

**Summary:**

# **Interaction between mobility and information and communication technology. A review of literature**

## **Great belief in technology as problem solver**

Ever since the telephone was introduced 120 years ago, the interaction between travelling and telecommunication-technology has been discussed. Throughout time, the potential of saving both time and money by using the telephone instead of travelling has been emphasised. However, communication has increased exponentially, both by means of transport technology and other communication technologies. Graham Bells first telephone call, when he asks his assistant to come to his house, is well-known in this respect. The new technology immediately generated a trip.

When the 'new' information- and telecommunication technology (ICT) was introduced, the potential of substituting travel by ICT was believed to be high. Both the technology determinism and optimism was striking. A substantial part of life was thought to be organised from people's homes, and the environmental problems created by road traffic would be reduced. Nowadays, the opinions are more differentiated.

## **Technology in a social context**

To predict the potential of substitution of one category of communication technology with another, it is necessary to study how they interact, the social context in which the interaction takes place, and the institutional frames of action. In it self the technology represent a possibility of action. The social context conditions the use.

The purpose of this report is to review the literature on the interaction between transport and information and telecommunication technology (ICT). The review covers both national and international literature and it is limited to passenger transport. Freight transport and use of ICT for transport management are not included in this work.

The social context of the interaction between mobility and ICT is shown in the figure below.

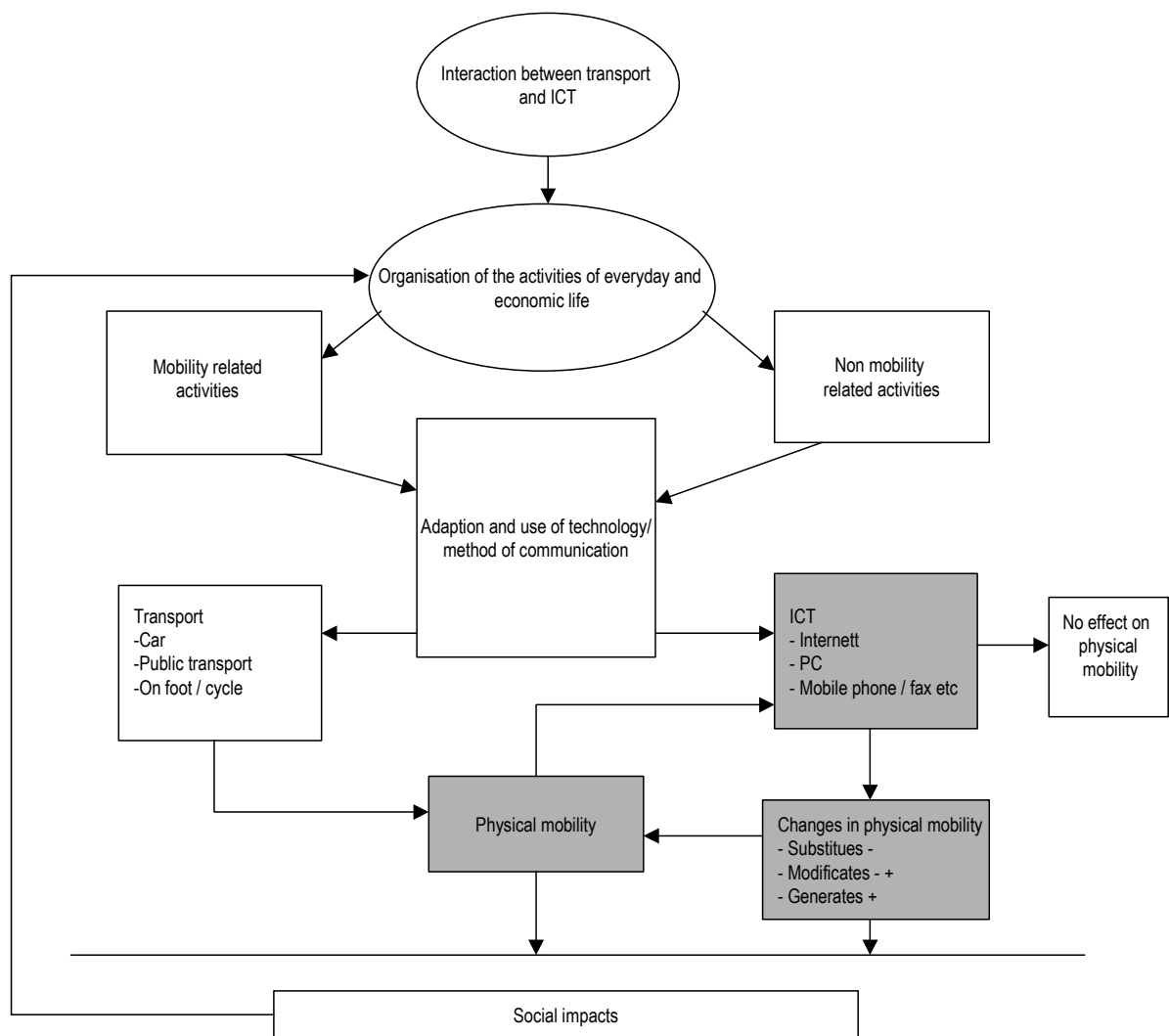


Figure 1. 1 The relation between activities of everyday and economic life, use of different types of ICT, physical and virtual mobility

To understand the interaction between transport and ICT, one have to study the conditions for organising activities, both in everyday and economic life. In the figure, this is the point of departure. It is differentiated between activities, which usually demand transport, and those not usually demanding physical mobility. However, in both groups there will (in many cases) be a need of communication. Knowledge about the activities will also give knowledge about how the communication forms can interact.

The question is - will the interaction be substitution, modification, generation, or neutral, i.e., no relationship between the two forms of communication? The use of technology and the interaction between them can change the premises for organisation of everyday and economic life.

The research presented in this report will to varying degree have a comprehensive perspective as illustrated in figure 1. Most of the studies reported are occupied by limited objectives, often concentrated to the three grey boxes in the figure.

## **Telework has limited effect on transport**

Telework or telecommuting has not reached the level of diffusion predicted 15-20 years ago. Accepting a wide definition of telework, between four and eight percent of western Europeans have this type of work arrangement. To the worker, the flexibility in time and space is the most favourable aspect of telework, loss of working environment a significant drawback. To the employer, reduced costs are advantageous, less control of the employee a disadvantage. Since the arrangement is not common yet, the disadvantages are probably perceived as greater than the advantages.

In general, the reported studies show that telework to some degree reduces the number of work trips, vehicle kilometres and emission. Thus, A moderate substitution effect is revealed. This result is related to the travel pattern of the teleworker. The effects on other household members are only to a limited degree taken into consideration.

Considerable parts of the studies on telecommuting are carried out among workers who had long work trips, were under high time pressure and high frequent car users. The results from these studies can therefore only to a certain degree be generalised to the average workforce. The effects will probably be minor among 'average' workers.

In the pilot projects of teleworking, where the workers could choose the number of days working from their homes, most of them preferred 1-2 days per week.

## **Surveys with shortcomings**

In several surveys a possible manifestation of different forms of latent transport demand are discussed, but they are to a very little degree studied:

- Studies on aggregated effects of telecommuting have not been done, that is to which degree unused capacity on the roads are replaced with other car-users who previously did not travel or used other transport means. If telecommuting takes place in areas with traffic congestion, a reduction of work trips in the rush time hours can be a possibility.
- The impact of telecommuting over time has not been studied. If a person teleworks a couple of days a week, it will probably not be profitable to buy a season card for public transport. It will perhaps be more easy to choose the car.
- To which degree new trips will be carried out as a result of telework, either at home or at a telework centre, or if other members of the family will travel more, or use the car for own purposes, are not verified or rejected in the studies carried out.

## **Few studies about the impact on land use and localisation**

To a minor degree, the studies have been occupied with the effects on land use and localization. Assumptions point towards more urban sprawl and longer trips. But studies to verify this assumptions have not been done. These assumptions do

not take into consideration that housing preferences and household structure change. The tendencies toward reurbanisation and reduction in household size make the central urban areas more interesting as residential areas, with various numbers of jobs, culture and entertainment.

A survey of residential preferences and travel pattern in Oslo, Bergen and Trondheim shows that more people in the inner parts than the outer parts of the cities telework.

One of the best ways to study the impacts on land use and localization is to do longitudinal studies, to follow both workers and workplaces over time.

### **Electronic shopping and video conferences**

For the time being e-shopping (Business to Consumer, B2C) amounts to one percent of the activity on Internet in Norway. Twenty-eight percent have bought goods on the web some time, and 11 percent during the last month.

A comparison between Norway and Sweden shows that the behaviour of the consumers is very similar. Music, books and data equipment are the most frequent bought goods on the web. In Norway, travels, hobby equipment and tickets for various arrangements are also common goods for shopping on the net. Grocery shopping amounts to only 2 percent of B2C.

Studies show that Norwegian customers shop on the net due to the price, 26 percent, 14 percent because of the selection, and 10 percent because it was an easy way to get the goods. About 20 percent do not shop on the net because they perceive the security to be too poor, and 10 percent do not shop on the net because they want to see or try the goods.

It is too early to present empirical results of transport impact of e-shopping. For example, a reduction in private shopping trips can be outweighed by more distributional freight transport.

Studies show that use of videoconferences is low. The application amounts to few users, purposes and places. The most common use in Norway is between branch offices within the same company for exchanging routine information, often between leaders. In the longer term various factors indicate a more increased use:

- More flexible and quicker forms of communication is needed
- The relative costs between videoconferences and travelling
- Better access to equipment and a lower users threshold
- Time costs are increasing
- Increased cooperation between industries leads to increased routines in the flow of information
- Increased social cost related to travelling

## Flexibility in time and space

Mokhtarian's (1998) preliminary conclusion is that we can not expect a significant reduction in travel activity related to the use of ICT. Telecommuting will first of all have an impact on when and where people will do their job. It will give the employee a flexibility both in time and space.

The uncertainty about impacts on transport of other types of ICT, like e-shopping and videoconferences, are more evident than for telecommuting. This is partly caused by low use and partly by few empirical studies of the phenomena.

Even though the technology optimists were too optimistic about the impacts of ICT on transport, and that we have to remember that problems which in their basis are social, not can be solved by technology, ICT has a potential for changing of society. Those changes can be of different significance, and they might not go in a wanted direction. Because of these facts it is important to study trends and impacts of and interactions with this type of technology.

## Further research

This literature review shows that much work remains to be done, both to increase the quality of the methods used and to widen the objectives. Therefore, four areas for further research are suggested:

- *Telework in a household perspective.* Most of the studies presented lack a holistic perspective. They do not take other household members into consideration, and most of them lack both a retrospective and a prospective view, which is of importance when studying social change. In our view it is important to study the effects of telecommuting taking these aspects into consideration.
- *Economic life – a comprehensive study of communication in companies.* Studies referred in this review show that videoconferences have a limited area of use. To find out the potential for use of different forms of ICT and the effects of the use on transport, it is important to have knowledge of the comprehensive communication pattern of the companies.
- *Communication study about(on) the interaction between travel and ICT.* In Norway, travel behaviour studies are done every fourth year. For the time being no systematic survey is carried out to map the ownership and use of ICT. To understand the interaction between these two forms of communication, surveys combining information on travel pattern with ownership and use of ICT are called for.
- *Urban development, land use and localisation – effects of ICT.* As the review has shown, this research area is characterised by empirical snap-shots and some theoretical discussions. Longitudinal studies are necessary, and different methods can be used to get a better understanding of this area.

In addition to these four themes, many objectives have actuality in relation to questions about the interaction between transport, mobility and ICT. The research area is relatively new, the development is very fast for some phenomena, while other development processes are slower. Common for most of the areas is that

research and development have a long way to go. Within the field of transport use of technology for traffic management has been more in focus than the social consequences of the use of ICT. In the longer term the social consequences of ICT might have more important impacts on transport than technological. It is therefore of great importance that the social perspective is not lost when the possibilities and effects of ICT on transport and land use are discussed.