

Case Studies of the Information Society
and Sustainable Development

May 2000

Foreword

There is a growing public and political awareness that the current model of growth is unsustainable, even though we are not hitting limits in resource depletion, the major concern of the 1970s. The new constraints are associated with congestion and the impacts of material use itself: we have increased natural material transfers in the environment by over 100% and released into it tens of thousands of new chemical and biochemical products, with often surprising results.

“De-materialisation”, in the sense of reducing the amount of material extracted from, synthesised, and dispersed into the environment per unit GDP, is now the key to longer-term sustainability. It can be realised by process improvement, product improvement, product to service conversion and structural change. All can be influenced by the information and communication revolution, but in different ways and to different degrees.

Process re-engineering for e-business has been given a major stimulus by the emergence of multi-media information infrastructures. While de-materialisation and energy saving are not primarily goals, benefits have been realised and the business benefits and methodologies of re-engineering have been recognised and tested. If these proven techniques can now be applied with the goal of reducing material use and transport, further incidental business benefits will almost certainly emerge.

Product improvement has come through use of new materials, better suited to the product’s function. But, the “information content” of products in terms of their market value has risen faster than their material content has fallen. Over 50% of the market value of a car is related to its “information” content - through research, design, production and retail management. In terms of their market value, most products can be substantially de-materialised.

With advanced communications, other **products become services**. A newspaper becomes an on-line news service; an instruction manual becomes an interactive technical advice service; cinema film re-production and cinema chain management becomes a “video-on-demand” service in the home; a post-operation recuperation institution becomes a medical surveillance service in the home. The de-materialisation is evident.

Structural changes in the way markets are organised, in the way our transport infrastructures are organised and used, in the way we work and live; these are the hardest changes to stimulate. But it is here that the greatest benefits in sustainability are to be realised. The emergence of information infrastructures changes all the ground rules of an industrialised materialist society.

"Case Studies of the Information Society and Sustainable Development" in this report illustrate various initiatives already taken in Europe. They have been prepared by the Swedish business consultant and writer Lennart Forseback (see Annex 1) on behalf of Telia: the largest Swedish telecommunications service provider. They have been translated and are published by the Information Society Directorate General of the European Commission, with the kind permission of Telia, as a contribution to ongoing discussions of European Policies. Special thanks are due to Ms Nina Thompson, Ms Rosemary McLaren, Mr Ken Broady and Mr John Jones, who translated the case studies from Swedish.

The views expressed are those of the author, Mr Forseback, and do not necessarily reflect those of the European Commission.

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1. DEMATERIALISATION: SUSTAINABLE SERVICES

1.1. Dematerialisation reduces demands on the environment

Opportunities to transform a physical product into a service play a significant part in the prospects for long-term ecological sustainability. This can happen in a number of different ways, for example the way in which leasing a car, for example, a refrigerator or a photocopier, replaces the purchase of a similar product. In other words the customer buys a transport service, “refrigeration” or “copying”.

Turning products into services

Another example is what is known as dematerialisation, which is the replacement of a product such as a video recorder or answering machine with an on-line service. With regard to the total impact on the environment which is associated with dematerialisation, it is of critical importance that what is known as a life cycle analysis can be carried out on the products which takes account of the need for raw and added materials, and the consumption of energy and materials, as well as the travel and transportation which are associated with manufacture, the demands on the environment which accompany operation and, lastly, the impact on the environment which is involved in disposal.

An LCA of this type can be carried out, for example, on a video-conferencing system, which can replace a number of physical journeys. Another example is the telephone answering service TeleSvar which replaces answering machines in the home and office. Yet another example is the average rental of a mobile telephone, which includes the manufacture, carriage, operation and disposal of telephone and system, all of which has an energy-related impact on the environment which is equivalent to driving a car a distance of 100 kilometres.¹

ISO 14040 specifies standards for LCA analysis

The international environmental management system, ISO 14000, with, amongst other things, its sub-system ISO 14040, specifies standards for the factors which should be taken into consideration in a life cycle analysis.

A standard telephone answering machine may be compared with the TeleSvar service in respect, for example, of weight, power consumption and the greenhouse effect expressed in CO₂ equivalents.

A study which was undertaken within Telia takes just such a comparison as its point of departure.² A standard answering machine, weighing about 1.2 kg, was compared with the TeleSvar service. The TeleSvar system produces a lower potential contribution to all of the effects on the environment which were included in the study than the alternative – an

¹) Hedén, Flemming: Paper “Avmaterialisering och effektivare fysiska transporter med IT” in “IT och de nationella miljö kvalitetsmålen”. Naturvårdsverket Report 5022. September 1999.

²) Study undertaken by Flemming Hedén, Telia Nära AB.

answering machine. This also applies to the scenario involving the reclamation of the answering machine.

TeleSvar thus imposes fewer demands on the environment as a factor of the manufacture, transportation and disposal of all of the equipment, as well as the operation (power consumption, cooling and maintenance) of the service, than the manufacture, transport, operation (power consumption during use) and disposal of an answering machine.

TeleSvar involves 100-800 times less impact on the environment

Two central points of comparison between the answering machine as a product and the TeleSvar service are power consumption and contribution to the greenhouse effect. In both respects TeleSvar is clearly superior.

	Answering machine	TeleSvar Service	Factor
Weight, kg	1.2	0.06	20
Power consumption, kWh	1,308	5.7	230
Greenhouse effect, g CO ₂ equivalents	140,000	590	240

The systems compared produce the same benefits with different environmental profiles as a consequence. The service always has a significantly lower impact on the environment. TeleSvar's impact on the environment can be estimated at between 100 and 800 times less than the equivalent in the case of an answering machine.³

Equivalent to heating 2,000 private homes a year

This factor can then be related to the number of answering machines on the market, and the number of people who subscribe to TeleSvar or a similar service. Looking at power consumption, a comparison may be made with the corresponding need for heating in our homes. The savings which are made by the 700,000 or so customers who subscribe to TeleSvar are equivalent to about 2,000 houses heated with electric heating a year.

Nowadays a large number of Swedish households have an answering machine at home. There are also a large number of answering machines in small companies, especially in Sweden's 400,000 or so one-man firms.⁴ It is not easy to estimate exactly how many telephone answering machines there are in Swedish homes and businesses, or how many plan to acquire an answering machine. In the USA, for example, the number of people who have a telephone answering facility in the shape of an answering machine or service is

³) E-mail conversation with Flemming Hedén, Telia Nära AB, November 1999.

⁴) Forseback, Lennart: "IT är svaret – Men vad var egentligen frågan". IHM förlag 1998.

more than twice as many as in Sweden. In Sweden the number of telephone answering operations may therefore increase as demands on the environment decrease.⁵

⁵) E-mail conversation with Flemming Hedén, Telia Nära AB, November 1999.

10,000 tonnes less CO₂ emissions a year

It is possible to carry out an experimental calculation on the basis of the data which is referred to above. Let us assume that half a million people who currently have an answering machine might in future choose to subscribe to the TeleSvar service when their machines have worn out. This would mean that together they reduce CO₂ emissions by 10,000 tonnes a year.⁶

Businesses – especially small and medium-sized businesses – are increasingly subscribing to the Centrex service, which is provided by Telia, particularly to invest in a private branch exchange of their own. To put it simply, Centrex may be described as a virtual exchange. The Centrex solution usually involves lower costs and a higher level of service for the subscriber. To this should be added a reduction in the exploitation of natural resources and a reduction in demands on the environment.

Centrex solution saves millions

The initial results of a study which was commissioned by Telia show that Centrex involves appreciably less environmental impact than the physical solution. The study which is not complete, compares impact on the environment for all of the phases in the life cycle.⁷

This applies to manufacture, which usually has the greatest impact on the environment, and operations, which as a rule have the next greatest impact on the environment. The two solutions were also compared with regard to the installation, transport and disposal of cables, which might produce a negative effect on the environment, but in some cases positive effects, for example when certain materials are incinerated in a power station, thus reducing the consumption of district heating. The results which are presented below are thus based on the combined effects for the whole life cycle for Centrex and the physical solution respectively.

Six times less depletion of non-renewable resources

Subscriptions to Centrex involve a depletion of non-renewable resources which is six times less that of the physical solution. Closer analysis shows that Centrex involves less depletion of resources for all parts of the life cycle other than cable-laying.

In the case of Centrex it is manufacture which accounts for the greatest (relatively speaking) depletion of resources. In the case of the physical solution the reverse is true, i.e. operation accounts for the greatest drain on non-renewable resources.

One third of the greenhouse effect

Looking explicitly at contributions to the greenhouse effect, Centrex involves three times less impact on the environment than the physical solution. In the case of both Centrex and the physical solution, it is manufacture which accounts for greatest (relatively speaking) impact on the environment. In the case of Centrex, it is in particular the manufacture of

⁶) E-mail conversation with Flemming Hedén, Telia Nära AB, November 1999.

⁷) Study undertaken by Malin Larsson for Telia Telecom AB.

the equipment at the customer's end which produces considerable emissions of CO₂. At the same time, the manufacture of the physical telephone exchange involves twice as much greenhouse effect, while during the operational phase the greenhouse effect is appreciably greater.

In the case of a number of other environmental parameters Centrex also exhibits an appreciably smaller impact on the environment. This is true, for example, of the breakdown of the ozone (one third of the impact), something known as eutrophication (a quarter of the impact on the environment) and the formation of photo-oxidants (a little less than half the impact).

If we take a final look at the effects on acidification, the physical solution exhibits twice the potential impact of the Centrex solution. In the case of both solutions it is manufacturing which accounts for the greatest impact.

Companies which choose a solution involving Centrex primarily to acquire their own private branch exchange can therefore expect not only financial advantages but also a high level of service. Centrex is also the most outstandingly environmentally-friendly option.

1.2. The paperless office - Myth or reality?

The paperless office is a myth for many people today, or perhaps it is simply regarded as a bad joke. Instead, computers and printers in every office are considered to lead to higher paper consumption with far more printouts and copies being made. However, there are factors which indicate that perhaps we are nevertheless moving towards a society with much less paper.

In the past, it was possible to demonstrate a link between higher growth and higher paper consumption in a society. However, it seems far from obvious that, say, the great new Asian economies consider "paper" to be the natural choice to make. Perhaps it is therefore necessary to find a way of development which involves less use of paper.

Deforestation and rising paper consumption

During the last hundred years, the world has lost almost half of its original forests. It is chiefly the tremendous rise in demand for paper which has contributed to deforestation.⁸ Where forest cover has been reduced, water flow has increased after rainfall, often resulting in flooding, soil erosion and a lower ground water level.

At the same time, pressure on the world's forests is growing. Of the products made from raw forestry materials, it is the consumption of paper which is rising fastest. Around the world, more than five times as much paper is used today as in 1950. By 2010, consumption is estimated to be twice what it is today.⁹

Consumption is far from evenly spread across regions and countries, however. The 20% of the world's population who live in North America, Western Europe and Japan today consume about 70% of all paper in the world. The average American consumes 46 kg of paper on average per annum, while the average Indian consumes 3 kg.

Any rise in average world paper consumption to bring it closer to that of the USA and Western Europe is likely to be unsustainable. As far as can be judged, paper consumption in the rich world should be reduced in favour of a slight increase in the developing countries.

Acute shortage of paper fibre

At the same time, the forecasts are that paper consumption will continue to rise in North America and Western Europe, for example, by about 2% a year during the next decade. The rise in China and the rest of Asia is estimated at 4-5% during the same period.¹⁰

⁸ Brown, Lester R.: "The Future of Growth" in State of the World 1998. Worldwatch Institute - Swedish Nature Conservation Society - Swedish Environment Protection Agency

⁹ Abramowitz, Janet N.: "Cultivating a New Relationship with the World's Forests" in State of the World 1998. Worldwatch Institute - Swedish Nature Conservation Society - Swedish Environment Protection Agency

¹⁰ Information from Jaako Pöyry Consulting.

Demand for paper is now rising fastest in Asia and Latin America, which actually have a paper shortage. China in particular is facing an acute shortage of fibre for paper production according to analysts in the industry.¹¹

However, some of the principles of international management theory today - based on various assumptions - do point to the existence of what seems to be a paperless office. In the past, it was often claimed that long-term sustainability is the "business of the business".¹² Businesses can and must themselves accept greater responsibility for the environment - even where there is a strict profitability motive.

"Natural capitalism"

In September 1999, the book "Natural Capitalism" was published which sets out to show the way forward for the next industrial revolution in which greater efficiency of energy and resources will be self-evident even from the narrow business perspective.¹³ Like the best-seller "Factor Four: Doubling Wealth, Halving Resource Use", which appeared in German in 1996 and was published in English two years later, it gives a large number of examples of how energy and resources can be made more efficient while business at the same time boosts its profits.¹⁴

Some of the examples of higher energy and material efficiency which are given are based on the proper consumption of paper: Only 10% of all paper produced is deliberately saved, for example, in the form of books or records. A large proportion of the rest of the paper ends up directly in the office's waste paper baskets. The average US office worker uses a sheet of paper every 12 minutes and that sheet of paper in turn accounts for about 70% of all the office waste.

Paper forms disappearing

The principal ways in which paper is used are also changing, e.g. as regards forms. The production of printed forms in general and computerised forms in particular is falling considerably. Even official forms can be downloaded, completed and sent back in digital form.

There is a dramatic fall in the use of traditional multi-copy forms due, among other things, to the fact that present-day printers cannot produce carbon copies.

According to International Business Forms Industries (IBFI), the market share in printed forms is falling by 3.2% a year. These are being replaced by electronic documents.¹⁵

¹¹ Article: "Paper consumption rising in accordance with new forecast", Sv D 16/9 1999.

¹² See Article "Beyond Greening: Strategies for a Sustainable World", Stuart L. Hart in Harvard Business Review, Jan-Feb 1997.

¹³ Hawken, Paul, Lovins, Amory B. & Lovins. L. Hunter: "Natural Capitalism. The Next Industrial Revolution. Earthscan Publications Ltd. UK 1999.

¹⁴ Von Weizsäcker, Ernst Amory B. & Lovins. L. Hunter: "Factor Four: Doubling Wealth, Halving Resource Use". Earthscan Publications Ltd. UK 1998.

¹⁵ Report "Graphic companies in the media industry - What shall be do now? An analysis of the situation and strategic possibilities" Grafiska företagens service AB. Stockholm, September 1999.

Many public authorities are also making brochures and other documents, e.g. public reports, proposals, etc. available on the Internet. This is the case with publications from the Swedish Parliament and Government.

The Managing Director who burnt up all the paper

The book "Natural Capitalism" also tells about Dan Caufield, the Managing Director of the employment company Hire Quality and an ex-US marine who early one morning rushed into his office, looked at all the employees' desks, gathered up all the paper he could find and then threw it into a metal bin and set fire to it. This was not as impulsive as it might seem. Caufield had a newly developed document handling system up his sleeve. The purpose of the somewhat dramatic action was to illustrate the necessary cultural revolution.

The new document handling system cost the company about USD 400 000, but the advantages were soon obvious: 200 000 personal files could be electronically sorted into 150 job areas. The cost of handling an application was reduced by a quarter, the number of interviews to obtain a reference was reduced by half and the time to send out a CV - by fax - to an employer was cut by nearly 90%.

The paperless office - Nothing ventured, nothing gained

But that was still not the main achievement. That was quite different: a dramatic improvement in the quality of work, a faster and smarter flow of information and, above all, teamwork with the employees - not paper files - in the middle.

The aim of the cultural revolution Caufield started was therefore not the paperless office. It was to increase quality and improve information and teamwork. The paperless office was one way of achieving this.

The transparent organisation

Similarly, Lars Kolind's aim on joining the Danish company Oticon, the world's third largest manufacturer of hearing aids, as Managing Director in the early 90s was to create a transparent organisation.¹⁶

- There was a lack of integration within the company, says Lars Kolind, who has now left the firm. Everyone sat in their respective area, research or development, marketing, sales, economic, logistics, production or administration, and knew very little about what happened elsewhere.
- I had a vision of how a knowledge-based organisation should look and saw four key areas in which to change the way people worked: Tasks, organisation, working environment and communication.

From bankruptcy to a stock exchange leader

¹⁶ Interview with Lars Kolind on 26.8.1999 and Forseback, Lennart: "Telemanagement - How to create and manage a flexible organisation". IHM Förlag 1997.

Lars Kolind's description of his vision was followed by six months of very intensive discussion.

Everything was questioned and big and small were mixed up:

- Individual offices or open-plan?
- Smoking or non-smoking?
- Bosses or no bosses?
- Standard or flexible working hours?
- Paper records or "everything on computer"?
- Working from the office or from home?
- Equal pay or differentials?

From the discussions emerged what is now one of Denmark's most successful companies. In 1990, the company had a stock exchange value of DKK 150 million, of which 100 million represented the company's book value. In 1995, the company was quoted on the Danish stock exchange at DKK 2.4 billion, of which 2 billion represented intellectual capital! In 1999, the stock exchange value is DKK 10 billion.

To release and arouse enthusiasm for this knowledge capital was also Kolind's business idea. Looking back, it can be said that this ambition has been more than met.

A transparent, paperless organisation

Paper has in principle now been totally abolished at Oticon. Every morning, incoming paper mail is scanned into a computer and directly destroyed. All information is accessible to everyone.

- I had a clear ambition to break the information monopoly, says Lars Kolind, looking back at the revolution he brought to the company. I want *everyone* - literally - to be able to see any problem in the organisation. Transparency therefore became a keyword and, as everyone knows, paper is not transparent. About 50% of all paper quickly disappeared from the organisation as it was a barrier, "locking in" information and knowledge.
- The information therefore became very "transparent", says Lars Kolind. Everyone in the company knows our development plans and what are normally business secrets. This does of course involve a risk, but the risk is worth taking. Otherwise, independent efforts would not be working towards the same objective.

Maximum flexibility

The organisation enjoys maximum flexibility, among other reasons because paper has been completely done away with. Those working in the office have access to all information in all the computers and choose where to sit to work. On each floor, there is a coffee bar and the cafeteria is open all day long.

- I encouraged the staff to take long lunches. That is where ideas are born. On the whole, we started speaking to each other rather than sending memos, said Lars Kolind. We have definitely got rid of the old culture of meetings which go on for hours. After the "cultural revolution", each meeting consisted of 20 ten-minute talks a day between 2-4 employees.

The scouts as an example

Lars Kolind has now left Oticon after 10 successful years as the company's Managing Director. He is now Chairman of three large Danish companies, has his own company and is starting up new ones, including Internet and telecom firms.

In addition, he is devoting himself to political work in three Danish and international joint advisory bodies which try to define business's social responsibility in society. And that is not all: Lars Kolind is also Chairman of the Danish "College of Wise Men", which is trying to establish its terms of reference for Denmark, he manages a large farm in Jutland and is on the Board of the Order of World Scouts.

It was also from the scouts that Lars Kolind sought inspiration and experience for creating the transparent organisation:

- The scout movement is based on voluntary action and organised teamwork across all boundaries, to do things of your own free will without anyone having to give the go-ahead. This was the energy I wanted to release, says Lars Kolind.

Is paper needed at all?

Perhaps it is a mistake to see things in terms of paper versus electronic documents and systems? What about "electronic paper", a computer screen which looks like a sheet of paper but can be recycled at least a million times. Nick Sheridan of Xerox Palo Alto Research Centre who invented it believes that "e-paper" can be economically produced and will be on the market in 2000.¹⁷

New copiers are also being developed which make it possible to print out and recycle the same paper up to 10 times. With plastics technology using polymers, the ink can be "dissolved" in hot water. The polymerised ink is collected and taken back to the local office supplies dealer who adds new water-binding materials. The ink is then returned to the copier and so forth in a closed circuit.

For many people today, the paperless office is a myth or merely a joke. But perhaps even the conventional office with its reams of paper on shelves and in piles will come to be seen as something of a joke in future.

¹⁷ Hawken, Paul, Lovins, Amory B. & Lovins. L. Hunter: "Natural Capitalism. The Next Industrial Revolution. Earthscan Publications Ltd. UK 1999.

1.3. Videos on line

The opportunities for "de-materialisation" whereby, for example, goods are replaced by services, of course play an important part in the discussion about how to create a sustainable society. One of the most recent examples is perhaps the replacement of videos and CDs by on-line services and the publication of newspapers in electronic form.

Pay per view.....

"Bio Hemma" (home cinema) is the name of Telia's pay-per-view service which was introduced in January 1996. With "Bio Hemma" customers can order films or events by telephoning from their homes. Customers connected to Telia's cable TV network who have a digital TV box can order 25 or so films of various types each month.¹⁸

Every day there is a choice of between six to ten different films with around 50 showings. The use of digital technology means that the picture and sound quality is better. In addition to films, events such as Mike Tyson's comeback match against François Botha are transmitted.

...or view for free?

With "pay per view" films are transmitted at specific times. The next stage in the development is "video on demand" where films are stored in a large video server and customers decide themselves when they want to watch them. An advantage of video servers is that several customers can see the same film without having to view it at the same time.

In 1995 Telia began the commercial testing of video on demand with some 500 households in Jarlaberg in Stockholm. The test ("Raket" = rocket) was one of the first with video-on-demand services. In addition to ordering films, customers were able to test "delayed broadcast". This service gives customers an opportunity to download TV programmes so that they can watch them later.

In future it will also be possible to download films directly into the digital TV boxes by equipping them with a hard disk. This is a cheaper and simpler technical solution than using video servers.

"Video on demand" has been talked about for quite some time. Research is being conducted in a number of other places in Sweden. The big problem can be summed up in a single word: "bandwidth".

Bandwidth is the key question

In order to be able to "take home" a video film or a piece of music via the Net and obtain good quality, it is necessary to have sufficient bandwidth. There are many technical solutions, eg ADSL, cable TV and optic fibres.

¹⁸ Information from Hans G. Larsson, press officer at Telia InfoMedia TeleVision AB.

Fibres are now being installed as never before. This is the case with the networks connecting the various parts of the country but also the urban networks.

- Today in practice, virtually all the municipalities in Sweden have some form of urban network about half of which can also be used to offer a number of commercial services. According to Stefan Tegenfalk, who works in the field of business and technology development at the multimedia operator TeleCyber with 15 or so employees, this is part of the company's business concept.¹⁹ Considering that it is primarily the large cities that have urban networks, around 80% of the population is probably served by an urban network.

1800 times quicker than a standard modem

The company targets the inhabitants of blocks of flats and small businesses in the vicinity of the urban network, e.g. STOKAB's network in Stockholm. TeleCyber builds a hypernet, a very high quality broadband network, in the premises which choose to be connected. For the individual households which choose to be connected, the fact of being connected, together with a network card for the computers which TeleCyber makes available, means that the computers can send and receive 1 800 (!) times faster than with a normal modem. This provides between ten and one hundred times quicker transmission than with today's cable TV or ADSL technology. An even quicker solution is available if the customer requests an upgrading of the PC network card and a "port" in the building's exchange.

It is necessary for a sufficiently large number of households to be interested in being connected before owners will decided to get buildings connected. Demand is around 20% in inner Stockholm and 35% in the surrounding areas. After three years the network is transferred free of charge to the owner.

The household connection costs are just under SKK 2 000 (including VAT). There is a also a monthly charge of around SKK 200.

Kungsholmstorg is one of the biggest residential areas of inner Stockholm. Between 150 and 200 households have excess to TeleCyber's service package there, e.g. for videos, music and games. The games industry today plays the role of "technology driving force" that the defence industry used to perform. It has now grown to gigantic proportions.

- According to Stefan Tegenfalk, the games industry today is bigger than both the film and music industries.

Great potential for "de-materialisation"

The business concept applied by Stefan and his colleagues offers considerable potential for de-materialisation. A single video, CD or game can in practice be used by an unlimited number of households at the same time. The customer uses the programme locally in his PC as a "thin client" and cannot download it to his hard disk. Consequently, piracy is impossible. Video films and music on CD are copied digitally and TeleCyber only needs for this a single MPEG file or CD from the supplier. TeleCyber keeps ongoing statistics

¹⁹ Interview with Stefan Tegenfalk, 10 May 1999.

about the use of the various programme products which can subsequently be fed back to the supplier.

- According to Stefan Tegenfalk, they will shortly, for example, be able to offer their customers around 250 different "video-on-demand" possibilities, and will be expanding to other residential areas of greater Stockholm.

Another aspect is that in the case of videos and CDs there will of course also be a reduction in the traditional physical distribution network consisting of wholesalers, retailers, video-rental outlets, etc.

Again according to Stefan Tegenfalk, Swedish households which rent videos at present rent one video a week. Just over 80% of households now have a video player. The majority of them, let us say 75%, probably hire videos now and then.

This means that there is a potential corresponding to 52 hired videos x about 2.4 million households (80% x 75% x 4 million households), i.e. a total of around 125 million video hirings. And the potential is probably even greater: it can sometimes be more appealing to watch a video film than to go out when it is raining or the weather is foul.

High "transport intensity"

The total distance travelled by Swedes in 1995 was 130 billion person-kilometres, i.e. 15 000 km/capita. If we consider transport intensity measured in terms of how many kilometres we travel on average over the 16 waking hours of the day, service, purchasing and leisure activities away from home represent the highest "transport intensity", namely 5.0 or 5.2 km/hour of activity, i.e. considerably more than, for example, the corresponding value for work, namely 2.2.

Our daily shopping for food and hygiene articles, as well as video rental, are some of the most significant examples of activities with a high transport intensity, i.e. long journeys compared with the actual time spent on the activities in question. In other words, we travel quite a long way compared with the time it takes to do our daily shopping, hire a video or whatever. At the same time, there is considerable potential for replacing this particular type of travel with on-line services. Consequently, "video on demand" will be an attractive alternative for households provided that the technology is satisfactory and the choice is attractive.

Many different services offered

TeleCyber offers a number of other services, e.g. Internet connections at no extra cost, and also free telephony within TeleCyber's network. At present, this possibility is only available in the residential block itself and other properties that are connected. Free telephony will become more interesting once 100 000 or so houses are connected, which Stefan thinks will be the case in the near future.

Households which are connected can also be connected to the programmes needed for various computer functions: word and text programmes, image-making and -processing programmes and of course communication programmes. Negotiations are in process with some of the leading programme makers.

- According to Stefan Tegenfalk, there are still a number of problems to be resolved. Perhaps the biggest is the conservatism prevalent in the sector.

As far as can be judged, this applies to representatives of all the sectors are coming together in a new multimedia-data-telecoms sector, from established players such as Warner Brothers, Disney and the Swedish SF to “newcomers” such as Microsoft.

Fewer transport operations and less materials

It can be very beneficial for companies to distribute films, music, games and other services on line rather than sell them as hardware products. Many transport operations can be avoided between suppliers and retailers and hirers and between retailers and hirers and customers. We can dispense with the mountain of materials represented by videos, CDs and games. Savings can also be made on the paper, plastic and other packaging which we throw away when we buy these articles.

The recent government report “Swedish Film Policy” (SOU 1998:142) finds that just over 80 % of Swedish households now have access to a video player. The rental market peaked at the end of the 1980s. It then fell, only to rise again after 1995. Over the same period the video-sales market has expanded considerably, rising from 800.000 videos sold in 1989 to just over 6.3 million in 1996. Children’s films dominant the sales market.

The report also finds that there are many unrecorded rentals/sales, among other things because nobody knows the scale of the market for the rental and sale of porno films. On the basis of information from the eleven video wholesalers in Sweden, turnover can be estimated at around SKK 1.1 billion, but the report would add to this an estimated number of unrecorded rentals/sales corresponding to about 20%. This means that the video market has a bigger turnover than the cinema market. No one knows for sure how many video rental outlets there are in Sweden, but the trade estimates the figure at around 2 000.

A hypothesis

Assuming that all videos rented or sold are replaced by “video on demand”, there will be a considerable potential for “de-materialisation” bearing in mind the following:

- there are just over 3.2 million (81 % x about 4 million households) video players in Sweden,
- 6.3 million video cassettes are sold every year,
- around 1 million cassettes are rented every year,
- the packaging for all the cassettes,
- there are around 2 000 video rental outlets in the country (although it should be borne in mind that many video rental outlets engage in other activities on the same premises, e.g. the sale of petrol, basic consumer goods, etc.),
- transport to the 11 video wholesalers and their storage areas,
- transport from these wholesalers to the 2 000 or so video rental outlets, and

- the journeys made by customers to rent or purchase video cassettes.

The same hypothesis can be made for CDs, games, etc. Even if only let us say 20% of these products are replaced by on-line services, this will have a significant effect on de-materialisation and result in major savings on transport and other journeys.

1.4. “Banking” is essential – but not banks

Internet banks are now making encroachments on a broad front, not least in our own country. This applies both to the established giants and to the small burgeoning companies or niche banks, such as IKANO, owned by IKEA, and JP Bank. At the same time competition is also on the increase from foreign banks which have already established themselves or plan to do so. To all appearances, the financial sector is faced with considerable structural changes which will have an impact on the entire banking structure, the services offered, the numbers of employees and of branches.

Rapid restructuring

The trend is already in evidence. In the USA alone. 300,000 bank jobs disappeared between 1984 and 1994, i.e. before the Internet had had any impact.²⁰ This was part of a general campaign to reduce costs. Chase Manhattan, the USA’s third largest bank, for example, made savings in the order of USD 2.5 billion a year. In New York City alone, the number of branches was halved from 1,000 to 500. At the same time Chase, and another major North American bank, Citicorp, are investing something like USD 2 billion a year in new technology.²¹

The trend is virtually the same in Europe. A forecast has stated that 250,000 bank jobs will disappear in Europe over the next 3-5 years.²²

The number of branches will be halved

Sweden’s banks will obviously not be able to escape the effects of this trend. On the contrary, the computer-awareness of the population and the success of the Internet in general and on-line banking in particular, are an indication that the trend will have a rapid effect in Sweden. The McKinsey Consultancy anticipates that the number of people employed in the Swedish banking sector may be reduced by around 40 %.²³

Commentators also suggest that the number of branches in Sweden will be halved in a few years, from around 2,700 today to 1,350 in the year 2000. This should be compared with the 1,200 or so branches which have disappeared over the last 15 years.²⁴

The Internet is accelerating the process

In addition to on-line banks, the merger of Föreningsbanken and Sparbanken, as well as other mergers and increasing demands for cost rationalisation on the part of shareholders,

²⁰) Forsebäck, Lennart: “Telemanagement – Hur man skapar och leder en flexibel organisation”. IHM Förlag 1997.

²¹) The Economist, On a wing and a prayer. A Survey of International Banking, 17.4.1999

²²) Forsebäck, Lennart: “Telemanagement – Hur man skapar och leder en flexibel organisation”. IHM Förlag 1997.

²³) Forsebäck, Lennart: “Telemanagement – Hur man skapar och leder en flexibel organisation”. IHM Förlag 1997.

²⁴) Forsebäck, Lennart: “Telemanagement – Hur man skapar och leder en flexibel organisation”. IHM Förlag 1997.

have contributed to the reduction in the number of branches. The Internet is just accelerating the process.

The process seems almost relentless. This is apparent not least if we compare the costs of transactions for a variety of services. A study in US dollars has shown that every visit to a bank costs USD 1.07, the use of a phone-bank USD 0.54, the use of a cash dispenser USD 0.27, and the use of the Internet USD 0.01.²⁵ A visit to a bank thus costs a hundred times as much as an Internet transaction. The bank will say: an Internet transaction means that it is the customer who does most of the work him- or herself and it is “free of charge”. In other words the IKEA concept translated to the world of finance.

“No need for banks”

“Banking is essential to the modern economy, but not banks”, observed Business Week in a widely-read and much-quoted article as long ago as 1995.²⁶ Or in the words of the outspoken Bill Gates: “Banks have become dinosaurs”.

Well aware of the threat facing them, banks throughout the western world are now investing heavily in IT. The investments are often global, e.g. Citybank’s Internet investment Direct Access, which exists as an on-line bank in 20 countries. Customers who wish to speak directly to a representative of the bank are referred to a single “call centre” in Germany, which serves the whole of Europe.²⁷

At the same time it is difficult to assess the trend. In favour of the newcomers to the financial markets is the fact that they do not carry any baggage in the shape of staff or location costs. Against them – and in favour of the established players in the financial markets – is the need for massive resources to invest in the actual IT.

SEB pioneers

During the last year the cost of IT in Sweden’s banks has increased from seven to ten billion Swedish kronor. The forecast for 1999 points towards SEK 12 billion. Nor does this increase seem to be incidental, associated with the problems of Y2K and the Euro. There is every indication that the level will remain at a continued high level.²⁸

In 1997, one of the pioneers in on-line banking, SEB, invested SEK 2 billion in IT, equivalent to almost 20% of the bank’s overall costs. One of its competitors, Handelsbanken, invested even more relatively speaking, SEK 2 billion out of a total of SEK 7.7 billion in costs.

900,000 Swedish customers for on-line banking

Today almost 900,000 Swedes are banking on line. This represents a twofold increase compared with last year.²⁹ And the increase has been very rapid. Banks now get 50,000

²⁵) Booz-Allen & Hamilton: The emerging Digital Economy. www.ecommerce.gov

²⁶) Article “The Future of Money”, Business Week 12.6.1995.

²⁷) Article “The Future of Money”, Business Week 12.6.1995.

²⁸) Article “Bankerna knäar under IT-tyngden”, Veckans affärer 15.2.1999.

²⁹) Article “Handelsbanken växer snabbast på Internet”, Dagens Industrin 23.8.1999.

new customers every week, and it is expected that the 1,000,000 barrier will be breached in October 1999.³⁰ With 270,000 on-line customers, SEB has long been regarded as one of the leaders when it comes to “Internet banking” in Europe.³¹ The target which has been established means an additional 100,000 new customers before the end of the year. The five-year target has been fixed at as many as 5 million on-line customers in Sweden and worldwide! An expansion has already been instigated in Scandinavia and in the rest of Europe.

SEB is also one of the banks which can offer a much wider range of services on line. It is not only possible to make transfers to and from one’s own account and to other banks. Customers are also offered the option of paying bills and monitoring payments like standing orders, loan applications, and the purchase of bonus stocks and shares. Electronic invoicing is being pilot tested just now.

But the other banks have also attracted a large number of on-line customers. This is true in particular of Föreningsbanken, which with its 290,000 customers has now overtaken SEB.³² Handelsbanken has 150,000 on-line customers and Nordbanken approximately 11,000. Handelsbanken has grown most quickly as regards on-line banking, from 46,000 on-line customers in August 1998 to 150,000 in September 1999, i.e. an increase of around 225 %!³³

The newcomers - Finn

But as has already been mentioned, there are also the newcomers. One of them is Sparbanken Finn of Lund, which last year was awarded the distinction of “Newcomer of the Year” by *Privata Affärer*, as did Sparbanken Gripen of Lund.³⁴

The proportion of bank transactions which are carried out on line is high. Services are also free. Nor do the banks charge their customers or businesses fees for their cards. Sparbanken Finn also gives a higher rate of interest than average.

- Other banks manage their cards and branches as separate services, says Magnus Gustafson, who is responsible for self-service facilities at Finn. And he continues: the increase in self-service facilities and reduction in the amount of cash which is handled have reduced our costs enormously. There has been a reduction in the constant withdrawal and paying-in of cash, from which everyone has benefited. Staff do not have to count money, and we can improve the level of service.³⁵

Finn has also been a pioneer in other respects. The bank was the first in Sweden to launch a debit card for small purchases, which served as a model for Cash. This was in 1995, and

³⁰) Article “Skandiabanken – Sveriges bästa Internetbank”, *Internetworld* 1999:4 and article “Huggsexa om kunderna”, *DN* 20.6.1999.

³¹) Article “SEB ska erövra Europa med hjälp av Internet”, *SvD* 22.7.1999.

³²)Article “Handelsbanken växer snabbast på Internet”, *Dagens Industrin* 23.8.1999.

³³) Article “Handelsbanken växer snabbast på Internet”, *Dagens Industrin* 23.8.1999

³⁴) Article “Nu ska Geijer få se på grejer”, *Veckans Affärer* 27-31, 5.7.1999.

³⁵) Interview with Magnus Gustafson 13.8.1999.

the same year saw the creation of Sweden's first PC bank, which with the Internet has developed into "Datorbanken".

Self-service as a business concept

Sparbanken Finn has thus made self-service facilities a cornerstone of its business concept. Staff resources are instead being invested in giving customers personal advice. More straightforward transactions are handled by the computer or telephone banking service. Sparbanken Finn has also launched the concept of the “Bank Shop” to complement its self-service facilities. One of its Bank Shops is located centrally, directly opposite the Central Station in Lund. Generous shopping hours have been adopted. The Bank Shop, which is open from 6.00 in the morning to 10.00 at night, and manned when the shops are open, offers customers a wide range of financial services and advice.

In many respects Sparbanken Finn was the forerunner of Bank-Sverige. For example, the bank launched cash dispensers as long ago as 1969. It was not until 1977 that Minuten was introduced in Sweden.

A cashless society is coming

- A cashless society is coming, even if it will take a little time, says Magnus Gustafson, who is responsible for self-service facilities at the bank.

“Cashless Lund” has become a household expression in Skåne. The policy means that handling cash, which costs the bank (and its customers!) some SEK 40 – 50 million a year, will be limited. To this should be added losses in interest and not least security risks.

Sparbanken Finn has put the great downturn in the number of branches behind it. This happened early in the 1990s, when the number of branches was reduced from 23 to 14. Since 1995 the bank has closed eight of its smaller branches, but still succeeded in keeping over 90% of their customers at those branches.³⁶

At the same time the branches which were left have been streamlined. They were given a strengthened core competence. Customer Services for the Telephone Bank, consisting of a “call centre” in Eslöv, which according to Magnus Gustafson could actually have been located anywhere in the country, serves the Telephone Bank and deals with more straightforward enquiries.

Card transactions encouraged

Sparbanken Finn thus contrasts with the rest of Bank-Sverige in a number of respects. This applies not least to the policy which has been adopted towards both individual customers and shop owners when it comes to payment by card. Whereas some banks imposes charges – sometimes on both the customer and the shop – in connection with card transactions, Sparbanken Finn adopts a policy which is directly the reverse. Shop owners are given a bonus in connection with card transactions – receiving one Swedish krona per card purchase and extra interest on card turnover.

This has also proved successful. During the five-year period between 1993 and 1998, the number of cards grew from some 46,000 to more than 78,000. The number of card transactions increased from about 1½ million to over 5 million during the same period.

³⁶) Article “Sparbanken Finn tappade 30 Mkr”, Dagens Industri 23.8.1999.

Thus there has not only been an increase in the numbers of card customers: they also use their cards more often.

Telephone and computer banks increasing in popularity

During the 1990s, transactions changed dramatically. In 1991 cash and Minuten transactions accounted for 21% and 61% respectively. In 1998 the corresponding figures were 6% and 29% respectively. The use of cards over the same period increased from 10% to 35%. The proportion of transactions by telephone or computer bank increased from 8% to 29%.

Everyone has benefited from the development. At the same time banks can focus their resources on giving personal advice to customers.

“Banking” without branches or banknotes

The development in Bank-Sverige and the financial world as a whole seems quite unambiguous: the number of bank branches is declining, which means that large spaces can be released. The competence and know-how available at the remaining branches is being streamlined, though this scarcely requires larger locations.

The business pages in today’s newspapers are describing in bold print – and quite correctly – how the financial industry is formally storming the Internet. The investments are considerable, expansion is dramatic and profit expectations significant, when the same banking services on the Internet can be provided at perhaps one tenth the cost of the equivalent in a branch. The actual basic conditions which are needed if on-line banking is to become good business, - i.e. major cost rationalisation in the traditional bank structures – are described in much smaller print. Fewer employees and fewer and smaller branches. But we shall probably get to hear and read a great deal about this in the near future.

At the same time the flow of banknotes and coins is declining. All in all the development constitutes one of many elements in a process of dematerialisation. The society which is growing up will be a “light society”, in which many of the industrial society’s heavy structures, such as banking’s complex systems of branches and local offices, will be replaced with electronic communications.³⁷ Or should we with Rudy Puryear, senior consultant at Andersen Consulting, be talking of a “-less society” with “store-less shopping”, “campus-less education” and not least “cash & cheque-less banking”?

³⁷) Forsebäck, Lennart: “IT är svaret – Men vad var egentligen frågan?” IHM Förlag. 1998.

1.5. Digital photography revolutionises environmental activity

“Photography”, i.e. the production and development of photographic products, is part of the chemical industry, which accounts for significant impact on the environment. The most important environmental problems are the leakage into the atmosphere of gases which affect the climate, and toxic waste, which may, for example, contain residual mercury (metals) and organic substances. Waste water from photographic processes often finds its way into municipal sewage treatment works.

Many chemicals which are harmful to the environment

The environmental problems associated with photographic processes exist primarily in the seepage into water of a great number of chemicals which are harmful to the environment, including toxic organic substances which are difficult to break down, like silver and chromium. Harmful waste, as we have mentioned, is also produced.

This harmful waste consists primarily of colour developing baths, fixing baths, bleach fixing baths and other waste containing silver. The chromiferous cleaning baths which are used should also be regarded as harmful waste.

“The photographic industry”, i.e. the businesses which develop and print photographic film and paper, today consists of amateur and professional laboratories, i.e. laboratories which develop films for both amateur and professional photographers, parts of the graphics industry and radiography in the spheres of medical and dental care.

20 million m² of developed film affects the environment

Between them, amateur and professional laboratories are responsible for the greatest amount of developed film and paper with (1991) almost 12 million m² of “developed surface”. The equivalent figure for radiography and the graphics industry is approximately 6 million m², of which the graphics industry accounts for the greater part.³⁸

More recent assessments indicate that today professional photographic laboratories alone produce some 10 million m² of film and paper. Minilabs, as they are known, in the “Expert” chain of shops, for example and similar photo shops, account for a significant share of developing.³⁹ All told, the sum total of photographic processing today may involve some 20 million m² of developed film and paper.

Intensified environmental demands on the photographic industry

If we look more closely at the harmful effluent, silver compounds and chromium will be found among the chemicals which are deemed to be the most harmful to health and the environment. Within the industry, attempts have been made to tackle the problem by on the one hand recycling and treating process waste, and on the other by using closed – and thus waste-free – systems.

³⁸) Industry data “Fotografisk verksamhet”. Naturvårdsverket, March 1994.

³⁹) Interview with Christer Erntson, Linköping, 19.10.1999.

In 1994 the Swedish Chemicals Inspectorate undertook a study of photographic chemicals and the environment.⁴⁰ The study resulted in heightened demands for, amongst other things, manufacturers and importers to provide an analysis of the properties of products which are harmful to health and the environment, demands for the use of less harmful chemicals in production, and expanded requirements for product data.

Digital technology revolutionises environmental activity

But gradually digital technology is penetrating the photographic industry. This applies in the graphics industry, in radiography departments serving hospitals and dental surgeries, and in the longer term amateur photography as well.

To the graphics industry, the adoption of digital technology represents a revolution from the point of view of the environment. Digital printing renders photographic developing chemicals and film redundant. No printing plates are required, and there is no discharge of damping water. Printing machines similarly require minimal cleaning.

Environmental gains on a number of levels

Photographic laboratories and studios mostly already operate digitally. In the digital process, which is now on the point of breaking through in the industry, stages such as scanning, mounting, manual proofs and printing disappear. If you go direct from a digital document to a plate, the film disappears.

Many companies in the graphics industry now offer to keep a digital archive for their customers, which – in combination with what is known as Print on Demand – also reduces the need for storage. Proofs can be transmitted digitally for local printing. All in all there are thus significant environmental gains on a number of levels.

Looking at amateur photography, digital technology is growing rapidly. This is happening from a low level – perhaps 0.5% of the entire market at present. But with an increase of some 100% a year, digital photography will become a factor to reckon with even in the private market.⁴¹

Kodak invests in digital technology

Kodak is investing seriously in digital technology, both in the USA and in the rest of the world.⁴² In conjunction with AOL (America On Line), for example, the company, has created the “You have got pictures” service, which gives the renowned photographic giant an Internet identity. The customer can leave his films at any chemist, and later download them over the Internet.

- this may gradually become as big as e-mail, says Barry Schuler, Managing Director of AOL’s Interactive Services.

⁴⁰) “Fotokemikalier – farligt? Tillsynsprojekt fotokemikalier”. Report by the Chemicals Inspectorate 1994:1.

⁴¹) Interview with Christer Erntson, Linköping, 19.10.1999.

⁴²) Article ”Kodak places its digital bets”, Business Week, 2.8.1999.

Kodak is also making a bid to invite its customers to get their photographs on CD, providing high-resolution imagery on the home PC.

Digital camera for SEK 10,000

Digital cameras are gradually gaining ground in comparison with conventional technology. The market is judged to be growing by a total of about 25% a year, and it is estimated that in the USA alone turnover will be approximately USD 6.5 billion in 3-4 years' time.⁴³

In Sweden good-quality digital cameras are currently being sold to the private market for about SEK 10,000. The cameras, which weigh 3-400 grams, work largely in the same way and with the same degree of refinement as conventional cameras, e.g. zoom, autofocus etc.⁴⁴ There is every indication that they will soon undergo further development, while prices come down.

Digital radiography reduces stress on the environment drastically

The processes which are used in connection with radiography generate waste which per unit of film developed has a greater impact on the environment than the graphics industry and conventional amateur photography. Against this background, amongst other things, many local authorities, including those in Stockholm, are now seeking to replace the conventional process with digital technology.

One of the main motives for local government in Stockholm – and for a number of other local authorities, where a similar trend is in evidence – is an ambition to protect the environment. Digitisation of radiography means that the need for X-ray film and photographic chemicals will in time disappear. For local government in Stockholm alone, digitisation of radiography will mean a significant reduction in the impact on environment:⁴⁵

- reduction in use of X-ray film – approximately 230,000 m²
- reduction in use of developer – 100,000 litres
- reduction in use of fixer – 120,000 litres

Investment in digital radiography will have other positive consequences for the environment, e.g. reduced doses of radiation for both patients and staff. The need to move individual X-rays between hospitals, which is at present usually done by car, will be reduced or disappear. It will also be possible for duty doctors and other medical staff to attend to some of their work from home, and thereby avoid having to travel in to the hospital.

⁴³) Article “Kodak places its digital bets”, Business Week, 2.8.1999

⁴⁴) Article “Proffset testar digitalt”, Aftonbladet IT, week 41 1999.

⁴⁵) Article “Nytt om miljö”, Stockholms läns landsting”, <http://192.44.242.74/miljo/nytt>

Sös Hospital reduces floor space by 1,800 m²

As part of rebuilding, Södersjukhuset Hospital is currently moving its radiography department to new and more appropriate accommodation. An image diagnosis centre will be created at the Hospital, in which radiography will be completely digitised. Since there will no longer be any need for X-ray film, the use of the heavy metal silver will be reduced by about 200 kg a year. At the same time 40,000 litres of photographic chemicals and waste consisting of almost 2 million litres of contaminated rinsing water will also disappear.

Floor space will be reduced by about 1,800 m² in connection with the changeover to digital radiography. At the same time the operating time for radiography equipment will rise from the current eight hours to twelve hours which will drastically improve the service to patients. Direct financial savings are estimated to be approximately SEK 8 million. To this should be added a significant reduction in impact on the environment, an improvement in the working environment and in quality of work, more effective utilisation of doctors' experience and increased availability for patients.

An explosion in the use of digital dental radiography

Digital radiography will thus result in a dramatic reduction in the impact which health care has on the environment. A similar trend is apparent in dentistry. In France, more than a third of all dentists are already using the technology, which – in addition to the consequences for the environment – also brings a number of other advantages.⁴⁶

As soon as an exposure is available, the image can be studied on the VDU – by both dentist and patient. Details in the image can easily be enlarged, and in the case of a more complicated operation, such, for example, as a root-filling, photographs can be taken continuously during treatment. As radiographic imaging sensors are more sensitive to light, the radiation dose can be reduced considerably.

Britt Råbock, a dentist in Östersund, who has used digital radiography for a few years, sees considerable advantages. These include shorter treatment times, and the capacity to show patients exactly what their teeth look like. The investment soon repays itself, since conventional development takes about seven minutes and costs about SEK 25 for each frame.

- I believe that there will be an explosion in a few years, says Britt Råbock. Then everyone will want to have digital dental radiography.

Major financial gains

There are also major financial gains viewed from the perspective of dentistry as a whole. In Nynäshamn the National Dental Service Clinic has gone over to digital radiography.⁴⁷ The internal working environment has improved significantly, amongst other things

⁴⁶) Article “Digital röntgen sparar tid och miljö” i KTH-nytt 1996:6 www.admin.kth.se/info/kth-nytt/6-96/rontgen.html

⁴⁷) Article ”Nytt om miljö”, Stockholms läns landsting”, <http://192.44.242.74/miljo/nytt>

because radiation doses have been significantly reduced. The safety aspect has also improved. To this should be added the direct financial gains, which are considerable.

Consumable items and the removal of the harmful waste associated with what is known as manual radiography used to cost the National Dental Service about SEK 35,000 a year. These costs have now been reduced to about SEK 4,000. The digital radiographic equipment which has been installed at Nynäshamn costs about SEK 100,000. The investment will thus soon show a profit, even if account is only taken of the direct financial gains.

2. SUSTAINABLE MOBILITY

2.1. Environmentally-friendly shipment of food

Historically, there has been a close relationship between economic growth and the development of GDP on the one hand, and an increase in shipments on the other. The acceptance of JIT, “just in time”, when it comes to deliveries, has broken this connection. Shipments, measured as kilometres per vehicle, are now increasing more rapidly than GDP in the West. Today this constitutes perhaps the greatest threat to sustainable long-term development.

Shipments of agricultural products and food account for a significant proportion of haulage activity, approx. 13% of the combined volume of shipped goods or 18% of haulage in tonnes per kilometre which is carried out on major roads.⁴⁸

Load factor less than 50%

Nowadays, food is distributed with little concern for the environment. Nor does there seem to be any great concern for cost. Deliveries are increasingly made using vehicles which are designed for a specific type of food, such as milk, meat or bread. To some extent this is necessitated by special temperature, packaging and handling requirements in conjunction with the shipments. The “just in time” requirement for deliveries also results in food being delivered in small quantities to each distribution point.

The average load factor associated with the shipment of food is less than 50%. To put it simply, a large number of manufacturers and wholesalers deliver a large number of consignments to a large number of – largely the same – retailers.

Third-party logistics provide new opportunities

What is known as third-party logistics releases the manufacturer and/or wholesaler from any responsibility for shipments, transferring it to specialised haulage and logistics companies. These companies do not need in turn to build up special stores. Instead they can use computer and telecommunications support to co-ordinate collection from a large number of producers or wholesalers in the most effective way possible, and make deliveries to a large number of retailers – by the shortest possible route. This sometimes requires that the food is packed in a certain way, and that the vehicle may have to be divided up into sections for different types of food.

The Swedish University of Agricultural Sciences has recently undertaken a study in the Uppsala region in association with the local authority and the Transportforskningsinstitutet (Institute of Transport Research) with the purpose of looking more closely at opportunities for co-ordinating the distribution of food.⁴⁹ The main purpose of the project was to cast light on the role which IT can play when it comes

⁴⁸) Gebresenbet, Girma: “Effective food distribution in and around Uppsala town through co-ordination and route optimisation”. Sveriges Lantbruksuniversitet, Inst. För Lantbruksteknik, December 1998.

⁴⁹) Gebresenbet, Girma: “Effective food distribution in and around Uppsala town through co-ordination and route optimisation”. Sveriges Lantbruksuniversitet, Inst. För Lantbruksteknik, December 1998.

to using co-ordination and dynamic route-planning to produce distribution systems which are both economically effective and ecologically viable. It was also an unexpressed objective of the project that distributors should be able to reduce the costs of transport, the household should be able to store the minimum possible amount of products, and society should benefit from a reduction in the demands made on the environment.

All parties can be winners

In other words all parties should be able to be winners. The purpose of the study was to optimise the activity on a number of levels, for every individual route, for every company, for companies which distribute similar products and for the group of companies which took part in the project as a whole.

To this end a number of different parameters were studied:

- time required for different stages (e.g. loading and unloading, driving, stopping at different distribution points with engine running/switched off)
- effective exploitation of vehicle fleet
- goods as weight at each delivery
- distance, speed and road conditions
- geographical location of manufacturer, store if appropriate and distribution points
- emissions into the atmosphere

A dozen or so companies took part in the project – bakeries, wholesale butchers, wholesale florists and distribution companies.

Three data systems

Three systems were used to measure and analyse the routes and evaluate impact on the environment. GPS was used to record distribution routes, locations of manufacturers/wholesalers and distributions points, and vehicle speeds. A special system – LogiX - was used to plan routes, which allowed shipments to be simulated and optimised, and estimates made of savings in distances travelled and journey times. Finally a dynamic simulation model – MODTRANS – was used to describe the flow of materials and calculate vehicle emissions.

Deliveries were made to some 15 shops, restaurants, schools and day nurseries. The study compared actual journeys, on the basis of the drivers' experience and local knowledge, using the best routes as calculated by the computers.

58 % fewer delivery runs and half the emissions

The comparison revealed a number of interesting results. It was possible to reduce the total distance covered by 39%, the number of vehicles by 42% and the number of journeys by as much as 58%!

As will be seen from the Table below, it was possible to reduce the number of vehicles – while maintaining the number of shipments – from 19 to 11. This alone represents a significant saving from the point of view of both company finances and the environment:

Parameters	Non-optimised	Optimised	Reduction, %
Distance, km	4,322	2,636	39
Vehicles	19	11	42
Journeys	38	16	58

Among other things, the study of the impact on the environment analysed the weight of a load, idling time, and the geographical distribution of the rounds. It was apparent that all emissions (CO, CO₂, No_x, HC and S) were reduced by half as a result of optimising deliveries. Emissions of carbon dioxide, for example, fell from 2,447 kg to 1,272 kg.

Extensive duplication of effort during deliveries

There are a number of explanations of the considerable impact which is apparent in the shape of reductions in cost, journey times and impact on the environment. For one thing, it was apparent that many of the distributors had located their businesses in close proximity to one another. They also shared a large number of customers, with the result that they in effect were actually playing “follow my leader” when making deliveries. In other words, deliveries involved a significant amount of duplicated effort.

It was also apparent that the shortest possible route was seldom used. Instead deliveries often observed a given order of priority – regardless of distance and route. The first to get their deliveries were shops, followed by restaurants. Then schools and day nurseries received their orders. The study also revealed excessive idling time in connection with unloading and delivery.

The Swedish National Road Administration’s Environment Prize - 1999

Taking the study’s findings as its point of departure, a project has now been launched which involves some 30 or so shops in the commercial centre of Uppsala. One of the haulage companies taking part in the project is Skandi System AB, which in 1999 won the Swedish National Road Administration’s Environment Prize. The National Road Administration justified its decision as follows:

“Skandi System, a haulage company in Uppsala, has made extensive efforts to make the company more effective and at the same time reduce its demands on the environment.

The company has actively sought to co-operate with researchers and engineers. It has made use of the latest information technology in a way which shows how a fresh and unbiased attitude to information can yield dividends, both for the environment we share and for the company.”

A profitable environmental package

- When we started on our environmental and quality activity, we soon realised that it brought both financial and environmental advantages, says Catherine Löfquist, environmental co-ordinator at Skandi Systems.⁵⁰

Environmental thinking within Skandi Systems is based on a number of premises: joint loading, co-ordination of delivery rounds, alternative fuels, most effective use of vehicles, and a new transport management system. Combined, this resulted in cost savings to the company of 20-25%. At the same time impact on the environment in the shape of the emission of pollutants was reduced to a similar extent in both urban Uppsala and in the wider Mälardal region, which is Skandi's area of operation.

- Investment in the environment has also been profitable for the company, says Catherine Löfquist. Customers have flooded in and we are forever having to enlarge our lorry park. We now have 60 vehicles, most of them running on alternative fuels - rape-oil and biogas. The older vehicles are gradually being phased out and replaced with alternative vehicles which are more environmentally friendly.

Joint loading as a business concept

Joint loading plays a central part in Skandi's business concept. As was mentioned above, the distribution of perishable goods in urban areas currently involves a large number of vehicles which drive to and fro collecting and delivering their products. Sometimes they must also queue outside the entrances to shops and in loading bays. Skandi invites long-distance hauliers to discharge their loads at Skandi, which will then distribute them to customers, shops, restaurants, schools and day nurseries etc..

- Joint loading allows loads from a number of suppliers to be handled by a single vehicle rather than perhaps 4 to 5 different vehicles, says Catherine Löfquist. In this way we cut down on a large number of unnecessary journeys. We save money and reduce emissions into the atmosphere.

GPS indicates the nearest vehicle

In co-operation with a number of data companies Skandi has also built up a new transport management system. 40 vehicles have already been fitted with GPS, and the other 20 will soon be fitted with the same equipment. This allows the transport manager to see where different vehicles are on his VDU screen. The vehicles appear as numbers on the map on the screen. The traffic manager can always use the vehicle which is nearest, and which is most suitable whenever a customer asks for transport. For the customer this also means an improvement in service and a reduction in the distance travelled.

The transport management system also makes it possible to estimate the best route in advance. Any unusual features will be recorded immediately, including both environmental and safety factors. Valuable shipments, for example, can be monitored, and doors and cabinets locked by the transport manager. As a last resort the transport manager can choke the fuel supply to get a vehicle to leave the planned route.

⁵⁰) Interview with Catherine Löfquist 9.11.1999.

Co-ordinating journeys to shopping centres.

Efforts are now even being made to launch a project which involves a number of shops in the centre of Uppsala co-ordinating their deliveries. The project is dependent on the two shopping precincts in the centre of Uppsala. One of these, St Per, with its total of 34 shops, is managed by Margareta Engström:⁵¹

- I can see only advantages in co-ordinating trade deliveries to the shopping precinct, says Margareta Engström. Our goods-inward is at present under considerable strain. At the same time it is obviously important that delivery schedules should be maintained and also that costs should not rise as a result of the extra transfers of loads which will be required.

- The impact which deliveries to the shopping precinct have on the environment is

being measured at this very moment. In parallel with this the shops in question are considering their attitude to participation in the project. If our requirements in respect of delivery schedules and costs are satisfied, it will obviously be in our interests to continue, says Margareta Engström. It would also have a positive impact on the environment. Many of our shops currently get a number of deliveries every day.

A sixfold increase in effectiveness?

The significance of the logistics concept which Skandi represents should not be underestimated. Small consignments by private car, i.e. company car, currently represent 50% of all loads, while at the same time they represent 94% of all deliveries.⁵²

In a study, TFK, the Institute for Transport Research, has compared urban distribution for a typical company car with a large wholesaler who co-ordinates deliveries from hundreds of suppliers such as ICA and KF or ASG and Schenker BTL.⁵³ The study shows that deliveries by company car account for 48 metres per kilogram of distributed load against 8 metres in the case of the large wholesaler, in spite of the fact that quite similar product groups were involved. In theory there should be scope to increase the effectiveness of deliveries, currently made by company car, by a factor of six!

“Smart city logistics” save millions

A study with its point of departure as the conditions in the Stockholm area has indicated considerable scope for reducing numbers of vehicles, distances covered and journey times in minutes by the adoption of IT-based co-ordination of deliveries by company car.⁵⁴ A simulation based on the LogiX route-planning system indicated potential savings in respect of distance travelled (54%), journey times (51%), number of routes (68%) and number of vehicles (60%).

⁵¹) Interview with Margreta Engström 11.11.1999.

⁵²) Kristiansson, L. & Pettersson, M.: “Varudistribution i innerstad. Möjligheter och hinder för en samordnad livsmedelsdistribution.” Chalmers Tekniska Högskola. Stads- och Trafikplanering. 1996.

⁵³) “Intelligent citylogistik ur ett samhällsperspektiv - CITYLOG”. TFK. Publikation 1997:23

⁵⁴) Wetterwik, H, Henriksson, A. & Sörensen, H.: “Samordnad varutransport – möjligheter och hinder. Om firmabilens roll i en uthållig varudistribution”. TFK Rapport 1998:6.

To this may be added any other conceivable scope for co-ordination which the study does not analyse in greater detail, e.g. scheduling the use of vehicles more effectively by combining different types of products which have different requirements as regards delivery times. In fact, company cars are nowadays only used in the morning. According to the study in question this means that the vehicle fleet is only used at 17% of capacity, which must be regarded as a very low rate of use.

The concept of “smart city logistics” can thus yield considerable dividends, both financially for the company and for the environment thanks to the way in which IT is used to co-ordinate deliveries from the point of view of both geography and scheduling. A reduction in the numbers of vehicles on the town’s roads will also release new spaces, which can be used, for example, for walkways and car-parks. In addition, businesses in the centre will have better opportunities to assert themselves against out-of-town establishments, hypermarkets and supermarkets, which otherwise enjoy competitive advantages in the shape of low distribution costs and rents.

2.2. The Dutch government invests heavily in IT for traffic management

The Netherlands is the most densely populated country in Europe, with around 375 inhabitants per square kilometre, as compared to around 20 in Sweden. The country also has to cope with a high level of through traffic, both in a north-south direction and vice versa, and from the large container terminal in Rotterdam to a series of European destinations. The Dutch economy is also heavily dependant on foreign trade, with imports and exports representing around 50% of GDP.

These factors naturally place great demands on transport infrastructure and traffic-management solutions. Amongst other things, the Dutch government is investing in so-called transport telematics: IT-based solutions to improve the efficiency of traffic management and reduce environmental pollution. The objective is ambitious: a 25% reduction in the number of "vehicle hours", i.e. the time spent by passenger cars, transport vehicles, etc. in traffic.

The objective is set out in the programme for the period 1998-2003: "Telematics in traffic and transport". Dynamic traffic management with IT support is the recurring theme of the action programme. Concrete examples are given of applications to all modes of transport, private motoring, public transport by train, bus and plane, and transport by road, rail and water. The latter is relevant both in connection with the major port at Rotterdam and the many canals, which are the most developed in Europe and carry an annual freight volume of around ¼ billion tonnes.

Less pollution

There are many motives behind the Dutch government's investment: to improve the utilisation of existing infrastructure, increase access to the economic centre of the country, add value to the transport industry which is so important for the country, improve the levels of service for travellers and transport operators and, not least, reduce pollution.

- The latter is an important goal for us, says Job Klijnhout, a member of the team which drew up the programme.⁵⁵
- A number of financial considerations lie behind the government's investment, but there is a clear environmental aspect to all the measures being supported, says Hans Zwijnenberg, who also took part in the work to draw up the programme. Reducing queues and shortening the distances travelled will reduce the amount of pollution produced.
- There are other common themes behind the Dutch investment, says André Oldenburger, another Department member of staff who helped draw up the programme. These include "implementation through market orientation" and a "chain approach", the aim of which is to use IT solutions to enable different modes of transport to work together more effectively in a chain. This makes it possible to provide "door-to-door" solutions for both private journeys and transport operations.

Electronic detector loops

⁵⁵ Interviews with staff in the Dutch Department of Transport carried out on 14-16 June 1999.

These are market-oriented in that households and companies are willing to pay for high-quality traffic information. The collection, processing and distribution of traffic data can serve as an illustration. The State-run Traffic Information Centre (TIC) is responsible for gathering information from the 3 000 electronic detector loops now covering the whole of the Dutch motorway system. This network currently registers all signs of congestion in real time along the busiest 600 kilometres of road.

TIC also collects data on, for example, weather conditions, roadworks, ferry departure times, etc. The information collected is then processed by TIC's computers. The result is a consistent and reliable overview of traffic patterns in real time. The system not only gives information on the length of queues but also on the estimated queuing time.

Commercial distributors deliver information

A series of different commercial distributors are responsible for delivering the traffic information to the final user. Existing radio stations are still the most common way of passing on traffic information. ANWB, the Dutch equivalent of the Swedish *KAK* or *Motormännenn*, broadcasts traffic information following news bulletins. However, an increasing number of motorists are using the digital service RDS-TMC (RadioData System - Traffic Message Channel), which gives continuous information direct from the computer.

Many of the traffic navigation systems now being introduced in the Netherlands also use information collected by the TIC. The information is also available on the Internet. For around SKK 250, Reis Routes, a company based in The Hague, will provide a "journey planner" in the form of a CD ROM providing information, and above all advice, on the best route to avoid traffic congestion. The "journey planner" gives static information, based on traffic statistics for different sections of road at different times of day, but can be supplemented with a network service providing up-to-date information on the actual traffic situation in real time.

Free-text panels give real-time information

In the west of the country, including the Rotterdam area in particular, an advanced system has been established using so-called DRIPS (Dynamic Route Information Panels), i.e. free-text panels providing real-time information for motorists. The panels provide information on the actual length of queues and the estimated travelling time by car from The Hague to Rotterdam, the least congested ring road around the city at the time, etc.

Detailed road traffic information is also an integral part of another government objective relating to traveller-information. High quality, reliable and up-to-date traffic information will help to break down barriers to using public transport.

17 million traffic tips a year

With regard to public transport, a considerable amount is currently being invested in the so-called OVR, a travel information service provided by the public authorities in cooperation with commercial players, including KPN, the Dutch telecommunications company (equivalent to the Swedish *Telia*). The starting point is to provide travellers with the best "door-to-door" solution, 24-hours a day, in cooperation with different operators, in particular train and bus companies.

Each year, OVR receives around 17 million calls to a special call centre. The caller pays NLG 0.75/minute for this service, or just over SKK 3. The same service is also available (free of charge) on the Internet.

OVR is now moving in the direction of voice recognition and speech technology to develop the traffic service even further. At present, the technology is only used in connection with train services, but is being developed to provide "door-to-door" information. Speech technology solutions are also being developed to provide "speech to text" and vice versa.

"Multimodal" solutions

As mentioned above, the Dutch approach places great weight on so-called multimodal transport solutions. The MRI project (door-to-door journey planning for both goods and passenger transport) aims to provide a single source of integrated information with full coverage of all types of transport and ways of combining them to the best advantage of travellers. Amongst other things, there is a CD version of MRI providing information on the whole of the public transport system, public footpaths, cycle paths and all larger roads and statistics on traffic congestion, parking facilities, etc.

A similar CD ROM has been produced for transport companies and other professional users. Both CDs can be supplemented with on-line information on, for example, detours, delays, queues, etc. MRI was initiated by the Dutch government, but is now operated by a private consortium.

Another aspect of the Dutch government's initiative is the LBS (Logistical Management System). This is an instrument to optimise public transport with regard to punctuality, reliability and use of resources.

More attractive public transport

The difference in travelling time between public transport and cars is described in terms of a mobility factor, or VF. Experience shows that when this factor is higher than 1.5, the public transport option is regarded as less attractive.

Today, barely 13 of the 25 most-travelled routes in the most densely populated areas of the Netherlands achieve the figure of 1.5. Using the LBS makes it possible for around 20 of the routes to achieve that figure, and drastically improves the rating of the remaining 5 routes.

Your left hand is your ID card!

There is a good deal of innovation and creativity in the Dutch transport industry aimed at reducing lead times, improving transport efficiency and thereby also reducing pollution. The container traffic in the Rotterdam terminal is increasing steadily, in line with increasing trade. This requires advanced logistics. In response to this, the Cargo Card project has been developed in cooperation between Rotterdam's municipal port authority and commercial operators in the port.

Most drivers, usually those who use the port most regularly, are given a Cargo Card (a smart card which also contains biometric data on the driver's left hand), in principle a type

of extended fingerprint. This simplifies the work of the stevedores when checking the collection and delivery of containers.

All the necessary information on the contents of containers, the sender and recipient, etc., are managed by EDI. Loading and unloading take place automatically as soon as a driver is "legitimised" by holding up his left hand in front of a screen. In principle, not a single document is required for loading or unloading. The driver does not even need to leave the vehicle. Even if the infrastructure for warehouse space, loading and unloading equipment, etc. remains the same, the number of containers handled can be greatly increased. Waiting times are also reduced and the existing vehicle fleet can be used more effectively. The innovation will also lead indirectly to a reduction in pollution.

Innovation from the Dutch government

The Dutch government has also adopted an innovative approach in many areas. The government's action programme describes four different phases in the development of passenger transport, with the focus changing from questions of technology, traffic and transport to an overall view of transport services and customer orientation. In parallel with this development, IT has become an ever more important resource.

In the first phase, the main public-sector objective was to build and maintain the physical infrastructure, and finance public transport. In the second phase during the 1980s and 90s, the focus was more on optimising logistics and using existing infrastructure and transport capacity more effectively.

In the current stage, the so-called multimodal approach is in focus, i.e. individual travellers must be given the information, support and advice they require to combine different means of transport, walking and cycling, public transport, private cars, taxis, etc. in an optimal way with regard to each journey being undertaken. This should apply to both private and public transport. Telematics play a vital role in this new concept. It also opens up completely new possibilities with regard to policies to encourage "green" travellers through taxation and other means.

From mobility to accessibility

A further shift is occurring, according to the action programme, from the concept of *mobility* to that of *accessibility*. This involves those responsible for premises and facilities such as shopping centres, congress and exhibition halls, theme parks, large office developments, etc. assuming increased responsibility for the transport links to their premises. The town plan adopted for the city of Utrecht is one example of this innovation. A consortium building a new shopping centre may find it too expensive to build parking facilities adjacent to the centre. It may therefore have to look for other solutions, for example a dedicated bus service taking customers to and from the centre (a service already offered by IKEA), perhaps in connection with a home delivery service. A separate solution would be to build a so-called "transferia" offering parking facilities separate from the shopping centre, collection by bus, delivery of the goods by a taxi delivery service, etc.

- The market has to provide intelligent service solutions, says Hans Zwijnenberg. Advanced telematics are essential if this is to be possible.

"Tele-activities" - an alternative

Following on from this development, the action programme sets out another aspect of the move from mobility to accessibility. Ever more companies and public institutions are seeking alternatives to the high cost of premises. This is making may "tele-activities", such as teleworking and distance learning, more attractive.

The Dutch government has also grasped the nettle and encouraged its own departments, not least the Department of Transport, to employ teleworkers. Trials were started as long ago as 1989.

- Do not travel or transport goods unless it is absolutely necessary, says Tanja van Beek, under-secretary of State in the Department of Transport.⁵⁶ Tanja van Beek estimates that around 50% of the Department's 12 000 employees could work at home. She also calculates that this would result in a 15% saving on the cost of premises.
- We must change our habits as consumers and our way of working and living, says Tanja van Beek. Until now, we have built motorways and laid rails to improve mobility. We now see that the solution does not lie in that direction. The Dutch government has started to apply "behaviour-altering" methods to change the trend.

⁵⁶ Forsebäck, L.: *Telemanagement - Hur man skapar och leder en flexibel organisation* ("Telemanagement - How to create and manage a flexible organisation"). IHM Förlag 1997.

2.3. Environmental improvements and increased profitability go hand in hand

"You breathe in what we breathe out" and "We drive less and think more". That is how the Norwegian transport company Tollpost-Globe presents its attempt to reduce the number of transport operations and thereby help protect the environment. The company is a European leader in the field of advanced logistics and environmental awareness. This background was one of the factors which led the European Union to choose Tollpost-Globe as a partner in the environmental project Green Trip.

- The whole thing began around 10 years ago, says Jørn Kveseth, the project leader, and also a head of department at the Oslo central traffic management centre. We started to develop an electronic register of addresses and roads in cooperation with *Telenor* and *Kartverket* (equivalent to the Swedish *Lantmäteriet*).⁵⁷
- We could see the potential of supplementing the computerised, but static system for optimising transport with a dynamic system providing information on the actual positions of vehicles at any particular time.

The Green Trip project

The partners in the EU Green Trip project, other than Tollpost-Globe, are SINTEF, a research institution focusing on applied mathematics affiliated to NTNU (the Norwegian University of Science and Technology, Trondheim); the University of Strathclyde, regarded as a world leader with regard to transport optimisation, and the French software company Ilog, which will market the final product. Another partner is the Italian company Pirelli, which produces cables as well as tyres. Pirelli's motive for becoming involved in the project was to select optimal locations for both warehouses and production plants in Europe.

The project had a budget of just over NKK 43 million, half of which was contributed by the EU.

The goals for the project were to improve transport capacity and reduced journey lengths using advanced technology, and considerably reduce environmental pollution as a result.

Journeys reduced by 25%

The results, which are now available, can be summarised as:

- fewer and shorter transport operations, in all a 25% reduction in journey lengths
- more efficient use of the vehicle fleet
- a better planning tool which can also improve the quality of the service provided (not least in terms of punctuality)
- a 10 % cost saving

⁵⁷ Interview with Jørn Kveseth held on 19 May 1999.

Environmental improvements, quality gains for the customer and higher profitability therefore go hand in hand.

Even the static, computerised route planner had considerable advantages when it came to optimising the use of the vehicle fleet. The statistical factorials give the theoretical number of combinations. If a driver has to make 6 deliveries or pick-ups in one journey, there are 720 possible solutions. If a transport vehicle has to carry out 50 tasks in a day, in theory there are as many as 10^{65} (10 to the power of 65) different solutions!

The system must be dynamic

Tollpost-Globe has to deal with around 3000 transport operations in Oslo on a daily basis. Against this background, the computerised route planning system is a vital planning tool. The system has no dynamics, in itself, however. It cannot take account of loading or unloading taking less time than expected. Above all, the system cannot predict the actual driving time, which is largely determined by the traffic situation.

- in transport terms, every day is different, says Jørn Kveseth. That is also why a dynamic system is needed, to make it possible to modify the daily route plan for each individual vehicle.

The cornerstones of the system being used by Tollpost-Globe are the geographic information system GIS, the global positioning system GPS and mobile telecommunication. GIS has been used to build up the so-called ELVEG, a database which also contains addresses. The database is updated 10 times a year with regard to street addresses, new roads, etc., and twice a year with regard to so-called characteristic data, such as speed limits, one-way streets, "no left turn", etc.. A system of mobile telecommunication between traffic management and drivers has been established in cooperation with TeleNor Mobil. The former Mobitex is now being phased out in favour of GSM-based communication. GPS is being tested in parallel to this.

Traffic management always up-to-date

Each individual item to be delivered or collected is marked with a barcode. Each box collected or delivered is scanned into the hand terminal carried by each driver in connection with each job. As the barcode also contains information on the address, this gives the traffic management up-to-date information on the location of each vehicle.

- On average, each vehicle in Oslo carries out 7 jobs per hour, says Jørn Kveseth. This means that there are around 9 minutes between each task. On average, therefore, no information is more than 4-5 minutes old. This means that the traffic management always has up-to-date information on the location of a vehicle, both in physical terms, on the map, and in terms of a street address.

Customers on the net can also obtain information on the location of their consignments with a special password.

- The big advantage is the scope for dynamic planning, says Jørn Kveseth. Traffic management can now make continuous changes in the route plan throughout the day in the light of new consignments of goods, new collection orders, etc.

- At the moment, 3000 orders are placed each day in Oslo. Those placed before 12:00 must be carried out on the same day. In future, when we have improved the system even further, we may be able to set a "deadline" of 14:00 or even 15:00 and still carry out the order on the same day.

Good experience with GPS

Tollpost-Globe has also tested the satellite navigation system, GPS, during the research period. The results are good, but it is doubtful whether the advantages of the system in terms of precise positioning in real time are in proportion to its costs.

- There are also other aspects to be taken into consideration, says Jørn Kveseth. *Norska media* would like to promote the use of GPS as a means of enabling companies to monitor and control their drivers. Drivers do not regard this as a problem at all. On the contrary, they emphasise the increased security of having the traffic management permanently aware of the position of the vehicle with regard to the risks of attacks, theft and hijacking of whole cargoes of goods particularly liable to be stolen, such as alcohol or tobacco.

The Green Trip project is now drawing to a close. In June 1999 Tollpost-Globe and the other partners submitted their final report to the EU. In the autumn the broader implementation will be prepared and in early 2000 successive new projects started outside Oslo. The next cities in line are Fredrikstad, Halden and Moss, followed by Drammen, Skien, Porsgrunn...

One system for the whole of Europe

The perspectives are even broader than that, however. The enthusiasm shown by the EU for the project is naturally due to the vision of a future characterised by even more serious environmental problems. Paris, London, Madrid, etc. would be able to optimise transport operations in a similar manner, thereby reducing environmental pollution.

- We now carry out fewer, shorter transport operations, and they are also more effective, says Jørn Kveseth. Everything indicates that we will be able to achieve a 25% reduction in the distances travelled using the dynamic route-planning system. Perhaps the final evaluation will show the reduction to be only 20%, but it could also be as high as 30%.
- It is interesting to compare the effect this has on the environment in relation to all the efforts now being made or planned to make the actual vehicles more environmentally friendly. If all the measures were taken - alternative fuels, catalytic converters, biodynamic oils, environmentally friendly tyres, measures to reduce air and roll resistance, water-based paints and freon-free cooling fluids and antifreeze - you name it - the damage to the environment would be reduced by only 3-4%. Against that background, the 25% reduction in environmental damage which we can achieve through dynamic route planning is certainly not to be sneered at, says Jørn Kveseth. He adds: - it also does no harm if environmental improvements and increased profitability go hand in hand!

2.4. The company that reduced home-to-work travel by 75 000 km/year

Siemens Nixdorf is one of the pioneers in the field of teleworking in Sweden. The project began when the company relocated from Solna to Upplands Väsby in 1994. Various studies have indicated the advantages of teleworking for both employees and the company, eg increased productivity and quality of work, reduced staff turnover and less sick leave. However, there are also a series of benefits in terms of the energy bill and environmental impact.

Fabian von Scheele and Kjell Ohlsson at Luleå Technical University have looked at these questions in greater detail and carried out surveys and studies among the 200 or so employees of Siemens Nixdorf.⁵⁸

75 000 km/year reduction in home-to-work travel

The company has made a saving on travelling time corresponding to some 5 400 hours/year. The total reduction in distance travelled is estimated at 74 600 km/year.

Of course, these figures cannot simply be extrapolated for the entire labour market in Greater Stockholm, let alone for Sweden as a whole. Nevertheless, some hypotheses can be made. In the case of Siemens Nixdorf, teleworkers "saved" about 19 km on average every day they worked at home instead of going to the office (almost exclusively by car). Applying this to the entire Mälars region, ie the counties of Stockholm, Uppsala, Södermanland and Västmanland, we can come up with a hypothesis on the basis of what we know about the scope and potential for teleworking.

250-300 million km/year can be saved in the Mälars region

We know that 115 000 employees in the region work at home at least one day a week.⁵⁹ That should represent an annual saving of 19 km x 45 working weeks x 115 000 employees = 98 325 000 person-kilometres. We also know that in the Mälars region there are a further 205 000 or so employees who do not at present work from home, but feel that they could do so, bearing in mind the sort of job that they do. That represents a potential further saving of 19 km x 45 working weeks x 205 000 employees, ie 175 275 000 person-kilometres.

All in all, some 273 600 000 person-kilometres, or in round figures between 250 and 300 million kilometres/year could be saved on travelling in the Mälars region.

This is a hypothesis, and it is possible that the average distance travelled to and from work in the region is not 19 km but rather shorter or longer. At the same time we know that in the country as a whole 30 % of the population travels more than 10 km (each way) between home and work. We also know that many teleworkers work at home more than one day a week on average.

Another study has been carried out by the Swedish Institute for Communications Analysis (SIKA) based on a 1995 SCB survey which indicated that some 325.000 employees were

⁵⁸) Von Scheele, Fabian & Ohlsson, Kjell: "Time, efficiency and quality". KFB report 1998:10.

⁵⁹) Mälars Valley Council report "The Mälars Valley in the IT society", 1998:1

engaged in teleworking. Assuming that they work at home on average one day a week and that 75% of journeys to and from work are made by car with an average distance of 23 kilometres and an occupancy factor of 1.1 persons/car, this produces a saving corresponding to 0.4-0.5 billion vehicle-kilometres this year corresponding to about 3% of all home-to-work travel by car.⁶⁰

80.000 litres of petrol saved and 52 tonnes of paper recycled

- According to Fredrik Sandberg, who is now responsible for teleworking at the company,⁶¹ their new way of working has saved some 80 000 litres of petrol/year.

Siemens also makes another contribution to achieving a sustainable society. Together with teleworking, or mobile working as the company prefers to describe it in connection with the relocation in 1994, the company also created the flexible office. At a stroke it halved the amount of office space that needs heating, cooling, maintaining and cleaning all year round, making a considerable saving on heating costs alone.

The relocation to Upplands Väsby also triggered a move towards the paperless office.

- According to Mats Carlberg, the head of marketing,⁶² they sent 52 tonnes of paper for recycling when they relocated.
- According to Fredrik Sandberg, abandoning their old office "cells" provided an opportunity to create if not a paperless office then at least an office producing very little paper.
- All internal information is communicated electronically within the firm. As a result, they save at least 5 A4 sheets of paper per employee per day. That represents three packs of paper per day which multiplied by 220 or so working days gives 660 packs of paper or 1.3 tonnes/year.
- To this should be added all the paper documents which they scan in, such as manuals etc. which are now produced in digital form instead of as paper brochures. On-line documentation about their products, together with the other measures, has reduced the amount of documentation by about 50%.

Mobile service technicians

Another aspect of how Siemens Nixdorf operates should also be mentioned. Their service technicians operating all over Sweden are also in a way teleworkers. They work partly at home and partly out in their vehicles and at their customers' premises. Deliveries are made at night, when there are no traffic jams, using their service vehicles. Their way of working represents both "de-materialisation" (no offices) and more efficient transport (at

⁶⁰) Forsebäck, L.: "IT is the answer – but what was the question? Flexible working from various societal perspectives". IHM Förlag 1998.

⁶¹) Interview with Fredrik Sandberg 17 May 1999.

⁶² Forsebäck, L.: "Telemanagement – How to create and manage a flexible organisation". IHM Förlag 1997.

night), as well as replacing journeys to and from the office by telecommunication from home and service vehicles.

2.5. CommIT Project Nacka Strand – investing in environment-led business development

"CommIT" stands for communication and IT of course, but also for "commitment" and courage. The courage to go for groundbreaking solutions. Businesses in Nacka Strand are working together in the CommIT project on sustainable transport, among other things, with the aim of using IT-based solutions to reduce the environmental impact of transport, and at the same time make potential savings of more than SEK 200 million.

Four businesses in Nacka Strand have joined forces to devise a sustainability concept for the area. The four - Telia, Ericsson, Apoteksbolaget and Nacka Strand's Real Estate Administration (Fastighetsförvaltning), which is owned by the 4th National Pension Insurance Fund (AP Fund) - are now jointly developing a number of environment-friendly services to cover the communication and transport needs to and from the area. There are some 100 businesses with a total of just over 6000 jobs in Nacka Strand, as well as around 600 permanent residents.

- Today's environmentally-damaging perks for staff will be replaced in future by common IT services, says Roland Lahti, head of environmental policy at Telia MegaCom and Afo Företagskommunikation. Company vehicle fleets, company cars and the family's second car will be replaced by car and cycle pools, video- and teleconferencing, ComFort (Green Taxi), etc. We will use a variety of incentives and bonuses to try to change habits and break ingrained behaviour patterns. IT support will also help companies make efficient use of common resources and coordinate waste handling, for example.⁶³

Joint initiative to reduce environmental pressure

- The CommIT project is a joint initiative to reduce environmental pressure in Nacka Strand, says Roland Lahti. As former head of internal services with responsibility for the company's premises, he was instrumental in the change from personal offices to flexible workplaces. Roland Lahti was already thinking about the inefficient use of large amounts of space at the beginning of the nineties. Managers and other staff had their own large offices which, brightly lit and with computers on, often stood empty. He calculated what it cost the company and presented the figures to the CEO.

Teleworking, flexible offices and sustainable transport

Teleworking and the flexible office are one of the cornerstones of the CommIT project. They are linked to a number of services that together are designed to increase utilisation rates by changing behaviour patterns and travel requirements:

- Ferry shuttle between Stockholm and Nacka Strand – a new long-term IT-based concept
- Procurement of transport services from the Stockholm Transport Company - shuttle buses with environment-friendly engines and fuels

⁶³ Interview with Roland Lahti on 21 June 1999 and summary of speech "Sweden's environment bosses", Anne Örtengren www.nmc.a.se.

- ComFort or Green Taxi - environmental specifications in a joint procurement exercise
- Car pool with Statoil as contractor
- Videoconferencing - a public, easily accessible service that makes certain trips unnecessary.

A key theme in the project is to bring about more efficient and hence less environmentally damaging use of cars. In concrete terms, this means:

- the "right car" for each individual journey in terms of size, etc.
 - higher utilisation rate with the aid of IT solutions - less pressure on garage and parking spaces in the area
 - increased freedom of choice, when travellers are no longer faced with problems of "where to leave the car"
 - significant savings both for the individual and for the company.
- By focusing on companies, I believe we can have much greater leverage than by trying to influence private households. We are now seeking to develop proper economic incentives in cooperation with the companies' human resources and travel management departments. That is where the expertise and awareness of costs and environmental issues are to be found.

Cars that are poorly utilised, expensive and pollute the environment

- The basic premise for the project is that cars - just like large offices - are poorly utilised, pollute the environment and costly for the firm. It makes no difference whether they are part of the company fleet, company cars or private cars used for work, says Roland Lahti. It is important to create transparency. All other costs are closely scrutinised, but car fleets have a kind of special status.
- We also think that our staff, who charge their customers high hourly rates, should not drive to their meetings. Driving in Stockholm is stressful and looking for a parking space is often time-consuming. People are stressed out when they get to their meetings and sometimes arrive late. They could make much better use of their time by taking a Green Taxi. They could either work during the journey on their mobile office, or sit back and plan the meeting.

The project objective is to reduce the proportion of journeys made with company cars or private cars used on company business as well as the amount of air travel. There should be greater use of car pools, green taxis, buses, ferries, trains and cycles for business journeys. Some travelling can be replaced by videoconferencing.

Surveying transport volume - and the alternatives

As there is only one road in to Nacka Strand, it is easy to measure road traffic to companies and to monitor the changes as the project proceeds.

- We began by surveying the total transport volume by type of vehicle, says Sten I M Svensson, consultant and manager of the CommIT project. This enabled us to assess market volume for CommIT's services. We then reviewed the activity of existing car pools in Sweden.
- We investigated the tax and insurance implications. We also did calculations for different types of travel for businesses and private individuals. In addition, we defined environmental specifications for vehicles and specified certain features of the booking and invoicing system. Finally, we surveyed the range of vehicles, rental services and other transport services on offer.
- It will be above all the company car, private cars used for work and business trips with one's own car that will be replaced by the car pool, green taxi and ferry, says Roland Lahti. The use of videoconferencing facilities will also increase substantially.

Coordinated procurement with environmental specifications

The CommIT project is being launched in stages in 1999. The emphasis is to be on car pools initially, which will get under way in September. But companies will also work together in areas other than transport, e.g. on procurement, where coordinated action makes it possible to set more stringent environmental specifications. All the waste from companies' sorting stations will be collected at an "environmental market". IT solutions can be used to control emptying schedules: a decoder detects when a container is full. In future, an electronic nose will detect any malodours and so trigger emptying of the container.

From product to function

An important step in the project is to try to look at the function and the service rather than the product. Perhaps the most obvious, but at the same time the most emotionally charged, product that could be replaced by a service is precisely the private car. Obvious, because the private car represents a large item of expenditure for both private households and companies and at the same time is used only for a limited part of the day. Emotionally charged, because the car has a symbolic value for its owner - sometimes signalling status and prestige, but most of all it stands for total freedom for most people.

The possibility of leasing a car for certain periods rather than owning one can be an alternative for some households or businesses. Car pools have existed in Sweden, as in the rest of Europe, for some time now, often in the form of cooperatives which have joint ownership of one or more vehicles. HSB, the cooperative housing society, has opted for car pools for its residents in certain areas.

Alongside the cooperative car pools, commercial alternatives are now emerging which are usually based on IT solutions for reserving or booking the vehicle and for registering and invoicing journey distance and time. A system of car sharing has long existed in Denmark, in cooperation between Hertz and Shell.

IT solutions increase utilisation rates

- IT solutions allow us to dispense with the old system of literally having to enter your name on a list if you want to use the car. They also increase the utilisation rate considerably. It is easy to sit at your desk or in your armchair and plan your bookings

by computer, so many people will find it a very attractive option, says Lennart Ljung, the person responsible for the car pool project operated by Statoil in connection with the CommIT initiative. He also emphasises the importance of the cars in the pool always being located in the user's vicinity rather than at a central depot.⁶⁴

A test has recently been completed and Ljung anticipates a rapidly growing market where the transport function replaces the car as a product. The linchpin of the system set up by Statoil is a fully computerised car pool system, where all bookings are done via the Internet on a special server which also manages journey distance and time. The system also registers where any car is at a given time. The server, which has a voice answering facility for people without Internet access, communicates directly with the vehicles and supplies other computers with invoicing data. The driver's "car key" is a smart card with user ID and pin code.

Lennart Ljung sees a market for these computerised car pool services, not least for companies that have little time for the outdated, unwieldy and costly administrative and booking system that used to be necessary. Of course, the financial burden that leased cars currently represent for businesses is also a decisive factor.

Fewer service cars needed

- It is worth comparing with conventional leasing, says Lennart Ljung. Today, calculating at the lower end of the scale, every leased car costs the company SEK 7.000/month. For private motorists, that cost will be between SEK 2.5 and 3/km.
- Imagine a company that currently needs a fleet of 10 cars - which often stand idle in the car park - being able to manage with one. Or perhaps more realistically, that a company with a fleet of 100 cars can manage with ten. That naturally represents a hefty reduction in the fleet size and at the same time a dramatic reduction in costs for a given number of leased vehicles. And think of all the parking spaces that would have to be rented for these cars, says Ljung.

Statoil charges a private individual or a company that wants to join a car pool a basic monthly fee per user. There are also the variable costs per km including fuel, plus a charge per hour of vehicle availability.

Competitive alternative

Take a practical example: two people on a business trip for the day from Stockholm to a place 200 km away. The cost of hiring a car at the conventional leasing rates would be about SEK 1.500 for one day. The car pool alternative would give a cost of 2 x 200 km travelled x SEK 13, i.e. SEK 520, plus the charge for the time during which the car was made available, e.g. between 08.00 and 17.00, i.e. 9 hours x SEK 12, i.e. SEK 108. The business trip for that day would therefore cost the firm about SEK 630 in all. When the cost is spread over two persons, the car pool alternative becomes extremely competitive, even compared with a first-class train journey over the same distance.

Much lower costs and reduced environmental impact

⁶⁴ Interview with Lennart Ljung on 10 May 1999.

Thus the CommIT project in Nacka Strand has the potential to make huge savings of more than SEK 200 million for businesses, employees and residents together, according to the preliminary studies carried out. This is possible through businesses in Nacka Strand acting together to tackle all issues that do not concern their own core activity. Services are purchased as required according to the pay-per-use principle.

If the initiative is scaled up to the whole of Greater Stockholm, with approximately 1.4 million inhabitants, the potential saving amounts to approximately SEK 40 billion. At the same time, the distances travelled, use of fuel, need for parking spaces, etc. are significantly reduced. The end result is greatly reduced costs and significantly lower environmental impacts.

2.6. Stockholmers' teleshopping can save some 200 million km in car journeys

The B & W chain of stores, owned by the Swedish Cooperative Union, is one of Sweden's pioneers in e-commerce. Business has more than doubled annually since the launch in autumn 1995. Customers benefit because of the convenience and the time they save for other activities, e.g. with their family. There are also significant environmental benefits: today, eight to ten shopping trips by car can in principle be replaced by a single delivery round.

- Business is expanding rapidly, with numbers of orders, numbers of on-line shoppers and turnover all up, says Bho Vilhelmsson, Head of Development and responsible for B & W's e-commerce initiative, Express Food.⁶⁵

Over 20% of all sales of basic consumer goods

Sales during the first four months of 1999 alone, at just over 5.5 million, exceeded those for the whole of 1997. On-line shopping for everyday consumer goods is becoming an established phenomenon. Take Express Food's share of B & W's total sales, for example, which is now well above the 10% mark and reached a new peak in week 10/1999. Between Monday and Friday of that week, on-line shopping accounted for over 20% of total sales of everyday consumer goods at B & W's Täby branch.

- A number of trends are now apparent, says Vilhelmsson. Not least, sales of fresh goods on-line are increasing and now account for more than 50% of the total. On-line shoppers are also becoming more "loyal". The number of regular customers, i.e. those who teleshop at least once a month, now accounts for a good third of our total of 3 200 registered households shopping on-line. The number of households teleshopping every week is also rising rapidly.

Go forward or go under

- I believe that teleshopping for everyday consumer goods is on the point of a breakthrough, says Vilhelmsson. But that means we have to step up our efforts even more. Quite literally, we have to go forward or go under.
- One of our current initiatives concerns a special order-picking centre, which will be sited at the optimum point to reach as many homes as possible by the shortest possible route. One possibility would be to locate it in the Bromma area, from where we can reach over 300 000 homes within a radius of 12-15 kilometres.

Shopping trips of 1.2 million km saved

The estimate for 1999 is for 14 000 deliveries to homes. The statistics for the first few months of the year show that this objective will be reached. If we take today's average delivery round to eight homes as a basis, this means that 14 000 individual shopping trips will be replaced by 1 750 delivery rounds of approximately the same length. In other words, the saving will be something over 12 000 trips. If the average shopping trip is assumed to be 20 km, this amounts to a saving of trips equivalent to 240 000 km/year.

⁶⁵) Interview with Bho Vilhelmsson on 3 June 1999.

You have to add to this the equivalent for our competitors, such as NKHallen, PrisExtra and a number of smaller retailers, says Bho Vilhelmsson. He estimates that Express Food has a share of about 20% of teleshopping for basic consumer goods at present. If we assume that other on-line shops make equivalent savings in journey distances, the overall saving would amount to 1.2 million km per year.

Optimising journey distances

The Post Office (Posten) is responsible for deliveries to households. The distributor invoices on a per-customer basis, i.e. not according to the time taken for delivery or the distance travelled. This naturally creates a powerful incentive to plan the route carefully in order to optimise both the time taken and distance travelled.

Customers currently pay a fixed charge of SEK 75 plus 3% of the shopping bill. The average customer pays SEK 113 per order.

- We never receive complaints from customers about the cost of deliveries, says Bho Vilhelmsson. This is only natural, considering that a family on average saves perhaps 2 ½ hours in time. You also have to consider the cost of a car journey, which currently stands at about SEK 3.5/km.

Sold her car

Customer care is obviously crucial, says Vilhelmsson, who has a stock of positive reactions to report from families who teleshop. One customer, for example, quickly came to the conclusion that the family no longer needed a second car. She decided to sell the car and now saves SEK 2 000 net every month, i.e. by comparison with what the car used to cost and the current cost of deliveries from Express Food. Then there is the time saving of perhaps ten hours per month.

Plans are now being made for a special order-picking centre, that will be built according to a totally different logistical principle from the traditional supermarket. In simple terms, the goods are arranged according to how much they weigh rather than with display in mind: the heavier goods are "furthest away" in the warehouse given that they are to be put at the bottom of the box to be filled.

Floor space halved and used more efficiently

- The new order-picking centre needs only half as much space as an equivalent shop, says Vilhelmsson. It can also operate around the clock in principle, which also means that space is used much more efficiently.
- In the long term, the order-picking centre will be fully automated. Staff will be given portable computers that will automatically print invoices, etc. In the long term, more and more of the order-picking will be done by robots.
- The savings will naturally make themselves felt in customers' wallets, says Vilhelmsson. I expect prices to be about 7-10% lower than those in a traditional supermarket.

Full range important

Bho Vilhelmsson believes that KF and ICA, the established major players, have the best prospects of remaining among the leaders in future when e-commerce has become firmly established:

- We alone can offer a full range, including, for example, 300 frozen products. Why should people shop on the Net if they still have to take the car to buy fresh foods?

Express Food already has a large number of day nurseries and recreation centres among its customers. But Vilhelmsson sees major potential for expansion in the area of care for the elderly, in particular the home-help service. A project is under way with a number of municipalities.

- There are many far more important tasks for home helps than doing the shopping for the elderly, says Vilhelmsson. It would make sense to subsidise teleshopping, as it would greatly improve the home-help service.
- Families where both partners go out to work are still the backbone of our e-customers, says Bho Vilhelmsson. But there is every sign that they continue the habit when they get older. In the long term, we will also be able to make inroads into the pensioner group.

40% will shop on the Net

What is the potential volume of e-commerce in everyday consumer goods?

- In 2005, at least 40% of all shopping will be electronic, says Vilhelmsson. If the current trend continues, this share might be even greater.

Let us take an example based on the planned order-picking centre in Bromma, which can reach 300 000 customers within a radius of about 15 km. We assume an average saving of 15 km twice a month. This is equivalent to a saving of shopping trips amounting to 15 km x 2 x 12 months x 40% x 300 000 homes, i.e. 360 km x 120 000 homes or a total of 43 200 000 km.

The delivery vehicles will make an average of 12 deliveries per trip with an average journey length of 20 km. This is equivalent to 20 km x 120 000 homes x 2 x 12 months/12 deliveries per trip = 57 600 000 km/12 = 4 800 000 km. The annual savings would therefore be 43 200 000 – 4 800 000 km = 38 400 000 km per year.

200 million fewer km by car in the Stockholm area

This example can be scaled up to the whole of Greater Stockholm, with a population of about 1.5 million. The final figure would be a saving from teleshopping equivalent to (5 x 38 400 000 =) 192 000 000 km per annum.

Stockholm's traffic could therefore shed about 200 million km in car journeys in the scenario for the year 2005.

This example can and should of course be criticised on a number of points. In the first place, it is merely an example, not a prognosis. Secondly, we do not know whether part of

the routine travelling that can be saved will be replaced by other trips for more leisure-related purposes when we have more time at our disposal. Still, this example does illustrate the potential of on-line shopping to limit the number of car journeys and thereby reduce environmental impacts.

2.7. To travel or not to travel on Government business

“To travel or not to travel” is the title of a report which was jointly published in June 1999 by ten Government-owned companies.⁶⁶ Amongst other things, the report describes how and when it is appropriate to replace travel with telephone or video conferencing, and the factors which may bear on this. The report also includes suggestions for policy on travel, control of travel and scheduling travel which are designed to make it easier for the individual to act in a way which is environmentally friendly. The environmental stresses which attend the use of different means of transport are compared.

Summing up, the report points to considerable gains in the shape of savings on time, reduced costs and not least environmental gains, when conventional meetings, which require travel, can be replaced with telephone or video conferencing. This is hardly surprising, considering the scale of “official travel” nowadays. It is estimated that public authorities spend between five and ten billion Swedish kronor on travel a year, depending on what is taken into account – direct costs of travel only, or plus indirect costs in the shape of working hours lost etc..

Government relocation increases travel

One of the starting points for the work of the working group is that Sweden’s public administration should set an example with regard to environmental activity. As part of this work, the Swedish Government has designated 25 public authorities that will be included in a pilot project to be known as “Environmental management systems in public administration”.

Part of the background also resides in the relocation of Government-owned enterprises, which has been happening since the 1960s, in particular for reasons associated with regional policy. This means that authorities which have a significant requirement for contact and meetings have had their activities moved outside Stockholm. This is true, for example, of Sweden’s National Road Administration (to Borlänge) and the Swedish Civil Aviation Authority (to Norrköping).

Wait and see – or lead the trend?

In its own internal work, the working group, which thus consists of representatives from ten companies in the public sector, most of them located outside Stockholm, has also made considerable use of video conferencing. The Group’s report states that greater demands must be placed on society: “instead of unilaterally introducing increased charges which have the greatest impact on rural commuters, the Swedish Government and Parliament must in the first instance compel the authorities to change the way they behave ... None of (the measures which the report proposes) requires any great sacrifices on the part of travellers, it is only the attitude of the authorities which must change. The same authorities which in many cases encourage the status quo and delay the development of alternatives by waiting and seeing rather than taking the lead on the work of development.”

⁶⁶) Att resa eller inte resa? RESOR/VIDEOKONFERENSER Inom ramen för miljöledning i offentlig förvaltning. May 1999.

The conclusion is obvious: policies within the authorities alone are not enough. Some kind of incentive – stick, carrot, or perhaps both – is required of Parliament, the Government and the Departments.

The working group also wants to try to provide the individual civil servant with a real incentive to stimulate the selection of more environmentally-friendly options. Whether a train is selected as a means of transport or video conferencing is adopted, a special “environmental charge” could be paid. According to the calculations, a system of this kind should result in lower costs for the authority.

Video conferencing is increasing rapidly

According to a study which was carried out by the Swedish Government Institute for Communications Analysis, the use of video conferencing is now increasing rapidly, even though it started from a low level.⁶⁷ The proportion of employees between the ages of 15 and 84 that used video conferencing during the last few months of 1997 was 1.3%. The following year, 1998, this had increased to 3.6%, i.e. almost tripled during the course of a single year.

A survey of the heads of the ten authorities that are represented on the working group indicated that over a third of them had at some time taken part in a video conference. An index calculated as the quotient between the number of video and three-way telephone conferences divided by the number of travelling days during the same three-month period points to relatively large differences between the authorities concerned from 0.14 (the Swedish Patents Office) to 0.66 (The Swedish Defence Material Administration).

More than 1,000 Swedish Crowns per employee and year

One of the authorities included in the working group has recently purchased video conferencing equipment, which can provide a clear picture of the costs.⁶⁸ The equipment, which allows at least six parties to be connected simultaneously, runs to approximately SEK 750,000, which, if they are written down over three years, produces a rough cost of about SEK 300,000 a year. The authority in question has some 1,000 employees distributed over three sites in Sweden, with the greatest distance between any two of them equivalent to approximately 600 miles. As was stated in the working group’s report, an investment equivalent to SEK 300 per employee per year appears moderate. To this should be added operating and service costs, which are estimated to be approximately SEK 750,000 a year.

The total cost per employee per year can therefore be estimated at SEK 1,050. If a single long distance domestic journey, e.g. between Stockholm and Gothenburg, can be cut out for every employee during the course of a year, the investment will be financially justified.

⁶⁷) Kommunikationsundersökningen 1997 resp. 1998, Statens Institut för Kommunikationsanalys.

⁶⁸) The purchase is a “codec” for translation and compression of images and sound, video-in for two cameras and VCR, video-out for VGA-SVGA monitor and VCR, monitor and camera (colour, motor powered), PC connected to LAN (internal network) as well as the housing which contains the equipment and which is moveable.

To put it another way, any savings on official travel which go beyond a thousand per year per employee represent a financial gain for the public authority.

This will be accompanied by a significant reduction in environmental stress. // Insert life cycle analysis from the SVT case at this point?//

Guidelines for travel and video conferencing

The working group also suggests that the public authorities introduce guidelines on the use of video conferencing. The guidelines could look something like this:

“To make a journey, a number of requirements should be met, for example:

- the official business must last at least one day
- an initial meeting to get to know each other in the group
- the problem which is to be dealt with must be such that it requires physical presence
- that the meeting had been scheduled as travel when the project was initiated

The following apply, conversely, to video conferencing:

- the meeting lasts at the most half a day
- the meeting is broadly speaking for the purposes of review or to provide information
- a relatively large number of delegates should/can join in
- the meeting had been scheduled as a video conference when the project was initiated”

The working group also recommends that every public authority define a travel policy with five main principles:

- official travel must always be justified and weighed against other options, e.g. telephone meetings and video conferencing
- environmental considerations must always be taken into account when choosing a means of transport
- cost-effectiveness (time and money) must also be taken into consideration
- responsibility for timetabling and evaluation rests with both management and employees.
- the policy must be monitored with a view to guaranteeing it

If the working group’s suggestions are adopted in general by the public authorities, this would mean significant investment in video conferencing with tangible and positive effects for both the Swedish Treasury and the environment.

2.8. Video-conferencing preserves the environment and saves money

For major international companies, video-conferencing is increasingly replacing the business trip. The motives are many, e.g. the opportunities for saving time. Obviously, this applies not least to IT companies, whose short product development cycles oblige them to operate with what is known as “time lodging”. This means that employees in different parts of the world relieve each other. In practice they work shifts, but because of the differences in time they do not feel as though they are.

Extensive experience within the Ericsson Group

One company which has made extensive use of video-conferencing over a lengthy period of time is Ericsson. As part of their exam work, two college students at Mälardalen looked more closely at Ericsson’s experience of video-conferencing.⁶⁹

The study was based in part on home pages and annual reports, and also on interviews with a number of key personalities (e-mail, telephone interviews and interviews in person). Relevant data for calculating CO₂ emissions during journeys was produced with the help of SAS, SJ, a number of taxi companies, and in discussions with staff at Ericsson.

The study encompasses financial, social and environmental considerations.

Study based on in-depth interviews

Within the Ericsson Group, in-depth interviews were undertaken with employees. Some with a positive attitude to video meetings and business trips and some with a more negative attitude. Interviews were also undertaken both with employees who make frequent use of video-conferencing technology and/or make business trips and with employees who seldom if ever use either form of communication.

There was a clear intention to have the Ericsson Group, a company with an international operation making a large number of business trips, as the subject of the study. The choice was also based on the fact that at Ericsson there is extensive access to video-conferencing equipment, and many years of experience of the technology.

Once a company had been selected for the case study, fictitious cases were devised in order to make it easier to focus the work on relevant areas. These cases were designed on the basis of personal interviews with a number of employees in the Ericsson Group.

Two return journeys to the sun

Ericsson is a world-wide communications company with operations in 140 countries worldwide. The major part of these operations are still concentrated in Sweden and Europe, with more than 95% of sales made to countries other than Sweden. At the end of 1997 the Group had more than 100,000 employees worldwide. For obvious reasons the company ships most of its products by air.

⁶⁹) Ahrnberg, Lisa & Ljung, Maria: “Affärsresor eller videomöten – en jämförande studie med avseende på CO₂-utsläpp, sociala och ekonomiska aspekter inom Ericsson-koncernen”.

In 1997 Ericsson's employees in Sweden flew a total distance of 572 million km on business. Their trips are thus almost equivalent to two return journeys to the sun!

Environmental goals carry weight

The Ericsson Group sees its mission as being to "meet future needs for environmentally-friendly communications". One of its primary objectives is that the use of Ericsson products should contribute to a reduction in environmental stress by, amongst other things, reducing travel.

Every year the Group produces an environmental report which describes operations from an environmental point of view. Three overriding environmental goals have been identified up to the year 2000. The goals involve:

- the introduction of an environment management system
- a reduction in the consumption of energy
- the development of a product register.

700 video-conferencing systems

The Ericsson Group has some 700 video-conferencing systems around the world, of which 400 are so-called desktop systems. More and more mobile video-conferencing systems will be bought in coming years.

The technical equipment which accompanies the video-conferencing system varies between the different companies in the Ericsson Group. It seems to be common practice to have what is known as a document camera for video-conferencing systems. So called "smart board equipment" does not seem to be as common.

The technical equipment which is used in the Ericsson Group has the capacity to handle what are known as "multi-conferences" with up to five or six different sites taking part – parties as they are known. However, Ericsson does not often use this technology. The usual thing is for two parties to confer with each other simultaneously using video-conferencing equipment.

Booking on the network

The Ericsson Group's video-conferencing equipment is located in conference rooms which are also used for purposes other than video meetings. Video meeting rooms usually contain folders with instructions on how the equipment works and practical tips on how to conduct a meeting, including how delegates should behave.

On Ericsson's intranet there is an internal booking system for video meetings called the "web-book". Employees can use this "web-book" to book rooms for video meetings in a number of countries simultaneously and thereby identify a time when all of the video meeting rooms of the parties involved will be free. The system also takes account of time differences, which means that the system is felt to be simple and quick.

14 mobile systems at the new Head Office

As we know, the Ericsson Group's new Head Office will be located in London, where 14 mobile video meeting systems will be installed. Management offices will have three walls with screens which will be connected during video meetings with Ericsson's offices in Stockholm, Dallas and Tokyo.

- So far the technology has been used only in connection with internal projects within the Group, says Åsa Clachan of Ericsson Radio Systems, who has many years' experience of video meetings with colleagues, primarily in Japan, where some 800 Ericsson employees are located.⁷⁰ But Ericsson has also arranged distance training aimed at its Japanese employees using video-conferencing equipment.

5-10% video meetings

Today between 5 and 10% of all meetings within Ericsson are video meetings, and it is not only in connection with international meetings that tele- and data communications are used.

- The distance between, for example, the Telefonplan at Midsommarkransen and Ericsson's facilities at Kista is a matter of a few miles, but during the rush hour half a day can be wasted, says Birger Fridman, who works as project co-ordinator at Kista.⁷¹

Åsa Clachan stresses that it is not only the effectiveness of video technology which is important to the synchronisation of effective sound and images. "Meeting techniques" are of equal importance:

- there must be a strong and precise Chairman, and a clear agenda for the meeting. The purpose of the meeting must be communicated clearly and correctly to all of the delegates. Thought should also be given to such obvious things as presenting delegates to the meeting. Otherwise there will be a danger of everything becoming completely confused.

Reduction in travel

When it came to the impact which the use of video-conferencing systems had on travel, opinions in the study were strongly divided:

"Most of those interviewed considered (..) that video meetings reduce the numbers of people travelling. They considered that many of the journeys which they had once been obliged to undertake could now be replaced by a video meeting. They also considered that reduced opportunities for video meetings would necessitate an increase in travel in order to perform the same tasks as today.

Many of those interviewed expressed the view that video meetings can increase effectiveness at work. In particular one of those interviewed saw the opportunity to take part in a video meeting in the morning, and in a meeting with delegates from another part of the world in the afternoon."

⁷⁰) Interview with Åsa Clachan 7.6.1999

⁷¹) Interview with Birger Fridman 7.6.1999.

The study also compared the environmental consequences of some typical cases with regard to a conventional meeting and a video meeting.

The table below illustrates distances and CO₂ emissions per person and by person/kilometre between the three destinations which served as typical cases – Gothenburg, London and Dallas. The different forms of meeting and transport (rail, air and video meeting) which were studied are compared.

Dramatic reduction in emissions of CO₂

It is evident from the table below that the use of video-conferencing involves considerable reductions in emissions of CO₂, regardless whether the alternative is to travel by train or air and regardless of the distance.

	<i>Distance km</i>	<i>CO2 kg/ person</i>	<i>CO2/ person/kilometre</i>
Rail Gothenburg	946	7.6	8.08
Air Gothenburg	1,080	188.8	174.8
Video Gothenburg	0	0.81	0
Air London	1,980	276.4	139.6
Video London	0	2.4	0
Air Dallas	10,322	1620.1	157
Video Dallas	0	4	0

As expected, emissions of CO₂ are dramatically higher in the case of meetings which require travel by air. Looking at emissions per person/kilometre in conjunction with flight, they are greatest when Gothenburg is the option.

Generally speaking, video-conferencing is considerably superior when it comes to impact on the environment. Life cycle analysis (LSA), which takes account of the energy consumption and use of materials when video-conferencing equipment is being manufactured, also shows that video-conferencing has decidedly less impact on the environment than travel by air. Provided the video-conferencing equipment is used relatively frequently, the impact on the environment is broadly comparable with the most environmentally-friendly means of transport – the train.

Significant savings with regard to official travel

A recent dissertation indicates the scale of the savings which can be achieved if official travel is replaced with video-conferencing. The study compares four Swedish case studies in respect of person/kilometres saved.⁷²

Company Savings expressed as person/kilometres

	Total	Per capita	Per meeting
Telia VC1	410,674	3,208	2,750
SVUG	289,536	4,928	5,022
Tetra Pak	68,025	2,834 (5,485*)	1,660 (3,212*)
Skånska Lant-Männen	12,935	1,294	n/a

*) Estimated on the assumption that journeys in excess of 1,000 km are on average one-way journeys of 2,000 km.

Depending on the specific conditions which apply in a company, the number of international contacts, the nature of the work etc., there is obviously considerable scope for limiting the number of person/kilometres by making use of video-conferencing instead. On the basis of the studies referred to above, this should involve between about 1,300 km and 5,000 km per person per year. Calculated per meeting, the savings will be in the range between about 1,700 km and 5,000 km.

Pays for itself in 22 days

The use of video-conferencing also means significant savings on cost. In the case of Ericsson, it may be mentioned that in a week of “budget negotiations” in 1998, the company saved about SEK 3 million by making use of video-conferencing.⁷³ According to Ericsson’s own estimates, the costs of an hour’s video-conferencing with the USA is equivalent to the cost of getting to the airport!

A complete video-conferencing system at Ericsson costs about SEK 300,000. It is estimated that this investment will pay for itself in 22 working days.⁷⁴ This means that every conferencing system saves the company the equivalent of SEK 3 million a year.

⁷²) Arnfalk, Peter: “Information Technology in Pollution Prevention – Teleconferencing and Telework used as Tools in the Reduction of Work Related Travel”. Lunds Universitet. Inst. för Internationella Miljöstudier. Lund, October 1999.

⁷³) Ericsson. Nyhetsmagasinet Contact 1998:15

⁷⁴) Project “Miljöanpassning av statlig förvaltning”. Grupp 6 Travel/video-conferencing. <http://www.miljo.chalmers.se/miljoled/ag/grupp6.htm>

3. NEW JOBS AND METHODS OF WORK

3.1. Call centres reduce need for new infrastructure

“The move to the cities is not without its price for society. Homes, schools, hospitals, factories and roads stand idle in some parts of the country, while other communities have to build new ones.” This sums up the terms of reference for the Inquiry into Future Regional Policy which was set up in the spring of 1999.⁷⁵

The flight to the city is accentuated

Now that Sweden’s economy is beginning to speed up again, history seems to be repeating itself: movement from the forest provinces, sparsely-populated areas and old industrial centres to the conurbations is accelerating. In Norrland and Dalarna in particular the trend is a depressing one. With the solitary exception of Umeå, all local communities are showing a reduction in population.⁷⁶

The problem obviously encompasses a number of parameters: regional imbalances, human tragedy and cultural impoverishment. But the trend has put one environmental aspect in focus: the money which has been invested in homes, schools, nurseries, hospitals and nursing homes, roads and other infrastructures, may be wasted in areas which are losing population, at the same time as similar structures have to be built in metropolitan areas which are already hard-pressed.

10,000 homes listed for demolition

When it comes to homes in depopulated areas, demolition is often the only realistic answer. According to the Swedish National Housing Board's latest questionnaire for local authorities, some 10,000 flats are listed for demolition. There is every indication that the number will be significantly greater, despite the fact that the number of flats which are unlet has fallen a little since it peaked at 70,000 flats a few years ago, and despite the fact that some 13,000 flats have already been demolished during the last five-year period.⁷⁷ Today empty flats represent a loss in rent of about two billion Swedish kronor.

Demolishing flats is not a cheap option. The physical demolition alone costs approx. SEK 40,000 for each flat. To that must be added the SEK 20,000 or so that it costs to re-house any remaining tenants, i.e. about SEK 60,000 per flat. No account has been taken of the flats’ book value, which means a (usually additional) loss in the landlord’s budget. This usually involves local government housing corporations in a crisis, which in many parts of the country now see demolition as the only option.⁷⁸

⁷⁵) Committee Directive 1999:2: “Utredning om den framtida regionalpolitiken.”

⁷⁶) SCB’s statistics, referenced in “Sveriges Nya Geografi 1999. Vinnare och Förlorare.” Mälardalsrådet 1999.

⁷⁷) Forsebäck ,Lennart: “IT är svaret – Men vad var egentligen frågan” (IHM Förlag 1998) and article ”10.000 lägenheter jämnas med marken”, SvD 11.4.1999.

⁷⁸) Forsebäck ,Lennart: “IT är svaret – Men vad var egentligen frågan” (IHM Förlag 1998)

Local authorities SEK 20 billion poorer

New legislation, which came into force at the turn of the year, and which forces local authorities to enter market values in their accounts rather than book values, illustrates the scale of the problem:⁷⁹ local authorities are obliged to write down the value of their housing corporations by SEK 20 billion.

At the same time new homes and other infrastructure must be built in areas that are already “overheated”, especially in Greater Stockholm. This in turn generates new problems, such as increasing traffic congestion, and it has a serious impact on the environment.

SEK 73 billion in grants with no return

Images of a divided Sweden appear with increasing clarity. The SEK 73 billion that is invested every year in traditional “regional policy” hardly seems to generate any regional development, only costs. According to a study carried out by ESO, the Expert Group for Studies of the Public Economy, current regional policy is hardly generating any regional development, while at the same time growth as a whole risks being hampered.⁸⁰

There is obviously no simple solution to a problem of this size. But to some extent what are known as “call centres”, workplaces for which distance is not an object, may help communities to survive, retain their populations and so continue to enjoy the investments made in homes, schools, hospitals, etc..

“Every factory which is closed results in a call centre”

The concept is based on the geographical separation of the “front office” and the “back office”, something which is happening increasingly throughout the world.⁸¹ The “front office” presupposes a large amount of direct physical contact, and must therefore be located centrally. The “back office” communicates instead with customers and clients via telephone, fax or e-mail 100% of the time, and can therefore in fact be located anywhere.

“For every factory which is closed down a “call centre” pops up”. This was how the Financial Times described the trend viewed from the British Isles.⁸² Without doubt call centres are becoming a factor to reckon with in the labour market throughout Europe.

37 % of all new jobs in call centres

According to analysts at Datamonitor, the industry has accounted for as much as 37% *net* of all new jobs in Europe over the past three years!⁸³ In Europe a total of approx. 1 million people are at present employed in call centres. Forecasts indicate an increase of about 30% a year at least over the next five years.

⁷⁹) Article “Bostadsbolag riskerar konkurs”, DN 21.3.1999.

⁸⁰) Discussion article “Regionalpolitiken bortkastade pengar”, Helene Norberg, ESO i DN 30.9.1999.

⁸¹) Forsebäck ,Lennart: “IT är svaret – Men vad var egentligen frågan” (IHM Förlag 1998)

⁸²) Article “Med Internet och virtuella telegor sitter du med kunden i knät...”, tidskr. Akademiker 2 1999.

⁸³) Article “Callcenter kan ge 100.000 arbetstillfällen till Sverige”, SvD 8.3.1999.

According to Lars Reinius, who manages a call centre project in a co-operative venture involving ISA, the Invest in Sweden Agency, and Telia, there will be scope to create between 55,000 and 95,000 new call centre jobs in Sweden in the next few years. The uncertainty is due, amongst other things, to the share of the Scandinavian market that Sweden manages to win.⁸⁴ The development assumes that the company has a single joint call centre in Europe, against 5 - 6 regional call centres based on language areas.

Sweden is specially qualified

With Scandinavia as a starting point, Sweden should have all the requirements needed to assert itself. Sweden has the biggest market in Scandinavia, and is geographically central. Costs are more favourable and language competence is greater than in neighbouring countries.

- in Denmark and Norway, says Lars Reinius, few people can speak Finnish, and in Finland few people can speak Norwegian or Danish.

The potential is thus considerable. But what concrete significance have call centres had so far as regards opportunities for the survival of small communities?

Existing investments can be exploited

Patrik Winqvist is the Managing Director of Svenskt EtableringsCentra, a company that is working with regions and local districts to help firms establish themselves in smaller communities:

- Call centres have meant that thousands of new job opportunities have been created in “communities which are threatened with closure” from Tärnaby in the north to Ronneby in the south. In concrete terms, this has meant that existing investments in, for example, hospitals, homes and other infrastructure can be preserved and exploited.
- One example is the mental hospital at Furunäset, a few kilometres – i.e. cycling distance – from the centre of Piteå, says Patrik Winqvist. When the hospital was emptied ten years ago in connection with the extensive reforms in mental health care, there was a complete infrastructure of approx. 30,000 m² that faced the prospect of being razed to the ground. But Anders Sundström, who was a local government commissioner in Piteå at the time, saw other options. He wanted to try to attract companies for which distance was no object, especially in the financial sector, rather than demolish.
- The endeavour, says Patrik Winqvist, was a success. Today there are some 1,000 workplaces at Furunäset. Some 75% of the 400 or so jobs that are not distance-dependant are in the financial sector. The Gallup group is also located at Furunäset where it has some 100 employees who offer call centre service on the basis of outsourcing.

⁸⁴) Address to conference “Hemma bra men borta bäst”, Rosenbad 16.9.1999.

Local authority avoids demolishing 1,000 flats

- But, says Patrik Winqvist, the companies for which distance is not an immediate object have also produced significant spin-off effects. They have been a catalyst that has led to the creation of a considerable number of small service companies with a local or regional market, and these have been able to take advantage of the advanced telecommunications system that has been created in the area. To this should be added the knock-on effect, which varies in size depending on the type of job.
- I estimate, says Patrik Winqvist, that the knock-on effect for about 500 of the 1,000 jobs at Furunäset is about 3. This means 1,500 jobs. And 1,500 jobs is in turn equivalent to about 1,000 flats. It might pointedly be said that if the hospital had been demolished, there would also have been the risk that 1,000 flats would have had to be pulled down!

Local rates in the Mälaren region - Piteå

Among the companies which established themselves at Furunäset we can mention Föreningssparbanken, MeritaNordbanken and the Gallup Group, as well as VM-data Owell and BT Sverige. The area also has a number of other advantages: proximity to water, plenty of greenery, and great cultural value. Many of the buildings were erected at the turn of the century. Furunäset also offers hotels, restaurants and conference centres.

The call centres which operate in Furunäset offer local rates to households and companies in the Mälaren region which want to communicate with Furunäset. Since 1998 a call centre training course for 40 people has also been on offer at Furunäset. Telecommunications in the area are first class.

Dals Ed avoids demolishing 100 flats

There are many examples of the way in which call centres have made it possible to preserve and make use of the existing infrastructure:

- In Dals Ed, according to Patrik Winqvist, the local authority discussed the demolition of about 100 flats about a year ago. But then the Sykes call centre came into the picture, and established itself with 400 jobs. This made any thoughts of demolishing the flats redundant.

100,000 call centre jobs in Sweden by 2004

The development is thus a rapid one when it comes to call centres in Sweden, as it is in the rest of Europe, while in the USA the market is thought to be stagnating in the short term. According to Philip Cohen, a veteran of telemarketing, the number of jobs at call centres in the USA and Canada currently stands at about 4 million, but this figure is expected to increase by “only” 25% by 2006.⁸⁵

In Europe, on the other hand, it is estimated that there will be an increase of about 240% over the same period, from barely 700,000 jobs at present to almost 2½ million in 2006.

⁸⁵) Interview with Philip Cohen 16.9.1999.

The corresponding figure for Sweden is currently almost 20,000 and a little over 70,000 in 2006, i.e. an increase of almost 400%. It may be mentioned that ISA estimates that the current number of call centre jobs in Sweden is already 33,000, and will break through the 100,000 barrier by no later than 2004.⁸⁶

“Virtual call centres”

At the same time technology is now creating opportunities for new solutions. This includes what are known as “virtual call centres”, in which a number of home work stations, small tele-cottages or other miniature workplaces can be linked together by a data network and telenet. The conditions therefore exist for even the most remote outposts of sparsely-populated areas to be in a position to contribute to employment, and be given the opportunity to maintain and exploit the existing infrastructure.

In the 1980s call centres were already investing 020-numbers, automatic call distribution and computer-based telephony. Nowadays many call centres are investing in, for example, statistics systems, call steering and voice activation, and systems which distribute e-mail.

The telephone is increasingly being replaced by electronic communications. This is also one of the reasons for the increase in training requirements.

Long-term stable investments

In the general debate there is a notion that jobs in call centres are both unqualified and extremely mobile: “Easy come – easy go”.⁸⁷ This has been firmly rejected by Patrik Winqvist:

- call centres are a long term, stable investment in a locality. Training of at least one year is required, and someone who is then trained for a year or more “is worth” between 1/2 and 1 million to the company. The qualification requirements are also constantly increasing.
- it is, says Patrik Winqvist, a myth that call centres are highly volatile. It is considerably easier, for example, to close down a furniture factory and move it anywhere in the world.

Today, call centres are making it possible to preserve and make use of homes, schools and day nurseries, as well as hospitals and other infrastructure in depopulated areas. And at the same development in overheated areas can be limited. The result will be a reduction in energy consumption for building and construction, and a reduction in the impact on the environment. To all appearances, the potential will be even greater over the next few years.

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⁸⁶) Address to conference “Hemma bra men borta bäst”, Rosenbad 16.9.1999.

⁸⁷) Forsebäck ,Lennart: “IT är svaret – Men vad var egentligen frågan” (IHM Förlag 1998)

3.2. Home-working has considerable potential for the environment

Examples of substitution – where data communications and telecommunications replace travel, either completely or partly – are numerous: home-working and distance learning, electronic commerce, telemedicine, tele- and video-conferencing are a few of the most obvious examples. What these applications have in common is their considerable potential to contribute to a reduction in demands on the environment.

In a dissertation which was presented in October 1999, Peter Arnfalk, a researcher at the Internationella Miljöinstitutet (International Environmental Institute) at Lund University, attempted to compare some of the most frequent examples of substitution with regard to direct and indirect demands on the environment.⁸⁸

A comparative study

In his study, Arnfalk compares nine different applications with reference to:

- *potential*, i.e. the opportunities which an application presents without regard to any obstacles there might be
- *realistic outcome*, i.e. an assessment of the actual and/or probable impact of the application on the environment, including both positive and negative environmental factors as well as any obstacles
- *association and measurability*, which means that it must be possible to associate the environmental benefits with the application, and that it must be quantifiable.

The parameters which were evaluated have been classified on a scale of 1 – 3, where 1 represents poor potential/a low expected level of realistic outcome/low level of association and measurability/other negative aspects. On the other hand Grade 3 represents improved/enhanced positive aspects.

⁸⁸) Arnfalk, Peter: "Information Technology in Pollution Prevention. Teleconferencing and Telework Used as Tools in the Reduction of Work Related Travel". Licentiate Dissertation, Internationella Miljöinstitutet vid Lunds Universitet, October 1999, and paper "IT-tillämpningar med en positiv miljöpotential" in "IT och de nationella miljö kvalitetsmålen". Naturvårdsverket Report 5022. September 1999.

The evaluation of different IT applications which was undertaken in the study can be summarised in a table:

Application	Potential	Realistic	Association/ measurability	Total
Private conversation, two/more parties	1.5	2	1	4.5
Home-working	3	3	2	8
Telephone conferencing	2	2	2	6
Fax	1.5	2	1.5	5
E-mail	3	2	2.5	7.5
Distance learning	2.5	2	2.5	7
Electronic business communications	1.5	2.5	2	6
Electronic commerce – households	3	2	2	7
Video/image conferencing	3	2	2	7

Home-working has the greatest potential for the environment

In parallel with electronic business communications, home-working is judged to have the greatest potential with regard to opportunities for reducing demands on the environment. The potential consists in particular in dematerialisation (reduced office space), transport substitution (reduction in travel to and from work) and a reduction in energy consumption (duplicated heating of home and office can be limited).

The potential, which is already considerable, is also expected to continue growing as a result, for example, of the rapid development of technology and the expansion of the service sector, and the increasing compression of companies and public enterprises. At the same time there are, speaking realistically, a number of restrictions, e.g. the difficulty of implementing savings in the heated office space, the need for additional equipment for the home-worker, possibly new journeys, and the risk of a shift from travel by public transport to journeys in a private car on days when work is transferred to the head office.

What the assessments made in the dissertation mean is that environmental gains do not “appear from nowhere”. The difference between potential and actual outcome may thus be significant in an individual case.

Comprehensive study at Telia

The study in question also described a number of case studies. The study which enjoyed the greatest number of answers and at the same time the lowest fall-out rate related to

employees of Telia.⁸⁹ Some 2,100 employees (43 %) replied to the Internet-based questionnaire which was used in the study. The selection which was made from among the 11,000 employees with a minimal in-house role, as it is known, represented 6.7% of the total number of employees at Telia.

43 % of those who replied to the questionnaire stated that they were uncertain whether there had been an increase in the amount they travelled or a decrease, while 10% stated that there had been an increase in the amount they travelled. But when it came to the rest, savings on travel to and from work had been quite significant. 27% stated that they had saved more than 1,000 kilometres a year.

6 % stated that they had saved the equivalent of between 1,000 and 2,000 km a year, and 6% between 2,000 and 5,000 km a year. Another 6% stated that they had saved more than 5,000 km a year. On average this group had saved as much as 20,000 km a year per person.

On average those who stated that they had made savings on travel to and from work had saved about 2,500 km per vehicle a year travelling by car. The savings for home-workers who travel by public transport are of more or less the same order.

Equivalent to hundreds of orbits of the Earth

All told, Telia's home-workers made savings equivalent to 3.8 million km per vehicle (sic) a year. This is equivalent to 95 orbits of the Earth. When we consider that this relates only to the 6.7% of the employees at Telia who took part in the study, we are talking, as far as can be judged, about hundreds more orbits of the Earth which will be saved.

Work-related travel also involves significant direct and indirect costs – for the individual employee, for the employer and for society. If we imagine savings on time equivalent to one hour a day, this is equal, spread over 220 working days, to a holiday of 5 – 6 weeks. Two days of home-working a week with an hour saved each time is equivalent to 11 days of holiday.

Savings of SEK 130 an hour

The time which is released can obviously be used for leisure, work, or a combination of both. If the time is used for work, we can express the savings relatively simply in financial terms. In relation to an average wage of just below SEK 130 an hour, the example used above yields a profit for the employer – after the deduction of payroll tax and welfare contributions – which is equivalent to SEK 16,000 a year.⁹⁰ If we add an overtime allowance, profits are even greater.

⁸⁹) Arnfalk, Peter: "Information Technology in Pollution Prevention. Teleconferencing and Telework Used as Tools in the Reduction of Work Related Travel. Licentiate Dissertation, Internationella Miljöinstitutet vid Lunds Universitet. October 1999

⁹⁰) SCB-statistik "Tjänstemännens löner 1998", ref. i Arnfalk, Peter: "Information Technology in Pollution Prevention. Teleconferencing and Telework Used as Tools in the Reduction of Work Related Travel. Licentiate Dissertation, Internationella Miljöinstitutet vid Lunds Universitet, October 1999.

It is also possible to estimate the cost to society of work-related travel. If we assume that 1 million Swedes travel 40 km to and from work every day, 220 days a year, and at a cost which is equivalent to SEK 15 for every 10 km, we arrive at a cost which is equivalent to almost SEK 13 billion or SEK 13,000 per individual.⁹¹

Society provides subsidies of SEK 3 billion a year

In 1998, some 870,000 commuters were subsidised to the tune of about SEK 8.3 billion in the form of allowances for work-related travel. If we take tax into account at 35 - 40%, the real value of the subsidy to the commuter, who overwhelmingly uses his or her own car to travel, is about SEK 3 billion a year.⁹²

Since the allowance is only granted in the case of amounts in excess of SEK 7,000 a year, the costs of work-related travel by this group may be estimated at about SEK 15.3 billion. To this we should then add work-related travel for the large group which does not reach the threshold of SEK 7,000 for the allowance.

Significant increase in productivity

It is pertinent to point out that conventional office work, accompanied by "routine" commuting, which thus costs a lot of money and is also subsidised by society, is not particularly productive. On the other hand studies which have been carried out in Sweden and elsewhere exhibit a broad degree of agreement in respect of a relatively significant *increase in productivity* as a result of home-working.⁹³

Looking at the international experience, there are accounts of increases in productivity in the order of 60%. (A British study of 250 major companies points to *an average increase in productivity of 45%*!⁹⁴)

The Control Data Corporation reports increases in productivity of between 15 % and 25 % in the case of employees who work from home.⁹⁵ The Traveller's Insurance Company succeeded by means of a programme of flexitime in increasing productivity by 22 % and another life assurance company, Aetna Life and Casualty, by 25 %. One division of the local authority in Los Angeles County recorded an increase in productivity of almost 40 % in conjunction with the adoption of flexitime.

⁹¹) Arnfalk, Peter: "Information Technology in Pollution Prevention. Teleconferencing and Telework Used as Tools in the Reduction of Work Related Travel. Licenciate Dissertation, Internationella Miljöinstitutet vid Lunds Universitet, October 1999.

⁹²) Arnfalk, Peter: "Information Technology in Pollution Prevention. Teleconferencing and Telework Used as Tools in the Reduction of Work Related Travel. Licenciate Dissertation, Internationella Miljöinstitutet vid Lunds Universitet, October 1999.

⁹³) For a more detailed discussion of the factors which contribute to an increase in productivity, see Forsebäck, Lennart "Telemanagement - Hur man skapar och leder en flexibel organisation". IHM Förlag. Göteborg 1997.

⁹⁴) Hodson, Noel: "The Economics of Teleworking". BT 1992.

⁹⁵) Kugelmass, Joel: "Telecommuting. A Manager's Guide to Flexible Work Arrangements". Lexington Books. New York 1995.

Other – more or less classical – examples of studies of increases in productivity in conjunction with the adoption of home-working or flexitime include New York Telephone - 43 %, University of Wisconsin Hospitals 40-50 %, FI Group - 30 %, ICL - 60 %, Pohjola Oy- 40 %.⁹⁶

Even though there is considerable variation in the scale of these increases in productivity, and the results of some individual studies are open to question, the conclusion is obvious: the adoption of home-working or flexitime *enables companies to increase their productivity*. There are a number of factors that contribute towards this.

Free-range hens lay the best eggs

Opportunities for working in a more concentrated manner are one of the factors which contribute to an increase in productivity. The same is true of the increase in self-determination and responsibility which allows the opportunity to decide for yourself where you work for different tasks.⁹⁷

The opportunities for flexibility in both time and space make it possible to work when you feel inspired to, and have the energy to, and take breaks or do something else if you feel like it, more readily than at a particular stroke of the clock.

Free-range hens lay the best eggs, as the saying goes. The same applies to people. We do more and perform better if we can “move freely”. i.e. decide for ourselves when and where we work on different things. At the same time there is considerable scope for reducing demands on the environment as the “cagebirds” become “free-range hens”.

Two alternative scenarios

The study referred to above compares two alternative scenarios in respect of home-working - “business as usual” and “collabication”.⁹⁸ In the first scenario, management’s attitude to home-working is either indifferent or even negative. The effects with regard to savings and increased productivity are severely limited and there is almost a danger of an increase in demands on the environment. According to the dissertation in question, this is far from being an extreme scenario, but may well reflect current reality in many companies.

In the second scenario, on the other hand, in which management amongst other things uses home-working as one of a number of tools for reducing demands on the environment, the results are obvious and positive. For example, employees are compensated for the spaces they make available for work in their homes and for the cost of office furniture, lighting, etc.. They are also encouraged, in agreements and in other

⁹⁶) Forsebäck, Lennart: “Telemanagement – Hur man skapar och leder en flexibel organisation”. IHM Förlag 1997.

⁹⁷) Forsebäck, Lennart: “IT är svaret – Men vad var egentligen frågan?”. IHM Förlag, 1998 and Forsebäck, Lennart, Ohlsson, Kjell och Rapp, Birger: “Distansarbete och produktivitet”. Basic report on “Distansarbetsutredningen”, SOU 1998:115, Sept. 1998.

⁹⁸) According to the author, phrases which combine “collaboration” and “communication”, were coined, by Evan Rosen in Personal Videoconferencing. Greenwich, Manning, 1996.

ways, to work from home when practical and appropriate. Managers are evolving towards “telemangement”, and flexible leadership.

Nothing ventured

The result will be a win-win situation in which both the company and its employees and society can make considerable gains. But nothing ventured, nothing gained. The “collabication” scenario involves considerably greater costs to management in the shape of investments in training and development, extra equipment, compensation to employees etc..

But the gains will pay for this several times over. The company can gain up to the equivalent of SEK 140,000 per employee a year, in particular as a result of increased productivity and quality of work. Alongside the welfare gains, improvements in the quality of life, greater freedom at work etc., employees can also make gains in ready money of about SEK 7,000 per employee a year. Finally, there are significant environmental dividends to be gained by limiting commuting of up to 12%.

Even if only half of these goals could be attained, everyone would gain from this. It should be an aim for many companies and public enterprises, which meet the external conditions.

Presentation of the Author

Lennart Forsebäck, a business consultant, an author and a lecturer, manages the company *Forsebäck IT & Euro Intelligence*, Nyköping, Sweden. Some of his most recent publications are:

- The book "The Intelligent Community" (about ICT and regional development, relocation trends, BPR, telework, distance education and other ICT applications) (120 pp), 1992;
- The book "The Stockholm Mälars Region in the Age of The Information Technologies" (published by the Council of the Stockholm Mälars Region) (90 pp), 1994;
- The book "20 Seconds to Work". Tele-Homework. Swedish experiences from a European perspective. State of the Art, 1995. (Published by Teldo in Swedish and in English) (140 pp), 1995;
- The manual "Work Where You Want - All You Need to Know About Flexible Work". (Published by Canon Sweden Inc.) (200 pp), 1996;
- The book "Telemanagement - How to Create and Manage a Flexible Organisation". (IHM Business School & Förlag) (360 pp), 1997;
- The book "ICT Is The Answer - But What Was Actually the Question? Some Societal Aspects of Flexible Work"(IHM Business School & Förlag) (370 pp), 1998;
- The book "Cybershoppers, Intermediaries & Digital Merchants" (about households on the electronic market) (Published by Teldok & Kommunikationsforskningsberedningen) (130 pp), 1998;
- "ICT & the Environment" - 44 essays on the theme ICT and its implications for the environment (An "e-book", published June 2000. 250 pp.).

Lennart Forsebäck has also produced a large number of booklets as well as articles and essays in Swedish and European newspapers, magazines and periodicals. He gives annually about 50 speeches and lectures. Lennart Forsebäck has also been engaged by the Swedish Government as an expert on telework (Government Committee 1998-1999).

He has earlier held positions as:

- Advisor to the President of The Swedish Central Organisation of Salaried Employees, TCO;
- General Secretary at The Nordic Trade Union Council, NTUC or NFS, representing the trade unions in the five Nordic countries;
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