

# What Drives eWork? – An Exploration into Determinants of eWork Uptake in Europe –

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## ABSTRACT

The paper uses the SIBIS database (which stems from population surveys undertaken in 2002/2003 in all current EU25 Member States<sup>1</sup> plus the remaining candidate countries Bulgaria and Romania, as well as Switzerland and the USA) to explore the determinants of eWork uptake at the level of the individual. The analysis shows which factors increase or decrease the likelihood of a person taking up eWork, hereby distinguishing between what today is called multi-locational eWork on the one hand, and tele-cooperation or uni-locational eWork on the other hand. Before doing so, the authors discuss a definitional framework for eWork which is intended to clarify the relationship between traditional telework and other types of locationally flexible work, and to point out the implications this has on eWork-related policy-making. SIBIS was funded by the European Commission through its Information Society Programme.

*Keywords: Telework, Multi-locational work, Mobile telework, Tele-cooperation, Tele-collaboration, Survey.*

## 1 INTRODUCTION

From early on the notion of telework, i.e. workplaces which have been made locationally flexible by the use of information and communication technologies (ICTs), has made policy-makers hope for achieving a number of goals, from reduction of private car traffic (most prominently in the USA) over integration of the disabled into working life (in the EU) to breathing new life into remote areas which are threatened by depopulation (for example in Finland). In many cases, this debate has been resting on an image of teleworkers as fairly low-skilled, mostly female workers who have been provided by the employer with a computer workplace in their home and who spend more or less all of their working time there.

Much recent data, however, seems to suggest that this image does not reflect reality adequately. Large majority of teleworkers seem to spend most of their working time at a central office. They also often carry out some of their work at third places, enabled by mobile office technology. For this phenomenon, the term “multi-locational work” started to be used recently [7][21]. It implies that persons work wherever it suits their work tasks, business schedule, and/or lifestyle.

Moreover there is evidence suggesting that teleworkers are likely to be recruited from the segments of the labour market which are anyway in an advantageous position. This means teleworkers are more likely to be male, high-qualified, and located in urban agglomerations rather than female, low-skilled, and living in remote areas, as the original scenario suggested (see e.g. [5][13][20]). However, it is vital to disentangle the influence of these characteristics on telework uptake from others factors which have been found to determine the probability of a person to do work which is considered feasible for teleworking, such as occupation, economic sector and type of work.

Moreover there is a necessity to analyse telework in the context of other developments in the organisation of work, some (but by no means all) of which are also related to the possibilities opened up by ICTs. Women and the low-qualified, for example, appear to be much more affected by changes to the geography of work which have led to dislocation of service

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<sup>1</sup> with the exception of Malta and Cyprus

jobs while maintaining the traditional shared-office environment. Prominent examples include call centres [2] as well as other types of remote back offices and electronic outsourcing [27].

A related development (which has been largely overlooked in the public debate around telework) is what is called tele-cooperation or tele-collaboration [43], i.e. the use of ICTs to bind together traditional workplaces across space and time via electronic communication using mainly e-mail, file-sharing and CSCW platforms. Tele-cooperation often means that working conditions at workplaces which are co-located together in central offices are becoming increasingly more similar to those of teleworkers [14][47]. This shift, however, is taking place in the context of more general changes to business processes, which means it is much less visible than implementation of telework. The term “eWork” has found increasing usage for describing this wider definition of ICT-enabled locational flexibility as well as telework in its original meaning [7][11][27].

If telework is viewed not as an isolated phenomenon but as only one part in a bigger process of transforming work organisation in the capitalist economy, it becomes clear that further diffusion of locationally flexible work will not necessarily contribute towards fulfilling the hopes of policy-makers. Policy measures will only be successful if they rest on a proper understanding of reality, and on a grasp of the interrelations which exist between the development of individual types of eWork, and between eWork and more general trends in employment patterns, business imperatives, political regulation, and social values and attitudes. This paper intends to contribute towards this discussion.

In order to do so, we will use the SIBIS database (which includes data from 2002/2003 covering all current EU25 Member States<sup>2</sup> plus the remaining candidate countries Bulgaria and Romania, as well as Switzerland and the USA) to explore the determinants of eWork uptake at the level of the individual worker. The methodology behind SIBIS is briefly explained in chapter 2, while chapter 3 includes a discussion of some key findings from the survey, including country differences and the interrelation between different types of eWork. Next, chapter 4 tries to show which factors increase or decrease the likelihood of a person taking up eWork, and whether there are differences between telework (multi-locational eWork) and tele-cooperation (uni-locational eWork). The chapter first outlines the current state of knowledge about determinants of eWork at the individual level, before digging into the SIBIS data. Finally, chapter 5 sums up key findings from the analysis, draws some conclusions and outlines the need for further research.

## 2 DATA COLLECTION METHODOLOGY

In the context of the project SIBIS, which was funded by the European Commission through its Information Society Programme, two major pilot surveys were conducted covering a number of issues related to the Information Society, including new ways of working and the use of ICTs for work-related purposes.

The first wave of the survey was conducted in April-May 2002 in all 15 EU Member States plus Switzerland and the USA, using computer-aided telephone interviews. The survey was co-ordinated and executed by INRA Deutschland GmbH, Mölln. The population for the study was all persons aged 15 and over living in private households in the respective countries and speaking the respective national language(s). 11,832 interviews were successfully completed. The average interview length per country varied between 10 (Greece) and 20 minutes (Sweden).

Target households were selected at random in all countries, either by random dialling techniques such as permutation of final digits or by drawing a random sample from official sources. Mostly a geographical stratification was implemented beforehand. For the selection of the target person common random keys were applied in all countries except for the U.K. where quota was used. In two cases (Spain, USA), screening had to be directed towards male respondents towards the very end of the field work in order to gain gender representativeness.

The second wave of the survey was carried out in January 2003 in the 10 Candidate Countries Bulgaria, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Poland, Romania, Slovenia and Slovakia, using face-to-face respectively “paper and pencil” interviews (PAPI). The survey was co-ordinated and executed by NFO AISA, Czech Republic, Prague. 10,379 interviews were successfully completed. The average interview length per country varied between 20 (Romania) and 40 minutes (Lithuania). Target households were selected at random in all countries, either by multistage stratified random-route sampling or by drawing a random sample from official sources. Mostly a geographical stratification was implemented beforehand. More methodological information as well as the survey instruments used for data collection are available from the project website ([www.sibis-eu.org](http://www.sibis-eu.org)).

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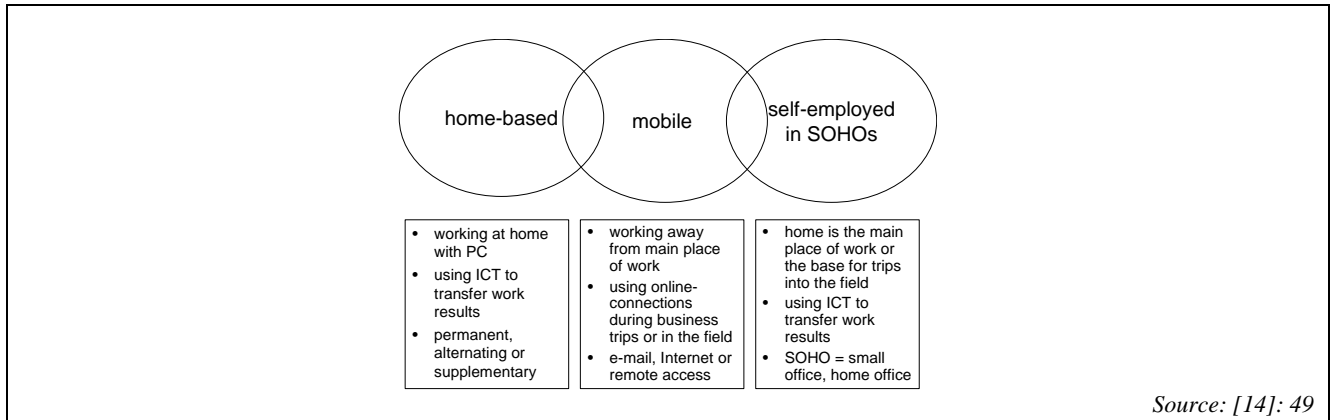
<sup>2</sup> with the exception of Malta and Cyprus

### 3 eWORK IN EUROPE

#### 3.1 Telework as multi-locational eWork

For a discussion on the diffusion of telework we distinguish between home-based telework, mobile telework and telework by self-employed who work from SOHOs, i.e. small offices in their home [17][20], see Figure 1. These together we might also call multi-locational eWork to highlight the fact that in addition to the traditional office workplace, teleworkers make use of ICTs to work at other locations as well, e.g. at home or while travelling. Among home-based teleworkers, we additionally distinguish between permanent/alternating (at least one full working day per week) and supplementary teleworking (some working time, but less than one full working day per week).

Figure 1: Types of telework (= multi-locational eWork) and interrelations



It is important to note here that this definition of telework requires that *paid working time* is spent at remote locations. This definition implies that some form of agreement between employee and supervisor/employer exists about the issue<sup>3</sup>.

Table 1: Development of multi-locational eWork in % of total employment in EU15 and the NAS10

| Type   | EU15       |             | NAS10 |                        |
|--|------------|-------------|-------|------------------------|
|  | 1999       | 2002        | 1999  | 2003                   |
| Alternating or permanent home-based telework | 2.0        | 2.1         | -     | 0.8                    |
| Supplementary home-based telework            | 2.0        | 5.3         | -     | 2.2                    |
| Mobile telework                              | 1.5        | 4.0         | -     | 1.2                    |
| Self-employed telework in SOHOs              | 0.9        | 3.4         | -     | 1.7                    |
| <b>All telework (excluding overlaps)</b>     | <b>6.0</b> | <b>13.0</b> | -     | <b>5.4<sup>4</sup></b> |

Data source: SIBIS 2002/2003, weighted.

Table 1 shows how diffusion rates of these different types of multi-locational eWork have developed in recent years (averages for EU15 and NAS10<sup>5</sup>), while Table 2 presents national shares of teleworkers in the EU15, ten NAS10, Switzerland and the USA.<sup>6</sup>

According to the survey data, the share of teleworkers in the European Union is considerable lower than in the USA. In the country where the telework idea was born, every fourth worker has some type of teleworkplace (25%), while the average in the EU is only 13%. The clear leader in Europe are the Netherlands (26%), the only EU country with a higher share of teleworkers than the USA. The three Nordic countries Finland (22%), Denmark (22%) and Sweden (19%)

<sup>3</sup> Definitions which also include unpaid work-related activities quickly arrive at figures of between a quarter and half of all workers doing work at home ([9]:85).

<sup>4</sup> Average excludes Lithuania because of missing data for mobile telework.

<sup>5</sup> NAS10 = New Member States plus Romania and Bulgaria, but excluding Malta and Cyprus.

<sup>6</sup> The figures have been validated with data from previous surveys carried out by Empirica (see [5],[31]) as well as secondary data sources such as LFS and Eurobarometer data, where available (e.g. [6]). Results show a high degree of congruence. However, comparisons are made difficult by the huge variety in data gathering methods.

follow, in front of the United Kingdom (17%) and Germany (17%). Below EU average shares of teleworkers were found in the countries of Southern Europe, namely Italy (10%), France (6%) and Spain (5%).

Table 2: Spread of eWork in the EU15, CH and USA 2002 (Source: SIBIS)

|   | AT | BE | DK | FI | FR | DE | EL | IE | IT | LU | NL | PT | ES | SE | UK | EU        | CH | US |
|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----------|----|----|
| <b>Multi-locational eWorkers</b>            | 14 | 11 | 22 | 22 | 6  | 17 | 11 | 11 | 10 | 6  | 26 | 3  | 5  | 19 | 17 | <b>13</b> | 17 | 25 |
| <i>thereof:<br/>Home-based teleworkers</i>  | 7  | 8  | 18 | 16 | 4  | 8  | 6  | 6  | 2  | 3  | 21 | 2  | 2  | 15 | 11 | <b>7</b>  | 11 | 17 |
| <b>Tele-cooperation</b>                     | 36 | 38 | 56 | 55 | 26 | 46 | 13 | 37 | 35 | 42 | 45 | 10 | 21 | 52 | 49 | <b>38</b> | 48 | 53 |
| <i>thereof:<br/>Uni-locational eWorkers</i> | 26 | 30 | 37 | 38 | 21 | 32 | 6  | 27 | 27 | 37 | 25 | 8  | 17 | 37 | 34 | <b>27</b> | 33 | 32 |

The additional data from the Candidate Countries complements the European picture. As might have been expected, the countries from Central and Eastern Europe have lower levels in telework penetration on average (5.5%). Romania has a figure of only 2%. However, there are comparatively high numbers in Estonia (12%) as well as in Lithuania (9%), Slovenia (9%) and Poland (8%). Estonia's figure is very close to the EU average, although the country has a GDP per head which in 2002 was only 41% of the EU average. Overall, the Candidate Countries have teleworker shares which are roughly similar to those in southern Europe including France, Italy, Portugal and Spain.

Table 3: Spread of eWork in the NAS10 2003 (Source: SIBIS)

|   | BG | CZ | EE | HU | LV | LT | PL | RO | SK | SI | NAS10      |
|---|----|----|----|----|----|----|----|----|----|----|------------|
| <b>Multi-locational eWorkers</b>            | 6  | 5  | 12 | 4  | 6  | 9° | 8  | 2  | 4  | 9  | <b>5°°</b> |
| <i>thereof: home-based teleworkers</i>      | 4  | 1  | 8  | 1  | 3  | 8  | 5  | 1  | 1  | 4  | <b>3</b>   |
| <b>Tele-cooperation</b>                     | 15 | 21 | 31 | 13 | 20 | 21 | 17 | 8  | 14 | 32 | <b>16</b>  |
| <i>thereof:<br/>Uni-locational eWorkers</i> | 12 | 16 | 21 | 9  | 16 | 15 | 10 | 7  | 12 | 25 | <b>11</b>  |

° excludes mobile teleworkers; °° average excludes LT

Looking closer at types of teleworking, the overall share of the EU workforce practising home-based teleworking is 7 percent. Of these, only 2 percentage points spend at least one full working day per week at home (alternating telework), and their number has not grown much at all in the last three years. Permanent telework by persons with a contract of employment is so rare in Europe that it could not be measured in a statistically significant way using the SIBIS sample of ~ 12,000 interviews in the EU15 (Among the self-employed, permanently working from home is more wide-spread, for obvious reasons). These findings have been confirmed by research carried out at the national level (Germany: [15]; USA: ILO, quoted in [9]: 30; UK [9]: 37; Finland: [40]) and by a newer survey covering six countries [3].

It has become more and more obvious in recent years that permanently teleworking at home, while having potential benefits for the environment and regional development [35], is in most cases not sustainable with regard to psychosocial [26] and economic factors [16]. The FAMILIES project [8] has reported evidence from a major Danish company according to which telework's mid-term effect on productivity was slightly negative in case of permanent or near-permanent telework, while it was very positive for alternating teleworkers. The reasons given for the poor performance of permanent teleworkers refer to the lack of social and informal interaction with colleagues, which resulted in a loss of motivation and insufficient access to intra-company information flows.

But while permanent teleworking at home remains an exotic phenomenon, and alternating home-based telework is hardly increasing at all, supplementary home-based telework is on the rise (see Table 1). In 2002, there were more than two and a half times more supplementary teleworkers in the EU15 than three years before. These findings suggest that there is a shift of home-based teleworkers towards less time spent at home. Obviously, the progress in the availability of

cheap and powerful remote access technology has not led to workers spending more and more time working at home, but rather to more and more workers spending only a fraction of their weekly working time at home. This points towards a greater flexibility in the use of individual working locations, but at the possible expense of some of the traditional advantages ascribed to telework such as savings on commuting.

Mobile teleworkers are those who spend a considerable share<sup>7</sup> of their working time away from their home and their main place of work, e.g. on business trips, travelling or on customer's premises, and make use of online connections while doing so. According to the SIBIS survey, 4% of the EU15 workforce can be described as mobile teleworkers. Switzerland is the leader here among the countries in the survey, followed by Finland, the USA, Germany and Italy. The penetration in Eastern and Central Europe is much lower with an average of about 1%, although Estonia and Slovenia have impressively high figures.<sup>8</sup>

Mobile computing technology and online access have diffused fast in recent years and are increasingly used for work. The share of mobile teleworkers has grown from 1.5% to 4% in the course of only three years. This is likely to benefit employers, in particular, as the efficiency of business process increases because of more continuous communication flows [19][28]. The advance of 3G mobile networks and the surrounding mobile applications will act as another strong push in this direction. Working from just anywhere does not sound such a futuristic proposition anymore today. This trend is also reflected by data from the Working Life Barometer 2002 in Finland (a forerunner country with respect to mobile phone usage) according to which almost 40% of wage and salary earners have been carrying out work tasks in their leisure time by means of a connection to their employer via mobile phone or ICT network [40]. The boundaries between work at a central office, on the road or in the field, at customer's premises, at teleservice centres and at home are likely to further disappear step by step. The same applies, it seems, to the boundaries between working time and leisure time [47].

Table 4: Telework – working locations

| Multi-locational eWork         |                                       |  |                                 |                                     |                    |
|--------------------------------|---------------------------------------|--|---------------------------------|-------------------------------------|--------------------|
| Base →                         | (a)<br>at home or the<br>same grounds | (b) at<br>second location of<br>employer | (c)<br>at customers/<br>clients | (d)<br>at a hotel/<br>meeting venue | (e)<br>on the move |
| at home or the same grounds    | 100.0                                 | 40.4                                     | 42.2                            | 39.1                                | 42.5               |
| at second location 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.

It has been suggested that to categorise teleworkers as “home-based” or “mobile” teleworkers distracts from the fact that many teleworkers spend their working time at a number of different locations [21], among which the home might be only one option. This trend has obviously been enabled by mobile office technology which has liberated work from being bound to a particular space and time, and is often discussed as multi-locational eWork. Table 4 gives a picture of how this might look in practice, based on data from the BISER survey conducted in 2003 in 38 regions which together roughly represent the EU average<sup>9</sup>. The interview asked in detail for time spent at each of five “atypical” working locations. Table 4 shows the share of those teleworking from one of these locations (columns) who also work at each of the other locations (rows). For example, of persons teleworking from the home (a) 11.5% also work at a second location of their employer and use online connections to stay in contact when doing so. Another example: 42.5% of those who telework from mobile locations (e) also spend time teleworking from home.

The figures in the table provide evidence that multi-locational work has indeed become a normal way of working for a considerable share of total employment. Only persons teleworking from home are unlikely to spend time teleworking from other locations. The reason for this might be that the equipment in home offices is often fixed in space, i.e. cannot

<sup>7</sup> Here: 10 hours per week or more.

<sup>8</sup> Data from Lithuania is missing for this indicator.

<sup>9</sup> For information about methodology see [21].

be used for teleworking from other locations (e.g. desktop, home-bound Internet access). On the other hand, once workers have access to mobile computing equipment, they seem to choose any of a number of different working locations, including a second location of their employer, the premises of customers or clients, hotels and meeting venues, and temporary locations while travelling.

Self-employed teleworkers in SOHOs are self-employed persons who work from home, on the same grounds as their home or with their home as their base, and use online ICTs for interaction with clients, collaborators and suppliers. The SIBIS survey showed that 3% of EU employment belong to this group, which translated into 21% off all self-employed. The share of teleworkers is therefore considerably higher among the self-employed than among workers with a contract of employment. Telework seems to be on the way to becoming the standard working mode for the majority of the self-employed and among them freelancers (many of which traditionally work from home), in particular. Austria, Germany, the Netherlands and the UK have the highest share of SOHO-based teleworkers in Europe. Greece also has a high score on this indicator which is mainly due to the massive overall share of self-employed in the workforce. Between 1999 and 2002, the number of SOHO-based teleworkers has grown from 1% to more than 3% as a result of annual growth rates averaging more than 50%. The candidate countries (average 2%) are somewhat behind the EU, but to a lesser extent than it is the case for the other types of telework.

### 3.2 From telework to eWork

Discussion on telework has in recent years been subsumed under the newly invented term “eWork”[11], a development which has certainly not led to more clarity in the discussion about ICTs impact on work locations. From the research and practitioner literature<sup>10</sup>, it appears that the way in which notions of eWork change from the earlier concept of telework are the following:

- While telework in the traditional sense is mostly focussing on individualised changes of work location, most prominently at home<sup>11</sup>, eWork also includes remote work in shared office premises, such as call-centres and (other) remote back offices.
- The discussion around eWork usually also covers telemediated work forms carried out by workers being located in traditional office environments, as in the case of virtual teams which stretch across the boundaries of single organisations and, by implication, mostly also across sites, regions and even countries.

The EMERGENCE project has done valuable work in conceptualising eWork ([27]: 5). The basic analytical approach chosen by Huws and O’Regan is to look at performed work as a service which is provided by a worker/contractor and delivered (via telemediation) to a taker (client or “respondent” in the same organisation). This allows them to interpret employees, freelancers and specialist service supply companies as different types of basically the same phenomenon (eWork). The roles of client and contractor, as used in EMERGENCE, could also be called *principal and agent* to highlight the fact that these type of relationships can be coordinated via the open market, but are also common practice inside of all hierarchical organisations. The principal is somebody who does not act directly but instead by giving incentives (such as money, career prospects) to other persons, called agents. Principal-agent theory assumes that as a result of self-interest and potential goal conflicts, the fact that a situation of asymmetrical information exists between principal and agent leads to a problem of control – a common theme in much of the management literature on telework (see e.g. [10][39]) and also out-sourcing and collaboration.

Hanhike and Gareis [23] have extended the EMERGENCE model by also including tele-cooperation and other types of telemediated co-work which is not being based on principal-agent relationships [43]. Not all work performance conforms to the agent/respondent model. In many cases, there is no hierarchical relationship between co-workers, but rather cooperation or collaboration (see also [11]: 12). Collaboration in general means, as the Cambridge dictionary puts it, “when two or more people work together to create or achieve the same thing”.

Hanhike’s and Gareis’ [23] definition of eWork therefore comprises any type of telemediated remote work and includes the following types (see Table 5):

- individualised or shared-office based (this refers only to the physical workplace of the worker, not to the fact that they share an office with the principal or collaborators);

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<sup>10</sup> For an overview see [11]

<sup>11</sup> Exceptions which have often been mentioned include tele-centre developments. These have, however, never attained anything like the prominence as originally foreseen, see [29].

- collaborative work (tele-cooperation, virtual teams) or work which is performed in the context of principal-agent type relationships;
- work interaction which is inter-organisational, i.e. coordinated over the market (such as in client/contractor relationships and freelance work) or work interaction which is intra-organisational, i.e. not coordinated over the market.

“Telemediation” is defined as the transfer of work inputs and/or outputs via data telecommunications links. Remoteness refers here to the physical distance between persons involved, either principal and agent or various collaborators. Any definition (as in “remote work”) either leaves much room for interpretation, or must appear rather arbitrary. Nevertheless, most often remote work is being (implicitly) defined as meaning different sites/locations/addresses. For example, telemediated work exchange between two establishments, even if they belong to the same organisation, should be considered eWork if they do not share the same address. On the other hand, co-located workers who nevertheless make extensive use of computer supported collaborative work should not count as eWorkers, because distance does not play any significant role in their case.

Table 5: Modified typology of eWork

|                   |                                  | Involved actors   |   |   |  |
|-------------------|----------------------------------|---|---|---|--|
|                   |                                  | Principal/agent   |   | Collaboration   |  |
| Type of workplace |                                  | intra-organisational  | inter-organisational  | intra-organisational  | inter-organisational   |
|                   |                                  | <b>Individualised (away from office premises)</b>   | <ul style="list-style-type: none"> <li>• Employed home-based telework</li> <li>• Mobile telework</li> </ul>     | <ul style="list-style-type: none"> <li>• Freelance teleworkers (mostly in SOHOs)</li> </ul>                   | ---  |
|                   | <b>On shared office premises</b> | <ul style="list-style-type: none"> <li>• Other sites of same company (e.g. remote back offices)</li> <li>• Employees working on third party premises</li> </ul> | <ul style="list-style-type: none"> <li>• Outsourcing to specialist business service supply companies</li> </ul> | <ul style="list-style-type: none"> <li>• Virtual teams composed of employees from a single company</li> </ul> | <ul style="list-style-type: none"> <li>• Virtual teams composed of employees from different companies</li> </ul> |

Source: [23], based on [27]

### 3.3 Tele-cooperation as uni-locational eWork

Because tele-cooperation allows flexible configurations of human capital without actually moving people from one place to the other, it has proven to be a very attractive option for employers in the context of the restructuring of business processes and economic relationships at a global scale. SIBIS collected data on the extent to which the EU labour force is involved in tele-cooperation already. For this, a very basic definition was used which 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. As the third lines in Table 2 and Table 3 on pages 4-4 show, tele-cooperation defined as such is already widely in use in Europe (see Table 6) with an average of 38% of EU workers practising it. In Finland, Denmark and Sweden more than 50% of workers tele-cooperate at least occasionally. Again we can observe a north-south divide in Europe with Portugal (10%), Greece (13%), Spain (21%) and France (26%) at the tail end.

Based on these data, we can now distinguish between

- multi-locational eWorkers (teleworkers) who use ICTs to increase their locational flexibility by working at home or at other alternative locations (see first line in Table 2 and Table 3 on pages 4-4); and
- uni-locational eWorkers who use ICTs to cooperate with work contacts across the boundaries of place and organisation, but who do still spend their working time at a traditional workplace, e.g. in a central office environment (fourth line in Table 2 and Table 3).

Comparing both promises to offer new insight into the way ICTs changes work organisation (and related societal variables), and the extent to which the locational flexibility made possible by the time/space contracting characteristics of the Internet and other ICTs affect different types of workers and subgroups hereof.

## 4 DETERMINANTS OF eWORK UPTAKE

### 4.1 Previous Research

While there have been a number of attempts to explore the characteristics of multi-locational workers (specially home-based teleworkers) and compare them to the overall workforce, research into tele-cooperation has focussed almost exclusively on technical and organisational aspects [43].

A number of studies have looked at which features increase or decrease the probability of a person practising telework. This has sometimes been done by using probability samples in order to identify persons teleworking already, or establishments/enterprises which let their employers telework. This method allows extrapolations to be made which give insight about the overall population of teleworkers, within certain statistical margins of error.

For example, [5], [20] and [21] all found that teleworkers tend to be male, have above level qualification and live in households without young children. Even when looking at home-based telework only, data such as that from BISER [21] suggest that women and households with small children are not more likely to telework than other members of the labour force. This finding is confirmed by other research which used representative (probability) samples, as opposed to case study research with hand-picked teleworkers [4][41]. Only when looking into permanent home-based teleworking (most of which appears to be traditional low-skilled homework which has been technologically upgraded by a telecommunications link to the principal), some studies have found larger numbers of women than men ([9]: 29-44).

Some recent research has come to the conclusion that telework usually takes place in urban settings, with residential locations of home-based teleworkers tending to be in the suburban area rather than city centres [33]. Apart from anecdotal evidence of individual cases [32], no research has yet been able to prove that telework has strengthened the ability of peripheral and rural areas to attract high quality workplaces. It appears more likely that telework will actually strengthen the competitive advantage of central urban agglomerations over the periphery [22].

A second group of studies have based calculations on certain assumptions about which type of jobs are most feasible for telework, and under which conditions workers will choose to ask for telework. This approach has been applied, in particular, for forecasting potential numbers of teleworkers e.g. in the context of research on the effects of teleworking on traffic volumes [24][36][37]. While models explaining the adoption of telework at the level of the individual are very advanced already, attempts to link them with macro labour market data and survey-related data about the uptake of eWork have not been successful yet.

A third group of studies used survey-derived data on interests, perceived feasibility and future plans in order to estimate how teleworker numbers will develop in the near future [20]. [21] found that about one quarter of all jobs are considered feasible for alternating home-based teleworking by their holders, more than 10 times the number of actual people teleworking in this way. Feasibility is hardly a matter of interest on the part of workers. Surveys have consistently found that between half and two third of the labour force are interested in telework either at home or at a remote office located close to their home ([20]: 25). Differences in interest across countries are remarkably small [17][39]. Moreover, workers from all main groups of workers (e.g. occupations, job position, sector) appear to be similarly interested in working from home, at least part of their working time. On the supply side, however, employers tend to be much more cautious about telework [13][20].

Finally, a fourth group of studies, mainly coming from a business management background, has tried to identify characteristics which make a successful candidate for teleworking (see [1] for a good overview). These are usually split into individual characteristics (e.g. skills, preferences), characteristics of the working location (e.g. availability of separate study), task characteristics (e.g. communication and coordination requirements) and organisational characteristics (e.g. corporate culture, control mechanisms, strategy). Since most teleworking appears to take place outside of official company schemes, i.e. in informal arrangements [4], it is by no means guaranteed that the characteristics of actual teleworkers comply with the requirements as listed in the management literature. Its value for our analysis is therefore limited.

Since there are enormous differences between EU Member States with regard to the diffusion of eWork, it seems clear that national peculiarities have a considerable influence as a determinant of telework uptake [4][5][9][14][41][46]. It has been much less discussed, however, to what extent this influence is due to structural differences in socio-demographic



composition of the labour force and in the economy, rather than representing a direct outcome of the regulatory framework or, as [46] suggests, “cultural” factors. This is unfortunate, since in the current political discussion (e.g. in the context of the European Commission’s eEurope action plans) it is often presumed that national policies alone have the power to determine how fast and how far beneficial innovations, as telework is understood to be, diffuse in a given country [6].

## 4.2 Analysis of SIBIS data

As we deal mainly with non-metric variables, it is not useful to apply a linear regression model since no linear association can be expected. For our purpose, logistic regression is most appropriate. The logistic regression model is simply a non-linear transformation of the linear regression. For a case with two variables, the logit model is described as:

$$\ln\left(\frac{p_i}{1-p_i}\right) = a_1 + bx_i$$

whereby:

$\ln$  is the natural logarithm,  $\log_{\exp}$ , where  $\exp=2.71828\dots$ ,

$p$  is the probability that the event Y occurs,  $p(Y=1)$ ,

$\frac{p_i}{1-p_i}$  is the "odds ratio", i.e. the probability of the event divided by the probability of the nonevent,

$\ln\left(\frac{p_i}{1-p_i}\right)$  is the log odds ratio, or "logit",

$a$  is the coefficient on the constant term,

$b$  is the coefficient(s) on the independent variable(s), and

$x$  is the independent variable(s).

The logistic distribution is an S-shaped distribution function which is similar to the standard-normal distribution (which results in a probit regression model) but easier to work with in most applications (the probabilities are easier to calculate). The logit distribution constrains the estimated probabilities to range from 0 to 1. The dependent variable can be dichotomous and nominal (i.e. discrete not continuous).

To analyse the impact of different demographic, socio-economic and work related variables on the uptake of eWork, we use the **binary logistic regression** procedure in SPSS. As Table 8 in the annex shows, the variables which we want to analyse are mostly non-metric variables. In fact, the dependent telework variables selected for the analyses are nominal scaled and dichotomous, which is one constraint for the chosen statistic model. The independent variables are of interval level or categorical, one is metric scaled.

For interpretation we use the effect coefficient  $\exp(b)$  which is the effect of the independent variable on the odds ratio. The last column of Table 6 displays the increase/decrease of the odds ratio as percentages.

As Table 6 shows, there are a number of factors which have a considerable influence on the odds of doing multi-locational as well as uni-locational eWork. Most obviously, occupational category and educational attainment play a dominant role. The former partly reflects the feasibility of carrying out the work with the help of electronic mediation: most blue collar jobs can be expected to be unsuitable for telework, just as is the case with personal service occupations. The influence of educational attainment reflects the over-representation of high-qualified workers in knowledge-intensive jobs, which can be expected to be most suitable for multi-locational work just as much as for tele-cooperation. In comparison, post-secondary educational attainment is of even bigger power as a determinant for telework than for uni-locational eWork. Longer working hours increase the likelihood of using tele-cooperation as well as telework.

Interestingly, there are several differences between the determinants of multi-locational as opposed to uni-locational eWork. Let us look at employment-related factors first: here, the small (<50 staff) as well as the larger (250+ staff) company size classes increase the likelihood of a person doing uni-locational eWork considerably, but have no influence on the uptake of telework. On the other hand, being employed in the private sector increases the likelihood of being a teleworker by as much as 64%, while it has no influence on uni-locational eWork.

Table 6: Multi-locational eWork (telework) and uni-locational eWork (logistic regression, Exp(b))

|  | Multi-locational eWork |            | Uni-locational eWork |            |
|--|------------------------|------------|----------------------|------------|
|  | Exp(b)                 | in %       | Exp(b)               | in %       |
| Gender (reference: male)                                   |                        |            |                      |            |
| female   | <b>0.535**</b>         | <b>-46</b> | 0.935                | -7         |
| Age class (ref.: 14-24)                                    |                        |            |                      |            |
| 25-34  | <b>1.382*</b>          | 38         | 0.929                | -7         |
| 35-49  | 1.327                  | 33         | <b>0.779**</b>       | <b>-22</b> |
| 50+  | 1.114                  | 11         | <b>0.589**</b>       | <b>-41</b> |
| Household type (ref.: 1-person household)                  |                        |            |                      |            |
| household with kids aged <6                                | <b>1.303*</b>          | 30         | <b>0.775**</b>       | <b>-23</b> |
| household with kids aged 6+                                | 1.207                  | 21         | 0.899                | -10        |
| 2-person household without kids                            | 1.059                  | 6          | 0.966                | -3         |
| Educational attainment (ref.: none and basic)              |                        |            |                      |            |
| low secondary  | 2.134                  | 113        | <b>2.043**</b>       | <b>104</b> |
| high secondary   | <b>3.030**</b>         | <b>203</b> | <b>3.009**</b>       | <b>201</b> |
| post secondary   | <b>6.205**</b>         | <b>521</b> | <b>4.235**</b>       | <b>324</b> |
| Occupation (ref.: blue collar)                             |                        |            |                      |            |
| white collar   | <b>3.975**</b>         | <b>298</b> | <b>5.481**</b>       | <b>448</b> |
| managerial or professional                                 | <b>7.821**</b>         | <b>682</b> | <b>6.878**</b>       | <b>588</b> |
| Employment contract (ref.: self-employed)                  |                        |            |                      |            |
| with employment contract                                   | <b>0.248**</b>         | <b>-75</b> | <b>4.124**</b>       | <b>312</b> |
| Company size class (ref.: 50-249)                          |                        |            |                      |            |
| 0-49   | 1.043                  | 4          | <b>0.825**</b>       | <b>-18</b> |
| 250+   | 1.242                  | 24         | <b>1.400**</b>       | <b>40</b>  |
| Working hours  | <b>1.815**</b>         | <b>81</b>  | <b>1.333**</b>       | <b>33</b>  |
| Sector (ref.: public and non-profit sector)                |                        |            |                      |            |
| private sector   | <b>1.640**</b>         | <b>64</b>  | 1.112                | 11         |
| Income change in last three years (ref.: income decreased) |                        |            |                      |            |
| income increased   | 1.056                  | 6          | <b>1.349**</b>       | <b>35</b>  |
| income remained the same                                   | <b>0.744*</b>          | -26        | 1.025                | 3          |
| Long standing illness (ref.: long standing illness)        |                        |            |                      |            |
| not impaired, no long standing illness                     | 0.993                  | -1         | 1.171                | 17         |
| Size of residential locality (ref.: small city/village)    |                        |            |                      |            |
| city   | 1.179                  | 18         | 1.125                | 13         |
| big city   | 1.187                  | 19         | <b>1.416**</b>       | <b>42</b>  |
| Country (ref.: Germany)                                    |                        |            |                      |            |
| Austria  | 1.085                  | 8          | 0.801                | -20        |
| Belgium  | <b>0.534*</b>          | -47        | 0.780                | -22        |
| Denmark  | <b>1.567*</b>          | 57         | 1.342                | 34         |
| Finland  | 1.357                  | 36         | 1.368                | 37         |
| France   | <b>0.376**</b>         | <b>-62</b> | <b>0.516**</b>       | <b>-48</b> |
| Greece   | <b>0.356**</b>         | <b>-64</b> | <b>0.139**</b>       | <b>-86</b> |
| Ireland  | 0.528*                 | -47        | 0.912                | -9         |
| Italy  | <b>0.446**</b>         | <b>-55</b> | 1.076                | 8          |
| Luxembourg   | <b>0.376**</b>         | <b>-62</b> | 1.130                | 13         |
| Netherlands  | 1.429                  | 43         | 0.741                | -26        |
| Portugal   | <b>0.164**</b>         | <b>-84</b> | <b>0.193**</b>       | <b>-81</b> |
| Spain  | <b>0.290**</b>         | <b>-71</b> | <b>0.710*</b>        | <b>-29</b> |
| Sweden   | 1.182                  | 18         | 1.181                | 18         |
| Switzerland  | 1.199                  | 20         | 0.924                | -8         |
| UK   | 1.060                  | 6          | 1.098                | 10         |
| USA  | 1.266                  | 27         | 0.802                | -20        |
| Bulgaria   | <b>0.267**</b>         | <b>-73</b> | <b>0.325**</b>       | <b>-67</b> |
| Czech Republic   | <b>0.281**</b>         | <b>-72</b> | <b>0.558**</b>       | <b>-44</b> |
| Estonia  | 0.769                  | -23        | <b>0.586**</b>       | <b>-41</b> |
| Hungary  | <b>0.188**</b>         | <b>-81</b> | <b>0.341**</b>       | <b>-66</b> |
| Latvia   | <b>0.428**</b>         | <b>-57</b> | <b>0.397**</b>       | <b>-60</b> |
| Lithuania  | <b>0.437**</b>         | <b>-56</b> | <b>0.332**</b>       | <b>-67</b> |
| Poland   | <b>0.467**</b>         | <b>-53</b> | <b>0.288**</b>       | <b>-71</b> |
| Romania  | <b>0.088**</b>         | <b>-91</b> | <b>0.166**</b>       | <b>-83</b> |
| Slovakia   | <b>0.213**</b>         | <b>-79</b> | <b>0.331**</b>       | <b>-67</b> |
| Slovenia   | <b>0.594*</b>          | -41        | 0.934                | -7         |
| Constant (b)   | 0.002                  | 0          | 0.003                | 0          |
| Number of Observations                                     | 10494                  |            | 10497                |            |
| -2LL   | 5371.0                 |            | 9095.4               |            |
| Cox&Snell R <sup>2</sup>                                   | .154                   |            | .183                 |            |
| Nagelkerke R <sup>2</sup>                                  | .313                   |            | .279                 |            |

Data source: SIBIS GPS 2002, SIBIS GPS-NAS 2003, n=10.497 (\*p<.05, \*\*p<.01).

Increases in income (in the three years before the survey) appear to be a good determinant for uni-locational eWork – however, it is not clear in which direction a causal relationship would work, as it may also be that income increases result from being in a job which makes use of ICTs for tele-cooperation.

There are also differences with respect to the effect of personal circumstances. Being a women significantly decreases the likelihood of multi-locational eWork (which includes teleworking at home), while it has no significant effect on uni-locational eWork. The opposite association is to be found with regard to older age and households type: When controlled for industry sector, educational attainment, occupation etc., age appears has hardly any significant influence on multi-locational eWork, while older workers are considerably less likely to practise uni-locational eWork. Meanwhile, both categories of eWork are independent from whether a worker has a disability or a long-standing illness.

Finally, the type of residential location of a worker does have a significant influence on uni-locational eWork, as a location in a major agglomeration increases the likelihood of doing this category of eWork by 42%, but not so on multi-locational eWork.

### **4.3 The country influence**

Table 6 also shows the effect of the country which remains after other major factors such as economic sector, occupational structure, educational attainment and company size – all of which are known to differ considerably across EU Member States – have been controlled for. The reference variable here is country = Germany.

Some of the gaps between “fore-runners” and other countries which appear when simple rates of diffusion are compared (see Table 2 on page 4) have become less obvious as a result of the calculation, in particular in the case of uni-locational eWork. A negative country influence (when compared against the reference which here is Germany) on the likelihood of both uni-locational and multi-locational eWork is detectable for France, Greece, Portugal and Spain, and all (then) Newly Associated States with the exception of Estonia and Slovenia. Italy, Luxemburg and to some extent Belgium, Ireland and Slovenia are worth mentioning as a negative country influence can only be observed for multi-locational eWork (which arguable has higher demands on the flexibility on the regulatory framework), but not for uni-locational eWork. Working in Estonia does not increase the likelihood of tele-cooperation in general, but it does so when teleworking at home or at other alternative locations is concerned. Finally, working in Denmark means a significantly higher probability to do multi-locational eWork, but no significant influence on uni-locational eWork.

## **5 DISCUSSION AND OUTLOOK**

With regard to the hypotheses and statement contained in the literature – research publications as well as policy documents – main findings from our analysis are:

- Women are less likely to telework from home or a mobile location than men. No such relationship can be found with regard to tele-cooperating from a traditional office workplace. This suggests that the flexibility increases offered by ICTs with regard to the working location are unequally distributed between male and female workers. Women make significantly less use of eWork in order to be locationally flexible. This is surprising given that telework was initially promoted as an attractive way for women to combine family and work obligations.
- There is some evidence that telework (multi-locational eWork) has been taken up by segments of the labour force which are otherwise threatened to be excluded from the knowledge economy, such as elderly workers and persons in rural areas. While members of both groups are less likely to practise uni-locational eWork, no such influence is evident in the case of telework.
- The same applies to some extent for workers in small and micro enterprises (<50 staff) which are less likely to use ICTs for tele-cooperation in traditional office environments, but make as much use of multi-locational eWork as persons working in bigger organisations.
- Tele-cooperation as a working method has been adopted as much in the public as in the private sector. There are notable differences, though, when it comes to multi-locational eWork. It appears that regulatory barriers and potentially outdated management methods keep the public sector in Europe from exploiting the advantages of freeing workers from the traditional constraints of time and space.
- After controlling for the major factors which describe the structure of the labour force and the economic environment, a number of EU Member States still show a significant negative country effect with regard to take-up of eWork.

- Examples are Italy and Luxemburg, where country-specific factors seem to hinder the take-up of multi-locational eWork, while no such influence is detectable concerning eWork in traditional office environments (uni-locational). This points to regulatory conditions and/or cultural factors which affect work which takes place at alternative workplace locations.
- Comparison with established indices on labour market regulation and individual risk aversion suggests that both may at least partly explain these findings: Table 7 shows that the EU Member States with strongest labour market regulation, as expressed by the OECD index on employment protection legislation [38], are almost identical to the countries which show the biggest negative influence on take-up of uni-locational and, in particular, multi-locational eWork. Only two exceptions are notable, namely Ireland and Belgium, both of which have a comparably low level of employment protection but also comparably low numbers of eWorkers.
- Similarly, countries with a negative influence on the odds for eWork tend to be those ones in which Hofstede [25] found a high degree of risk aversion. The only exception here is, again, Ireland which we would expect to have higher numbers of eWorkers if risk-aversion was a good predictor for take-up of eWork.

*Table 7: Comparison of country effect on multi-locational and uni-locational eWork and indices on employment protection legislation and risk aversion*

|                | Index of Employment Protection Legislation 1998 <sup>12</sup> | Effect of country on odds for being a... |  | Hofstede Index of Risk Aversion (Germany = 100) |
|----------------|---|--|--|---|
|                |   | multi-locational eWorker (ref.: Germany) | uni-locational eWorker (ref.: Germany) |   |
| United Kingdom | 0.5   | +6                                       | +10                                    | 54  |
| Ireland        | 1.0   | <b>-47*</b>                              | -9                                     | 54  |
| Denmark        | 1.5   | <b>+57*</b>                              | +34                                    | 35  |
| Finland        | 2.1   | +36                                      | +37                                    | 91  |
| Belgium        | 2.1   | <b>-47*</b>                              | -22                                    | 145   |
| Netherlands    | 2.4   | +43                                      | -26                                    | 82  |
| Sweden         | 2.4   | +18                                      | +18                                    | 45  |
| Austria        | 2.4   | +8                                       | -20                                    | 108   |
| <b>Germany</b> | <b>2.8</b>  | <b>---</b>                               | <b>---</b>                             | <b>100</b>                                      |
| France         | 3.1   | <b>-62**</b>                             | <b>-48**</b>                           | 132   |
| Spain          | 3.2   | <b>-71**</b>                             | <b>-29*</b>                            | 132   |
| Italy          | 3.3   | <b>-55**</b>                             | +8                                     | 115   |
| Greece         | 3.5   | <b>-64**</b>                             | <b>-86**</b>                           | 172   |
| Portugal       | 3.7   | <b>-84**</b>                             | <b>-81**</b>                           | 160   |

*Data source: OECD, latest data (1998), see [38]: 84; and [25]. No data for Luxembourg and NAS10. \*p<.05, \*\*p<.01.*

In the course of our research, we have identified a number of issues which require further research efforts. **First**, and with respect to the findings of the multi-variate analysis reported above, further research should explore whether the observed correlation between the spread of multi-locational eWork and employment protection legislation can be confirmed, and if so how it can be explained. Important contributions to a comparative analysis of regulatory frameworks for eWork have become available recently [48], but there is a lack of attempts to integrate these into a holistic model of eWork diffusion in a given national context. These would also need to take into account socio-cultural factors such as and risk aversion which cannot be expected to be changed with political means at least in the short term.

**Second**, data should be collected to obtain insight into spread, intensity and impacts of all types of eWork, as conceptualised in Table 5 on page 7. Until now, statistics on several parts of the framework are available, but these have not made use of a coherent survey approach and methodology, which means they cannot be integrated in a valid way.

**Third**, more efforts are needed to develop and apply a more refined definition of tele-cooperation/tele-collaboration, as discussed in this paper. This definition must account for the type and intensity of interaction between work contacts. It is clear that this puts considerable demands on operationalisation for survey research, as workers cannot be expected to be aware of the type of business processes they are involved in.

**Fourth**, the influence of gender on the probability of take-up of telework merits more in-depth research.

<sup>12</sup> The index value can be between 0 (low employment protection) and 6 (strong employment protection).

And **finally**, it should be noted that the flexibility which is inherent in multi-locational eWork does not necessarily benefit the worker, but may rather be imposed by the employer/client. This is the case, for example, when companies equip their staff with tele-workplaces in order to lower resistance against work at “unsocial hours”. We need, therefore, to be careful in order not to equate all types of flexibility with an increase in the quality of work on the part of the worker. Rather, we always have to be aware of the fact how increases in flexibility are distributed between worker and employer [30]. Further insight into the way in which eWork-enabled changes to flexibility affect both employers and employees is very much in demand.

## REFERENCES

- [1] Bélanger, F. and Collins, R.W. Identifying Candidates for successful telecommuting outcomes. In: R.T. Watson; R.B. Bostrom (Hrsg.): Proc. Telecommuting'96, Jacksonville/Florida. 1996.
- [2] Belt, V., Richardson, R., Webster, J., Tjinders, K. and van Klaveren, M. Work Opportunities for Women in the Information Society: Call Centre Teleworking (WOWIS), Final Report, Commission of the European Communities: Brussels. 1999.
- [3] Brynin, M. and Lichtwardt, B. Work, Home and Work at Home. Final Report. Institute for Social and Economic Research, The University of Essex. 2004.
- [4] Commission of the European Communities. Status Report on European Telework 1998, Office for Official Publications of the European Communities: Luxembourg. 1998.
- [5] Commission of the European Communities. Benchmarking Telework and e-Commerce in Europe – ECATT Final Report. Brussels: Commission of the European Communities. 2000.
- [6] Commission of the European Communities. eEurope Benchmarking Report. Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions, COM(2002)62 final, Brussels. 2002.
- [7] Commission of the European Communities (eds) eWork, Competitiveness, Productivity and Sustainable Development. Proceedings of the 9th European Assembly on Telework, Paris, September 2002, CD-ROM. 2003.
- [8] Cullen, K., Kordey, N., Schmidt, L., and Gaboardi, E. Work and Family in the eWork Era. IOS Press: Amsterdam et al. 2003.
- [9] Di Martino, V. The High Road to Teleworking. International Labour Organization: Geneva. 2001.
- [10] Dimitrova, D. Controlling teleworkers: supervision and flexibility revisited. *New Technology, Work and Employment*, Vol. 18, No. 3, (2003), pp. 181-195.
- [11] Eichmann, H., Saube, Bernhard and Schwarz-Wölzl, M. Critical Issues Pertaining to the Code of Practice for Global E-work, project document, Vienna: Centre for Social Innovation. 2002.
- [12] Ellen, I.G. and Hempstead, K. Telecommuting and the Demand for Urban Living: A Preliminary Look at White-collar Workers. *Urban Studies*. Vol 39, No. 4, (2002), pp. 749-766.
- [13] Empirica. Benchmarking Progress on New Ways of Working and New Forms of Business Across Europe. ECATT Final Report, IST Programme, KAI: New Methods of Work and Electronic Commerce. Brussels: Commission of the European Communities. 2000.
- [14] Empirica. Benchmarking Work, Employment and Skills in the Information Society in Europe and the US, SIBIS Report, Brussels: Commission of the European Communities. 2003.
- [15] Freudenreich, H., Klein, B. and Wedde, P. Entwicklung der Telearbeit – Arbeitsrechtliche Rahmenbedingungen. Forschungsbericht 269a, Bonn: Bundesministerium für Arbeit und Sozialordnung. 1997.
- [16] Gareis, K. Telework and the Bottom Line - Costs and Benefits of Telework in German Insurance Companies. In: Suomi, R., Jackson, P., Hollmén, L., Aspñäs, M. (eds.). *Teleworking Environments*, Proceedings of the Third International Workshop on Telework, Turku. TUCS General Publications, Nr. 8. 1998.
- [17] Gareis, K. Benchmarking Progress on Telework and Other New Ways of Working in Europe. Proceedings of the Fourth International Workshop on Telework, Tokyo, August 31st - September 3rd 1999, n.p. 1999.
- [18] Gareis, K. The Intensity of Telework in 2002 in the EU, Switzerland and the USA. Paper presented at the 7th workshop of the ITF, Badajoz, August 2002. 2002.

- [19] Gareis, K. Home-based vs. Mobile Telework. The Interrelationship between Different Types of Telework. In Rapp, B. and Jackson, P. (eds). *Organisation and Work Beyond 2000*. 171-185, Heidelberg and New York: Physica. 2003.
- [20] Gareis, K., Kordey, N. and Korte, W.B. Statistics on Trends in eWorking in Europe. In: Commission of the European Communities (eds). *Collaboration at Work – The 2003 Report on New Working Environments and Practices*. pp. 20-27, Brussels: Commission of the European Communities. 2003.
- [21] Gareis, K., Kordey, N. and Müller, S. *Work in the Information Society – the Regional Dimension*, BISER Domain Report No. 7, URL: [www.biser-eu.com](http://www.biser-eu.com). 2004.
- [22] Gillespie, A.E., Richardson, R. and Cornford, J. *Regional Development and the New Economy*, EIB Papers, (6)1: 109-131. 2001.
- [23] Hanhike, T. and Gareis, K. *Modelling eWork. Towards a Better Understanding of Information Technology's Impact on Workplaces and Work Locations*. Paper presented at the 22nd Annual International Labour Process Conference, Amsterdam. 2004.
- [24] Heinonen, S. *Analysis of the Finnish Telework Potential –Calculation model*, ESF publication 34/98, Helsinki: Edita Helsinki. 1998.
- [25] Hofstede, G. *Cultures and Organizations: Software of the Mind*. New York: McGraw-Hill. 1997.
- [26] Huuhtanen, P. *The Health and Safety Issues for Teleworkers in the European Union*. Consolidated report, Working paper No WP/97/29//EN 1997, Dublin: European Foundation for the Improvement of Living and Working Conditions. 1997.
- [27] Huws, U. and O'Regan, S. *eWork in Europe: The EMERGENCE 18-Country Employer Survey*. IES Report No. 380, Brighton: Institute for Employment Studies. 2001.
- [28] Julstrud, T.E. *Combinations and Tracks: An Investigation of the Relationship Between Homework and Mobile Work*. In Suomi, R. et al. (eds). *Telework Environments*. Proceedings of the Third International Workshop on Telework. TUCS General Publication, no. 5, (1998), pp. 148-163.
- [29] Korte, W.B. *Erfahrungen mit Telezentren im Ausland - Top oder Flop?* Paper presented at the conference "Telearbeit außerhalb der Ballungsgebiete", Sternenfels. 1998.
- [30] Korte, W.B. and Gareis, K. *e-Work in Europe: Indicators for Measuring Adaptability of Work Arrangements*. Proceedings of the 8th European Assembly on New Ways to Work 'Telework 2001', Helsinki, September 12-14. 2000.
- [31] Korte, W.B. and Wynne, R. *Telework – Penetration, Potential and Practice in Europe*. Amsterdam et al.: IOS Press. 1996.
- [32] Kotkin, J. *The New Geography : How the Digital Revolution Is Reshaping the American Landscape*, New York et al.: Random House. 2000.
- [33] Levin, M.R. *Teleworking and Urban Development Patterns*, Lanham: University Press of America. 1998.
- [34] Lund, J.R. and Mokhtarian, P.L. *Telecommuting and Residential Location: Theory and Implications for Commute Travel in the Monocentric Metropolis*. *Transportation Research Record*, No. 1463, (1994), pp. 10-14.
- [35] Millard, J. *Summary of European Experience of Telework and Telecentres in the Regions - A Guide for Policy Makers*. Flexwork Working Paper, [www.flexwork-ei.org](http://www.flexwork-ei.org). 2002.
- [36] Mokhtarian, P.L. and Salomon, I. *Modeling the Choice of Telecommuting: Setting the Context*. *Environment and Planning A*. Vol. 26, (1994), pp. 749-766.
- [37] Mokhtarian, P.L. and Salomon, I. *Modeling the Choice of Telecommuting: 2. A Case of the Preferred Impossible Alternative*. *Environment and Planning A*. Vol. 28, (1996), pp. 1859-1876.
- [38] Nicoletti, G., Scarpetta, S. and Boylaud, O. *Summary Indicators of Product Market Regulation with an Extension to Employment Protection Legislation*. Contribution to Workshop on 'Concepts and Measurement of Labour Markets Flexibility/Adaptability Indicators', Brussels, 26-27 October. 2000.
- [39] Nilles, J.M. *Managing Telework – Strategies for Managing the Virtual Workforce*. New York et al.: John Wiley & Sons. 1998.
- [40] Nurmela, J. and Ylitalo, M. *Tietoyhteiskunnan kehkeytyminen, suomalaisten tietoyhteiskuntavalmiuksien ja – asenteiden muutos 1996–2002*, Tilastokeskus Katsaukseia 3/2003.
- [41] Paoli, P. and Merlié, D. *Third European survey on working conditions 2000*. Dublin: European Foundation for the Improvement of Living and Working Conditions. 2001.

- [42] PonTell, S., Gray, P., Markus, M. L. and Westfall, R. D. The Demand for Telecommuting. In: Watson, T. and Bostrom, R.P. (eds.). Proceedings of the Telecommuting '96 Conference, Jacksonville, Florida. 1996.
- [43] Reichwald, R., Möslein, K., Sachenbacher, H., Englberger, H. and Oldenburg, S. Telekooperation. Verteilte Arbeits- und Organisationsformen, Berlin et al.: Springer. 1998.
- [44] Schäfer, R.A. Ökologische Beurteilung von Telearbeit – Konzeption und Realisierung eines Bewertungsmodells of Basis einer Verhaltensbilanz. Aachen: Shaker. 2004.
- [45] Stanworth, C. Telework and the Information Age. *New Technology, Work and Employment*. Vol 13, No. 1, (1998), pp. 51-62.
- [46] van Ommeren, J. Telework in Europe. In: Suomi, R., Jackson, P., Hollmén, L., Aspñäs, M. (eds.). *Teleworking Environments, Proceedings of the Third International Workshop on Telework*, Turku. TUCS General Publications, Nr. 8. 1998.
- [47] Voß, G. Entgrenzte Arbeit und entgrenzte Arbeitskraft. Eine subjektorientierte Interpretation des Wandels der Arbeit. *Mitteilungen aus der Arbeitsmarkt- und Berufsforschung*, Vol. 31, No. 3, (1988): 473-487.
- [48] Weißbach, H.-J. Telework Regulation and Social Dialogue, report, Euro-Telework, URL: [www.telework-mirti.org/reports/sum\\_DEEN.htm](http://www.telework-mirti.org/reports/sum_DEEN.htm). 2000.

## APPENDIX

Table 8: Set of variables used for logistic regression

|                              | Variable name          | Variable description  | Variable values  |
|------------------------------|------------------------|---|--|
| Dependent variables          | Multi-locational eWork | Employed population who are teleworking (as home-based, mobile or SOHO-based self-employed teleworkers).              | yes<br>no  |
|                              | Uni-locational eWork   | Employed population who use selected ICTs for cooperating with external work contacts, excluding persons teleworking. | yes<br>no  |
|                              | Home-based teleworking | Employed population who spend at least one full working day per week teleworking from home.                           | yes<br>no  |
|                              | Mobile teleworking     | Employed population who practise mobile telework.   | yes<br>no  |
|                              | Teleworkers in SOHOs   | Self-employed population who work from a home office, and use ISTs to cooperate with work contacts.                   | yes<br>no  |
|                              | Telecooperation        | Employed population who use selected ICTs for cooperating with external work contacts.                                | yes<br>no  |
|                              | Independent variables  | Gender  | Gender of interviewed persons.   |
| Age                          |                        | Age in groups of interviewed persons.   | 14-24<br>25-34<br>35-49<br>50+   |
| Household                    |                        | Size and type of household.   | 1-person household<br>household with kids ageing <6<br>household with kids ageing 6+<br>2-person household without kids<br>not specified |
| Education                    |                        | Educational background of interviewees.   | none and basic<br>low secondary<br>high secondary<br>post secondary<br>not specified   |
| Occupation                   |                        | Occupation of interviewees classified by blue/white collar.   | blue collar<br>white collar<br>white collar, managerial or professional  |
| Employment contract          |                        | Persons who are self-employed.  | self-employed<br>paid employment   |
| Company size                 |                        | Size of company in which interviewees are employed (excl. self-employed).   | 50-249<br>0-49<br>250 +<br>unknown   |
| Working hours                |                        | Number of hours worked per week on average (metric scale).  |  |
| Sector                       |                        | Industrial sector in which interviewees are employed.   | public or non-profit sector<br>private sector<br>unknown   |
| Income                       |                        | Shift in household income over the last three years.  | decreased<br>increased<br>remained roughly the same  |
| Long standing illness        |                        | Persons who have long standing illness, disability or other impairment.   | long standing illness<br>not impaired, no long standing illness  |
| Size of residential locality |                        | Size of location where the interviewee lives.   | small city or village<br>city<br>large city  |
| Country                      |                        | Origin of interviewees.   | Each EU25 Member State excluding MT and CY; BG; RO; CH; USA.   |