful, this transition from almost purely social and person-to-person to increasingly remote and impersonal technology-mediated collaborations must take into consideration a number of issues such as the following:

- In order to mediate tacit knowledge, the systems must create an active and responsive community based on workers' internal motivation (not corporate policy or process).
- The existing systems must provide more and better support for problem solving and learning new tasks. They might consider incorporating some of the features found in eLearning systems, such as discussion areas and free-form commenting.
- The systems must not only be knowledge repositories, they must also act as contact mediators. In many cases, the most important information is not what is the answer? but Who knows the answer?
- If learning a task requires a visit to the site and a veteran worker (Master) to instruct the novice (Apprentice) in the successful execu-

tion of a task, it often either includes undocumented procedures or relies on context-sensitive problem solving. In either case, this kind of "master and apprentice" learning expects the ICT support systems to recreate the work experience of the situation instead of just providing the relevant facts. This may include multi-modal communications with live video imagery to improve the human-to-human communications, or intelligent recommendation systems, to make the human-to-system interface more efficient.

6.2 Recommendations

Mobile and distributed work is a complex phenomenon. The goals of the work are undoubtedly major factors, but they are not isolated entities. The environment in which people work and the technologies they use have a heavy influence on the work itself. At the moment, the use of technology seems to be taken as a generic utility that provides the workers the potential to perform their tasks. All participants try to hide their expectations and assume the tools are free of any values. Avoiding responsibilities when developing, acquisitioning and using technologies makes the work tasks more complex and hides the true meaning of the work. In order to change the course of current development, co-operation between technology developers, buyers and users is needed on three fronts: understanding the nature of technology-influenced mobile and distributed work, developing technologies with meaning and values, and coping with the constant change.

Nature of Technology-Influenced Mobile and Distributed Work ·Knowledge work, and especially mobile and distributed knowledge work, is heavily influenced by technologies. Though being professionals in their own field of work, only few of the workers are able to utilize and use modern technology efficiently or even configure their technological tools to function properly. At the same time, the portion of work tied to technical solutions is growing.

The IT departments of companies have trimmed their processes to supply technical solutions to their customers. Knowledge and understanding of the actual workers and their tasks seem to be vanishing behind the technical systems. Money is in many cases the driving force in technology acquisitions. The reasoning for savings is based on technology trends rather than on the true needs of the workers, i.e. the users of the acquired technologies.

Technology developers and product manufacturers seem to try to avoid the responsibility of deciding the purpose of the developed tech-

nology. *"The more generic the solution, the bigger the number of potential customers"*, seems to be the dominant argumentation behind their decision making. However, technology producers have the best knowledge of the possibilities and limitations of different technologies.

The ability to utilize the latest ICT solutions has been fragmented among the IT department, ICT developers and the users themselves. As a result, cooperation between these parties is needed to truly understand and redefine what technology-influenced mobile and distributed work is.

Worker-Centred Technology Development · Development of technical systems and devices is restricted to the tasks and duties of engineers. Dialogue between the users and producers of technical solutions is at the moment restricted to *selling and buying* activities. All three parties, users, IT department, and manufacturing companies, have no shared forum to share thoughts and ideas about new systems. In many cases, there is no will to collaborate either.

In the product development world, user-centred design is one example of aiming at products that fit into the context of use and answer the needs of users. User-centred design does not, however, usually lead to dialogue between users and designers. Instead, the designers tend to settle for short reconnaissance events, e.g. interviews and observations.

Workers, on the other hand, seem to be quite reluctant to dig deep inside the provided technical solutions. Many are more than happy to give feedback about certain problems in current solutions, but cannot afford to use time and energy in participating in actual development processes.

The IT department sits in the middle, but instead of facilitating cooperation between users and producers, it views the situation almost completely from the produce-mediate-use process-model point of view and thus seeks cost savings by minimizing the extra communication between the process steps. In addition, the produce-mediate-use model does not even include direct communication and cooperation between the producers and the users.

Rapidly developing technologies need active dialogue between users and designers. Since one of the major characteristics of ICT product development seems to be aiming at generic solutions, the product development process can actually be seen to stretch over the mediating step towards using the product. In the extreme case, the ICT system or device is not defined until it is used (Example 1). Making everything possible, and giving the users the power to design what the product actually is, can be a good marketing slogan, but easily results in extremely complex products which are only used partially.

Example 1 · Let us say that there is a new technology X that is currently under development. X has a great potential to allow devices to communicate wirelessly. Device manufacturer produces a device Y and implements version 1.0 of technology X into it. Now device Y has a potential of communicating with other devices with version 1.0 of technology X in them wirelessly. In addition to this, the device Y has, of course, a great number of other potential possibilities designed into it.

Now a company's IT department decides to purchase the device Y for its mobile workers. IT department plans to purchase other devices with technology X as well, as soon as they are available. This gives the workers a potential ability to connect their own devices wirelessly and share information with each other wirelessly.

If a worker has a task that requires her to be in touch with customers and she uses the new device Y as a phone, then the device is a phone with a feature X in it. If a worker uses the device as a personal information manager (PIM) synchronizing the calendar and other information with technology X and makes phone calls mainly with her traditional telephone, then the device is a PIM with a phone feature.

Living in an Unfinished World

Nothing endures but change

-Diogenes Laertius in Lives of the Philosophers

One of the characteristics of modern technology in general, and of ICT in particular, seems to be incompleteness. ICT devices and systems support different technologies partially and bear great promises of next and better versions. When a device is "completed" it usually is also outdated compared to the devices and systems it is used with.

Continuous development and eternal incompleteness have to be accepted, not avoided or fought against. Change can be somewhat predicted and prepared for, but not ignored or prevented. The designers and developers need to understand how the tasks of the users are changing, while the users need to follow how technology is developing. The IT department can work as a mediator, especially when technology is in its early stages or new tasks are forming. The role of the IT department should diminish after the connection between users and developers is created and an initial understanding or shared language is found. Since every company uses a vast number of different technologies, it is not possible to participate actively in the development of each of them.

Companies can, however, take an active role in giving feedback and explaining their needs and potential uses. In other words, they can be actively involved in defining the developed systems.

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APPENDIX A: Research Interest

Our main interest was to study the kinds of challenges faced in designing, developing and managing the workplaces of the new type of distributed and mobile workers as they increase in numbers. The hypothesis was that these challenges could be met by combining the job requirements and human needs of end users to good practices of workplace design viewed from three perspectives: physical spaces and architecture, information and communication technologies, and human resources and organisation.

1. Where and What We Studied

The research was carried out in three companies: Nokia Corporation, Nordea Bank and Senate Properties. In each company, we collaborated with its corporate real estate teams. We focused on studying distributed and mobile work teams in each company and, additionally, workplace design practices at the organizational level in two companies.

In each company, the units of analysis were carefully selected. The case to be studied was to be a fraction of an organization, that is, a "team" or "project" that represented a likely future arrangement, thus making it possible to generalize research results. Each case was to meet several criteria:

- The case should be project focused, with a start and an end.
- The project should deal with a complex issue that involved a fairly wide range of people.
- The project would not be unique; it would include elements of regular practice and be typical of the challenges confronting the organization.
- The key people involved would be geographically dispersed, ideally some of them at least partially "mobile". The "central" office should be a significant player.
- The project's work process would include some communication that was not face-to-face and, ideally, use communication tools like e-mails, videoconferences, and conference calls.

1.1. Cases

Based on these criteria, five cases were identified and selected as units of analysis. Four of the cases concerned distributed and mobile teams, while one was an organization of about 100 employees. Table 1 presents the cases in greater detail. Case A and case B are from one organization; also, case C and case D represent the same umbrella organization.

Table 1 The description of case studies.

Name	Description of case	Studied period
Case A	Case A was a team of five experts distributed to three locations within Finland. The team's task was to coordinate a network of subcontractors in renovating a building owned by the company the team members came from. The case was, on the one hand, a fairly typical team in the multi-project environment of the organization: the team members used only 5–10% of their working time in that particular team. On the other hand, the case was novel in that a new planning element was introduced to the "normal" renovation process. The discussions and contradicting views of different team members and network partners of this new element helped us to see the challenges and dynamics of the team. For example, we found that the work process resembled more a relay of individuals than the synergistic cooperation of a five-person team.	Autumn 2004 – Spring 2005
Case B	Case B was much like case A (it was from the same company). It was a five-person team distributed to three locations planning a renovation of a building. We studied the team at the early phases of the renovation planning process since that was found to be fuzzy during the study of case A. Again, new components were introduced to the planning process, but some of them were better known than in case A. The challenges of the team were weak cooperation of the distributed members, lack of role clarity, and missing leadership in the early planning process.	Autumn 2005 – Spring 2006
Case C	Case C was an eight-person team developing advanced technologies for their company. They were distributed to four locations in four countries. The country-based legislation, conventions and other factors dictated that the solutions developed in each country were rather different from the others. Thus, the team was more like a knowledge-sharing forum for experts in the same technology area than a cooperating team. However, the major challenge the team faced was an organizational change that severely threatened the career possibilities of the team members outside Finland.	Spring 2005
Case D	Case D represents an organization of about 100 employees. The employees worked mainly in collocated settings and only some of them were mobile. The work was carried out mostly at the workplace during the official office hours. The mobile and distributed way of work was thought to be increasing, however. The organization considered, for example, telework as one possibility for doing work in the future. The organization was situated in the capital area and most employees worked in the same premises in their own workrooms. However, during the period of the study, the organization faced a significant change in their work environment as it was going to move to another place and employees were to work in an open-space office.	Autumn 2005 – Spring 2006

Name	Description of case	Studied period
Case E	Case E was a team consisting of eight highly mobile and distributed members. Team members were distributed in Finland as well as to Dallas and Singapore. None of the team members that worked in Finland had their own permanent workplace at the office; instead, members worked a lot at home or in shared office premises. Team members communicated together mainly via electronic means and rarely met each other face-to-face. The team aimed at developing organizational mobility. The objective of the team was divided between team members so that their collaboration together would help the team reach its common goal. The work tasks of each individual were separate, however, and the team faced problems in effective collaboration. The work required creative thinking and the ability to implement new possibilities in different kinds of contexts.	Autumn 2004 – Spring 2006

In addition to these five cases, we also studied their workplace management contexts at the organizational level. This means mapping the work and work practices of real-estate teams themselves, and of information technology and human resources units.

2. How We Carried out the Study

2.1 Research Methodology

The research was methodologically based on case studies and action research. As the project lasted two years, one of the goals was to continually adjust our methods as we moved through our learning. Our approach to research can be described as a process of discovery and adjustment that evolved to suit what we learnt in the particular circumstances of the corporations being studied. The observations made in case studies were processed, reflected upon, and discussed with company partners in their workshops. The aim was to increase a joint understanding that could be carried over to the workplace-making activities of each company.

In the case studies, the data was collected and analysed from the multiple perspectives of office premises, use of information and communication technologies, and group and organizational processes. Next, data collection and analysis in each of these areas are described in detail.

2.2 Data Collection

Data in each company was gathered by collecting documents, making observations, interviews and questionnaires. In addition to analytical methods, intervention methods like a simulation game, workshops and

all kinds of face-to-face and virtual meetings were used to collect data. Next, the methods are described in detail according to the three perspectives and the progress of the project.

2.2.1. Research Methods Used in Studying Office Premises[3]

The results of using the methods described below are reported in the chapter *"How work takes place – notes on distributed work environments"*. The scope of inquiry was limited to companies where the issue was topical or a part of the company's core business and to those that had explicitly expressed their interest in the quality of the physical working environment in the research project briefing. Four cases were studied: cases A and C were observed in winter 2004–2005 with the assistance of architect Jouni Rekola[4]; cases B and D were studied in more detail in winter 2005–2006. In addition, case E provided a secondary source of information.

Methodological Approach · The bedrock of this research was the recognition of the work environment as a *holistic formation* of the functional and aesthetic qualities and the psychosocial milieu of the environment in which one works (Seppänen et al., 2005). This choice aimed at providing a critical perspective to the recently resurrected belief in the so-called *behaviour-environment congruence* in office design thinking. According to this idea, particular environments such as open offices are assumed to promote or inhibit particular behaviour such as knowledge sharing via communication. The starting point in this research was the acknowledgement of a cyclical, feedback model of human cognition and behaviour where, in contradistinction to just responding to the qualities of the environment, people strive to achieve optimal environments *(human-environ-*

3 Anni Vartola wrote this section.

4 At the time of the research, Jouni Rekola was a student of architecture. He did his Master's Thesis as a part of the dWork project; the thesis is entitled ***Hajautunut työ – kietoutunut elämä (Distributed work – entwined life);*** this was supervised by Professor Simo Paavilainen and by Anni Vartola, Helsinki University of Technology, Department of Architecture 29.11.2005.

ment optimization). In addition, this research acknowledged *individual differences* in behaviour, perception and evaluation of the environment.[5]

This starting point resulted in subscribing to a methodological approach (Fischer, Tarquinio & Vischer, 2004) according to which 1) the *workspace* should be understood through its *physical conditions* so that the workplace should firstly be studied in terms of what facilities are available and the aesthetic and functional attributes of the facilities a person occupies; and 2) a person's experience of the workspace(s) s/he occupies should be understood in terms of a *professional self-schema* formed as a result of repeated positive or negative feedback s/he receives in his/her work situation through the experiences of success or failure in performing his/her work tasks. According to Fischer et al. (2004), a professional self-schema acts as a cognitive filter in two ways, affecting, firstly, how people perceive their work environment, and, secondly, how their evaluation of their workspace affects their perception of both their work and themselves.

The consequential hypothesis of this dWork research was that, contrary to being "mere users" who perform desired or undesirable transactions in office space, people are *managers of their own space* whose relationship with the workspace is characterized both by cognitive mechanisms of spatial orientation, place identification, doing work, and feeling secure, and by an affective reaction that may be positive or negative, translating into satisfaction or dissatisfaction (Fischer et al., 2004, 132).

With the above-described definitions in mind, the methods were chosen on the basis that they were efficient, they provided authentic data, they caught any particularities there might be in distributed and/or mobile modes of work, and that they were applicable to the available research literature on the topics of workplace design and the person-environment relationship in the workplace. Consequently, ergonomics and occupational health standards were left aside, and a considerable emphasis was placed on personal descriptions of the human-environ-

5 A classical dilemma for behaviour-environment congruence is the so-called Hawthorne Effect, discovered by Elton Mayo, who studied productivity at the Hawthorne works of the Western Electric Company in Chicago in 1924–1933. Any manipulation of workplace conditions (such as illumination level, rest breaks, pay etc.) for the better or for the worse resulted in a short-term rise in productivity; in the long run, productivity returned to the original conditions. This has been interpreted as being due to the psychological effect of the attention given to the workers as well as due to learning: the mere feeling of being studied produced the rise in productivity and not just the changes in the environment. See also Stokols (1978).

ment relationship as well as the evaluation of spatial solutions in terms of their suitability to the work processes performed in them.

Data Collection in Practice · *Phase 1* (autumn 2004-spring 2005; cases A and C) started with the *context interviews* carried out as a joint effort between all the dWork research approaches. The specific methods used in the architecture study for cases A and C included a *photo survey* and *interviews*.

In the *photo survey*, the case team members took photos of their daily work environments and typical work situations; these were then analysed and discussed. In the interviews, the interviewees were asked to describe the variety of environments in which they worked or performed work-related activities, e.g. offices, homes, public places, means of transport etc. They were also asked to analyse the nature of the work they carried out in these environments, e.g. communicating with people, reading, reporting, doing research, contemplating aspects of their current projects etc. In addition, the *interviewees* were asked to give a verbal, qualitative, functional, aesthetic, social and mental assessment of their work environments and to discuss their own and other stakeholders' performance and the overall workflow in their business environment, as well as the qualities of their employer's office facilities in general.

A substantial amount of information for phase 1 was also derived from the various case documents, site visits, and background interviews with consultants, service providers, and premises management representatives.

Phase 2 (autumn 2005-spring 2006; cases B and D) also started with a series of *context interviews* carried out as a joint effort between all the dWork research approaches. The specific methods used in the architecture study for cases B and D also included some *background interviews,* a *social network analysis, a workscape*[6] *analysis, interviews* and a *questionnaire*.

The *context interviews* aimed at forming a preliminary conception of the case. The questions dealt with the work profiles of interviewees, their tasks in hand relating to the case, and team organization from their point of view. In case D, a special emphasis was given to reflecting the compa-

6 The term 'workscape' refers to the "layers of where we work", i.e. the constellation of 1) virtual and real *work settings* (furniture + IT) within 2) particular *spaces* (meeting rooms, project areas, cafés etc.) that are, again, 3) located in a specific *environment* (office building, city district, street, home, airport, bus etc.). The cultural and social aspects are also included in the specific environment. See: Harrison, A., Wheeler, P. & Whitehead, C. (Eds.) (2004) *The distributed workplace*. London and New York: Spon Press. pp. 56–57.

ny's strategic visions as to workspace development. In case B, the target group was the case participants. In case D, the interviewees were representatives of the premises manager in charge of implementing the move process with the case target group.

In the context interview situation, the interviewees were given a *social network drawing assignment* in which the interviewee was asked to illustrate the network of him/herself and those who s/he regarded as his/her team or group members with the particular task (case B: their current business project; case D: implementation of the move group) in mind. The idea here was not only to get a graphic presentation of the case setting, but also to explore the construction and the level of consolidation and consistency in the case teams. The hypothesis was that the social network drawings should have been, at least to some extent, mutually commensurate if the team (or organization) had a unified picture of themselves as a group and had a shared view of their tasks and mutual responsibilities. In case D, the latter aspect was of special importance in understanding the objectives of the company's premises policy and in assessing its application in practice. Case B produced six drawings; case D produced five drawings.

The idea of the additional *background interviews* was to gain an additional reference point for assessing the quality of the case's workspace policy. The target group here was mainly third-party service providers such as consultants, and the questions tackled the design briefs, general objectives, schedules, decision-making, and interaction protocols.

The most fundamental data of workspaces was collected by *in-depth interviews* with the case team members at their assumed main workplace (case B + case D target group). The questions dealt with the interviewees' experiences of the premises they worked in, their favourite places to work, and the interviewees' ideas of their employer's workplace policies.

These *workspace interviews* were supplemented by a specific *workscape drawing assignment*[7], where each interviewee was asked to draw a diagram that illustrated the network of places where she/he performed any work-related activities. Based on Kevin Lynch's (1962) classical work on the mental images of a legible city and the taxonomy of environmental elements crucial to spatial orientation, the method aimed at illustrating the macro-spatial cognition of the interviewee and at making concrete the variety of places that the interviewee used for working and the paths he/she used to move between these places. The total number of workscape drawings was 20; case B produced five and case D fifteen. Additional

7 For the sake of confidentiality, all drawings used as a source of data displayed in this report are redrawn in order to have the same impersonal visual appearance.

information was gathered from five workscape drawings completed by case E participants.

The drawing assignment and the instructions were written in Finnish in the format of a simple-briefing-sized single A4 page and sent to the interviewee as an e-mail attachment a few days before the scheduled interview. In the e-mail, the interviewee was reminded of the interview time and requested to complete the given assignment, preferably beforehand.

The drawing was to be started from the centre with one's *'home base'*: the place that the interviewee conceived of as the most important and most significant to his/her work, whether this was his/her home, office or, for example, car. Then, the interviewee was instructed to put other places that related to his/her work around this home base. The interviewee was advised to think comprehensively about his/her daily life: did s/he work during work trips; did s/he contemplate work affairs during free time; what kind of places did the interviewee actually use – from coffee shops in the city to corridors of the office? Lastly, the interviewee was asked to depict the mutual relation of the places and their physical distance from one another. Respondents were advised that, if they preferred, they could use different colours to illustrate their interdependence and their specific role in the life of the interviewee, and to circle those places that the interviewee regarded especially enjoyable and supportive. The adjoining lines were requested to be drawn so that they corresponded with actual accessibility and frequency of use: the most important connections were asked to be drawn with thicker lines, the less important with thinner connectors. The interviewee was also encouraged to give additional commentary of his/her network of workplaces: to mention, for example, what means of transport s/he used for moving from one place to another.

In the actual interview, the drawing was addressed at the end of the session. If the interviewee had not completed the drawing beforehand, it was done on the spot at the interview (the interviewer had paper and pens available). The interviewee was asked to explain his/her drawing and s/he was asked to elaborate or give further information. For example: *"You have placed your car here in the middle; tell me about the ways in which you use your car for working…"* The interviewee was also encouraged to discuss his/her work processes and the general organization of work at his/her workplace by posing supplementary questions like: *"So, you think that you can't do your job without visiting your clients frequently? You just can't phone or e-mail them but you have to drive up to see them?"* In addition, the interviewee was asked to give qualitative assessments of each of the depicted places by, for instance, a prompt such as *"Tell me what your conference rooms are like. Do they work well when you have a*

meeting? Is there enough of them?" Lastly, the interviewee was asked to describe his/her personal relationship to the depicted places: *"Is there any place here on your drawing that you find really annoying or unsatisfying? Why is that? Where or in what kind of situations do you think that you are at your most creative, most productive?*

Data collection was completed by administering a "Workspaces of Knowledge Work" questionnaire that was given to all the personnel of case D (n_{sent}=120, $n_{received}$ = 42, response rate 32.6%) and to the team members of case B (5 respondents). The 12 question groups ranged from the respondent's own interpretation of his/her productivity to the general image of his/her employer's office premises while dealing with the following topics:

- Background information
  - gender
  - year of birth
  - years of service with current employer
  - type(s) of workplace solution(s) currently at his/her disposal (own room…desk sharing)
  - regular and occasional teleworking
- Productivity
  - personal assessment of experienced productivity
  - negative impacts of office location on productivity
  - negative impacts of the general office quality on productivity (indoor air quality, lighting conditions etc.)
  - negative impacts of the quality of the workstation on productivity (ergonomics, space allocation, furniture, IT equipment, location within the premises etc.)
  - negative impacts of the general quality of the premises on productivity (number and quality of meeting rooms, silent rooms, teamwork rooms, controllability of indoor air quality etc.)
  - negative impacts of office location on productivity
  - situational impacts on creativity, innovativeness, problem-solving ability etc. (communication, free-time activities etc.)
- Work processes
  - effects of disturbances
  - effects of interactions in the office space (discussions, traffic, phone calls etc.)
  - assessment of the physical and psychosocial milieu within the workplace (provision, usability and aesthetics of spaces, democracy, transparency, social cohesion etc.)

- Image
  - assessment of the image the spaces transmit (status, desirability, conformance to company values etc.)
- Meaning
  - decisive factors in changing the employer; the content of work would remain the same (wage level and other financial benefits, working hours, status of the employer, career prospects, location, quality of workspaces etc.)
  - most central elements of cost-saving (wage level, working hours, the number of personnel, efficiency, IT services, office location, amount and quality of office space etc.)

2.2.2. Research Methods of the Organizational Dimension[8]

The results of using the methods described below are reported in the chapter *"Organizing Distributed Work and Collaboration"*. In total, five cases were studied: cases A, C and E were observed in the period autumn 2004 - spring 2005, and cases B, D and E were studied in more detail in the period autumn 2005 – spring 2006.

Data Collection in Practice · In *phase 1* (autumn 2004 - spring 2005; cases A, C and E), cases were studied in detail with quite similar methods. Firstly, *context interviews* were carried out in all cases. In these sessions, the key informants of the case groups and the representatives of stakeholders working with the groups were interviewed. This round of preliminary interviews aimed at getting a holistic picture of the group, its task, goals, work processes, and interfaces. In addition, all relevant *company documents* regarding the group and the organization's practices were gathered and analysed. Based on the interviews and documents a *preliminary model of the group and its networks and working environment* was developed. This short story or graphic illustration was then briefly discussed with key informants of the organization and the group and adjusted to correspond to an understanding of the group in its context shared by researchers and informants.

Secondly, a set of *research questions* was formulated and operationalised for *in-depth thematic interviews* of all the group members. These questions mapped: 1) the history of the group, 2) member involvement and identification, 3) own and others' roles, 4) patterns of cooperation, 5) trust, 6) leadership and management, 7) possible diversity effects, 8) con-

8 Marko Hakonen, Satu Koivisto and Virpi Ruohomäki wrote this section.

flicts, 9) competencies needed, and 10) major challenges of distributed group work. The interviews took from one to two hours and were taped and transcribed.

Thirdly, case groups completed the *Virtual Team Questionnaire* that was developed at Helsinki University of Technology. The questionnaire includes topics such as interdependence of team members, clarity of team members' roles and team goals, leadership quality, trust, identification with the team, experiences of justice, and satisfaction with the team. The questionnaire results were analysed statistically for each case group. Although the exact statistics are not reported in the chapter, the results of the questionnaire study were used together with the other analysed material in the report.

In phase 2 (autumn 2005 - spring 2006; cases B, D and E) differing methods were used in the study. Case B was analysed in a manner similar to that of the first-phase cases A, C, and E by using data from the *context interview*. The main differences were that 1) all the group members were interviewed briefly; 2) stakeholders were not interviewed, because the study focused on the group's and organization's internal dynamics, and we had a quite good view of the networks and practices of the organization from phase 1. In addition, as a part of the interview, a *social network drawing* assignment was carried out through dialogue between the researchers and the interviewees[9]. The drawings proved to be very useful in showing the differences of perceived positions in the group as well as in finding potential conflicts and misunderstandings. As a result of the above-mentioned analytical actions, a rough *view of group dynamics and potential development* areas was constructed in collaboration with the representatives of the organization. Thereafter, an action-research-oriented *development phase* was carried out by surfacing and tackling the perceived challenges in a two-day workshop. Firstly, the group played the *Teamwork Game* by answering question cards and solving problems together. Secondly, based on the questions of the game, the group created operative ground rules or norms for work. The case group members also filled in a *questionnaire* before and after the workshop interventions. The questionnaire mapped multiple areas the research has found to be important in distributed work. Naturally, we do not know how many of the changes disclosed by the longitudinal measurement can be attributed to the two-day workshop intervention, but the results revealed improvement in group-related attitudes,

9 See Chapter 2.2.1 of this appendix for a more detailed description of the drawing assignment.

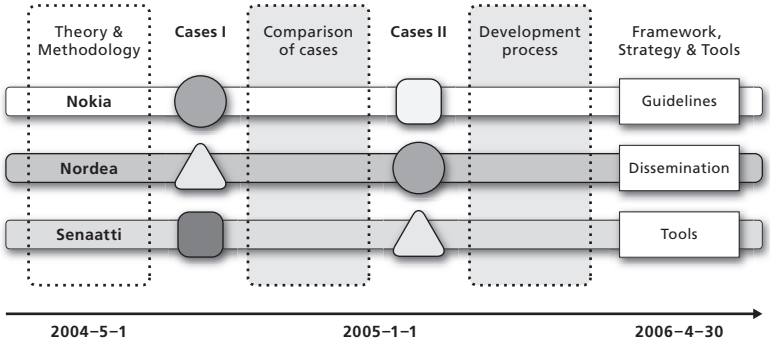

Figure 1. The progress and main phases of the dWork project.

but not in behaviours. These results were also considered to be intelligible by the group members in a *follow-up workshop*.

Studying case D differed from studying other cases as this case was not a distributed team but an organization that was about to move to another place and hence to face significant changes in the work environment. The research started with collecting background information from documents and interviews of focal stakeholders in the case. The organization had developed and administered a questionnaire for the personnel on the central issues concerning the forthcoming change. The researchers analysed the results of the questionnaire, and utilized them in developing in-depth thematic interviews. Then the representatives of the personnel (n=13) and Premises Management (n=7) were interviewed with semi-structured interview formats. The interviews concerned issues such as attitudes to the forthcoming change, possibilities and desires to affect the change, as well as expected effects of the change on work. The interviewees were also asked to draw their social network (Premises Management) or the places where they worked (workscape-drawings, case D members, see Chapter 2.2.2, this appendix). The interviews took from one to two hours and they were taped and fully transcribed. The analysis of case D based itself mostly on the interviews and the questionnaire results, but also the meetings concerning the research process that were organized during the research were used as material when reporting case D results.

Case E was studied in both phases of dWork study. However, the methodology of studying the case differed between these two phases. In the first phase, all the eight team members were interviewed by two researchers either face-to-face (n=6) or by telephone (n=2). Answers were written down and cross-checked, and then sent to interviewees to check. After that, a company report was written.

The results reported in the chapter *"Organizing Distributed Work and Collaboration"* are mostly based on the analysis of phase 1; however, the results gained from the second phase are also utilized.

A *new methodology* for studying the team's communication in different places and with different tools was developed in the second phase of the study. Firstly, each member kept a *self-observation diary*; secondly, each employee was *interviewed* individually; and, thirdly, a *workshop* was organized for the validation of the observations and to create ideas for the development of work. The case E study results are reported in the chapter *"Distributed and Mobile Workplaces"*.

Firstly, each member kept a self-observation diary for seven days. The form consisted of five columns that were titled "time", "place", "with whom", "media" and the "topic/purpose". The time when tasks were performed was requested in order to describe the blurriness of workdays. The place where team members communicate and collaborate was requested to obtain knowledge of the used spaces and their suitability for specific work tasks. The media that was used to transfer different kinds of information between different actors was asked about in order to obtain an idea of the media used and its suitability to the work of mobile employees. In addition, each participant was asked to save throughout the seven-day period (a) all e-mails in their inbox, outbox and trash of PCs, laptop and phone, (b) all dialled and received calls, (c) all SMSs sent and received, and (d) all multimedia messages (MMS) in sent and received. At the end of the period, the diaries were collected and the data analysed by researchers. Then each participant was *interviewed*. The diary results were used to support the interviews. Finally, in the workshop, the challenges of using physical, virtual and mental/social spaces were discussed and listed together as group work and, after that, suggestions for improvements were collected.

2.2.3. Research Methods of the Technology Dimension[10]

The results of using the methods described below are reported in the chapter *"Technology in distributed and mobile work"*. In total, five cases were studied: cases A, C and E were observed during the period autumn 2004 - spring 2005, and cases B, D and E were studied in more detail during autumn 2005 – spring 2006.

10 Mika P. Nieminen and Petri Mannonen wrote this section.

Methodological Approach · The chosen research approach for studying information and communication technologies (ICT) within distributed and mobile work was *user-centred design*. The main interest was not in the usability of any specific system, solution or device but in the overall state of the solutions used in the participating companies and in the influence that the technologies have in the lives of distributed and mobile workers.

Data Collection in Practice · *Phase 1* consisted of three cases (A, C, and E) and aimed at building a solid understanding of distributed and mobile work in participating companies from the technological perspective. All three cases were studied using *photograph probes*. In addition, the points of view of the companies' IT departments were collected through *interviews*.

A *photograph probe* is a critical incident method (Nieminen & Mannonen, 2005) in which participants take photographs of their daily life or special parts of it during a period of two or three days. Afterwards, researchers pre-analyse the photographs and design debriefing sessions in which the photographers look through the photographs and discuss the incidents and situations relating to each of them.

In this research, the participants were given a theme on which to take the photographs during a period of two to three working days. The theme was "spaces, equipment and activities relating to my work". In the debriefing sessions, the participants were asked to explain the reasons for each photograph taken and to talk about the situation related to it. In addition, the technological equipment both visible in the pictures and carried by the participants during the photographing was listed. The photograph probing produced a rich picture of the everyday work of distributed and mobile workers in the participating companies.

Phase 2 consisted of three cases (B, D, and E). The second phase aimed at deepening and focusing the findings of phase 1. The focus areas were chosen in co-operation with the participating companies. Since the research topics were different in each of the phase 2, other research methods were also used.

Within case B, attitudes towards technology and tools that were in many ways contradictory were studied. Distinct viewpoints for companies' IT departments and workers were found. The research was organized as action research. The interviews of the responsible stakeholders, i.e. product managers, were used to deepen the understanding of company's short- and middle-term goals and strategies regarding ICT. Based on these interviews and the findings of phase 1, the ICT workshops for distributed and mobile workers were planned.

The aim was to have three workshops, one for a distributed and mobile team (the actual case B) and two for different groups of workers with specialized roles in distributed projects. The tight schedule of the workers made it impossible to organize separate workshops based on their roles; these were replaced with interviews. In the workshop and the interviews, the workers' attitudes, expectations and hopes towards current and upcoming technologies were studied.

Case D was not a distributed group of mobile workers but an organization of about 100 employees facing a move to new premises. The technology dimension of research in case D focused on the differences of the ICT needs of distributed and mobile workers on the one hand, and co-located traditional workers on the other. In addition, the compatibility of the ICT offering of the IT department and the demands of the workers was studied. The research in case D was conducted with a web survey. The current ICT tools in use, acquisition process for each of them, satisfaction with them and their usage rates were questioned in the two-page questionnaire. The workers were also encouraged to write down stories about their recent successful and problematical encounters with technology. In total, forty-eight persons filled in the questionnaire.

In case E, the continuity from the first phase was most obvious. One of the findings of the first phase was that the workers organized their working days into events, i.e. meetings, phone conversations, e-mail and instant messaging sessions. In the second phase, the events (or episodes) were put under the spotlight. Different events were observed and recorded, and interviews based on the events and phenomena visible in them were organized[11]. In addition to group events, two individual working sessions were also observed. These sessions provided insights into individual ad-hoc communication events.

The results reported in the chapter titled "*Technology in distributed and mobile work*" are based on the combined results of the two phases. Since phase 1 was also the starting point for phase 2, the phase 1 results somewhat dominate the general point of view of the results. The phase 2 results are most apparent in Chapters "Distributed and mobile context" and "Current and upcoming challenges for ICT solutions".

11 The case E data was collected mainly by Pipsa Parviainen. The data forms the empirical part of her Master's thesis: Parviainen, P. (2005). Attribuutioita hajautetun työn onnistumisista ja haasteista. Pro gradu tutkielma, Helsingin yliopisto, Valtiotieteellinen tiedekunta, Sosiaalipsykologia.

3. How We Proceeded

The project proceeded in two main phases, each lasting around one year (Figure 1). Phase 1 looked at the operations of the CRE, IT and HR as they deal with one or more particular issues relating to one, or perhaps two, projects that involve distributed work. Three case studies (A, C, E) were completed as well. This phase was used to define the terms of reference and frame the problem within the particular context of each of the three organizations and also to select or begin to develop the tools of deeper analysis. Phase 2 looked at issues of distribution and mobility in more detail by means of two in-depth case studies (B, E). An additional case (D), involving a move project, was also carried out. This phase was more active and constructive, aiming at developing work practices and tools for integrated infrastructure management.

As the research project itself was distributed and mobile, the research teams from MIT and HUT worked mainly virtually by using video- and call-conferencing interspersed with some face-to-face meetings and mutual visits. Several joint corporate partner workshops were organised with the purpose of sharing experiences and learning from each other. The last such workshop was held in September 2006 at the University of Cambridge, UK under the umbrella of the Cambridge University-MIT Distributed Work Research Program Initiative. To report the case analysis and results, several company-specific workshops were also organised in each of the participating companies. Two public professional education training programmes covering the design and management of distributed workplaces were also arranged with the Finnish Real Estate Training Institute[12] in addition to two university courses at Helsinki University of Technology.

4. Who Participated in the Research?

Our research staff consisted of multi-disciplinary research teams from Helsinki University of Technology and the Massachusetts Institute of Technology working collaboratively with professional staff from the partnering companies. Nokia Corporation, Nordea and Senate Properties participated in the joint effort by contributing to the formulation of research objectives and methodology, assigning people to serve on the project's steering group and by supporting the field work within their organizations, participating in periodic workshops, and by contributing

12 Cordial thanks to Mrs. Pirjo Honkaniemi for her active and kind help.

to the funding of the project. Tekes funded the main part of the project. The following people participated in the project:

Project steering group
Satu Haaparanta and Reijo Kangas (Tekes), Marko Hakonen (HUT), Jorma Heinonen (Senate Properties), Päivi Hietanen (Senate Properties) Michael L. Joroff (MIT), Marja Kauttu (chair, Nokia), Chuck Kukla (MIT), Ari Leino (Nordea), Juha Olkinuora (Nordea), Matti Vartiainen (HUT), Outi Vuorio (Nokia)

Nokia Corporation, Workplace Resources steering group
Bethany Davis, Marja Kauttu , Eeva Ventä, Outi Vuorio

Nordea steering group
Mika Liukku, Ari Leino, Hannu Lonka, Susanna Nieminen, Juha Olkinuora, Jukka Ritari, Suvi Rossi, Kari Talvitie, Pirjo Törmänen, Juha Vaarama

Senate Properties steering group
Kaj Hedvall, Jorma Heinonen, Päivi Hietanen, Anne Sundqvist

MIT
Michael L. Joroff, Chuck Kukla, William Porter, Alexis Sanal in co-operation with Dr David Good, University of Cambridge, UK

HUT
Marko Hakonen, Satu Koivisto, Mika P. Nieminen, Petri Mannonen, Pipsa Parviainen, Virpi Ruohomäki, Matti Vartiainen, Anni Vartola, Mary-Ann Wirkström

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Seppänen, Hongisto, Holopainen, Kemppilä, Korhonen, Lahtinen, Lehtovaara, Niemelä, Palonen, Penttilä, Nykyri, Reijula, Saari, Siitonen, Takki, Tissari, Tuomainen, & Valkama (2004). *Tuottava toimisto 2005 loppuraportti*. Espoo: Teknillinen korkeakoulu, LVI-tekniikan laboratorio.

Stokols, D. (1978). Environmental psychology. *Annual Review of Psychology,* 29, 253–295.