

## **Telematics - Opportunity or Threat for Peripheral Areas?**

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*Abstract:* This article highlights some of the possibilities and constraints for utilising telematics in peripheral areas. Telematics is, semantically and technologically, an amalgamation of telecommunications and informatics. A theoretical basis for understanding regional and technological development is established. Theories that consider technology (including telematics) as primarily socially determined constructions, which are developed, diffused and renewed through interactions between actors, for example users and producers, are emphasised. Examples are given of the use and potential consequences for localisation of businesses within three very different 'industries': telework (production and delivery of services by means of telematics), tourism (especially hotels), and manufacturing industries. Telematics reduces the importance of geographical distance but does not eliminate the need for face-to-face-contact. Therefore, telematics does not remove the distance barriers for peripheral areas and may result in decentralisation as well as centralisation. While it is up to telecompanies and political actors in the regions to provide the basic prerequisites for businesses' exploitation of telematics, it is up to firms to meet the challenge of turning what might seem to be a threat but which - adapted to the firms' local conditions and networks - could be a prosperous opportunity.

### **1. Introduction.**

Development of the electronic information and communications technologies - also known as telematics - has great societal consequences. Telematics can potentially reengineer the internal processes of enterprises in practically every industry, and thus make these processes more efficient and effective. As to external relations of firms, i.e. their access to markets, knowledge, services and suppliers, telematics can diminish the disadvantages of peripherally. On the other hand, telematics may encourage centralisation of a number of

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economic activities, especially the high skills, high education, and development oriented types of jobs. This has, for example, taken place within the finance sector. Telematics has also dramatically changed the conditions of development for enterprises and regions. The question is, which opportunities, threats and barriers for the development of *peripheral areas* can generally be attached to the development and application of telematics.

In this article, peripheral areas are defined as those located at relatively great distance from big cities and with relatively low population density. Economic, social, cultural, or other qualitative dimensions of the concept of periphery are not emphasised here.

In the first section of the article a theoretical foundation for the understanding of regional and technological development, that attaches significant importance to local and regional structures, processes, and actors for regional as well as technological development processes, is presented. This departs from traditional neo-classical theories of regional economics as well as from deterministic conceptions of technological development as a linear, 'rational' process.

Next, some specific examples are cited of opportunities, threats, and barriers which application of telematics implies for peripheral areas. The examples are from three widely selected fields, namely telework<sup>2</sup>, tourism and manufacturing industries. The consequences of telematics for peripheral (remote) areas especially have to do with improved accessibility and communication facilities, while the possibilities for change of processes internally in the firms must be assumed to be largely the same irrespective of location. Therefore, here the focus is on the possible implications of telematics for localisation patterns of firms and their external relations.

Finally, based on the review of theories and the specific examples, factors are identified that seem to determine whether telematics has positive or negative consequences for peripheral areas and the implications of this for regional business policy.

## **2. Theories of regional and technological development.**

In the last couple of decades especially two opposing but interlinked trends seem to have affected the development conditions of firms and regions. On one hand competitive market conditions have been globalised, and on the other hand the significance of regional structures and processes for economic activity has increased. Intensified international competition between firms has led to increased specialisation and division of work, which means that in order to keep up their competitive position firms put still greater and more specialised demands on the area in which they are located, for instance concerning labour markets, services, suppliers and infrastructures.

Empirical studies indicate that increasing specialisation is not only manifested between *firms*, in the form of stretched product specialisation and outsourcing of an increasing number of functions, but to some extent also between *regions*, in the form of a more specialised spatial distribution of industrial activities and formation of regional clusters (Malmberg and Maskell, 1996). Such regional clusters of firms, embedded in and preserved by regional

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<sup>2</sup> Telework is not an industry as traditionally defined, but a common designation of some of the new work forms and products, which cross-cuts traditional industry definitions. Telework is here broadly defined as work which is carried out using an electronic medium and where the product is delivered to the customer in digital form, either via the telecommunications net or on diskette (cf. Storgaard et al, 1995 and 1996).

competences, learning processes, service industries, suppliers, public institutions etc., have for example been described by the concept “Industrial Districts” (Pyke and Sengerberger, 1992).

At the same time the accelerated speed at which new products, technologies and materials are developed, and the general increase in the knowledge content of products and production processes, have enlarged the importance of access to new information and knowledge and of connections to those innovative milieus, which generate this knowledge.

The research, technology and development (RTD) policies of most industrialised countries since World War Two have focused on the formal research system (universities, research institutions, the research departments of large firms, military labs etc.) as the main environment creating new knowledge and technologies. With a simple linear model of innovation (see figure 1) as theoretical basis, financial support have predominantly been directed to “Big Science” projects and lab-based research, assuming a more or less direct link between lab research expenditures and the effect for growth and competitiveness (Freeman, 1995).

Figure 1: Traditional, linear model of technological development.



In recent years it is increasingly perceived, that this model does not satisfactorily describe the way technological development and renewal actually occurs and is organised in society and in firms. The main reasons for this are twofold:

First, it seems clear that important impulses to the technology development and growth of firms is created through those - socially structured - network and learning processes in which firms participate and upon which they have built their specific production. Firm’s interaction with customers (users), suppliers, consultants etc. is an important factor in the development of new knowledge and technologies. The so-called *Social Construction of Technology* theory (cf. for example Bijker, Hughes and Pinch, 1987) has contributed significantly to an understanding of the fact, that technologies are not solely developed by engineers through targeted and strictly scientific experiments in isolated labs, but rather through socially constructed interactions between numerous actors, e.g. firms, customers, citizens, organisations, politicians etc.

Acknowledgement of this has led to reformulations of some RTD policies away from the linear innovation model. For example, the telematics programmes ACTS and Telematics Applications under the 4th frame programme for research 1994-1998 of the European Union (The European Commission, 1994), stresses the importance of network relations and of developing technologies in interaction with users.

Second, the poor performance of the linear model in explaining development and diffusion of new technologies is due to its lack of comprehension of the organisational, institutional, and social frames attached to the application of a given technology. The model does not comprehend the complex processes of change - both internally in the firms and in their environment - involved in technological development and renewal. Work processes and routines must be reorganised, new needs for qualifications, services and consulting arise, new supplier relations must be developed etc. The diffusion of technologies is not *only* determined

by their technical and economic rationale in relation to a given function but certainly also by the extent to which they socially, cultural and institutionally fit into firms and society.

In a regional context this systemic aspect of technological development means, that firm's possibilities of achieving economic benefits of a given technological development does not only depend on the characteristics of their production processes and their internal resources and capabilities to optimise and renew these by means of technology. Crucial factors are the qualities of firms external networks and institutional framework for innovation and development - the socio-economic milieu, in which the firms take part.

The social and cultural conditions is especially relevant to implicate when it comes to radically new technologies like telematics. The action plan from the Danish Ministry of Research, "The Information Society year 2000", 1996, is an example of a political initiative attempting to accelerate the adoption of information technology in society, that to a large extent implicates such a systemic aspect by formulation of the "Danish IT model" and by initiation of broad development programmes concerning not only the business sector but also sectors and issues like education, research, health care and environment.

In summary, it may be said that recent theories of both regional and technological development attach significant importance to the qualities of local and regional frame conditions. These frame conditions comprise the entirety of the industry structure, physical infrastructures, networks relations, competences, political, institutional, social and cultural properties of a given area. Also, the theories attach importance to whether the firms have access to and participate in the regional, national or international networks and innovative environments that contribute to develop new knowledge and technologies. In turn, the ability to innovate affects the competitive position of firms. Relevant questions include:

- Are frame conditions in peripheral regions as good as in core regions?
- Do firms in peripheral regions have as good opportunities of participating in the relevant networks and innovative environments, as firms in core regions?
- And what role does telematics play or could it play in this connection?

The questions cannot be answered simply and unequivocally. The qualities of the individual regions are in terms of attractiveness for different types of economic activities very different. They may, however, be classified by economic, geographic or demographic criteria. For example, income level, number of firms, size and distance to core regions and metropolises, population density and age distribution all vary by region. Just as there are stagnating and declining core regions, there are growing and developing peripheral areas (Henry and Drabenstott, 1996).

However, there is no doubt that physical distance, all other things being equal, is a disadvantage in terms of time and money, and that a small population does not give as great a local market and as varied supply of labour, services, education, consulting, suppliers, co-operative partners etc., as a great population. Though the development of modern transport and communication technologies certainly has allowed a less costly and more smooth long distance interaction, it has neither eliminated the needs for regular and direct face-to-face contact to exchange certain types of information and knowledge<sup>3</sup>, nor the advantages of proximity - both in terms of geography and in terms of shared language, values and culture (Malmberg and Maskell, 1996).

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<sup>3</sup> Thus, in parallel with the development and diffusion of telecommunication technologies there has been a great increase in person transport in the industrialised part of the world (Malecki, 1996).

This proximity advantages probably explains to a great extent, why firms within related industries and sectors often localise themselves in the same area. Localised in the same area they can constitute a specialised industrial environment with distinctive competences, mutual learning processes, associated service and supplementary industries, educational institutions etc. Such specialised industrial environments may of course also be present in peripheral areas. But, as mentioned above, the number of inhabitants puts a natural limit to the number of actors in the regional learning processes and to how differentiated and specialised the attached sub-supplier and service systems can be<sup>4</sup>. Generally the geographical catching area for relevant partners and specialised sub-suppliers and services therefore has to be larger for firms in peripheral regions than for firms in core regions. Thus, as not even the most advanced types of telecommunications replace the need for face-to-face contacts, peripherally located firms still have certain distance barriers in covering their needs for information, knowledge, services etc. **Fejl! Bogmærke er ikke defineret.**

Telematics does not automatically lead to decentralisation of the economy and it has not eliminated the disadvantages of peripheral localisation. In some ways it perhaps has even fortified these disadvantages. For example, diffusion of telematics in rural areas is often hindered by a less developed telecommunications infrastructure than in core regions (Malecki, 1996). And even in countries with a relatively well developed and decentralised telecommunications infrastructure, the peripheral areas' exploitation of telematics is often constrained by an relatively low level of education and a limited supply of the new types of labour, services, suppliers etc., necessary for the implementation of technological change.

However, peripheral areas *do* have the opportunity to utilise the technical potentials of telematics for real economic and social development - though such a development does not occur automatically. In the following section specific examples of opportunities and barriers for peripheral areas of utilising telematics are given from three different industries.

### **3. Telematics in three selected industries.**

#### **3.1. Telework.**

Telework is a general designation for a number of new work forms and products, which cuts across traditional industry boundaries, and can be defined as work which is being carried out at an electronic medium and where the product is delivered to the customer in digital form, either over telecommunications net or on disk. The organisation of telework can have a great number of different forms. For example, it may be carried out by employees, who have made a deal with their employer to fulfil their tasks (or part of these) from their home or in different types of media houses or telecottages near their home. It can also be carried out by freelancers or by independent firms with own employees. Thus, telework is work which is based on and often created through the new information and communication technologies.

In principle, all forms of work with information which may be digitised, be it numbers, text, photos, sound or combinations of these, is potentially telework. It may be traditional tasks. For example, journalists, lithographic artists, constructors, designers, consultants, secretaries, auditors, accountants etc., may today take advantage of being able to carry out

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<sup>4</sup> This is of course an argument, which is only valid in relation to the geographic distribution of the population at a given point of time. However, over time this distribution may change dramatically. Also the concept of periphery used in this article is historically relative.

their work electronically. It can also be completely new work tasks which have arisen because of telematics, for example software development. With computer, access to telecommunication links (cable-, radio chain, or satellite based), and manpower with the necessary skills to operate and maintain this equipment, these kinds of tasks can technically be carried out anywhere in the world, independent of the distance to the client<sup>5</sup>.

However, the need for personal meetings between clients and teleworkers can seldom be completely replaced by use of telecommunication technologies. Before entering into formal contracts about carrying out work tasks, there will unquestionably be need for personal meetings to build up the necessary trust and confidence between the parties and to negotiate the agreements and expectations. Also during the phases, where the teleworker accomplishes the tasks, regular personal meetings with the client will be necessary in order to solve problems which might have arisen, ensure quality, re-negotiate agreements, work schedules etc.

The new technical possibilities have meant, that many firms and public institutions are able to organise the accomplishment of a number of tasks as telework and thereby gain economically from rationalisations in the form of increased productivity, lower rents or wages, etc. For example, many American firms today out-source a number of back-office functions (book-keeping, accounting, keying-in of data, word processing etc.) to firms in low-wage countries like Barbados, India, China, the Philippines, Ireland etc. (Malecki, 1996).

There will, however, hardly be a general trend for firms to out-source and decentralise their most highly qualified and strategic functions (for example RTD activities and management) to distant teleworkers. Due to the continuing increase in the information and knowledge needed to produce competitive products firms are motivated to maintain their strategic research and development activities in major cities near universities and headquarters of large firms and organisations, providing a much greater supply of specialised high skilled labour than peripheral areas. Besides, especially highly qualified work tasks like RTD and management activities require regularly non-routine discussions, negotiations, exchange of information etc., that are very difficult to carry out by use of telecommunication technologies. Direct face-to-face communication is needed.

Nevertheless, although firms and public institutions perhaps will be reluctant to out-source their strategic and most innovative and qualified functions a significant growth in the number of teleworkers is expected in future. The European Commission has formulated as a goal for the EU member states, that 10 million people (approximately 7% of the work force) carry out their jobs as teleworkers in year 2000 and has started several research and development programmes in order to reach this goal (Korte and Wynne, 1996). So far, the opportunities to organise the accomplishment of work tasks as telework has only been exploited to a limited extent - at least in Denmark, where approximately 9.000 people (0.3% of the work force) were full-time employed as teleworkers in their homes in 1994 (Andersen Management International, 1996). The current very modest diffusion of telework in Denmark is apparently not because of technical obstacles, but mainly insecurity about what the consequences might be, and organisational and ideological inertia from employers as well as employees. However, also in Denmark telework is put at the political agenda as an objective

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<sup>5</sup> The message is not to claim that today it is technically unproblematic to communicate electronically via telecommunications networks. Rather the message is to point out the facts that today fairly reliable and user friendly systems exist and that it is not the purely technical problems, which are the main obstacle for the diffusion of telework.

for public intervention (Danish Ministry of Research, 1996a), and today several governmental and other public institutions are engaged in large-scale telework projects.

But which areas - in geographical terms - would especially be able to benefit from the expected growth in the extent of telework and what factors are in this connection decisive? Obviously, a precondition for growth in telework is the presence of a relatively extensive and well functioning telecommunication infrastructure with sufficient capacity required by telework tasks. An investigation of teleworkers on the Danish island of Bornholm (Storgaard, Manniche and Marcussen, 1996) has shown, that most telework tasks can be handled by means of an ordinary telephone line and that the tasks only seldom require capacity beyond ordinary ISDN connections, i.e. 64 Kbit/sec. Such connections are supplied in most parts of Denmark, but in the peripheral areas of many other countries with greater geographical distances and a more liberalised telemarket, the quality of the telecommunication infrastructure is usually much lower than in cities.

Another condition for an area to be able to attract telework is the presence of sufficient technical service and support. This requirement may very well constitute a serious barrier for peripheral areas to attract telework demanding more advanced or special equipment and software. The investigation of teleworkers on Bornholm revealed, for example, that several of the teleworkers carrying out text, picture and layout tasks on Macintosh computers, experienced difficulties in getting technical support, when the employee in a local computer firm, which was in charge of the support for the Macintosh users, left the island. However, just like the telecommunications infrastructure, the supply of technical service is reasonably good in most parts of Denmark. And besides, many teleworker frequently make use of distance independent computer networks, for example the Internet, for keeping technologically abreast and for support (Storgaard, Manniche, and Marcussen, 1996).

A serious barrier against peripheral areas in high wage countries to gain from the expected future growth in telework may be their competitive disadvantage against the newly industrialised countries with much lower wages and which also may have a large and well educated work force and a sufficiently developed telecommunications network. If firms out-source work tasks to teleworkers they might as well go one step further and source the tasks from the area, if this will maximise the economic benefits for the firm. On the other hand, teleworkers in distant parts of the world will often have great linguistic problems of carrying out information work tasks for firms in countries with "small languages", such as the Scandinavian ones.

Because of the relatively wide distribution in Denmark of traditional development conditions like communication infrastructures and supply of technical support, the residential preferences of the work force seem to be very important for which areas that will benefit from a growth in telework. Areas with attractive nature, safe atmosphere, well functioning public and private services and facilities (schools, shopping etc.), varied cultural offers or other similar qualities will be in a better position than areas without such qualities to attract teleworkers and thereby get new jobs and important input to local competence building and to social and cultural life. Consequently, if local governments want to attract teleworkers from outside the area and to stimulate local establishment of telework, not only traditional means of promoting business activities should be applied, like for example developing the telecommunications infrastructure and the necessary technical service and support. It is also important to establish and develop attractive natural/environmental, social and cultural frame conditions.

One of the findings from the bornholmian investigation was, however, that the perhaps most important element in strategies for stimulating local telework seems to be the establishment of some kind of a telework promoting organisation. The investigation clearly indicated the need, that some local actors actively take up the role of marketing the area as an advantageous location for teleworkers and of helping potential teleworkers to solve all those practical, legally, technical, organisational, financial and other problems, that unavoidably occur in the start-up phase as teleworker. This role can presumably not be driven on private basis, due to the modest financial resources of most potential teleworkers. So, to a large extent it has to be based upon public intervention and involvement.

### 3.2. Tourism

In this section opportunities and limitations of the application of telematics within the tourism and travel industry - especially in peripheral areas - are dealt with. Since the tourism industry is actually composed of parts of many industries, in the following we will focus on hotels.

The mere fact that hotels may be located in peripheral areas hardly implies any limitations as to their utilisation of telecommunications based information and sales channels. There are, however, a number of typical differences between hotels in centre vs. peripheral areas, which have implications for which electronic information and sales channels, which are most relevant, that is, which ones it is economically feasible to utilise.

Table 1. Typical characteristics of hotels in centre vs. periphery.

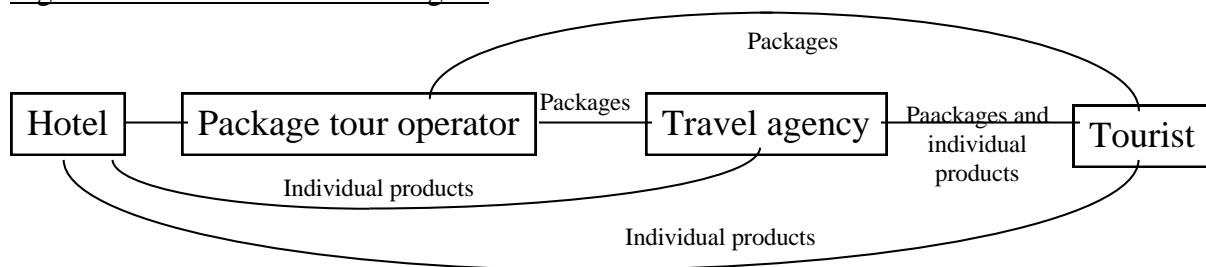
<b>Parameter/factor:</b>	<b>Centre</b>	<b>Periphery</b>
Market segment	Relatively large share of business travellers.	Relatively large share of leisure travellers.
Price level	High - medium.	Medium - low.
Open	All year.	Only in season.
Number of rooms per hotel	Relatively many rooms per hotel	Relatively fewer rooms per hotel.
Individual products or packages	Hotel nights primarily as individual products.	Both individual products and as part of package tours.
Number of nights per guest per visit	One or two nights: as individual products.	About one week: Relatively long stay.
Opportunities for sales apart from breakfast	Limited.	Good.

In peripheral areas there will generally be a relatively large proportion of leisure travellers/tourist and thereby a relatively small share of those who travel to and stay in the peripheral area because of their work. Typically the tourists come to the peripheral area on their own account and by their own choice to relax and enjoy nature and sights, primarily in a limited part of the year. The price level at holiday hotels are typically a little lower than at business hotels. Also the fact that holiday hotels in peripheral areas to a greater extent than

business hotels in centres are part of package tours contributes to reducing the price per night. Furthermore the former have peaks at one or more seasons, and their average size is smaller. Because of few alternative eating and entertainment opportunities in the area around the hotel, holiday hotels in peripheral areas have good opportunities of retaining the spending of their guests during their stay *within* the hotel, i.e. the hoteliers can encourage their guests to dine at the hotel and to spend time and money in the bar etc., for example by providing music. Nevertheless, the basis of revenue for hotels in peripheral areas is limited by several reasons already stated, and therefore also costs - including spending on telematics - must be kept at a moderate level.

The price of computer equipment for internal use and the price of participation in telecommunications based information media and booking systems are independent of the size of the hotel. Thus, for the typical tourist hotel in a peripheral area it is more difficult than for the typical business hotel in a centre area to financially justify investments in computer equipment and participation in telecommunication based information media and booking systems. Marketing and sales (distribution) of hotel nights - individually or as part of packages - takes place through a chain, which may consist of the following links:

Figure 2. Distribution of hotel nights.



The distribution chain may be electronic. In that case the distribution chain is largely the same, except that an extra link is required for the mediation of the electronic communication. Until a couple of years ago the telematics based systems only comprised those reservation terminals (now PCs), which are used by travel agencies for booking of primarily air tickets, secondarily hotel nights (and car rentals). The extremely fast development of the Internet, which has occurred during the last couple of years, has meant that there is a rather common direct electronic communication/distribution channel between tourism firms such as hotels and the individual tourists, which as mentioned may be leisure or business travellers.

The proposition must be made that that the advent of WWW and the possibilities of utilising the medium benefit hotels in rural areas relatively more than hotels in centres. Several factors support this proposition. The relatively expensive travel agency oriented booking systems (Computerized Reservation Systems, known as CRSs for short) primarily benefit the large and expensive hotels in centre (Beaver, 1995), which are oriented towards business travellers. Contrary to this, WWW gives more equal opportunity for all, since even small hotels located in a peripheral area may make themselves present on the Web, in principle world-wide, at a reasonable price. In other words, it seems that WWW comes to the rescue of small and medium sized hotels, also those located in peripheral areas, which otherwise is being “strangled because of lack of CRS accessibility” (Beaver, 1995). Hotels in peripheral areas may benefit from joining forces and present themselves at a common

platform on WWW<sup>6</sup>. The advantage is that lots of interesting information about a given peripheral area can be shown under a single umbrella, which should attract many virtual visitors, of whom some would hopefully get tempted to make an actual holiday there.

For hoteliers there are costs involved with hotel bookings received from the travel agency oriented systems (CRSs) for individual room nights, both in the form of an annual subscription fee and a fee per booking received. These costs can - if the hotels join these systems via a hotel representation firm or hotel chain - diminish the gross profit per room night significantly. Leisure hotels (in peripheral areas) may choose *only* to distribute themselves electronically via WWW, while business hotels should probably *both* distribute themselves through the travel agency oriented systems *and* WWW. Although *off-line* booking following the Internet user's search for information on hotels on WWW is a slow form of booking, WWW is an information medium - and increasingly a sales channel - which only few hotels can afford to disregard, and that also goes for hotels in peripheral areas.

### 3.3. Manufacturing industries.

The products of the manufacturing industries are physical whereas the output of telework and tourism is services. In addition to this the need for face-to-face communication in manufacturing industries is generally less than in service industries (Illeris, 1987; Malecki, 1996). Or perhaps more precisely: Within the manufacturing industries it is especially order manufacturing firms with customer adapted products, which need face-to-face communication with the customers. And furthermore, in these firms the needs are often centred around identifiable and distinctive functions and phases. For example, personal contact is important at order intake, where exchange of information about the particular requirements to the product and negotiations of sales and delivery conditions takes place, and at delivery of a prototype of the finished product, where the manufacturer demonstrates it and the customer evaluates quality.

Contrary to such situations the communication about routine administrative, technical and practical issues can often be managed by traditional (non-electronic) means of communication, e.g. telephone, fax and mail, though electronic communication technologies, like e-mail, Internet and EDI<sup>7</sup>, play an increasingly important role in major parts of the manufacturing sector.

In addition, the development of transport technologies and infrastructures and the general increase in technological complexity and content of knowledge in products and production processes, have marginalised the influence of transport costs on the price setting of most products. As a result, a lot of manufacturing industries can be localised far more distant from their markets than earlier, e.g. in places where wages and real estate prices are lowest and the necessary labour skills are available. Thus, in Denmark and in many other Western countries the recent decades have been marked by a significant overall decline in the industrial employment in the traditional industrial core regions, i.e. the major cities, and a

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<sup>6</sup> See for example "Bornholm on Internet" at <http://www.bornholm.dk> or "Tasmanian Tourism Operators with a presence on the WWW" under "Tasmania on the Web" at <http://www.tas.gov.au/tourism/tasweb.html>.

<sup>7</sup> EDI (Electronic Data Interchange) is electronic systems for exchange of structured data, like purchase orders or invoices, direct between enterprises computers via telecommunication, i.e. without re-keying of data in the receiver firm.

similar significant overall increase in the industrial employment in many peripheral areas (Maskell, 1986 and 1992; Malmberg and Maskell, 1996).

Malmberg and Maskell (1996) have analysed the development of localisation patterns for manufacturing enterprises in Denmark, Finland, Norway and Sweden from 1970 to 1990. Their study clearly indicates that the manufacturing sector as a whole had been geographical decentralised in all four countries. However, their study also indicates that this overall decentralisation of the manufacturing sector was the net result of a process, through which most individual industries had become more localised, i.e. geographically centralised. In other words: the manufacturing activities are geographical diffused from traditional centres in the big cities and to (some) peripheral areas but the diffusion process does not follow a pattern of randomness. Enterprises with similar manufacturing activities apparently tends to clustering in certain areas with especially advantageous localisation conditions. In a Danish context some examples of this tendency to cluster formation in traditional peripheral regions are the electronic industry in North Jutland and the textile industry in West and Middle Jutland.

Such localisation advantages can consist in specific natural or resource related conditions or in other physical-materialistic properties of the region. A far more important reason for the indicated ongoing agglomeration process is, however, presumably the advantages of agglomeration in itself, i.e. of localisation in an “industrial milieu” with specialised skills, competences and tacit knowledge, service and subsuppliers, educational systems and other private and public institutions, altogether constituting an institutional framework for certain manufacturing activities.

The cluster formation tendency supports the above mentioned argument that firms innovation and development processes not exclusively are driven by the formal research and innovation systems of universities and research institutions in the big cities. Crucial inputs are provided through interaction and learning processes related to specific production processes and industrial milieus located distant from such systems.

However, the overall decentralisation of the manufacturing sector has, as mentioned above, not credited all peripheral regions. The islands Bornholm and Lolland are Danish examples of peripheral regions in which the manufacturing sector has not developed as favourable as for instance in West and Middle Jutland. In addition, the cluster formation tendency rather confirms the importance of proximity to central cooperation partners, suppliers etc., than that localisation in places distant from markets, financial centres, national and international knowledge and expertise systems in itself are advantageous.

So, although telematics enhances the opportunity for distance independent communication it does not automatically lead to industrial development in the weakest industrialised peripheral regions. Nevertheless, manufacturing enterprises located in peripheral areas will, anything else being equal, potentially be able to gain greater advantages by use of telematics than manufacturing enterprises located in centre regions. Telematics provides a lot of possibilities for peripheral located manufacturing enterprises to strengthen their communication and interaction with customers, suppliers, consultants and co-operation partners, to ease their access to information and knowledge necessary for their production, to reduce their travel expenditures, i.e. to diminish some of the disadvantages and barriers connected to peripheral localisation. Some of the technological possibilities, which in this regard comprise important potentials, are:

- conference systems (video or computer based) for meetings, consultancy, education etc.,
- EDI systems for exchange of structured (administrative) information,
- e-mail systems for exchange of unstructured information's,

- Internet applications for marketing and search for specialised information, suppliers, co-operators etc.,
- and so called Engineering Whiteboard systems, i.e. multimedia based computer network applications with facilities for simultaneous co-work on shared electronic data and for simultaneous video and computer conferencing on the same screen - facilities which are highly useful in firm co-operation processes, for instance concerning product design and construction.

Manufacturing companies in peripheral areas can apply telematics in their communication with customers, suppliers, and teleworkers which might be associated, no matter if these are placed locally, in other parts of the country, or abroad. Like in other industries, one important technological trend within the manufacturing sector is integration of firms internal electronic data processing and external electronic communication. That is, for instance, the central idea of EDI. The use of EDI is especially widespread in the link between manufacturing firms and their customers, such as retail chains, or in the link between sub-suppliers and large factories, for example within the automotive industry. If small and medium sized manufacturing firms in peripheral areas or elsewhere hope to maintain their supplies to retail chain, large companies etc. using EDI, EDI is or becomes a *must*.

Now the much wider concept of Electronic Commerce has emerged. Electronic Commerce is defined as “any form of business transaction in which the parties interact electronically rather than by physical exchanges or direct physical contact” (The European Commission, Esprit Programme, 1996). The parties may be two firms, a consumer and a firm, or a consumer/firm, which communicates with public institutions. Electronic Commerce comprises a whole range of well established as well as more recent tools, including fax, e-mail, WWW, EDI and electronic payment.

For manufacturing enterprises located in peripheral areas - and both in Denmark and in many other countries these constitute a considerable share of the total population of manufacturing firms competing internationally - telematics is clearly rather an opportunity for development than a threat for survival. Surely one can argue, as in the above described case of telework, that firms conditions for actually realising these opportunities in general are less favourable in peripheral areas than in core regions, due to more limited supplies of services, consultancy and educational institution to insure the presence of the necessary technological competences. Compared to the present development stage of telework the manufacturing sector are, however, far more well-organised. Due to the long industrial tradition of manufacturing the needs of this sector is in many Western countries institutionalised in widespread supplies of specialised service, consultancy and educational institutions. This is definitely an important prerequisite for technological development and innovation - irrespectively of localisation.

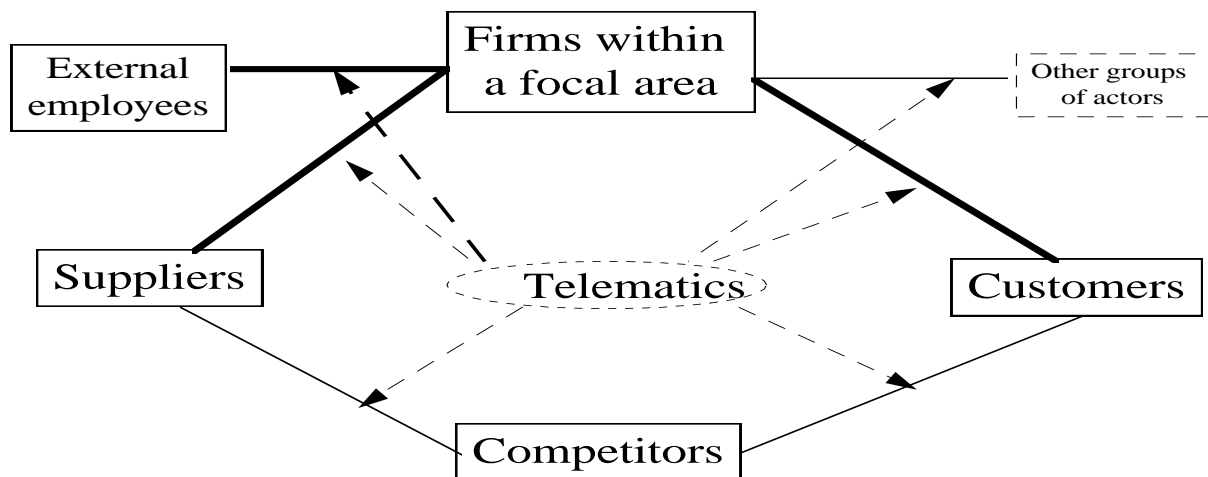
On the other hand, the long history of industrial manufacturing have also resulted in institutionalisation of technological and organisational paths, that can be very difficult to break for the actors within the sector. Today, the paths of the well-known Industrial Society are intensely challenged by the demands of the up-coming global Information Society. The emergence of Information Society will indisputably bring along radical changes in manufacturing firms’ organisation of functions and processes, like marketing, external and internal communication, product innovation, etc. A serious barrier for the accomplishment of these changes will probably be the difficulties in transcending the horizons, the ways of thinking, doing things and solving problems of the Industrial Society, that the actors are born

into. Whether this barrier would be greater or smaller in rural peripheral regions than in urban regions is very difficult to say. In general, one would expect that urban populations have taken one step further towards Information Society than most rural populations.

#### 4. Perspectives and discussion.

Telematics - the combination of telecommunications and informatics (computers) - generally improves the possibilities of faster and more efficient communication between suppliers, customers, and other partners. The below figure is general enough to cover the three widely different fields telework, tourism, and manufacturing industries. The focal area may be a peripheral area, but the model may also be applied to other focal areas.<sup>8</sup>

Figure 4. How does telematics affect firms' relations to their external employees, suppliers and customers as well as the bases of competition for firms within a focal area?



The so-called *teleworkers* can be placed three different places in the model:

1. As external employees.
2. As employees with suppliers to firms in the (peripheral) area.
3. As employees in firms in (the peripheral) area, which produce and deliver services to customers outside the area by means of telematics.

Thus telework can firstly be performed by persons, which are employees of the firm, for whom the work is carried out. Secondly telework may be carried out by a service supplier (which may be a one-man business), which delivers the result of their work *to* firms in peripheral areas. Thirdly, telematics also opens the opportunity to 'supply services using telematics' for firms *in* the periphery.<sup>9</sup>For example, it may be translators or computer

<sup>8</sup> An area is here thought of as *a region*, but the 'focal area' may actually also be an industry.

<sup>9</sup> Of course teleworkers living in the periphery may become employees of firms in centres, and people who are already employed by firms in centres may become teleworkers by spending one or more days a week at home, at telecottages, or on the road, and then keep in touch with the employer via telematics.

programmers, who could use e-mail (possibly using attached data files) for communication with their client. Telework can in principle be carried out anywhere in the world and be delivered within minutes. Telematics opens the market opportunities for services, but the threat is that competitors - who may be located in an area with relatively low wages - utilise the new opportunities more efficiently. This applies generally, but the perspectives in breaking down the geographic barrier is greater for firms in peripheral areas than for firms in centres.

Tourism firms - at least those within the hospitality industry - primarily have local suppliers.<sup>10</sup> On the other hand, their customers mainly come from outside the area, and for the hotels all of the customers are 'overseas' visitors. In the case of hotel accommodation the service has typically been booked before the guest arrives and receives the service.<sup>11</sup> Telematics can be applied for information processing before and during the sales, which may be carried out directly between product owner and customer or via a travel agency. Within tourism telematics presents a whole range of new information and sales channels. Thus, there are a number of new opportunities for reaching the target markets. The challenge for managers of touristic firms is to choose the combination of media, which is optimal for that particular firm. Furthermore, touristic firms - like all other firms - must endeavour to make the (economically) best possible use of computers internally for the administrative functions.

In connection with the adoption of the new opportunities within telematics, the individual firm can choose either to be a technological leader or a technological follower (Porter, 1985: 181), and there may be some advantages and disadvantages associated with both. If you are a technological leader this opens the opportunity of a positive differentiation from competitors. On the other hand, those who are (too) early, run the risk of going for the wrong technology, there are relatively few trading partners, with whom to communicate with via the new technology, and there is a risk of having to spend time/money to educate the partners in the use of the new technology. The advantage of being a 'technological follower' is that you can learn from others - and thus avoid the possibly expensive mistakes which they have made. Risk for the followers is, though, that they will differentiate themselves negatively from competitors, and thereby lose customers, by not being able and willing to apply the new information and communication technologies. Seen from a regional perspective it is important that the local organisations (such as chambers of commerce, counties etc.) keep themselves informed about new developments within telematics, and then pass their knowledge of the opportunities on to local firms, and possibly start initiatives within telematics, which may simultaneously benefit one or more industries.

While - in most countries - it is up to telecompanies and regional and national political actors to provide the basic prerequisites for businesses' exploitation of telematics (and for innovation and development in general), it is up to firms to meet the challenge of telematics and realise its potential advantages. It can be a hazardous attitude to consider telematics as a somewhat risky factor that one can avoid by not making any actions at all. The technological development will continue with or without the enterprises in the peripheral areas. Still, the development of telematics is not determined by any natural laws but only by impulses and active participation of businesses, politicians, engineers, organisations, ordinary citizens etc. and can be influenced by peripheral regions and enterprises. Telematics do not

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<sup>10</sup> According to ongoing research by Ms. E. Sundgaard of the Research Centre of Bornholm, between 80 and 90 percent of the purchases by hotels and restaurants on the peripheral island of Bornholm are from local suppliers.

<sup>11</sup> Thus, there is only 4 or 5 percent walk-in at hotels on Bornholm (Storgaard, Manniche & Marcussen, 1996).

eliminate the importance of cities and the element of physical distance for economic development. But it certainly *can* give firms in peripheral areas the opportunity to compensate for some of the disadvantages of their localisation, and *can* give the populations in the periphery the opportunity to combine a countryside-living with city-like jobs and education.

In summary, our answer to the question formulated in the title of this article is the following: Telematics is in itself neither an opportunity nor a threat. Telematics can be both. If the populations and firms of peripheral areas timely grasp the potentials of telematics and meet the challenge of change with strategic actions to exploit them, telematics will be an opportunity for development. If the attitude to telematics is that it is a factor that one can avoid by not making any actions at all, telematics will be a threat to development.

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