

BACKGROUND DOCUMENT N: A LITERATURE REVIEW OF ASPECTS OF TELEWORKING RESEARCH

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Teleworking has been defined as 'working outside the conventional workplace and communicating with it by way of telecommunications or computer-based technology' (Nilles, 1994). However, it has become apparent that there is a range of ways in which teleworking can be practised and so a more detailed breakdown of the term is needed.

The Labour Force Survey (LFS) collects quarterly data on teleworking, the only group to do this in Britain. The Survey defines teleworkers as people who do some paid or unpaid work in their own home and who use both a telephone and a computer. This is broken down into:

- People who mainly work from home in their main job - 'teleworker homeworkers'
- People who work from home in various locations but use their home as a base - 'home based teleworkers'
- People who do not usually work at home or use home as a base but did so for at least one day in the reference week - 'occasional teleworkers'.

This can be further divided into those that need a computer and telephone to do their job (TC teleworkers) and those that don't (Labour Market Trends, 2002).

There are some problems with the above definition that are worth keeping in mind when using LFS data. First, the survey does not immediately distinguish between those that are self-employed and those that work for an organisation, which is linked to the provision of office space at the place of employment. However, reports such as those in Labour Market Trends do break down the figures into employees and the self-employed. Second, there is no mention of telecottaging or the use of other satellite buildings as an alternative to working at home or in the office. Both of these have implications in the way that energy use is affected by alternative working patterns – particularly with reference to utilisation of office space.

When looking at telework studies in general there are some other variations in what constitutes a teleworker. The definitions above cover a huge range of teleworking frequency, with some studies requiring a minimum of once a week and others once a month for inclusion into the data set. Also, it is important that telework and flexiwork are not combined, so that no distinction is made between those that work at home for full days of the week and those that work in an office outside traditional working hours.

HOW MANY PEOPLE TELEWORK, AND HOW OFTEN?

Because there are so many different definitions and interpretations of definitions, there are also a number of estimates of how many people are teleworkers. The LFS reports that in spring 2001 there were 2.2 million, or 7.4% of all those in employment categorised as a teleworker (Hotopp, 2002) and 1.9 million as TC teleworkers. This is likely to be an underestimate of the total number of people working away from the office for full days of the week as it does not include those that work in a telecottage or those that telework irregularly. Other estimates of the teleworking population are not wildly different, such as the 1.8 million in 2001 calculated by Alan Denbigh of the telework association. Figure 1 is a break down of the 1.9 million TC teleworkers into the LFS subdivisions detailed above. Each type is then further divided into those that are self-employed and those that are employees. The bar chart below (figure 1)

shows that the largest numbers of teleworkers are home based and of these slightly more are self-employed (54%). The second largest proportion of teleworkers are occasional teleworkers, 84% of these are employees (Table 1 gives the source data). Of the teleworker homeworkers 44% are part-time compared to 16% and 10% part-timers amongst home-based and occasional teleworkers respectively.

There are virtually no estimates of the potential for telework uptake in the UK. In 1989 the Henley Centre for Forecasting suggested that over 4 million people in the UK could become teleworkers (Baruch 2001). However it is not clear how this was calculated. The Department for Transport (2002) predicts an annual growth in teleworker numbers of 9% over the next 10 to 15 years with the biggest increase amongst occasional employee teleworkers. Additionally, although above average, the proportion of the UK's workforce teleworking compared to some other European countries is still quite low (figure 2), suggesting that the saturation level has not yet been reached.

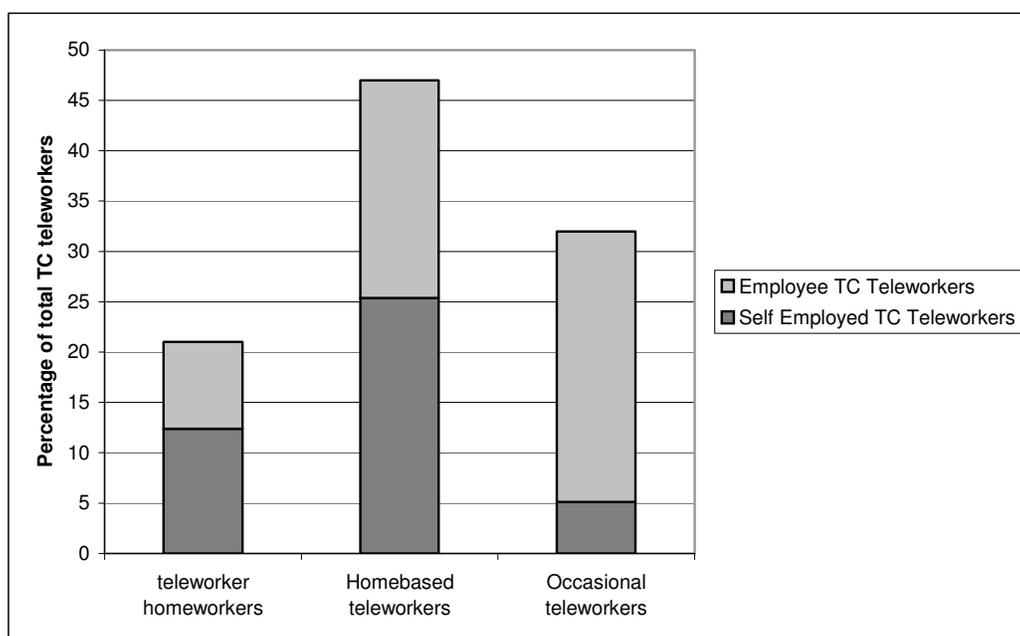


Figure 1: Breakdown of TC teleworkers into LFS-designated teleworker type and employment status

| Type of Teleworker | % of Total TC Teleworkers | Employees (%) | Self employed (%) |
|---|---------------------------|---------------|-------------------|
| Teleworker homeworkers (mainly work from home in main job) | 21 | 41 | 59 |
| Homebased teleworkers (work from home and various locations, but home is base) | 47 | 46 | 54 |
| Occasional teleworkers (work at least one day a week at home) | 32 | 84 | 16 |

Table 1: Proportions of different TC teleworker types in Britain, with employment status

The frequency of working from home varies widely amongst teleworkers. Two related studies (Banister and Stead, 2003; Hop Associates, 2002) quote a national average of 1.5 days per week spent teleworking. Unfortunately neither study sources this statistic, so it is impossible to know what parameters were used to define a teleworker in this instance.

TELEWORKING IN EUROPE

The Status Report on European Telework New Methods of Work, 1999, compared the proportion of the workforce teleworking in different European countries (figure 2 below). The average proportion of a European country's workforce teleworking is 6% compared to Britain's 7.62%. There are a number of reasons why some countries have embraced the notion of teleworking more than others. Most obviously if there is a high proportion of people that use ICT (Information Communication Technology) for work, the pool of potential teleworkers is larger. Clear regulations, tax laws and guidelines for health and safety implementation in the home is important to encourage teleworking. Also, the flexibility of organisations to teleworking and the open-mindedness of the business environment in general will have a big effect on the uptake of flexible working patterns.

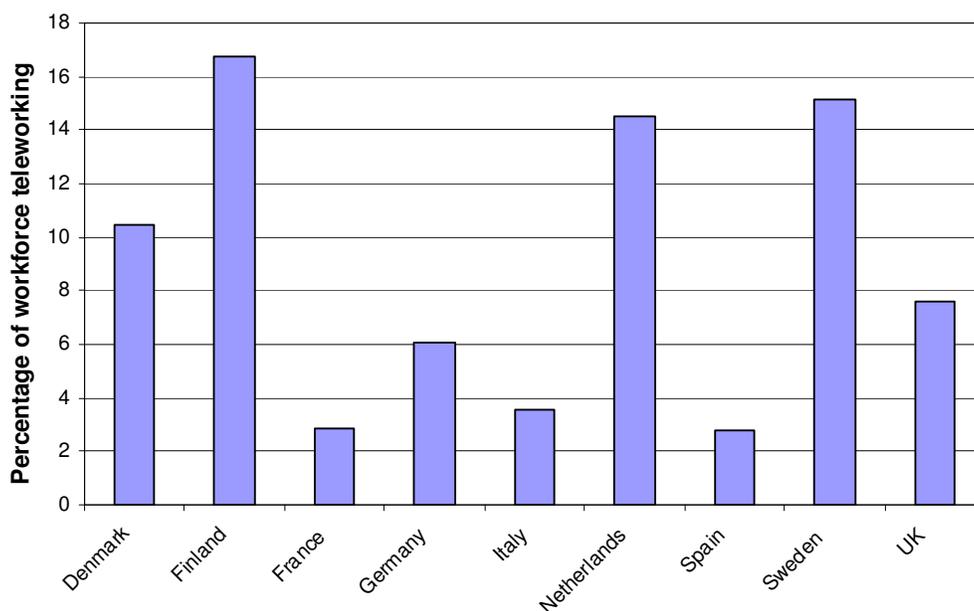


Figure 2: Percentage of the workforce defined as teleworkers in a range of European countries

(Adapted from Status Report on European Telework, New Methods of Work 1999)

ENERGY USE AND TELEWORKING

One of the main claimed advantages of teleworking is the potential environmental benefits. This aspect of the practice has been the subject of a number of studies, most of them focusing on transport. Few studies have taken a more holistic approach and looked at the overall energy balance that teleworking produces – taking into account energy used at the office, at home and for transport. This task is complex, as there are many ways in which working at home may or may not change how one uses energy. The table below (table 2) illustrates how teleworking might increase or decrease total energy use through different scenarios.

| Increase in overall energy consumption through teleworking | Decrease in overall energy consumption through teleworking |
|---|--|
| Rather than incorporating journeys (such as to shops or school) into the commuting journey, a number of smaller journeys are made from home, potentially using more fuel than is saved through not commuting. | Loss of the commute journey will decrease fuel use. |
| Each teleworker will need their own computer, telephone and (perhaps) copier/fax machine that may previously have been shared with others in the office. If equipment and space are still provided at the traditional work place, their ICT energy consumption will be increased substantially. | If teleworking is well established in an organisation, the number of desks and amount of ICT equipment in the office could be reduced, saving on space and energy. |
| Heating/cooling the home will be increased to accommodate the teleworker; also increased use of the fridge, dishwasher, kettle and other appliances. | See above: heating/cooling a smaller space and providing for fewer people would reduce energy use. |
|  Does teleworking encourage people to live further from their work place, thereby increasing the commute length even if decreasing its frequency? | |
|  Could one teleworker in the household mean that a previous non-car-user in the family increase their use of the now-available car beyond the saved commute? | |

One hypothesis put forward by a number of studies on telework is that working at home generates an equal number or more trips in the car to that if one were to commute. This is in opposition to the hypothesis that there is a reduction in car use through teleworking as a consequence of not commuting.

Mokhtarian et al (1995) reviewed eight studies (seven of in the United States and one in the Netherlands) that looked at changes in travel, energy and air quality resulting from teleworking. Three of the studies, including the Netherlands one, found an *increase* in the travel savings made by teleworkers, *above* what was saved from not commuting. This suggests that commuting encouraged people to make unnecessary journeys. The remaining four studies found that on average 0.3 miles were travelled on a telecommuting day that *would not* have been travelled had the individuals gone to the office; but the savings made by not commuting dwarf these 'extra' miles. A more recent study by Choo et al (2005) also found that overall vehicle-miles travelled by teleworkers decreased, but only by 0.8% on average.

A Californian study reviewed in the Mokhtarian paper found an increase in the use of automobiles for trips on telecommuting days compared to non-telecommuting days, i.e. trips that were previously made using forms of transport other than the car were done in the car when working from home. However, results of American studies are unlikely to be representative of the situation in Europe, where people tend to live closer to shops, schools and public transport. More research into the effect of teleworking on travel mode use would be useful, especially when considering how energy use changes with this practice.

Three of the studies reviewed by Mokhtarian et al (all carried out in America) attempted to include changes in household energy consumption resulting from telecommuting. Two found an increase in household energy use of between 5.5 and 7.9 kWh per telecommuting occasion, whilst the transport savings were between 50.4 and 58.6 kWh. The third study found an increase in household energy consumption of 20.5 kWh compared to transport savings of 80.6 kWh. These studies suggest that household energy use increases represent between 11 and 25 percent of the travel savings, resulting in total energy savings of between 75% and 89% per telecommuting occasion. Again, it is not clear how representative American studies are of the situation in Britain or Europe.

Unfortunately it was not possible to get hold of a study of this nature done in the UK. However Hop Associates (2002) quote a study carried out in Sheffield by A. Wright in 1997 that looked at changes in energy consumption across the board resulting from telework. This study was found to be overwhelmingly in favour of teleworking with 80% reductions in energy used in an 'ideal scenario' – where office space is decommissioned as well as eliminating the commuting trip. It is not clear how much the savings would decrease if office space remained the same, but it does highlight the importance of reducing working space and equipment at the traditional workplace if people are not using it.

An uncertain outcome of teleworking is whether or not it encourages people to move further from their work place. This possibility has not been thoroughly researched with only unsubstantiated hypotheses being put forward. Any studies that cite this as a potentially negative aspect of teleworking also tend to focus on occasional teleworkers rather than homebased or homeworker teleworkers. It is not clear that by moving house, homebased or homeworker teleworkers would change their energy use. However, it does seem as though relocation for occasional teleworkers is a logical possibility especially as the highest concentration of teleworkers is in the southeast and London (Department for Transport, 2002) where house prices are extremely high.

Another uncertainty concerning teleworking is whether or not it encourages other members of the household to use the redundant car. There are not many instances of this having been incorporated into studies, but where it has been there is no record of this happening. In fact, overall house travel is reduced (Mokhtarian et al, 1997 and Lyons et al, 1997). However, in both cases this was usually attributed to there being multiple car ownership in the surveyed households. It is not clear what the outcome will be if/when teleworking is taken up by families owning a single vehicle.

CONCLUSIONS/ FURTHER RESEARCH

- So far research has shown that teleworking does lead to a net decrease in car use, even when additional journeys are factored in to the energy equation. Also the availability of another car to other family/household members does not lead to more journeys being made.

- The small number of studies that have incorporated household energy consumption into the balance have also found in favour of teleworking, although it is not clear if there are energy savings when the office space vacated by the teleworker is left empty.
- There is no conclusive evidence as to whether teleworkers tend to move further away from their work place and therefore potentially end up making fewer but longer journeys.

Teleworking as a popular phenomenon is still relatively young and therefore so is the field of research surrounding it (especially in Britain). There are a number of unanswered questions vital to understanding how telework affects energy use. These are outlined below:

- How is travel mode use affected by teleworking?
- How many companies/employers alter their office space as a result of employees teleworking?
- What are the travel patterns of homebased teleworkers and do they travel more or less than their occasional contemporaries?
- What are the energy use patterns of teleworkers and non-teleworkers in Britain? A single study carried out in 1997 is not sufficient for concrete conclusions.

Studies in general use companies that have just implemented a teleworking programme in order to study the before- and after-effects of the practice on various aspects of a worker's life. Most of these companies begin with occasional teleworking to test the water. Therefore many studies do not look closely at the long-term effects of teleworking, such as changes in travel behaviour over time, or relocation; or the behaviour of homeworker teleworkers and homebased teleworkers which make up the majority of teleworkers in Britain (see figure 1).

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