

Changes in land-use AND organisations for shorter commuting

Paper presented at the Regional Science Association European Congress, Dublin, Ireland, 23-27 August 1999

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Abstract

The focus in this paper is on how urban working life could be organised with less commuting, but with high accessibility to the labour market. First, some researchers' ideas on the connection between transport demand and urban form are presented. This is followed by a discussion on the possible influence from the development of information technology on the organisation of work. Finally, the basis that has been built in the first parts is used to develop a scenario of a low-transport city. In the scenario, working teams are organised around individuals connected with telecommunications, whereas work mates are found at office hotels where the ordinary work place is situated. Thus, work mates do not need to be colleagues. This new organisational form facilitates an urban structure organised around a network of nodes for work, telecommunications and public transport.

1. Introduction

There are huge uncertainties regarding the effects from, and extent of, global warming. But the effects on the ecosystems that some researchers claim may occur are so serious that they must not be neglected. Transport is one of the most important sectors when it comes to global warming, through its extensive use of energy, and through the heavy dependence on fossil fuels.

If energy use from transport is to be radically reduced, technological improvements may not be enough. Travel will have to be limited as well **Error! Bookmark not defined.** But there are no indications of reduced travel in future. On the contrary, trends and forecasts indicate continued traffic growth. Even if the problem is rather clear, it is hard to find an easy solution to it. A reduction of travel may

lead to reductions in accessibility. There are no traffic measures that can do anything about that.

The main task of transport is to reduce geographical barriers, to increase physical mobility. Increases in mobility have traditionally been interpreted as indications of increases in welfare. But is mobility really a suitable welfare indicator? Obviously, increases in physical mobility leads to higher accessibility, if nothing else changes. But if a similar level of accessibility can be achieved without any physical transport, accessibility can be seen as a more relevant welfare indicator **Error! Bookmark not defined.**

The development of information technology has been very quick the last decades. Completely new opportunities to handle and transmit masses of information have been developed and the conditions for everyday life have changed. Therefore, it is relevant to choose the development of IT as one of the starting points when trying to find out how energy use could be limited.

The aim with this paper is to describe a scenario of a city where commuting distances are short at the same time as accessibility to work places is high. The basis for the scenario is land-use changes combined with changes in the organisation of enterprises, partly based on information technology. The reason for this research is that it looks like new alternatives are needed, since a development along trends seems to be very negative for the ecological system.

The approach here is inspired by backcasting **Error! Bookmark not defined.** As opposed to much related research, this paper does not aim at forecasting the future. Instead, the aim here is to present some of the new opportunities that can be realised by combining research on energy efficient urban forms with research on emerging organisational forms. By presenting these options, alternatives to action along current trends are visualised and thereby created. Solutions to transport related problems might be found in a wider area than the traditional traffic and transport field. New transport patterns may appear. Forecasts may be wrong. Development is not following a predestined path.

Here the focus is on accessibility instead of mobility, and on IT's effects on work rather than on traffic, i.e. outside the traditional traffic planning field. For example new patterns of contact may appear and location of activities can become dependent on new factors. IT may induce changes in organisational structures and thereby change the conditions for how work places can be located.

Section 2 presents some ideas from the literature regarding the relation between urban form and transport demand. Section 3 includes a presentation of some researchers' thoughts on how information technology changes the conditions for organisational forms. In section 4, the presentations in section 2 and 3 are synthesised into a scenario. The

scenario illustrates how the development described in section 3 changes the conditions for the analysis in section 2.

2. Transport demand and urban form

Many researchers in planning agree that there are several advantages with reduced travel. Reduced travel could give socially, environmentally, safety and health related benefits. However, the researchers have different opinions on how this could and should be achieved. The problem is that when travel is reduced, accessibility to e.g. work places is often lost. Therefore, much of the analysis in this field is concentrated on the balance between accessibility and travel in different urban structures.

There seems to be a consensus that high density and multinuclear cities have better opportunities than low-density cities, to keep the energy use for transport low. In some parts of the literature **Error! Bookmark not defined.**, the density's importance for energy efficiency is emphasised. This literature is mainly based on empirical findings. Another part of the literature **Error! Bookmark not defined.**, emphasises the importance of decentralised concentration, with mixed-use areas in smaller sub-centres around the city nucleus.

The different opinions can be related to Brotchie's urban triangle (figure 1). Proponents of higher densities recommend that cities should aim at getting as close to A in the figure as possible. Implicitly, they claim that if work places are spread out (the city moves right on the x-axis), commuting lengths will increase, i.e. the path will follow the A-B-line. The point with decentralised concentration is that such a structure may lead to a development along the A-C-line instead. However, a number of the researchers emphasise that for the commuting distances to decrease with this structure, changes in attitudes when choosing where to live, and the enforcement of different restrictions and/or economic measures, may prove to be necessary. In the worse case an increased share of work places outside the city nucleus may give a higher degree of travel between suburbs (the path in figure 1 leads towards B). This is stimulated by low costs for driving and good capacity on the road network. At the same time, it is difficult to arrange high-quality public transport, since travel would be more spread out.

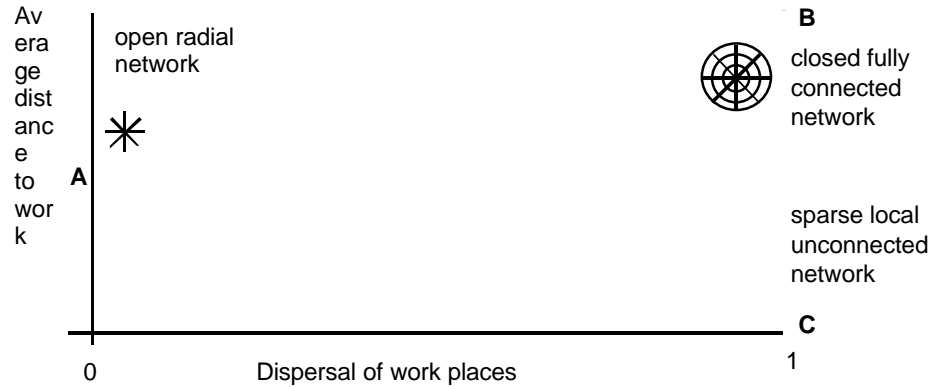


Figure 1: Brotchie's urban triangle **Error! Bookmark not defined.**

The possibility to live near the work place depends on the urban structure and on the location of functions. But there is also a problem of matching in a couple of different meanings. First, the housing prices must be such that the workers in an area also can afford living there. Cervero has shown that this was not the case at a number of American suburbs **Error! Bookmark not defined.** Second, it may also be difficult for households where more than one person is working to find a home that is close to the two working places. Third, people tend to change jobs more often than they move. Thus it may be difficult to keep a short commuting distance under a longer time period.

In sum, it seems like a decentralised concentration could be efficient in terms of commuting distances. However, there are a number of obstacles to this. The problem is to find out how commuting can be reduced, while accessibility is kept high. It is then evident that the matching problems must be handled, if the condition of high accessibility is to be fulfilled, for a city characterised by decentralised concentration. This issue will be discussed further in section 4, when section 3 has provided some tools to tackle it with.

3. Transport demand, IT and organisational change

The previous section was devoted to the relation between transport demand and urban form. It turned out that the theoretically most energy efficient urban forms are associated with some difficulties with regard to the balance between jobs and housing. In this section, the effect on the location of work by the development of the informational age is discussed. The information technology brings partly new conditions to the analysis of the relation between urban form and accessibility to work.

A number of authors **Error! Bookmark not defined.** have discussed possible changes of future organisations. A feature that the new forms of organisation have in common is that their implementation

will be simplified through the information technology's ability to short-circuit space.

When work can be done anywhere it becomes easier to switch more often between activities, and thus to co-ordinate working hours with other activities and circumstances. The increased flexibility of time that may come with information technology is thus not so much an effect of the possibility to do things simultaneously, as an effect of the ability to do things independent of space. And the independence of space is the key to making work accessible without having to travel.

In his three volumes on the information age, Castells is trying to catch the essence of today's society **Error! Bookmark not defined.** Castells argues that technology sets a frame for possible developments of society **Error! Bookmark not defined.** He calls current mode of development of society "informational", in order to emphasise that the whole society is influenced by this new technological paradigm **Error! Bookmark not defined.** The ability of individuals to handle information technology will be decisive for the individuals and societies possible development paths. Castells emphasises the importance of flexible organisations with "flextimers" and "networkers". This will open new opportunities for new forms of work, e.g. co-ordinated decentralisation of small work groups **Error! Bookmark not defined.**

A number of studies of the extension of telework have been made in Sweden the last few years **Error! Bookmark not defined.** The studies give quite different pictures of the number and socio-economic background of teleworkers. This is at least in part due to the fact that different definitions of telework are used in different studies. To summarise the studies it seems like about 500 000 persons (some 10 % of the work force) were teleworking at least one day a week in Sweden 1997. Many of these were working with education and many were highly educated.

Another IT-related type of jobs, which does not demand a high education, is becoming more and more common. These are service jobs such as ticket ordering, taxi switchboards and people working in insurance and banking companies. In Sweden there are several examples of such new types of distance-independent jobs that are placed in remote areas where office space may be cheap, accessibility to a motivated work force may be high and the surrounding environment may attract some employees **Error! Bookmark not defined.** These jobs are not telework, as defined in most surveys. However, they are at least as important when issues of work organisation, IT and commuting are discussed. Another important factor for these issues is the development of networks for small and medium sized enterprises **Error! Bookmark not defined.**

A number of researchers have analysed the relation between trip-generating and trip-substituting factors that can be traced from

telework **Error! Bookmark not defined.** The researchers have tried to understand how travel is affected by telework by using trip surveys, models and other analyses. It seems like some improvements with regard to reduced peak traffic may be anticipated, but the effects on total travel demand due to telework, are generally expected to be low.

Many of these studies take their starting point in how IT will affect transport. The question in the studies is "Where are we going?". This is quite different to the backcasting-oriented perspective that is used here. With this perspective emphasis is on finding solutions to problems and then discuss how they can be realised. Above, I have tried to describe how new forms of work are becoming increasingly common. I also mentioned that the main interest in the relation between new forms of work and commuting distances has been concentrated to telework. But distance work does not seem to give reduced travel.

However, a development towards ever-weaker physical connections between the units in an enterprise may, in a long perspective, make a network organisation on the individual scale feasible. When the organisation is network-oriented rather than space dependent, the members of the network do not have to act at the same physical place. This, together with decentralised organisation, may open new opportunities for a low-demand, high-access city.

4. Increased accessibility and decreased mobility?

It has been shown above that many researchers find that a decentralised structure, with mixed land-use, could be more energy-efficient than other structures. However, most attempts to build such areas during the 20th century have not been very successful. Obviously mixing homes with work places is not a sufficient strategy to achieve low commuting distances. The matching problems must also be solved. Information technology brings partly new conditions to the analysis of the relation between urban structure and accessibility to work.

This section is concentrated on the discussion of the "IT-node scenario". First, the scenario is presented briefly. The presentation of the scenario is then developed while effects, prerequisites and finally drives are discussed. This somewhat unusual order of presenting the scenario is perfectly in accordance with the backcasting approach. With that approach, the primary aim is to generate a scenario that fulfils certain goals. Therefore, the scenario generation is followed by an analysis of expected effects. Only if the effects are regarded as desired, the analysis is continued by looking at prerequisites and then at drives. The idea is that if prerequisites are not fulfilled, but the scenario is desired, something should be done to influence the prerequisites.

The IT-node scenario

Figure 2 presents the principal location of activities in two different IT-based scenarios. In the figure, telework (figure 2a) is defined as a job with two work places. Some days or parts of days, work is done at home. Other days/parts of days, work is done at a work place more like today's common work places.

Figure 2b illustrates how activities could be located in a society where work organisation has developed in line with the thoughts in previous section. One crucial difference between the IT-telework scenario and the IT-node scenario is the number of work places for each person. In the first, there is both a work place at home and the main work place. In the latter, there is only the node work place. The IT-node scenario is a development of ideas presented in a Swedish futures study on transport **Error! Bookmark not defined.**

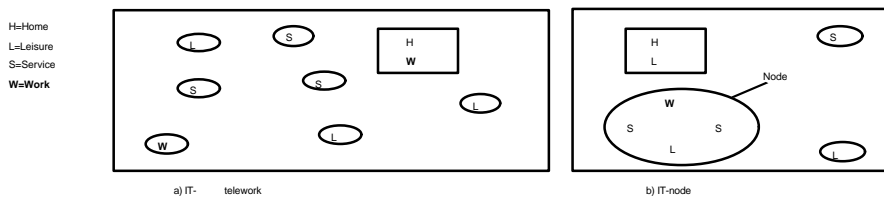


Figure 2: Location of activities in two scenarios.

Figure 3 is another way of presenting the differences between the two possible developments.



Figure 3: The urban triangle (cf figure 1). D in the figure denotes a fictive city of today. D' denotes the IT-telework scenario. D'' denotes the IT-node scenario.

In the IT-node scenario, networkers work in teams organised around individuals connected with telecommunications, whereas their work mates are found at office hotels where the ordinary work place is situated. Thus, work mates need not be colleagues. This new organisational form facilitates an urban structure organised around a network of nodes for work, telecommunications and public transport. In such structures, many office and service workers can find suitable places of work at a node placed nearby their home.

The IT-node scenario is characterised by decentralised concentration with network organisations. The nodes are local sub-centres located around a city nucleus, where networkers can find a work place at an office hotel. The sub-centres are located at good public-transport sites, and in rather densely populated areas. This facilitates and stimulates increased use of non-motorised transport modes.

Effects

It is hard to quantify the effects of a scenario described as briefly as the one above. The effects would depend on for instance the extent to which the scenario was implemented. Below I will, in spite of the difficulties, mention some possible effects of the IT-node structure and of the informational society.

In big villages and cities, people living near a node could get shorter, but just as many commuting trips as today. This would encourage non-motorised modes. In sparsely populated areas, the number of commuting trips could reduce, since the network organisation makes it easier to work from home. Altogether, work trips would decrease in volume.

The unbalance between housing and working areas could reduce, since it gets easier to change job without changing work place, and since two-worker households would get the opportunity to live near both work places, if at least one of them is a networker.

The demand for work places close to housing areas would increase. This would lead to a relative move of work places out from the city nucleus, leaving room for more housing in city. Thus, the mix of functions in the network city is greater than in most cities of today.

The concept “work mate” would change its meaning, since friends at the work place would normally not work in the same organisation. Professional contacts with others in the same network organisation would primarily be over telecommunications networks.

The labour market for network organisations would be limited physically only by the supply of office hotels. Such a jump in accessibility could lead to a higher frequency of job changes. As mentioned above, this would not necessarily have to lead to a higher

frequency of moving. Moreover, someone who does not like one office hotel can easily change to another, without changing job.

It seems like our future society will be very much influenced by information and telecommunication technology. Without a basic knowledge on how to handle this technology, many people will in practice become disabled. This way new social gorges may develop between those with knowledge and those without it. It is possible that technology will become increasingly more user-friendly. But even in this case, in order to learn the codes, technology must be available (“doubleclicking” “icons” to “open” them is hardly a genetic knowledge, at least not yet). If availability to technology is high, such things can be learnt very early. But a risk is that availability to both technology and to competent teachers will vary a lot between different families and different schools, leading to a dualisation of society.

Prerequisites

The IT-node scenario could not be fully implemented in a short perspective, since a number of prerequisites are not fulfilled. These prerequisites are not independent, but would need to develop in parallel.

The first prerequisite is that today’s space-dependent work organisations would have to develop in direction of network organisations. This implies as discussed above, that individuals belonging to the same work group are not dependent on physical contact with each other. Moreover, a number of security issues would have to be solved, e.g. the telecommunications networks would have to be reliable both in terms of function and in terms of security. The telecommunications would also need to be much faster and cheaper than today, so that it gets economically reasonable to stay almost continuously in video contact with other members of the work group.

A widespread implementation of network organisations requires that the workers’ ability to “telecommunicate” is much better than today. Thus, this is not purely a technical question on the quality of televideotransmissions, but just as much a question of attitudes and learning. The school is one important factor for this learning. And the role of games should not be underestimated. With increased use of computer games from very early ages, the relation to telecommunications may change completely over a generation. The children of today may develop the ability to telecommunicate that is much better than what we can imagine today. Some of this new knowledge may spread upwards in ages.

The interest for enterprises to introduce network organisation as described will require that attractive, well-equipped office hotels, located near the homes of the expected work force, is available.

Drives

Even if all the prerequisites were fulfilled, it is not evident that the IT-node scenario would be implemented. In order for a change to happen, someone must desire it. Mohtarian and Salomon have presented a number of drives for individuals to begin teleworking **Error! Bookmark not defined.** These are extended below and include drives for organisations and society as well.

For many people, working closer to home would imply shorter, healthier and cheaper commuting trips. And the scenario would give an increased personal flexibility and presumably a more attractive work place. A city structure organised around nodes would encourage livelier, more secure surroundings. For environmentally-minded people the IT-node scenario offers the opportunity to a wider variety of occupations, without requiring long, ecologically harmful, commuting trips.

For organisations, the most important drives towards network organisations would be increased flexibility and increased supply of labour. Physical location would become irrelevant when employing people. Moreover, those enterprises that begin the network organisation gets an advantage to other enterprises, since their employees may work where they want. Potential losses in identification with the company could be compensated by the broader contacts that employees would have.

Drives towards the IT-node scenario for the institutions in society would primarily be the environmental threats. Another energy crisis, or escalated proofs of global warming, could imply that travel would have to be reduced drastically. A city where commuting is low is less vulnerable to great changes in transport supply. Another drive for the scenario may be that investments in transport infrastructure could be limited. And the node structure may make investments more efficient. Finally, the increased use of non-motorised modes could give substantial health benefits.

The drives that have been mentioned here grow in importance if e.g. transport costs rise or attitudes towards the environment or towards the benefits with more vivid housing areas, increase.

5. Conclusion

Much work in the field of urban structures and transport demand is about – urban structures. And much work in the field of IT and transport is either related to Intelligent Transport Systems (ITS) or to teleworking and travel. Neither the research on ITS, nor the research on telework and travel, seems to conclude that any substantial environmental benefits can be anticipated from these fields. If the

environmental threat is to be taken seriously, the conclusion of these results should be that new research angles are needed.

The presented scenario acclaims a consciousness of the conflict between a low-commute society and high accessibility to labour, but tries to suggest how IT-based organisations could help overcome this conflict. The result is a city with possibly much less physical commuting than before. The potential number of people working in the nodes is considerably higher than the potential for teleworking, since the concentration of office workers in the nodes becomes a basis for new service business.

The aim with this paper has been to illustrate how accessibility to the labour market could be kept at a high level, while commuting reduces. This would imply great, but necessarily negative, changes. The risks that follow from continued environmental degradation, and the welfare losses that come with increased congestion are great. Moreover, environmental degradation and congestion are definitely negative, while it is not evident that most people would perceive the restructuring that has been described here as negative. These factors should be taken into consideration when comparing the IT-node scenario with other scenarios.

Traditional scenario descriptions have a tendency to strengthen trends, whereas if a greater change is needed, the trends must brake. This is a major point with using the backcasting approach. In backcasting, scenarios are developed as independently as possible of contemporary forecasts. One advantage with such an approach is that the opportunities to find unconventional solutions are greater. And it is possible that unconventional solutions will be needed in order to break trends that point in undesirable directions.

Evidently, the IT-node scenario is not the Final Solution. It should be challenged by other scenarios in a process aiming at widening the views on what is possible. The IT-node scenario can hopefully work as inspiration to a continued discussion on how society can develop in a more sustainable direction.

Future research on the feasibility and desirability of the type of scenario that has been described here will be necessary. This will have to include both a continued research on attitudes towards different kinds of telework, and modelling and other analysis of how different developments affect travel. Especially two issues can be identified there. One question is how total travel volumes change when commuting decreases according to the IT-node scenario. The other question is how housing patterns change, if work places concentrate to subcentres.

Acknowledgements

I wish to thank Lars-Göran Mattsson and Folke Snickars for their support and constructive comments to earlier drafts of this paper. I also want to thank the colleagues at the Environmental Strategies Research Group for the friendly and inspiring atmosphere at the group. Financial support for the work has been provided by the Swedish Transport and Communications Research Board, the City Council of Stockholm, the Stockholm County Council and the Stockholm County Administrative Board. This paper is a summary of a Swedish report from 1998 **Error! Bookmark not defined..**

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