TØI report
392/1998

PB99-173932

Sustainable Utopia

Individual Travel Behaviour

Guro Berge
Trygve Solheim

Institute of Transport Economics

Norwegian
Centre
for Transport

REPRODUCED BY: NTIS
U.S. Department of Commerce
National Technical Information Service
Springfield, Virginia 22161

TØI report
392/1998

Sustainable Utopia

Individual Travel Behaviour

Guro Berge
Trygve Solheim

ISSN 0802-0175
ISBN 82-480-0049-4

Oslo, May 1998

Tittel: Sustainable Utopia

Forfatter(e): *Guro Berge, Trygve Solheim*

TØI rapport 392/1998
Oslo, mai 1998
99 sider
ISBN 82-480-0049-4
ISSN 0802-0175

Finansieringskilde:
Miljøverndepartementet

Prosjekt: 2192 OECD Reisevaner

Prosjektleder: Guro Berge

Kvalitetsansvarlig:

Emneord:
Reisevaner; Bærekraftighet; Miljø; Makt; Innflytelse

Sammendrag:
Arbeidet som presenteres her er en del av OECD-prosjektet Individual Travel Behaviour. Målsettingen med rapporten er å vise internasjonale trender knyttet til individuelle reisevaner, å påpeke miljømessige og andre problemer som følge av økende mobilitet, å presentere viktige faktorer knyttet til individuell reiseaktivitet, å forstå reisevaner som sosial handling og å diskutere effekter av samferdselsrelevante tiltak. Rapporten fokuserer også på implementeringsproblemer og spørsmål knyttet til interessekonflikter og makt.

Title: Sustainable Utopia

Author(s): *Guro Berge, Trygve Solheim*

TØI report 392/1998
Oslo: May, 1998
99 pages
ISBN 82-480-0049-4
ISSN 0802-0175

Financed by:
Norwegian Ministry of the Environment

Project: 2192 OECD Individual Travel Behaviour

Project manager: Guro Berge

Quality manager:

Key words:
Travel behaviour; Sustainability; Environment; Power; Influence

Summary:
The work presented in this report is a part of the OECD project on Individual Travel Behaviour. The aim of the report is to reveal trends in individual travel behaviour, to point out environmental and other problems associated with aggregate mobility trends, to present major factors linked to individual travel, to understand travel as a social action, and to discuss effects of policies on individual travel behaviour. The report also focuses on the problem of implementation and questions related to conflict and power.

Language of report: English

Rapporten kan bestilles fra:
Transportøkonomisk institutt, biblioteket,
Postboks 6110 Etterstad, 0602 Oslo
Telefon 22 57 38 00 - Telefax 22 57 02 90
Pris kr 150

The report can be ordered from:
Institute of Transport Economics, the library,
PO Box 6110 Etterstad, N-0602 Oslo, Norway
Telephone +47 22 57 38 00 Telefax +47 22 57 02 90
Price NOK 150

Copyright © Transportøkonomisk institutt, 1998
Denne publikasjonen er vernet i henhold til Åndsverkloven av 1961

Preface

The work presented in this report is part of the OECD project on *Individual Travel Behaviour* and paid for by the Norwegian Ministry of the Environment. The OECD project on *Individual Travel Behaviour* has had two objectives:

- to provide new insights for government policy-makers from the social science, aiming to promote more sustainable forms of individual travel behaviour; and
- to identify research objectives and communications strategies that would more effectively develop and incorporate insights from the social sciences in policy formulation for sustainable travel behaviour.

The objective of the Institute of Transport Economics within this project was to do a review on literature. The aim was to reveal trends in individual travel behaviour, to point out environmental and other problems associated with aggregate mobility trends, to present major factors linked to individual travel and to discuss effects of policies on individual travel behaviour. The report also focuses on the problem of implementation and questions related to conflict and power.

The review was finished in 1996, but has up to now only been published as a working paper and distributed to the international project participants.

The work has been managed by research sociologist Guro Berge, who also has been the co-author together with research sociologist Trygve Solheim. Kari Tangen, Unni Wettergreen and Jack von Domburg have prepared the report for printing.

Oslo, May 1998
INSTITUTE OF TRANSPORT ECONOMICS

Knut Østmoe
Managing Director

Ingunn Stangeby
Head of Department

«I am an optimist on behalf of the 22. century. For the 21. century it is already too late.»

Arne Næss, Professor of Philosophy

Contents

1. Introduction **1**

2. Trends in individual travel **3**
2.1. Introduction 3
2.2. Differences in various parts of the world 3
2.3. Car ownership 5
2.4. Changes in travel behaviour 9
2.5. Differences between segments within a population 15
2.6. Urban structure and travel distance 16
2.7. Some conclusions 17

3. Environmental problems resulting from increased mobility **18**
3.1. Introduction 18
3.2. Climate and acidification 18
3.2.1. CO2-emissions 18
3.2.2. SO_2, NOx and biological diversity 20
3.3. The use of land 21
3.4. Local environmental problems 21
3.4.1. Local pollution 21
3.4.2. Noise 23
3.5. Social life and mobility 23
3.6. Miscellaneous 25

4. Major factors linked to individual travel. **27**
4.1. Introduction 27
4.2. Spatial structure 28
4.2.1. Introduction 28
4.2.2. Urban density 28
4.2.3. Location of dwellings and work-places 29
4.2.4. Shopping-centres and city centres 30
4.3. The effect of infrastructure 31
4.3.1. Introduction 31
4.3.2. Building of roads 31
4.3.3. Public transport 33
4.3.4. Amenities for pedestrians and cyclists 36
4.4. Demography 36
4.4.1. Introduction 36
4.4.2. Age structure 37
4.4.3. Household structure 38
4.4.4. Gender 38
4.5. Technology 39
4.5.1. Introduction 39
4.5.2. Technology improving physical travel 39
4.5.3. Technology substituting physical travel 40
4.6. Political and economic factors 41
4.6.1. Introduction 41
4.6.2. Economic growth and mobility 41
4.6.3. Growth in income 41
4.6.4. Prices on transport 42

4.6.5. Changes within the labour market 42
4.6.6. Women at work 43
4.6.7. Company cars 43
4.6.8. Policies related to location of activities 45
4.6.9. Extended opening hours 45
4.6.10. Planning measures that promote mobility 45
4.7. Cultural factors 46
4.7.1. Introduction 46
4.7.2. The ideology of automobility 46
4.7.3. Modernity 47
4.7.4. The car as a private room 47
4.7.5. Dangerous, but useful 48
4.7.6. Automobility in the mass-media 48
4.7.7. Car advertisements 49
4.8. A diversity of factors 49

5. Travel behaviour as individual action 50
5.1. Introduction 50
5.2. The traveller as a reflexive actor 50
5.3. Modal choice as different types of social action 51
5.3.1. Modal choice as instrumental action 51
5.3.2. Modal choice and environmental care 52
5.3.3. Modal choice based on emotions 54
5.3.4. Modal choice - a habit 54
5.4. Modal choice as consumer behaviour 55
5.4.1. The meta product of the automobile 55
5.4.2. The car as a communicative product 56
5.4.3. Lifestyle: Segmentation of the consumers 56
5.5. Different approaches 57

6. Effects of policies on individual travel behaviour 58
6.1. Introduction 58
6.2. Land-use policies 58
6.2.1. Measures to increase density 58
6.2.2. Integrating land-use and public transport 59
6.2.3. Developing vital urban centres 60
6.2.4. Containing urban development 60
6.2.5. ABC in Netherlands and policy guidance in UK 60
6.2.6 Experiences with land-use policies 60
6.3. Transport policies 63
6.3.1. Public transport 63
6.3.2. Cycling and walking 63
6.3.3. Traffic restraint 64
6.3.4. Traffic management 65
6.3.5. Road building 66
6.3.6. Direct measures to reduce fuel consumption 66
6.3.7. Standards and levels for noise and pollution 67
6.3.8. Towards a conclusion 68
6.4. Future policies and implementation 68
6.4.1. Finding workable policies 68
6.4.2. Some Norwegian experiences with comprehensive planning 70
6.4.3. The problem of implementation 70

7. Are sustainable cities utopia **72**
7.1. Introduction 72
7.2. A classical planning perspective 72
7.3. Growth, equity and the environment 74
7.4. Agents in conflict 76
7.5. The question of power 77
7.6. An industries influence 80
7.7. Real solutions demands real agreement 84

8. Epilogue: Maybe the problem will disappear **87**
8.1. The role of the expert 87
8.2. Heaven and hell 88
8.3. About changes 88
8.4. The object becomes superfluous 89
8.5. The activity gets replaced 90

Literature **92**

Summary:

Sustainable Utopia

This report is a result of project done for OECD. Institute of Transport Economics was in 1996 asked to do a review on literature to reveal:

a) Trends in individual travel behaviour.
b) Point out environmental and other problems associated with aggregate mobility trends.
c) Present major factors linked to individual travel.
d) Discuss effects of policies on individual travel behaviour.

Both c) and d) was extended into something more than just a presentation of relevant literature. Under c) we looked for alternatives to a simple and instrumental look at travelling as just a mean to an end. Under d) we focused on the problem of implementation and from that to questions related to conflict and power.

Trends in individual travel behaviour

Car ownership is increasing everywhere and follows a similar trend in almost all countries. Car ownership is higher in rural areas and small towns than in cities. When a car is acquired, members of households travel more than before and to new destinations.

Even over a short term almost every European country has a large reservoir of potential car owners. The number of driving licences exceeds the number of cars. Younger age groups show a much higher in acquiring a driving licence than the older ones. Assuming that these groups will keep their licence in the future, ageing creates a larger potential growth for owning a driving licence. The differences in licence rates between men and women is likely to diminish.

Due to measurement problems it is difficult to say that the number of trips per person per day is stable or increasing. However, the general trend is that the proportion of car trips per person is increasing, and the distance travelled per person is also increasing. Over time the registered increase in trips per day is first of all due to an increase in service trips. The explanation is related to the fact that more women are entering the labour market.

The variation between countries in distance travelled per day is about twice as large as that in number of trips and the time spent travelling. We might conclude from this type of data that (1) people travel to satisfy a certain number of access needs (for work, services, etc.) that do not vary significantly as the transport system changes, and (2) people operate with time budgets and will spend roughly

The report can be ordered from:
Institute of Transport Economics, PO Box 6110 Etterstad, N-0602 Oslo, Norway
Telephone: +47 22 57 38 00 Telefax: +47 22 57 02 90

the same amount of time travelling during each day, regardless of the average speed of the transport system. This would imply that measures that make travel faster will tend to increase the distance travelled. (Michaelis, OECD)

In most countries, public transport is used for longer trips than cars: The public-transport share of trips is smaller than the share of distance. Walking, cycling and moped trips, not surprisingly, are shorter on average than public transport and car trips in all countries.

Men and women have different travel behaviour. Different social roles and/or different lifestyles may explain these differences.

Sustainability as a social possibility

Sustainability is defined, if possible, as handling resources, in a wide meaning, in such a way as not to destroy the possibilities for future generations. Within the field of transport, this is especially important concerning global energy resources, pollution, and locally, concerning pollution, noise and land resources. Our conclusion is that the global problems related to energy and CO2 seem to develop in a more problematic manner than local emissions where new technology reduces some of the more critical emissions, but of course not noise. The increasing urban sprawl will also create significant problems for future generations in terms of land use.

Sustainability has also been connected to specific ways of life, as if some cultural forms should be more sustainable or have greater qualities than others. This is problematic. We have however tried to pinpoint some aspects of mobility that are social and may relate to sustainability.

- The car represents at present a very important symbol of what is meant by modern. And by many it represents the symbol of a new way of life where we get separated from each other. In opposition to this can be said that the car is first of all a practical means of transportation and we can not know for certain whether it actually creates a life in anomie or rather the opposite, a life filled with driving on visits. The car helps eliminate the problem of space rising from the separation of activities starting with the first separation of labour. The old neighbourhood is no longer the central sphere for social life. We have social contacts all over the city.
- The car represents a new division of classes, in the have and have not. This is true to the extent that a car is available for 80 per cent of the population in western societies. The group who doesn't have a car is mostly old people (but these are also the group with the strongest increase in car ownership), the young ones who just moved away from home and residents in inner city areas. To some extent car ownership is dependent on income, but not so much as the other reasons.

- The car is more of a class symbol when we compare rich and poor countries and the rich and the poor in the poor countries. The question is what is the worst case, being without a car when a strong majority has one or being without when the majority is in the same position.
- The car represents a new division of the active and the passive, in terms of different abilities to reach various arenas. This is true, but the division is not a new one and the groups without a car gets smaller and smaller. And not all those who are without are in a permanent and problematic situation. Mostly we are again talking about the elderly.
- The car represents in many ways the cause behind the deterioration of inner urban areas, partly directly with the construction of urban motorways through the inner city, and partly indirectly by making it possible for people to move to the suburbs (Jackson 1985)

Causes behind increased mobility

The main factors behind an increasing use of transport both for transport of persons and goods, over short as well as long distances are the following:

- Spatial structure is both a cause and an effect in that inhabitants in cities with a dense structure use less energy than those living in sparsely populated cities. And the development in general moves towards less and less density. People living in residential areas far from the city-centre use more energy compared to those living in central areas. The increase in city size and land use per capita gives more use of energy. People with a good supply of public transport close to where they work, spend less energy than those without such a supply. The supply of public transport where people live does not seem to have the same impact. But the tendency is towards a reduction in the supply of public transport, not an increase.
- The essential condition behind an increase in transport use, is the existence of new transport technology. But the main forms today existed also 50-70 years ago, with the jet plane as the exemption. The decrease in price for owning and using transport is probably a more important factor over the last years. So is also the enormous increase in transport capacity, in terms of vehicles and infrastructure. Especially in and around cities new road capacity creates more traffic. Technology that administers traffic in a more efficient way may also lead to an increase in traffic volume.
- The relatively steady increase in real economic wealth for consumers is probably the strongest force behind owning transport means and also of travelling. This works in several ways as more money gives capacity to purchase more goods and maybe more trips for leisure, and as economic growth means more people working and therefore more travelling.
- The car also represents cultural values. It is identified strongly with values of freedom, individuality, prosperity etc, and the use of a car is therefore in accordance with overall values. These are to some extent questioned in the

richest parts of the world, but not so in Eastern Europe and in developing countries.

Travel behaviour as social acts

Human beings are conscious beings, which means that they reflect on the reasons for their acts as well as the consequences of these acts. This may seem as an obvious proposition, or even a statement. The main reason for stating this point is that travels are more than just simple means to an end. People travel and choose modes for their trips based on other reasons than just to minimise the costs of travelling.

One way to understand human acts is to apply the sociologist Max Webers different forms of rationality; instrumental, value oriented, actions based on affective drives and traditional acts, that may have originated from one of the three others. In transport planning and in models for predicting behaviour, one very often takes the first form of rationality as given. But people also act according to what they think is right or wrong and they act according to emotions of the moment, without long calculations. This implies that policies directed towards changing behaviour also could be based on different sets of values and not only towards changing the conditions for travelling or for the use of different modes. Traditional acts or acts based on habit may be changed by giving information and thereby raising the level of reflexivity.

Life style is connected to how we show off our values by how we act and by the things we own. This implies that behaviour is an image of who we want to be. The consequence here is that behaviour may not change with changing conditions because we put other values into our travelling than just time or cost.

There is no conclusion to be drawn from these points, but we argue for an opening for the importance of individual choice, not only structural necessity. An example can be drawn from the first use of cars where driving both was promoted by strong forces in society, but also was a very conscious decision by those obtaining a car and by decision-makers who provided the infrastructure.

Politics for sustainable transport

Over the last 10 years politics that can reduce environmental problems originated from transport has been sought for and discussed. There are mainly two points that need to be mentioned as a conclusion:

- Differences between different countries concerning what kind of overall policies they seem to choose.
- The fact that no country seems to have found the good solution that both have the wanted effect on environmental problems and at the same time are realistic as a political measure.

Some countries seem to focus more on traffic management and in increasing the capacity of the road-network. This is especially true for the US and Japan. In European countries there seem to be some agreement now, that new road-capacity and better management only leads to more traffic. A change in policies towards regulating demand for transport is therefore necessary if a better environment, a sustainable environment, is to be obtained.

It also seems to be an experience that positive measures, improved technology and a better supply of public transport, are the easiest measures to get a political backing for, but that restrictive measures are the only ones that really work.

We can therefore conclude that a combination of restrictive measures and a better supply is necessary to reduce the amount of travel and give a good service for those being priced out. The question of the effect of land-use policies is still an open one.

In an OECD-report (OECD 1995) a three-stage strategy is set up to reach the goal of sustainability, if possible, sometime in the future:

- Adoption of best practice policies. This means to apply already known measures from different parts of the world, especially cities in Norway, Sweden, Switzerland and Germany. Measures include limiting urban sprawl, location of activities near public transport facilities, limiting car parking at work, limiting road investments, providing better facilities for cyclists and pedestrians, increase fuel taxes and tighten regulations on emissions from vehicles, introduce urban tolls, as in Norwegian cities, but with the clear aim of reducing the amount of traffic in the city.
- These measures are not expected to have a great impact on the total amount of traffic, but will limit other environmental problems, such as noise, emissions of CO and Nox. The problems related to energy use and land-consumption will not be solved by such measures.
- OECD stresses the need for innovations. In "Strand 2" they list possible areas of new measures that opt for cities to be reconstructed back to the urban village, to work for better and faster public transport and to implement higher taxes on energy consumption.

This way of thinking meets with several problems; will the selected measures really work, can we live with the other consequences they will induce on people, and are they in any way possible to implemented. This turns our focus towards real conflicts concerning values and to the question of power, within politics and within markets where producers and consumers meet.

Sustainable cities as utopia

In international negotiations around environmental problems, experiences have been obtained that points towards the fact that any successful policy need to satisfy both goals related to growth, equity and the environment. In addition solutions need to be technically possible.

- Analysis's shows very clearly that a basic problem is connected to the political situation as being a triangular conflict rather than a simple left vs. right conflict.
- A great deal of environmental problems in the OED-countries is a direct consequence of trying to obtain equity; the spread of consumer goods (including cars) and the increase in housing standards for a majority of the population. It is not a conflict between the rich and the poor, but a conflict of interest between dominant values of a majority of the population.
- A proper analysis will reveal conflicts both between growth and a sustainable development and between a traditional equity ideology and the environment. In many European countries these conflicts are as marked as the conflict between the blue and the rest.
- A change in paradigm will have to build alliances both to the right and to the left. In some countries we can see examples of such when old liberal parties work together with New Leftist groups for environmental solutions. The resistance against EU in Norway and some other countries are typical of such alliances.

A discussion of the process around the Dennis-package in Stockholm may be a good description of different kinds of conflicts and how they can be solved. The same can be said about the process around the Oslo-package which is actually implemented.

In the Oslo case, the important thing is to understand why the toll-system was actually implemented. The main reasons for the success was:

- Agents interested in heavy road building got their money, even though some kept arguing against and wanted more government funds.
- Agents interested in alternatives to cars got promises that 20 per cent of the complete package should go to public transport infrastructure.
- Agents interested in restrictions on car use, hoped that the toll-system had future possibilities as a restrictive measure, even though the systems main purpose was to optimise income.

An important part of the discussion related to actors and power is whether one should apply a conspiratorial theory with enemies and friends or whether the conflicts are open and real and of a political nature. Our standpoint is that the latest version is the most correct. Increased mobility cannot be considered something impressed on the people against the will of the people. That is one more reason for searching after real compromises on real conflicts.

Maybe the problem will disappear

As little optimism can be drawn from present trends and possible counter measures one must look for other possibilities. Our conclusion focuses on the following:

- *The need to travel.* At present around 2 in 3 trips are basic trips related to work, shopping caring for others etc. An increasing number of trips are performed in relation to conspicuous activities, which means that we may be able to reduce travelling without really reducing peoples basic welfare. If we also include changes in values and life style, especially concerning the value placed on mobility, this reduction may be even more possible. But strong forces works towards an increase in trips, at least in the near future, especially if we include Eastern Europe and developing countries.
- *Alternatives to travelling.* Focus has been placed upon alternatives to physical movements, especially travelling in cyber space. As yet we do not know what the effects of IT is going to be. Some believe that computers and telecommunications will induce a revolution in communication which may change transport patterns completely. This is possible, but so far history has showed that new technology seldom replaces old, but rather comes in addition to the old ones.

1. Introduction

Institute of Transport Economics was asked to do a review on literature to reveal:

a) Trends in individual travel behaviour

b) Point out environmental and other problems associated with aggregate mobility trends

c) Present major factors linked to individual travel

d) Discuss effects of policies on individual travel behaviour.

To review all relevant literature has been impossible. Some topics are therefore more thoroughly dealt with than others. In the work our aim has been to make a rough overview, and as far as possible to describe major trends within individual travel, to point out different explanatory factors influencing individual travel behaviour, and to provide concrete information on the effects of government actions and measures on individual mobility. We also feel that this work has ended up as something more than just a study of available literature.

We have tried to present some different conceptual models used in social science within the field of the transport sector and individual travel behaviour. But we have not been conclusive as to how these models differ in explaining "where the human race is heading". As far as we can see, this is a rather substantial task. However, this paper may serve as input for such work. The paper may also serve as an input for a discussion on how the social sciences can contribute to improve policies aimed at influencing individual travel behaviour.

The report is organised according to the four topics listed above; a) - d). In *chapter two*, we have tried to present an overview of existing studies on development-patterns of individual travel behaviour. The attention has been on shorter daily trips. To make a complete review one should also include longer trips and tourism. The focus is on differences between countries and continents as to car ownership, trends in travel behaviour like number of trips, trip-chaining, travel distances, travel time, modal shares and trip purpose. In the end we focus on some differences between segments of the population.

In *chapter three* we give a very short overview of environmental and other problems associated to individual mobility. The review is kept short as many have performed this task earlier (e.g. OECD 1995). What we have started however is a short discussion on what can be termed as cultural sustainability. We are in no way conclusive on this point, but present some points of view as to what kind of society we live in and move towards.

Chapter four is dedicated to major factors linked to individual travel. These factors are seen from a structural point of view. The common major factors that are listed are spatial structure, infrastructure, demography, technology, politics and macroeconomic factors and cultural factors. Not all the factors are commented upon to the same degree.

In *chapter five* the attention is on the individual traveller. Shortly we present a way of studying human beings as actors or agents with reflexive abilities that are often overlooked, with the ability to choose from their own will and with a conglomerate of more or less conscious motives for their actions. Modal choice as consumer behaviour is also reviewed.

Policies directed towards measures that effect individual travel are reviewed in *chapter six*. The main focus is on daily trips in urban areas, and limited to such measures as have the explicit purpose of reducing individual travel or get people to switch from using a car towards the environmentally more friendly transport modes, non-motorised or, given certain prerequisites, public transport. The different policies are divided into land-use policies and transport policies. The chapter end with the question of implementation.

In *chapter seven* we continue into the field of politics, but with the main purpose of discussing important agents within the field of transport and environment. Our main points are at least two; that basic conflicts and the existing structure of power are of a kind that cannot just be overcome by discourse and that the influence of a diversity of actors actually are a legitimate part of a democratic system. We also argue that possible solutions have to satisfy many interests to have any chance of being implemented.

We do not present any conclusions. In the *epilogue* we again lift up some themes that may be of importance in the future. But we also state, with respect, that any prophesy is a hazardous business.

2. Trends in individual travel

2.1 Introduction

Personal travel behaviour has to be studied through surveys that provide a wide variety of indicators, either at the personal or aggregate level. Travel behaviour analysis, being a relatively young field is characterised by a diversity of methodological approaches, and as there are no common standards for travel surveys, cross-national comparisons are difficult. Many countries do travel behaviour surveys regularly, but not synchronised. This makes the comparison even more difficult.

Despite these problems several international comparison studies on travel behaviour have been done. Many of these studies are based on international statistics collected by, for instance, The International Road Federation (IRF). Others are based on specific surveys with governmental officials of different countries as informants (i.e. OECD 1995). Others again presents general problems and trends related to travel behaviour based on a variety of national travel surveys (i.e. Salomon, Orfeuil and Bovy 1993). The overview of trends in personal travel below are based on a selection of these studies.

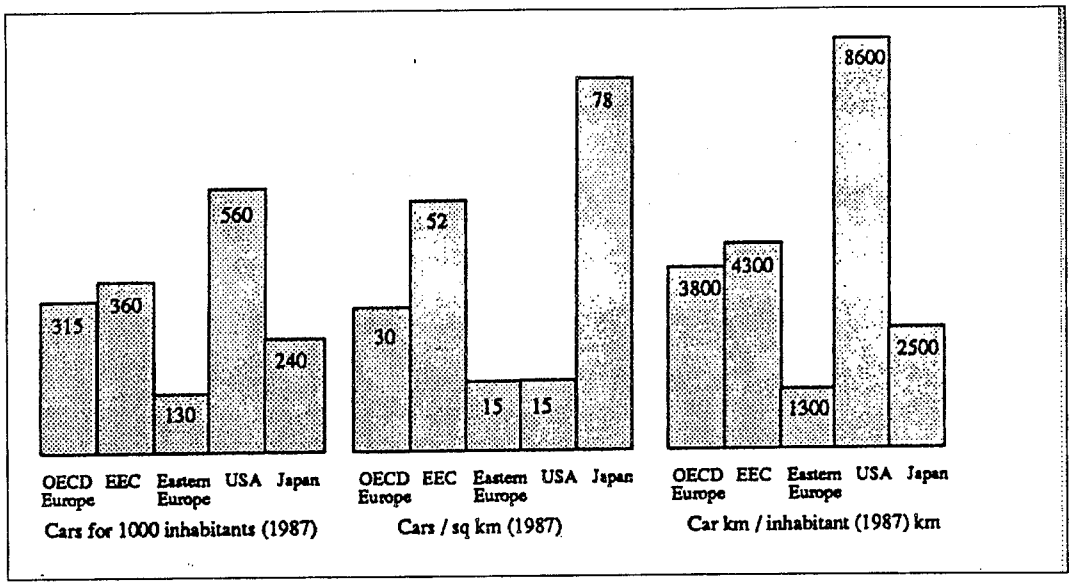
We will first focus on some general differences in various parts of the world, then show some key tendencies in car ownership and individual travel behaviour.

2.2 Differences in various parts of the world

European travel patterns are different from those of the North Americans and the Japanese. The main differences may be explained by geography (density and distribution of settlements), culture (Europe being in an intermediate position between the holistic approach of Japan and the individualistic culture of The American pioneers), and the domestic economic context (pricing policies, infrastructure investments) (Orfeuil and Bovy 1993).

Car ownership per inhabitant in the five «blocs» (OECD-Europe, EU anno 1990, Eastern Europe, USA and Japan) shown in figure 2.1, shows that the European level is higher than that of Eastern Europe and Japan, but lower than in USA. *Car density*, expressed in cars per square-kilometre, is however highest in Japan, followed by Western Europe. Looking at Japan and USA it seams that *travel distances* perform an inverse relationship with car-density. With low densities, high income and low prices for transport, North-American residents travel over longer distances. With low levels of income and car ownership, East European residents have the lowest mobility level (defined as car km/inhabitant). Despite higher income, global mobility per capita in Japan is only 77 per cent that of EU residents. The difference may be related to higher densities, specific policies to

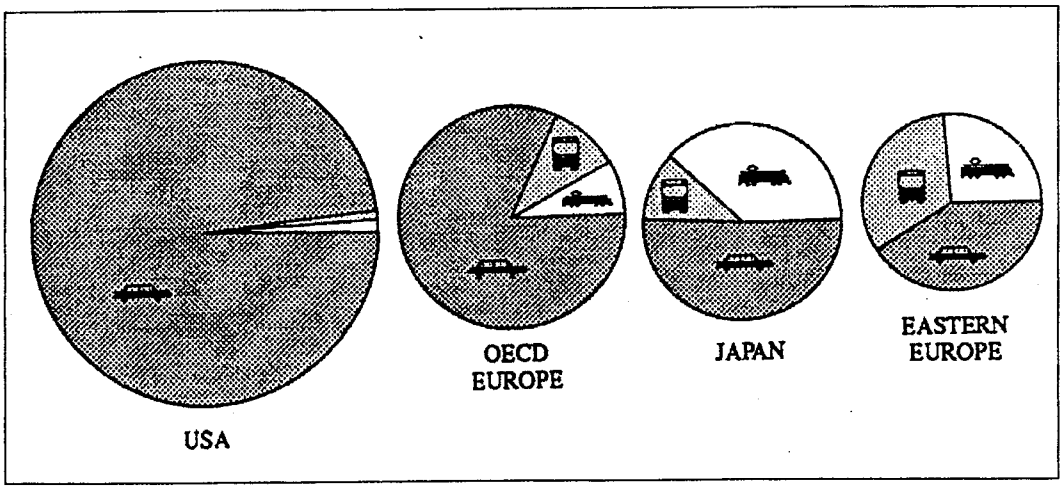
discourage the use of cars in urban areas, poor level of service of the road network, and time budgets, like long work weeks and short periods for holidays (Orfeuil and Bovy 1993).



Sources: Orfeuil and Bovy. 1993:15: ECMT (1990, 1991a); Japan Road Assoc. (1990); Koshi (1989); Linster (1989); US DOT (1990)

Figure 2.1: Differences between OECD Europe, EEC (1990), Eastern Europe, USA and Japan: Cars and motorways

The car has become the nearly exclusive mode of transport for short distance trips in USA, with 3 per cent of the market only for public transport and 10 per cent for soft modes (walking and cycling). In Eastern European countries and Japan more people are using public transport, which serves the majority of the market in urban areas (figure 2.2).



Source: Orfeuil and Bovy 1993:16

Figure 2.2: Differences between USA, OECD Europe, Japan and Eastern Europe: Modal Shares

Figures from West-Europe and OECD Europe (table 2.1) show that the share of the private car is increasing form 79 per cent to 83 per cent. Car use growth rates (2.8 per cent) exceeded public transport (1.3 per cent) by a significant margin.

The growth of personal mobility is lower in Central or Northern Europe than in Mediterranean countries. Only two countries, Denmark and Sweden, experience higher growth rates for public transport than of car mobility. Quite an opposite evolution is observed in Belgium and the UK, with a negative growth for public transport, and to some extent in Norway and Germany, with very low growth rates for public transport, compared to car mobility.

These figures show that there may be great differences between countries and states within a larger area.

Table 2.1. GDP and personal mobility, annual growth rates between 1970-1987 (in %)

Country	GDP	Perskm total	Perskm private modes	Perskm public modes	Car-km
Belgium	+2.1	+1.4	+2.0	-0.4	+3.2
Denmark	+2.0	+2.3	+2.0	+3.6	+1.6
Finland	+2.9	+2.5	+2.9	+1.6	+3.9
France	+2.3	+2.7	+2.8	+1.9	+2.9
Germany	+2.5	+2.1	+2.5	+0.3	+3.4
Italy	02.0	+3.6	+3.8	+2.9	+3.4
Netherlands	+1.8	+2.4	+2.8	+0.2	+3.4
Norway	+3.7	+3.5	+4.1	+0.6	+5.3
Portugal	+3.0	+5.8	+6.8	+2.9	+6.6
Spain	+2.3	+3.3	+4.0	+1.7	+5.5
Sweden	+1.8	+1.8	+1.7	+2.1	+2.3
Switzerland	+1.1	+2.8	+3.0	+1.6	+3.1
Turkey	+3.3	+3.5	+6.0	+2.1	+6.7
U.K.	+2.0	+2.3	+3.0	-0.9	+2.5
OECD Europe	+2.4	+2.5	+2.8	+1.3	+3.0

Sources: Orfeuil and Bovy, 1993:26: ECMT (90), OECD (85, 91)

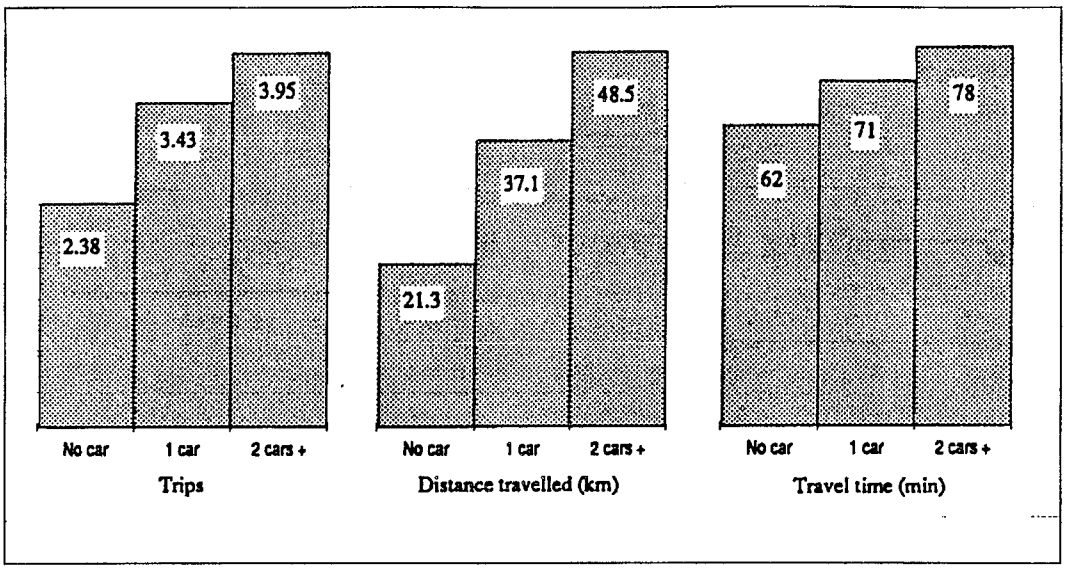
2.3 Car ownership

There is a close relationship between car ownership and mobility (figure 2.3). However, as we have seen in figure 2.1, the relationship between car ownership and mobility is not valid on an aggregated level.

Figures from 131 cities around the world (OECD 1995) show that cars per person, in 1990, varied from 0.1 in Bursa in Turkey to 0.7 in Phoenix (USA). National differences based on these data show in general that many of the cities in USA and Italy are clustered towards the highest levels of car ownership. In most of the European countries, the level of car ownership in cities was between 0.3 and 0.5.

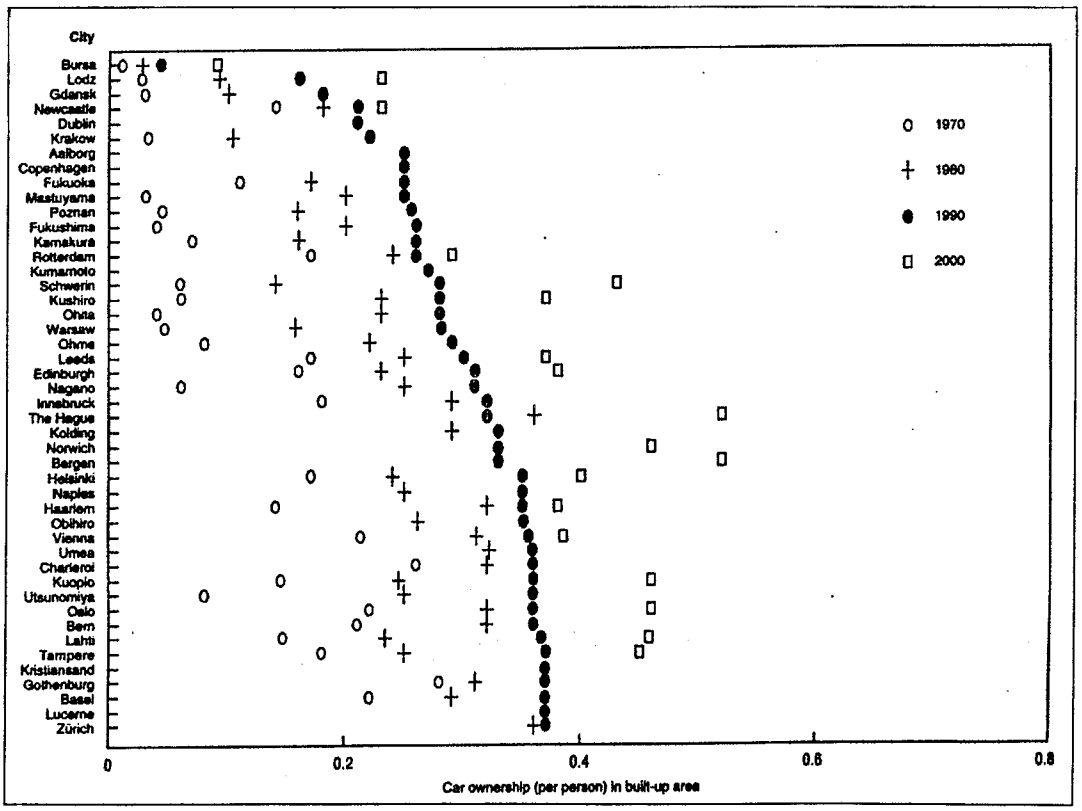
Over time there has been a marked shift towards higher car ownership. Whereas in 1970, 57 per cent of cities had below 0.2 cars per person, by 1990 only 3 per cent of cities were on the same level. As figure 2.4 shows, car ownership has risen almost everywhere in the 1970s and the 1980s. These trends are expected to

continue in the 1990s in all cities. On average, cities are predicting further growth of 20 to 25 per cent (OECD 1995).



Source: Orfeuil and Salomon 1993

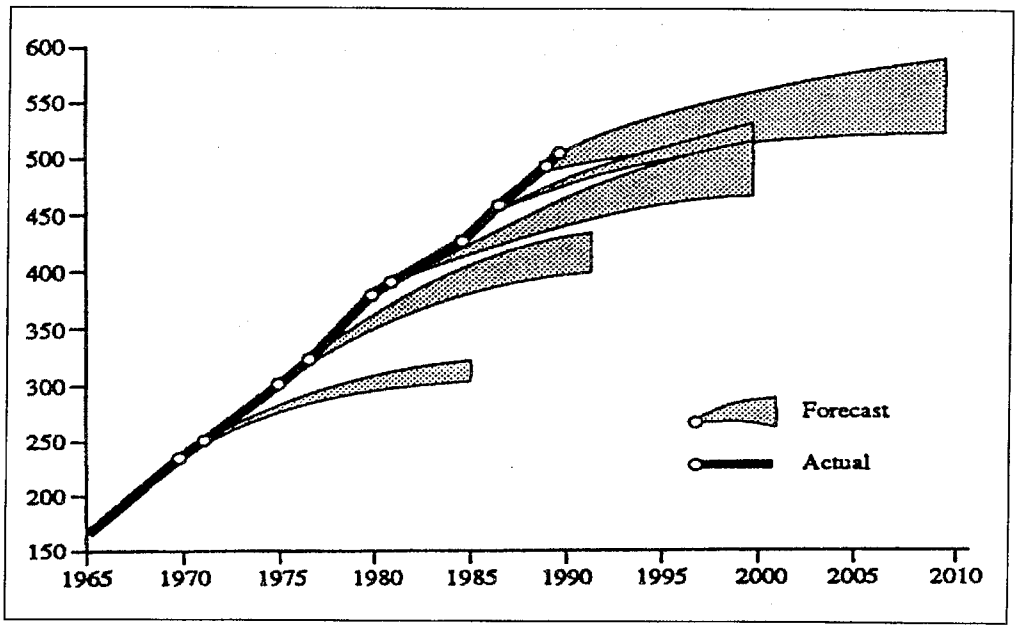
Figure 2.3. Mobility indicators by car availability, Norway 1985



Source: OECD 1995:167

Figure 2.4. Car ownership: Trends and forecasts

Determining the saturation level is proven to be a most difficult research problem (figure 2.5). Initially, the level of one car per household was considered the upper limit. Then, a saturation level of one car per worker was assumed. The next level was one car per adult. However, now it is becoming popular in more affluent households to have specialised cars: the number of people owning a leisure car, an urban car etc., is growing (Korver et al. 1993)

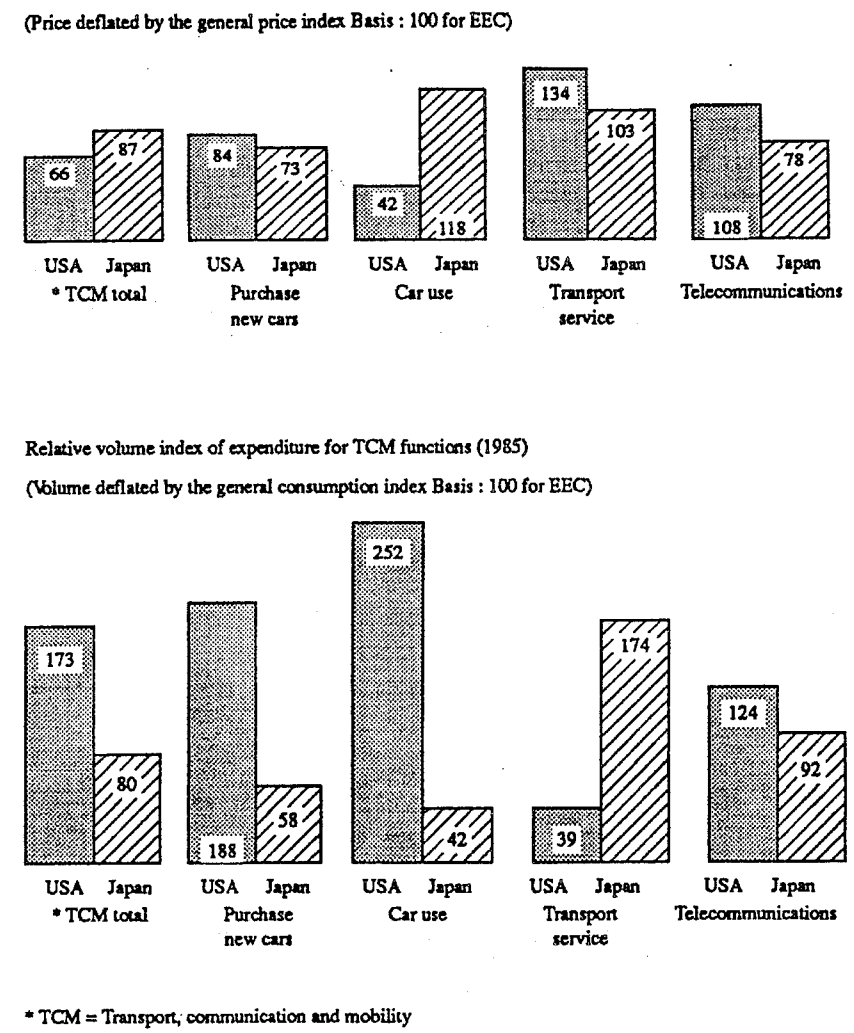


Source: Korver et al 1993:76: Strassenverkehrstechnik, 1990

Figure 2.5. Comparison of actual developments and SHELL forecasts of car levels in Western Germany

The share of *household expenses* devoted to transport and telecommunications (TCM) in EEC countries is 15 per cent. It equals the USA share but differs significantly from 9.5 per cent in Japan (1985 figures). Figure 2.6 shows the position of USA and Japan compared with Europe.

The *relative prices* of the car market are highest in Europe compared with USA and Japan (however, there are great differences between European countries). This means that an average European has to work more to buy a car than a Japanese or an American. The relative price of public transport is the highest in USA. Regarding *relative volumes* the differences are very clear: Europe is in an intermediate position for all items.



Source: Orfeuil and Bovy, 1993:18: Calculations from EUROSTAT (1986)

Figure 2.6. Relative price and volume index of transport, communication and mobility (TMC). USA's and Japan's proportion of Europe. Europe=100

The rate of car ownership varies between rural and urban areas, between cities with different volumes of inhabitants and within urban areas. In Germany, 74 per cent of the households in small communities (less than 20,000 people) have a *car*, a share that decreases to 55 per cent for cities over 500,000 people (Hautzinger, 1989). In France, the number of cars per household decreases from 1.2 in rural areas to 0.82 in the Paris area (Hivert, 1991, in Salomon et al. 1993). In Oslo, the number of cars per household is 1.2, but in the inner city it is only 0.4 (Berge 1994).

2.4 Changes in travel behaviour

Number of trips per capita per day has grown with urbanisation and economic development. In the most affluent countries of central Europe, it is now stated to be stable (Orfeuil and Salomon 1993). However, this is difficult to verify because of problems of measurements. The mean of trips per capita per day was in 1993 in the range 2.5 - 3.5 in most European countries.

One out-of-home activity may consist of many trips due to *trip chaining*. Chains are more complex for people who live in remote areas, or when there are sharp increases in fuel prices. In the European context in the beginning of the 90s, the mean number of out-of-home activities per capita ranges from 1.5 to 2.5. Many of these trips are simple trips between work and home, i.e. in the Oslo area 54 per cent of the trips are such simple trips.

The *travelled distances per capita* per day are in the range of 25-35 km and have never before been so high in Europe (Orfeuil and Salomon 1993). A study of 131 cities in Europe shows that there has been a shift to longer travel distances over time (table 2.2).

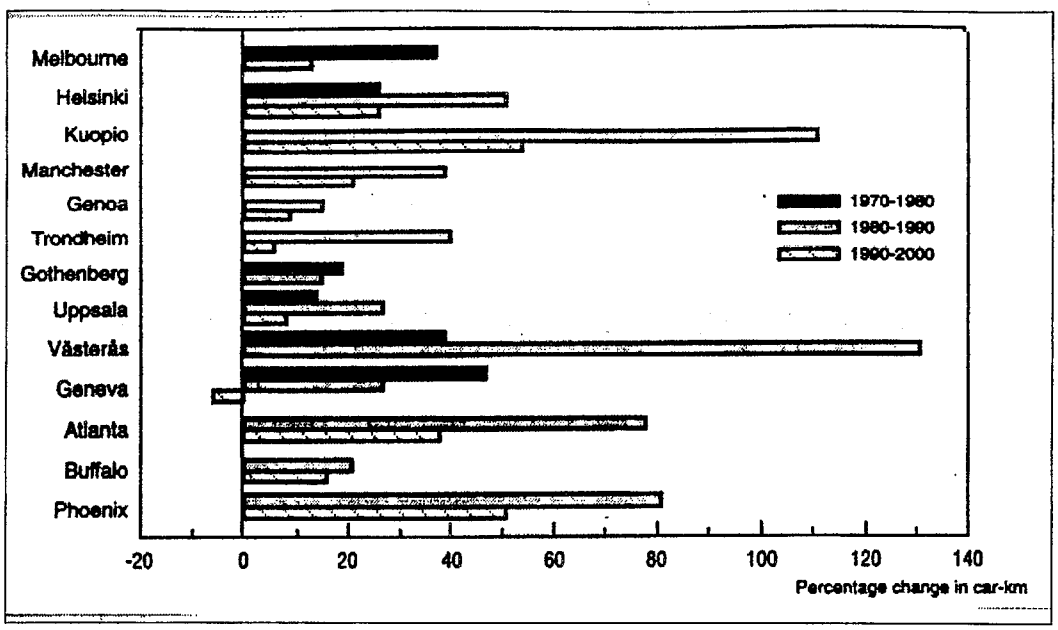
Table 2.2. Percentage of 131 cities in Europe categorised by average trip length

Average length (kms)	1970*	1980	1990
0-5	(56)	32	22
5-10	(33)	54	44
10-15	-	5	25
Over 15	(11)	9	9
Valid cases (=100%)	(9)	22	32

* The 1970 data is for a very small sample

Source: OECD 1995:179

The gradual increase in trip lengths together with the modal transfer to cars has in most cities in Europe resulted in increased *traffic levels*. Available data on car-km in Europe shows that in almost every city the upward trend were decisively in the 1970s as well as the 1980s, and had predicted growths for the 1990s (figure 2.7). On average, traffic has grown (or is predicted to grow) by between 30 and 35 per cent in each decade.

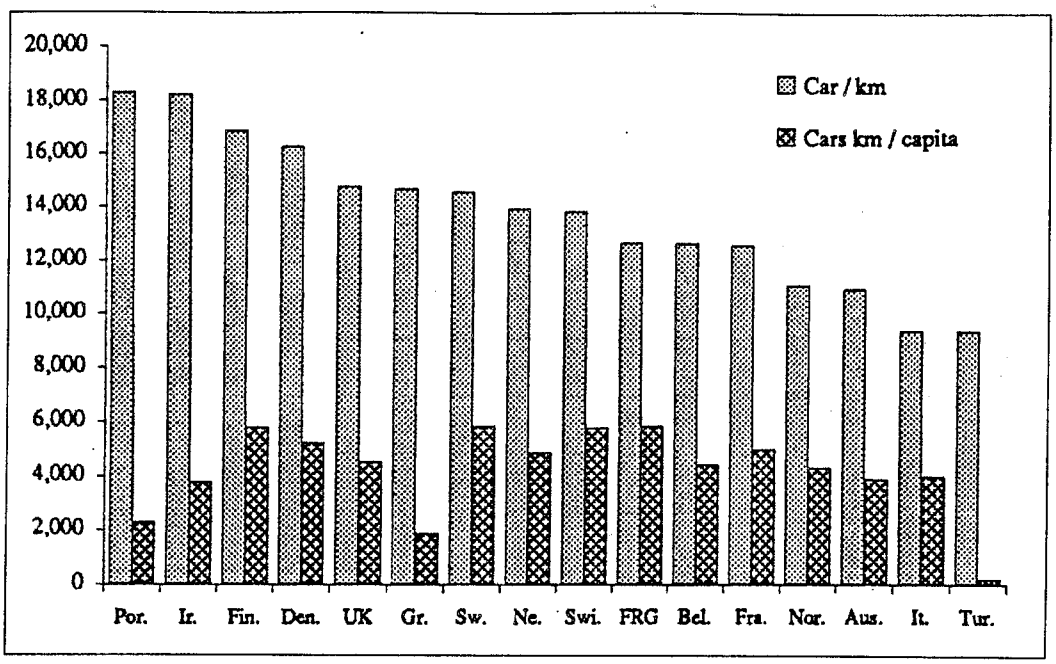


Source: OECD 1995

Figure 2.7. Percentage change in traffic levels: trends and forecasts

Numbers of km *driven by car per inhabitant* (figure 2.8) shows that Germany has the highest *car mobility* in Europe, 5.877 km per inhabitant, and Turkey the lowest, 210 km per inhabitant. A clear division into three groups is apparent: Germany, Sweden, Finland and Switzerland with a very high car mobility, and Portugal, Greece and Turkey with a very low car mobility.

The intensity with which cars are used has varied. In Sweden and the UK, km per car increased by nearly 20 per cent from 1970 to 1991, whereas in France it grew by only 2 per cent. Even in USA, with the highest car ownership rates in the world, average km per car grew by 7 per cent over the same period. In Switzerland, however, it decreased by over 10 per cent. (Car occupancy in Switzerland has also been falling and the growth in car passenger/km has been almost half the rate of that by public transport since 1985 - 2 per cent p.a. compared with 3.5 per cent p.a.) (OECD 1995).



Sources: Korver, Klooster and Jansen 1993:81: IRF 1989

Figure 2.8. Annual car km per car and car km per inhabitant (1987)

In the European Union, the average annual km per car is expected to decrease from 14.400 in 1990 to 13.400 by 2010, but total car km should increase by 25 per cent over the same period, from 1.727 to 2.166 km (EU Green paper 1992).

Despite increasing traffic and congestion, The *mean total travel time* evolves much slower than travelled distances, due to the increase in leisure trips which take place at off-peak periods.

Modal shares: When expressed by number of trips, in most Western European countries the car and soft modes (walk, bike, moped etc.) rank first. When expressed by distance travelled, the car has a predominant position (Orfeuil and Salomon 1993).

Trip length for different modes of travel (table 2.3) shows that, on average, trip lengths by bus and coach in European cities are shorter than those for cars which are in turn shorter than those for trips by rail/metro.

Table 2.3. Distribution of trip length by modes 1990

Length (kms)	Car	Bus/coach	Rail/metro
0-5	8	28	13
5-10	49	44	13
10-15	35	23	34
Over 15	8	5	40
Valid cases (=100%)	37	39	15

Source: OECD 1995:179

Taking large French towns as an example (Ceture 1990) 80-90 per cent of the population (over 6 years old) are trip makers. Walking concerns 20-25 per cent, 2-7 per cent use a bike or a moped at least once a day, 15-25 per cent use public transport at least once a day and 45-55 per cent use a car, as driver or passenger, at least once a day.

The differences in modal split vary between countries. One study from 1990 (Pucher 1990) shows for instance that the use of car varies from 82 per cent to 11 per cent of total trips (table 2.4).

Table 2.4: Comparison of modal split in urban passenger transportation in Europe and North America

Country	Percentage of total trips			Ratio of auto to public transport
	Auto	Public transport	Pedestrian & bicyclist	
Hungary	11	58	31	0,19
Soviet Union*	12	88	N.A.	0.14
Czechoslovakia	13	52	35	0.25
Poland*	15	85	N.A.	0.18
East Germany	24	27	48	0.89
Italy	31	26	N.A.	1.20
Sweden	36	11	49	3.30
Switzerland	38	20	39	1.90
Austria	39	13	40	3.00
Denmark	42	14	41	3.00
United Kingdom	45	19	33	2.40
Netherlands*	45	5	48	9.00
France	47	11	35	4.30
West Germany	48	11	40	4.00
Canada	74	15	11	4.90
United States	82	3	10	27.30

*Public transport here includes bus, streetcar, subway, and commuter rail as well as less conventional transit modes such as urban ferries, cable cars, inclined planes, and automated guideway systems.

The modal-split figures are the most recent available for each of the individual countries, ranging from 1978 for the United Kingdom and France to 1987 for East Germany.

Source: Pucher 1990: Based on data by the ministers of transport in each of the individual countries

Despite the upward trends in most motorised forms of transport, walking and cycling continue to provide a large proportion of mobility and access needs in many countries.

Figures form Norway (1991/92) show that more than 50 per cent of all trips by car are shorter than 5 km, 39 per cent 3 km, 28 per cent 2 km, and 16 per cent are shorter than 1 km. If we did not use the car on trips shorter than 2 km we would reduce the number of trips by 30 per cent and the total distance with 5-10 per cent. Yet, some of these short trips are parts of a trip chain and difficult to replace.

Table 2.5 shows information from a number of city travel surveys in Asia and Africa. The variation in travel patterns among cities in Asia, even at similar

income levels, is quite striking and is much greater than the variation among countries within Europe, for which survey results are provided in table 2.6.

Although current differences in urban travel behaviour are large, virtually all countries are moving toward greater car orientation. The continuing political and economic revolution in Eastern Europe will probably lead to much more market-oriented economies, less subsidisation of public transport, and significant increases in car ownership (Pucher 1990). Economic development in low-income countries will also push forward more car-oriented patterns of travel behaviour.

Table 2.5. Percentage of trips by mode in Asia and Africa

Country/city	Survey year	Non-motorized	Private motorized	Public transport and taxi
Asian City Surveys (Midgley 1994)				
Low income				
Tianjin	1987	91	-	9
Bombay	1981	26	9	65
Jacarta	1984	40	21	39
Middle income				
Seoul	1982	12	8	80
Kuala Lumpur	1984	12	46	42
Bangkok	1984	12	46	42
High income				
Central Tokyo	1988	24	25	51
Greater Tokyo	1988	22	54	24
African City Surveys (Davidson 1993)				
Abidjan	1988	30	12	51
Dakar	1989	50	17	32
Nairobi	1989	15	25	50
Conakry				
Low income		55	3	41
Middle income		27	19	54
High income		5	57	38

Source: Michaelis 1995

Table 2.6. Daily mobility of Europeans according to mobility surveys.

Country	Age limit	Type of period	Date of survey	Trips/ day #	Distance/ day (km)	Travel time/ day (min)	Modal distribution (trip/distance based)			Purpose % (trip based)		
							Soft	P.T.	Car	Mand	Serv	Discr
Austria	>6	WD	83	2.9	22	67	40/8	19/34	42/58	40	30-41	18-29
Finland	-	7D	86	3.1	-	71	31/6	12/19	57/75	33	34	33
France	>6	7D	84	3.1	21	53	41/8	8/17	51/75	38	36	26
Germany	>10	7D	82	2.9	30	69	41/8	14/25	45/57	39	32	30
Israel(*)	>8	WD	84	3.0	-	-	37/-	31/-	32/-	43	28	29
Netherlands	>12	7D	87	3.4	33	71	47/16	5/12	47/72	29	25	46
Norway(**)	13-74	7D	85	3.4	32	71	35/6	11/31	54/63	33	22	45
Sweden	15-84	7D	83	3.6	25	-	38/5	12/20	50/70	36	16	48
Switzerland	>10		84	3.3	29	70	46/10	12/20	42/70	36	34	30
UK	-	7D	86	2.8	23	-	37/9	14/19	49/72	30	40	30

(*) Mean value for Tel-Aviv, Haifa, Jerusalem
(**) Urban population only

Source: Salomon, Bovy, Orfeuil 1993:40.

Trip purposes can be divided into three groups:

1. Mandatory mobility: Work trips, school and business-related trips.
2. Service trips: Related to household management: Shopping trips, escorting children and personal business.
3. Discretionary mobility: Visits and leisure trips.

The proportions of these three depend on the geographical and occupational structure of the population and on the national income. The share of leisure trips (in the wealthier countries more than half of the total distance travelled) increases with economic development.

The distribution of trip purpose in a population reflects the activity patterns and the organisation of everyday life. Taking Oslo as an example, the distribution of trip purpose shows that 34 per cent of all trips are mandatory, 33 per cent are service trips and 26 per cent are discretionary trips. 7 per cent of the trips are others (table 2.7).

Table 2.7. Percentage of trips by purpose in the Oslo area

Type of trips	Purpose		Sphere
Mandatory	Work	27 %	Production
	School	4 %	
	Business	3 %	
Service	Escorting/care taking	8 %	Reproduction
	Shopping	25 %	
Discretionary	Leisure	16 %	
	Visits	10 %	
Others		7 %	
	Sum	100 %	

Source: Hjorthol (Transport i by '95. Trondheim 31.mai og 1.juni)

Over time the increase of trips per person are first of all service trips (table 2.8). The explanation of this is related to the fact that more women are working outside their homes, in combination with changes in opening hours.

Table 2.8: Number of trips per person in Norway. Trip purpose (RVU 1985 and RVU 1992)

		Work	School	Business	Shopping	Care taking	Leisure	Visits	Others
Trips per	1985	0,60	0,15	0,18	0,74	0,19	0,57	0,50	0,19
person	1992	0,67	0,11	0,11	0,83	0,27	0,58	0,48	0,20

Source: Solheim 1996

2.5 Differences between segments within a population

The use of soft modes and, to some degree, of public transport is greater among *women*, and conversely car driving is greater for *men*. Women make less commuting (and business) trips but have higher rates of service trips, especially shopping and escorting children.

Women travel 40 per cent less than men. However, if mandatory trips that are related to imperative social roles like commuting and business trips are excluded, the distances travelled by men and women exhibit no further differences (Orfeuil and Salomon 1993).

The numbers of trips for children are slightly lower than for *adults*, those for *teenagers* may be slightly higher. Children and teenagers travel short distances with greater use of soft modes than adults do. Again, leaving aside mandatory mobility the gap between children, adults and elderly people are reduced.

Higher mobility levels are correlated with higher *level of education*. Higher levels of education are positively correlated with *income*, and in Europe today, negatively correlated with age. The number of trips increases only slightly with income, but the distance travelled increase sharply, as well as the share of car driving.

Greater numbers of commuters, greater business mobility and longer commuting distances mainly explains the correlation between growth of travel distance with income. Travel behaviour patterns also vary depending on household type and size. Single person households are in general more mobile than married individuals in the same age group. The presence and age of children strongly influence its members' travel behaviour.

A study from Norway (Berge 1996) shows that there is a relationship between *lifestyle,* frequency of car use, car ownership, and *attitudes* towards transport and environment. Some lifestyle groups have more than other groups, a high frequency of car use, good access to car, are not concerned about environment and are against environmental taxes on petrol. This analysis also shows that differences in frequency of car use between gender, age groups and people from urban and rural areas, is only valid in some lifestyle groups.

2.6 Urban structure and travel distance

Despite no evidence of common *urban structures* in the European area, an analysis of transport supply and mobility patterns exhibits some common features (Orfeuil and Salomon 1993). The *size of the urban area* is associated with a U-shaped distribution of trip lengths. Long trip distances are observed in rural communities and in the greatest conurbation, while shorter distances are observed in medium-sized cities. A similar (but weaker) U-shape is observed for the total distance travelled. One explanation is that middle-sized cities offer maximum mobility to people (in terms of opportunities and trip numbers) at a minimum cost (in terms of distance).

Location of the residence relative to the centre of the urban areas generates huge differences in travel needs (table 2.9). The distance travelled by suburbanites ranges from two to three times that of comparable persons (same family size and income) living in the central cities. Private modes are judged to be essential in suburbanites because the travel needs in these areas cannot be met efficiently by public transport (table 2.10.).

Table 2.9. Total distance travelled per weekday by residential location (Persons over 6, Toulouse)

	Central city	Inner suburbs	Outer suburbs with local amenities	Less densely populated outer suburbs
Total distance travelled (km)	7.6	11.4	13.9	15.9
Car distance (km)	4.6	7.8	10.5	13.5
(% car)	(60%)	(68%)	(75%)	(85%)

Source: Salomon, Bovy, Orfeuil 1993:46:Orfeuil, 1983

Table 2.10. Levels of service of public transport by population of area of residence (Switzerland)

Urban population (1000)	<2	2-10	10-50	50-100	100-200	>200
Per cent population according to access time to the next stop:						
Less than 2 min	20	19	30	39	32	41
6 min or more	38	43	24	16	12	10
Per cent population according to headways (peak hours):						
5 min or less	1	2	13	25	43	67
More than 10 min	98	94	62	17	15	8

Source: Salomon, Bovy, Orfeuil 1993:46: EVED, 1988

2.7 Some conclusions

Car ownership is increasing everywhere and follows a similar trend in almost all countries. Car ownership is higher in rural areas and small towns than in cities. When a car is acquired, members of households travel more than before and to new destinations.

Even over a short term almost every European country has a large reservoir of potential car owners. The number of driving licences exceeds the number of cars. Younger age groups have a much higher percentage of individuals with driving licence than the older ones. Assuming these groups will keep their licence in the future, ageing creates a larger potential growth for driving licence pervasion. The difference in licence rates between men and women is likely to diminish.

Due to measurement problems it is difficult to say that the number of trips per person per day is stable or increasing. However, the general trend is that the proportion of car trips per person is increasing, and the distance travelled per person is increasing. Over time the registered increase of trips per day are first of all service trips. The explanation is related to the fact that more women are entering the labour market.

The variation among countries in distance travelled per day is about twice as large as that in number of trips and the time spent travelling. We might conclude from this type of data that, (1) people travel to satisfy a certain number of access needs (for work, services, etc.) that do not vary significantly as the transport system changes, and (2) people operate with time budgets and will spend roughly the same amount of time travelling during each day, regardless of the average speed of the transport system. This would imply that measures that make travel faster will tend to increase the distance travelled by people (Michaelis, OECD).

In most countries, public transport is used for longer trips than cars: The public-transport share of trips is smaller than the share of distance. Walking, cycling and moped trips, not surprisingly, are shorter on average than public-transport and car trips in all countries.

Men and women have different travel behaviour. Different social roles and/or different lifestyles may explain these differences.

3. Environmental problems resulting from increased mobility

3.1 Introduction

In this chapter we will present a brief overview of some environmental consequences of an increased mobility, with Norway as a main example. We will divide this presentation into four parts: one on global problems related to CO_2 and global heating, one on the use of land for transport purposes, one on local environmental problems (emissions of NO_x, CO, noise etc), and one concerning social problems that may or may not be related to an increased mobility. The first three are relatively well known both concerning causes and effects. The fourth one are very clearly the most difficult one, both when we try to say what is good and what is bad, and also when we try to promote causes for this and that phenomenon.

3.2 Climate and acidification

3.2.1 CO_2-emissions

Human-made emissions, especially of carbondioxide (CO_2), can change the climate on earth in a not too far away future. UN's climate panel expects an increase in the average temperature on earth by 1.5 to 4.5 degrees Celsius caused by a doubling of CO_2-concentrations in the atmosphere. Such a doubling may happen within the year 2070. This will result in the highest mean temperature on earth in 150 000 years.

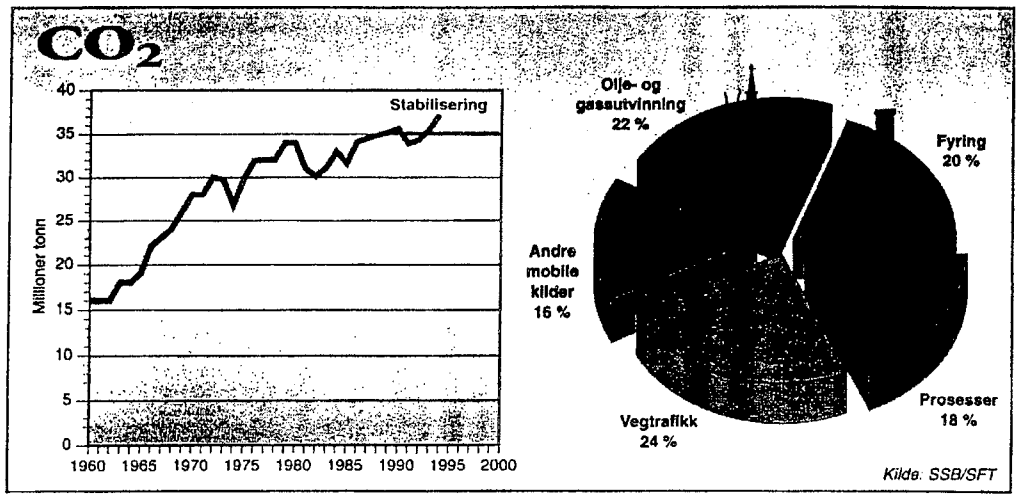
The increase may lead to changes in precipitation patterns, wind systems and movement of climate zones faster than what nature can adapt to, and a rising of sea levels.

For Norway, with a rather sparse population, large forests and a long sea-shore, estimates from 1992 shows that nature (forests, rivers etc.) can bind up to 15 million tons of CO_2, which amounts to about 40 per cent of the total emissions. Forests represents 60 per cent of the total intake. The forest ability to bind CO_2 depends on future forms of forestry and new planting.

In Norway, road-traffic represented 24 per cent of the total emissions of CO_2, while other mobile sources stood for 16 per cent. The sources are mainly transport by sea, which in Norway represents a rather extensive form of goods transportation. The oil and gas industry was responsible for 22 per cent of the total, almost as much as all road-traffic combined.

In 1993 the total emissions of CO2 in Norway amounted to 35.7 million tons. The energy consumed increased by 4-5 per cent from 1993 to 1994. The increase over

the last 5-6 years have been approximately 5 per cent, a rather small increase due to a temporary economic set back. And most of the increase stems from increased oil- and gas-production in the North Sea. In the coming years the emissions of CO2 are expected to increase, in Norway as in most other countries.



Figur 1.1 Norske CO_2-utslipp 1960 - 1994. Utslipp etter kilde 1993.

Figure 3.1. Norwegian CO_2-emissions 1960-1994

On a world basis it is estimated that 15 per cent of CO_2 stems from motor vehicles. The western and eastern industrial countries with 25 per cent of the world's population, stands for 80 per cent of man-made CO_2-emissions. Less developed countries, including China, with 75 per cent of the world's population, contribute with only 20 per cent. Table 3.2 shows CO_2-emissions for selected countries, share of world-wide emissions and emissions per capita. The countries with the highest emissions are those with the highest level of motor vehicle driving. However, some Eastern European countries also range high on the list over emissions per capita, probably due to heating etc. by coals.

Over the next 10-15 years an expected increase in road-traffic of about 30 per cent will, under present political conditions, lead to a 4-5 per cent increase in CO_2-emissions, world-wide. The assumption is full use of technological possibilities to reduce emissions per pass/km. Only very strict environmental policies can give a needed reduction in CO_2 of 25-30 per cent. But to reduce CO_2 to a sustainable level (down to maybe 40 per cent of today's situation) seems at present impossible.

Air transport has been left out from these considerations but represented in 1987 a total of 8 per cent of emissions from the transport sector and is expected to double within the next 10-15 years. Even considering a more efficient technology, the total emissions will increase by 30 per cent over the same period.

Table 3.2. CO_2 - emissions of 20 countries caused by energy consumption in the year 1986

Country	CO_2-emissions (tons x 10°)	Share of world-wide emissions (%)	Specific CO_2-emissions (tone/capita)
USA	4 766	23.8	19.7
USSR	3 737	18.6	13.2
PR China	2 030	10.1	1.9
FRG	1 067	5.3	13.7
West	715	3.6	11.7
East	352	1.8	21.2
Japan	914	4.6	7.5
U.K.	676	3.4	11.9
India	539	2.7	0.7
Poland	478	2.4	12.7
Canada	436	2.2	17.0
France	384	1.9	6.9
Italy	365	1.8	6.4
South Africa	293	1.5	7.7
Mexico	266	1.3	3.3
Australia	245	1.2	15.2
Czechoslovakia	244	1.2	15.7
Romania	212	1.1	9.2
Netherlands	203	1.0	13.9
Spain	189	0.9	4.9
Brazil	175	0.9	1.3
South Korea	162	0.8	3.9

Source: Banister and Button 1993: Enquete-Commission (1990)

According to UN's climate panel, CO_2-emissions should be stabilised on a 1989 level to prevent a dangerous effect on the global climate system. As already seen, this calls for rather strong restrictive policies. If we also bring into consideration the distribution on countries, the western world should reduce the energy consumption even more to give room for an increase in less developed countries.

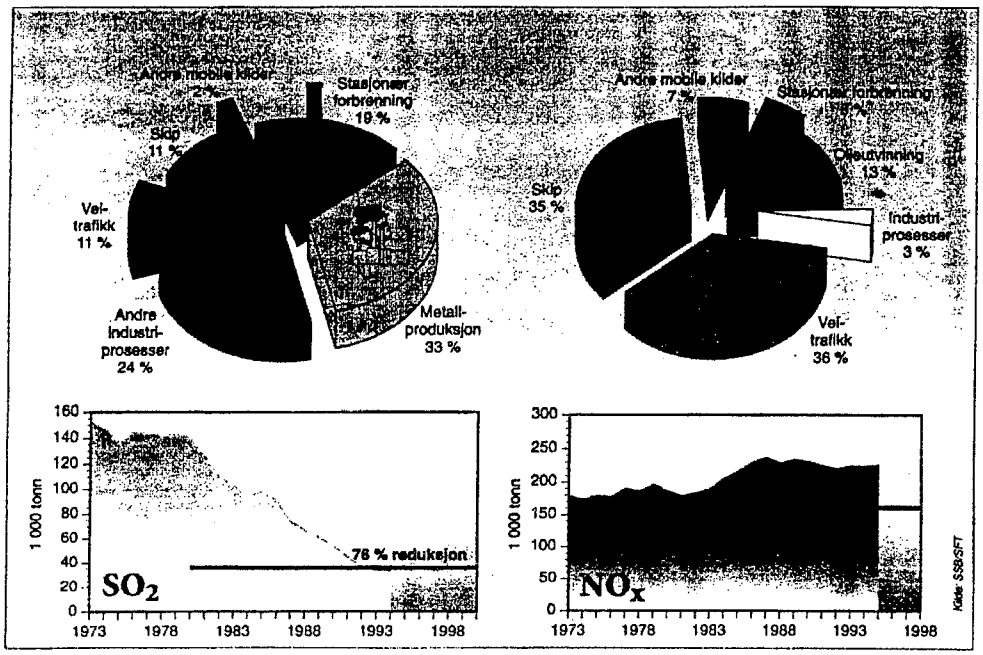
3.2.2 SO_2, NO_x and biological diversity

The emission of SO_2 (sulphur) and NO_x (nitrogenoxide) acidificates fresh water sources and disseminates the stock and range of fish and wildlife. Acid rain also destroys forests and buildings. Due to special circumstances Norway is especially vulnerable to the supply of SO_2 and NO_x. Around 90 per cent of these pollutants in Norway come from other countries, the UK, Central Europe and Russia.

Of the total production of SO_2 in Norway, mobile sources represents 22 per cent. Since 1973 these emissions have been reduced by more than 70 per cent. In the whole of Europe the emissions of SO_2 was reduced by 37 per cent from 1980 to 1993. This reduction is due to the lowered level of sulphur in autodiesel.

A large portion of NO_x comes from mobile sources. On a global level this is estimated to 50 per cent. In Norway the share is close to 80 per cent, probably caused by the large fleet of ships and the even larger production of oil. The emissions of NO_x has been growing until very recently, in Norway by 30 per cent

during the 80's. Over the last 5-6 years the emissions have been reduced, mainly because of the introduction of the catalysator. The future situation is not clear, whether the catalysator will reduce the emissions enough to counter the increase in use of cars and the transporting of goods.



Figur 2.1: Norske utslipp av SO_2 og NO_x 1973–1994. Utslipp i 1993 fordelt på kilder.

Figure 3.2. Norwegian SO_2 and NO_X 1973-1994 after source

3.3 The use of land

The trend of urbanisation has long been towards the increasing need for land. Over the last 30 years the built area of 13 Norwegian cities increased by 136 per cent while the population in those cities only increased by 27 per cent. In these same cities transport occupies more than 20 per cent of the total land used.

In even more car-dominated parts of the world like North America and Australia, cars occupy up to 50 per cent of land used for urban development.

It is, however, hard to come by numbers describing this development in more detail. Accidents, congestion and pollution seem to be more serious environmental problems than the misuse of the land we drive on. Future generations may think different.

3.4 Local environmental problems

3.4.1 Local pollution

Local pollution and noise is a problem for the health of human beings and their chances to thrive, especially in an urban environment. Air pollutants can cause diseases in respiratory passages and the lungs. CO affects the ability of the blood

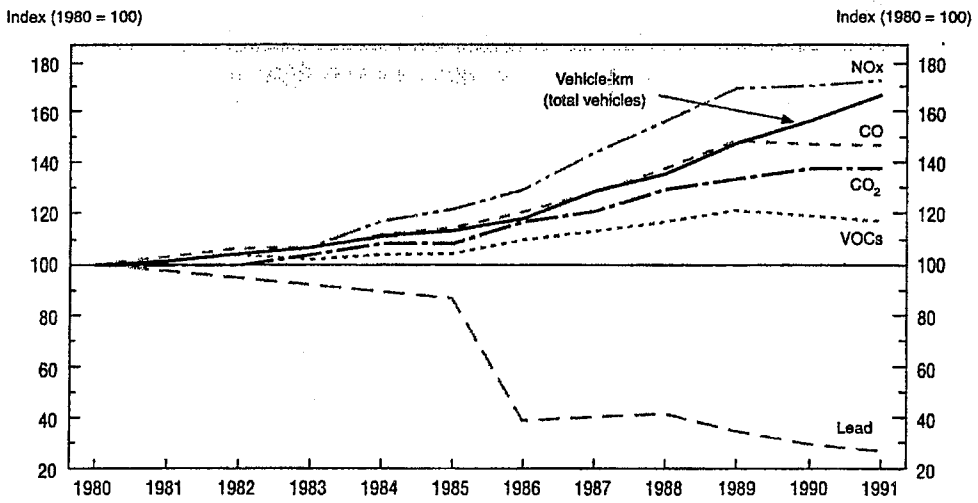
to take up oxygen. Road traffic stands for a very high proportion of NO_2, PM_{10} and CO, on a world level, probably around 85 to 90 per cent. And while CO, the result of incomplete combustion of energy, is reduced by the use of a catalysator, the other two is not affected and have not been reduced. Due to an expected increase in traffic, and a slow replacement in the stock of cars, the emissions of CO will also probably increase somewhat over the next years. In the UK a two per cent increase is expected over the next years.

Table 3.3.Transport sectors responsibility for different types of pollution

Pollutant	% of total emissions from road transport (range in brackets)[a]	% of transport emissions from		
		Private cars and vans	Urban roads	
			Cars only[b]	All vehicles[c]
NO_x	54 (26-84)	56	22	26
VOC	27 (16-61)	67	60	61
SO_2	3 (1-13)	50	36	41
CO	74 (66-100)	>80[b]	44	54
Particulates	(2-20)	30	34	58
Lead	87	94	..	..

[a] Range refers to 1980 figures
[b] Figures from Germany
[c] Figures from the Netherlands. All other figures relate to the EU

Source: EU Green Paper 1992 and OECD 1988a



a) Atmospheric pollution from road transport only.
Source: UK, Department of the Environment.

(OECD 1995)

Figure 3.3. Trends for the UK

3.4.2 Noise

Noise is especially a nuisance in urban areas. Whether this phenomenon should be considered a threat to a sustainable development is somewhat unclear. In most of the literature on environmental issues, noise is mentioned on the same level as pollution. And if we look at what problems that most bother people living in cities, noise is the greatest problem stemming from traffic. For the industrial world it has been estimated that about 110 million people are exposed to traffic noise that exceeds 65 dB(A). According to Banister and Button (1995) this amount seems to decrease slightly, due to changes in land-use and protective measures. But at the same time there is an increase in the amount of people who are exposed to a level between 55 and 65 dB(A).

3.5 Social life and mobility

Sustainability is mostly discussed in relation to the possibility of future generations lack of food, water, clean air, shelter, energy etc. etc. In short we think of natural resources when we worry about using up what our children should have. But there is one other aspect to sustainability and that is the misuse of cultural resources. The question is whether our way of organising social life reduces the welfare of coming generations.

The rise of sociology over the last 100 years or more is closely connected to this question. Since the industrial revolution really took of sometime in the middle of the 19th century, social scientists have been wondering and worrying what this meant to people. And not only did they focus on the growing poverty in modern cities, as described by e.g. English social statisticians. They focused on the theme of modernity in itself.

Founding fathers like Weber, Töennies and Durkheim, all tried to describe what seemed to be the main differences between a traditional, pre-industrial society, and a modern society based on large-scale industrial production. The most famous is probably Töennies' notions *Gemeinschaft* and *Gesellschaft*, describing by these the differences between modern societies based on companies and contracts and traditional societies based on family relationships and agricultural and craft-based labour. *Gemeinschaft* means community and relationships based very much on long-term kinship (Jary and Jary 1991).

Durkheim analyses the same topic in his work on the division on labour (Nisbet 1967). He sets up modern society as founded on complimentary tasks opposed to traditional society based on doing the same tasks. But according to Durkheim modern society may well be a society based on solidarity because the high division of tasks makes us dependant on each other. Anomie, alienation, competition without solidarity, is only a possibility in modern society, not a necessity. By anomie Durkheim means a society without the existence of unwritten rules governing behaviour. But this society is only a possible outcome of too harsh competition, of a too segregated organisation of labour.

This discussion of what modernity "does to members of society" is still going on. And it experiences a new flourishing with the discussion of what is meant by post-

modernity. We shall not try to clarify what is meant by this in the social sciences. We will just mention some central participants in the debate and whether they have important viewpoints to add in terms of sustainable social life.

We can probably define a non-sustainable development regarding social life as a development where old cultural norms and values are lost without being replaced by new ones. We should probably add that the contents of these norms are probably of importance. Values promoting some kind of solidarity, consideration or care is more sustainable than values stressing the need for harsh competition.

Giddens (1991) are one of today's central social thinkers. His main point is that we do undergo a process of detraditionalisation, which means undermining old norms and values. However, Giddens is not at all clear to whether this development means a harsher social life. We are going towards a social life more and more based on risk in our relations to others. Giddens also stresses all the examples where people are very capable of building new relations based on mutual trust, and a trust where we actually choose openly to trust the other, like between men and women based on new roles taken up by the two parties. The "problem" with these new relationships is that we have to continuously rebuild the existing trust.

Ulrich Beck (Beck 1992) also stresses the problems related to what he terms "The risk society". But Beck relates risk directly to the fact that we now face the fact, for the first time in the history of the human race, of possible eradication as a species. To Giddens, Beck and others, the notion of reflection is central of what they term post-modernism. For good and bad we are able to reflect on all aspects of human life, and make choices to how we want our lives to be. This is a new freedom in a post-traditional society. But to Beck this reflection has two sides. We also experience the reflection of our own past acts on our chances for a future life. And when "externalities" threatens us with extermination, they cannot continue with being just externalities.

There is a lot to be said about this debate and to the seriousness of detraditionalisation. There are many examples to the fact that:

- Old values do not disappear as fast as is believed (see e.g. studies of urban life, like Herbert Gans on urban villagers (Gans 1962)).
- Old values are not always as positive as are believed. They sometimes represent lack of freedom or even repression.
- Old values are replaced by new ones that may be fully sufficient to make social life full of solidarity, compassion and even joy.

The French sociologist Maffesoli (1996) analyses these questions when he peaks about the time of the tribes.

It is therefore of great importance to separate between social aspects of sustainability and what can be termed social problems.

What has this got to do with the growing number of cars in the western world? This can be answered in several ways:

- The car represents at present a very important symbol of what is meant by modern. And by many it represents the symbol of a new way of life where we get separated from each other. In opposition to this can be said that the car is

first of all a practical means of transportation and we can not know for certain whether it actually creates a life in anomie or rather the opposite, a life filled with driving on visits. The car helps eliminate the problem of space rising from the separation of activities starting with the first separation of labour. The old neighbourhood is no longer the central sphere for social life. We have social contacts all over the city.

- The cars represent a new division of classes, in the have and have not. This is true to the extent that a car is available to 80 per cent of the population in western societies. The groups who doesn't have a car is mostly old people (but these are also the group with the strongest increase), the young ones just moved away from home and residents in inner city areas. To some extent car ownership is dependent on income, but not so much as the other reasons.
- The car is more of a class symbol when we compare rich and poor countries and the rich and the poor in the poor countries. The question is what is the worst case, being without a car when a strong majority has one or being without when the majority is in the same position.
- The car represents a new division of the active and the passive, in terms of different abilities to reach various arenas. This is true, but the division is not a new one and the groups without a car gets smaller and smaller. And not all those who are without is in a permanent and problematic situation. Mostly we are again talking about the elderly.
- The car represents in many ways the cause behind the deterioration of inner urban areas, partly directly with the construction of urban motorways through the inner city, and partly indirectly by making it possible for people to move to the suburbs (Jackson 1985).

Is the car the reason or just a symbol for something that exists anyhow and anyway, and does it lead to final extermination of social life, as we know it? Life has never been just good. Whatever point we argue for or against, we end up with an unclear picture where we certainly cannot say that social life becomes unsustainable because of the car. In the early stages of urban sociology the viewpoint that the car lead to anomie was often put forward, but this is no longer the case.

3.6 Miscellaneous

In this part we have avoided one very important discussion, the question of what should be considered as non-sustainable as consequences of an increasing transport sector. In the literature we have considered, this is not a topic that receives any in length discussion. Instead it seems as if all problems that can be connected to car use should be considered as a threat to a sustainable development. This is obviously not the case. Accidents are most clearly not an environmental topic, as congestion is not either. The last mentioned might actually be good for the environment as it prevents more people from driving. And measures to reduce casualties may be opposed to environmental goals, e.g. new highways.

We could continue this discussion, dwelling on urban noise, urban decay, some kinds of local pollution, the role of public transport that may not be only environmentally for the good. But money and time sets limits to this problem. We will however stress the need for a clarification of goals. Without such a clarification, necessary measures will not be put through as we point out in chapter 5.

4. Major factors linked to individual travel

4.1 Introduction

It is who we are, our preferences, our travel resources, and what we are, that determine our travel behaviour. Characteristics of individuals and households influence people's activity patterns and the activities result in trips. The travel behaviour does not only reflect daily choices, but also long term decision about buying a car, where to live etc. Our daily trips are also influenced by our surrounding society. Structural conditions, like location of different functions, road network and quality of public transport, have decisive importance for which activities that are preferred, if the activities require travel, and in case, how the travel is performed.

It is basicly three aspects of travel behaviour that are important to understand; a) factors influencing the level of car ownership and car use, b) factors affecting demand and supply of public transportation and c) factors inspiring walking and bicycling. Several models and theoretical frameworks related to these aspects have been developed (i.e. a: Hjorthol og Vibe 1993, Bovy and Stern 1990:29, Bjørnland 1989, Orfeuil and Salomon 1993:50, Wit and van Gent 1986; b: Stern and Tretvik 1993 and c:Hjorthol and Nielsen 1984, Herrested et al 1995). Each of these works points out a range of factors that are influencing travel behaviour and modal choice. The common factors are mainly related to location and land use, demography, infrastructure, technology, and economy.

Taking account of both an individual and a structural approach, the major factors linked to individual travel are:

- *Spatial structure*
- *Infrastructure*
- *Demography*
- *Technology*
- *Politics and macroeconomic factors*
- *Cultural factors*

This chapter is organised according to these different factors.

4.2 Spatial structure

4.2.1 Introduction

The environmental problems related to transport is dependent on the amount of transport and the modes we use for different purposes. With the introduction of electric trams some 100 years ago, the age of using feats was left and spatial distances became less and less of an obstacle to partake in various activities. After WW 2 urban development has been dominated by an enormous increase in amount of land needed per inhabitant. In most western European countries this development really took off after 1960. In the US it started in the thirties.

Most of all, urban sprawl consists in a decentralisation of work places and houses for living (Jackson 1985). This sprawl has been possible because most of us have access to a car, and the need for cars grows with urban sprawl (figure 4.2). In Norwegian cities and villages one quarter of the space/area is used for roads and constructions made for cars (Ministry of Environment 1988-95).

However, studies from Norwegian cities show that (Kolbenstvedt 1996):

- inhabitants in cities with a dense structure use less energy than those living in sparsely populated cities.
- people living in residential areas far from the city-centre use two and half times as much energy compared to those living in central areas.
- people with a good supply of public transport close to where they work, spend less energy than those without such a supply. The supply of public transport where people live does not seem to have the same impact.

These points may actually be put into practical policies, even though their consequences may be of the long-range kind; dense cities with people living close to the centre or sub-centres and with a good supply of public transport.

4.2.2 Urban density

Urban densities vary considerably throughout the world with dense cities dominating in Europe and Asia and urban sprawl dominating in the US, Australia etc. Table 4.1 shows different cities with density and the direct consequences on transport mode used for work.

It is very clearly the case that dense cities have a much higher portion of people travelling by public transport, walking or cycling while at the other extreme, cities with low density have a high portion of car users.

Table 4.1. Travel modes for the journey to work in cities of different densities, 1980

City	Degree of land utilisation	Choise of transport type for travelling to work		
	(Housing and places of work per hectare)	Private automobile	public transport	Foot and bicycle
Phoenix	1.3	93	3	3
Perth	15	84	12	4
Washington	21	81	14	5
Sydney	25	65	30	5
Toronto	59	63	31	6
Hamburg	66	44	42	15
Amsterdam	74	58	14	28
Stockholm	85	34	46	20
Munich	91	38	42	20
Vienna	111	40	45	15
Tokyo	171	16	59	25
Hong Kong	403	3	62	35

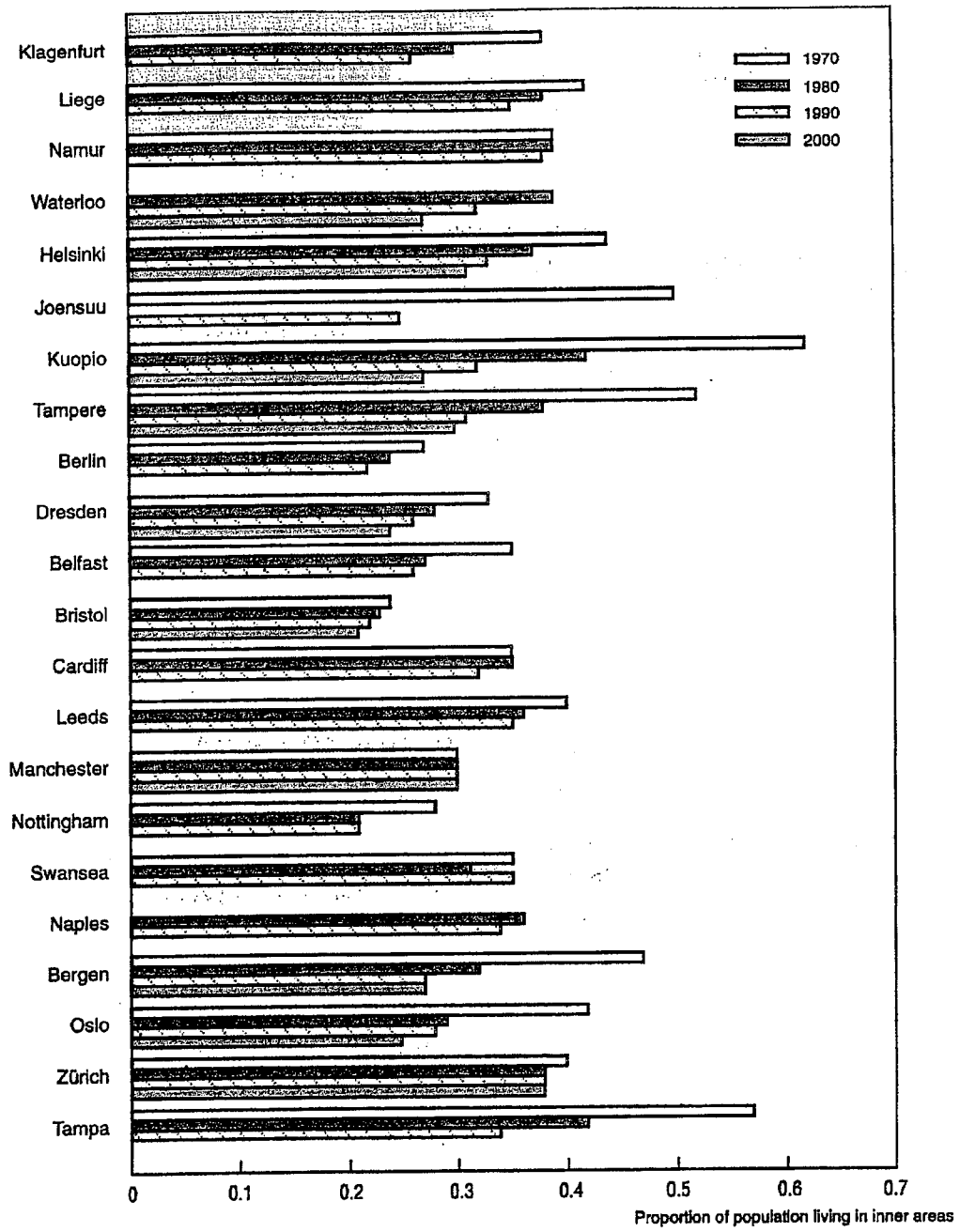
Source: Kenworth and Newman 1989

4.2.3 Location of dwellings and work-places

In the international literature we can find several examples of studies showing the relationship between location of activities and the use of different transport modes. OECD (1995) also shows a figure giving numbers for the part of the population living in inner areas. In all cities studied there has been a decrease in the part of the population living close to the centre.

As for work places similar figures are lacking, mostly because they are hard to obtain. But travel surveys from different urban area show that smaller and smaller parts of the population work in the inner areas. In the Oslo-region while close to 50 per cent worked in the inner city in 1977, the proportion in 1990 was well under 40 per cent (Vibe 1991).

Over the very last years there seems to be a totally new development as some people seems to be moving back to the inner city. Figures from Oslo indicate that there may be a new trend that can change some of our views concerning urban development and transport. The reurbanisation may be a result of a trend towards smaller households (se chapter 4.4.3), but so far we don't know if this is a steady development, and what its basic causes are.



Source OECD 1995

Figure 4.1. Changes in the proportion of people living in the inner areas of cities

4.2.4 Shopping centres and city centres

In most cities, at least in Europe, there is an ongoing discussion of whether to except the location of new car-attracting activities, like shopping centres. But so far stopping them has been rather difficult as such policies come into conflict with the need for new employment.

The building of such new centres has been said to kill the existing urban centre. But here we see different trends. While in some countries and cities, urban decay has been noticeable, many cities have experienced and also partially have worked for revitalising the city centre. People and jobs move out, but at the same time new activities moves in, especially entertainment, special jobs, hotels etc. Even in North America this has been the new development in some cities over the last 10 years (Boston, Toronto, San Francisco etc.).

The above mentioned movement back to the inner city may strengthen this revitalisation of the urban centres.

4.3 The effect of infrastructure

4.3.1 Introduction

Over the last 10-20 years the following statements and positions have been argued for or against:

- More roads give more traffic, by cars, lorries etc. If we want more traffic, we build more roads without closing old ones. If we don't want more traffic we stop building roads.
- More public transport gives more travel by public transport and less travel by car. If we want less car-traffic we should offer a better supply of public transport instead of cutting down on services.
- Better amenities for pedestrians and cyclists give more people walking and cycling and fewer driving a car. If we want less car-traffic we should build new and more effective amenities for non-motorised traffic.
- Information-technology will substitute the present need for transport. Bits will replace atoms. A true independence of space will be a possible the result in a not to far away future. (This will be dealt with in chapter 4.5.2.)

The picture is, however not this simple. We will try to present some facts about trends in infrastructure and possible alternative future trends.

4.3.2 Building of roads

Trends:

Kilometres of motorways may be a good indicator for the development in road infrastructure over the years. Table 4.2 and 4.3 represents data for OECD-countries and the world about changes since 1970 and the length of the present motorway-system.

The overall image is that there is a strong growth in the total length of motorways from 1970-88 (table 4.2.). We have not been able to locate more recent figures. The strongest growth was found in Japan, France and Spain, and in countries with a very short network, like Turkey and former Yugoslavia. The overall growth in the OECD-countries was a near doubling during those almost 20 years. The low

number for USA can easily be explained by the enormous length of the existing network, in 1970 and even more so, in 1988. If we exclude USA, the increase in the rest of OECD is around 200 per cent.

The increase in motorways is actually stronger, for the whole of OECD, than the increase in the stock of cars and the growth in car traffic. But we find variations between the countries with North America and Italy increasing motorway-length less than number of cars and car-traffic.

If we look at the ratio between vehicle/km and length of motorways this ratio is going down. This means that drivers have more roadspace to share.

Table 4.2. Changes in vehicle km, length of motorways and vehicle km per km motorway, 1970-88

	Billion vehicle km			Motorways km			Mill. veh. km/motorways	
	1970	1988	% increase	1970	1988	% increase	1970	1988
Canada	126	225	179	2 60	7 450	270	46	30
USA	1 787	3 307	185	53 700	83 960	156	33	39
Japan	226	521	231	700	4 410	630	323	118
Australia	79	153	194	1 030	1 100	107	77	139
New Zealand	13	22	169	100	140	140	130	157
Austria	22	54	245	480	1 410	294	46	38
Belgium	33	52	158	500	1 590	318	66	33
Denmark	23	36	157	200	600	300	115	60
Finland	19	39	205	110	220	200	173	177
France	208	414	199	1 550	6 950	448	134	60
W Germany	234	427	182	4 460	8 720	196	52	49
Greece	9	36	400	70	90	129	129	400
Ireland	11	23	209	1	10	1 000	11 000	2 300
Italy	146	297	203	3 910	6 080	155	37	49
Netherlands	48	89	185	980	2 070	211	49	43
Norway	11	21	191	80	290	363	138	72
Portugal	9	33	367	70	260	371	129	127
Spain	35	100	286	270	2 140	793	130	47
Sweden	35	61	174	400	1 000	250	88	61
Switzerland	25	48	192	380	1 500	395	66	32
Turkey	6	23	383	20	210	1 050	300	110
UK	179	357	199	1 060	2 990	282	169	119
Yugoslavia	11	37	336	10	810	8 100	1 100	46
OECD	3 288	6343	193	72 800	133 300	183	45	48

Source: OECD 1991a

Table 4.3: Selected transport and environment indicators 1977-1988.

	Canada	USA	France	W Germany	Italy	UK	Japan	North America	OECD Europe	OECD
Infrastructure										
Motorways % change	170	55	323	95	55	182	513	61	146	81
Road vehicle stock % change	92	66	87	104	151	68	198	68	111	94
Total ownership Veh/1000 inh	600	730	480	500	490	400	430	720	370	500
Traffic										
Total road traffic % change	75	81	92	78	99	83	113	80	92	86
Road freight traffic % change	107	70	69	94	179	47	79	72	105	84
Rail freight traffic % change	11	30	-23	-17	8	-26	-63	27	-6	21

Source: OECD 1991a

More roads means more traffic:

International experiences with effects from new road building are many, but actual evaluation of road-projects and their effects on the amount of traffic are harder to obtain. According to a summary of international experiences (Thomson 1977), especially with bypasses, we can conclude that such new motorways can work to improve the environment in smaller towns and cities. But looking at road-projects in larger cities like Oslo, Stockholm, Copenhagen, Vienna, Paris, London etc., new roads, in addition to maybe removing traffic from residential areas (the positive effect), creates new traffic by lifting the lid off repressed demand due to lack of road capacity.

The experience from a Norwegian study of a township in Oslo shows that very restrictive measures have to be introduced, in addition to the new road, like closing old ones, calming traffic etc.

In a long-term perspective those cities building most roads have the highest energy consumption per capita (Thomson 1977).

4.3.3 Public transport

Trends:

According to Stern & Tretvik (Salomon 1993) the present and past trends in urban public transit may be summarised at the following:

- European and North American cities experienced a sharp decrease in the share of trips made by public transport from the sixties and onwards.
- This was followed by a sharp increase in subsidies during the seventies. This levelled off during the eighties and is now in real decline. In some Norwegian cities the level is approaching 0.
- The level of services supplied varies between cities and countries and also due to the kind of system offered, i.e. rail or buses. In cities served by buses there has been a real decline in vehicle kilometres over the last years.
- Only in cities introducing new rail systems can we say that there has been a real improvement in services.

Figures 4.2, 4.3 and 4.4. shows changes in supply and number of passengers in some European cities. The trend is towards, at best, a slight increase over the last years.

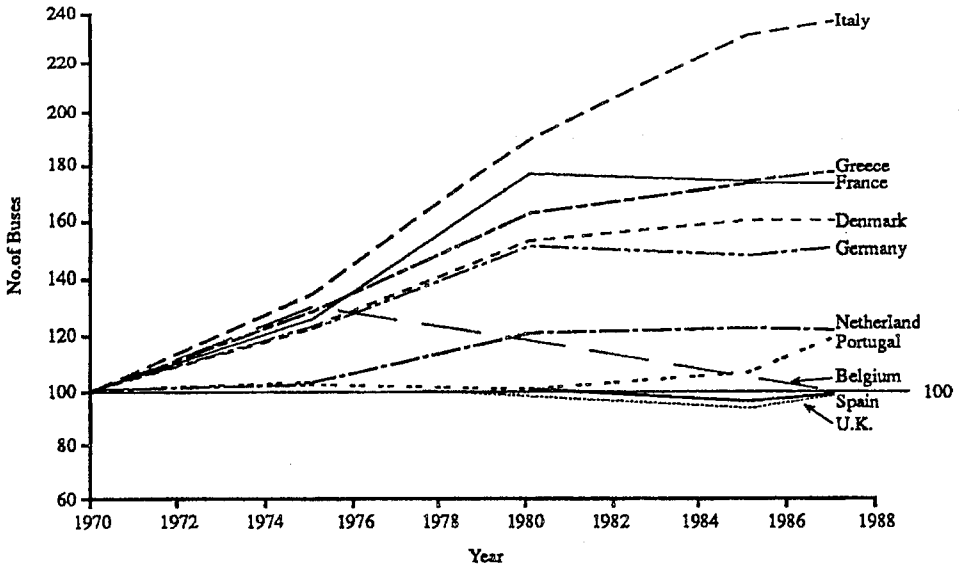


Figure 4.2. Number of buses 1970-88

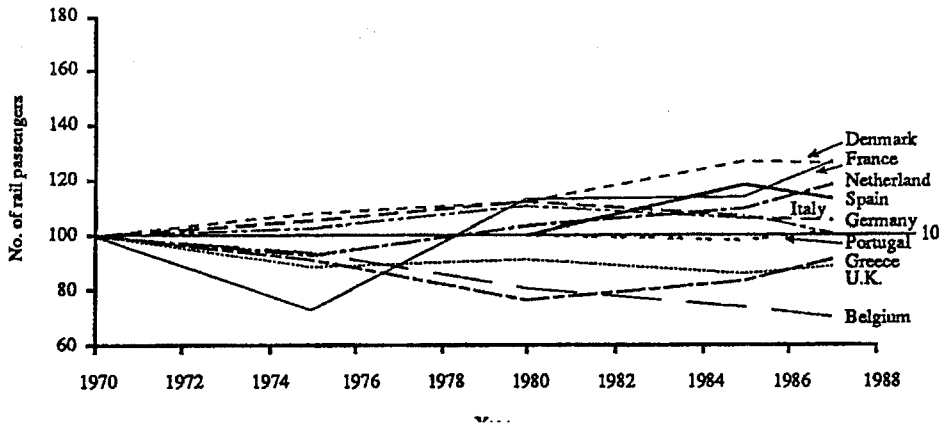
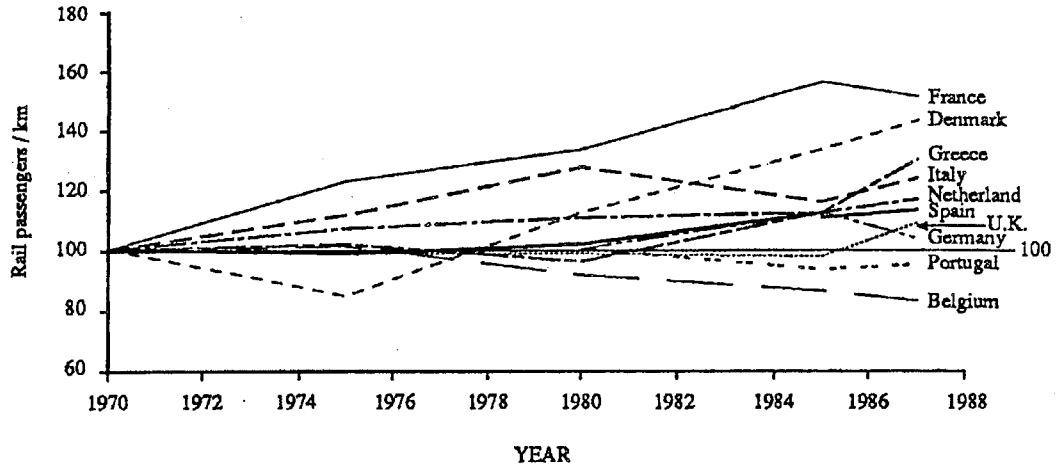


Figure 4.3. Number of rail pasengers 1970-88. Per cent



Source: Stern and Tretvik 1993

Figure 4.4. Number of rail passengers km 1970-1988

More public transport gives more passengers

The supply of public transport in cities in the industrialised world is not improving, rather the opposite. But in some countries, like in Switzerland, new lines for mainly light rail, are being constructed. Extensive studies of experiments with new public transport supply in Norway, has provided us with new insight into what kind of public transport that actually attract new passengers.

The overall experience is that improvements first of all should be made in frequency and punctuality. Lower fares do not necessarily attract new passengers, at least not in a short-term perspective (Norheim and Stangeby 1996).

To avoid people using a car to the station, the walking distant should not be more than 1,5 km (Tjade 1989). Studies shows that the travellers prefer shorter walking distance (to the station) and high frequency more than shorter travel time on the transport mode (Norheim and Stangeby 1993).

Similar results are found in other studies. In USA it is pointed out that over 60 percent would use train to work, if the walking distance to the station in both ends where shorter than 1000 feet (300m) (Cervero 1991). This result is independent of the family income of the person working.

But public transport has one problem concerning its effect on travellers:

- Improvements may only improve the situation for passengers already using the system.
- Improvements may only attract people that previously used a bicycle or their own feet.

- Only if new supply get people to shift from a car to public transport is the effect a clearly environmental one. Improvements in terms of increased frequency or new routes that do not attract a sufficient amount of former car-users can in fact be contrary to a sustainable development because the net emissions of pollutants increase.

4.3.4 Amenities for pedestrians and cyclists

Trends

Figures for how well pedestrians and cyclists are being served and if their situation is improving over the years do not seem to be available. We can only point to specific cities in Holland, Denmark, Germany, Sweden etc., where special roads for non-motorised traffic have been constructed. But an overall picture of improvements or worsening does not, to our knowledge, exist.

Amenities for pedestrians and cyclists give more non-motorised traffic

Cycling and walking are the most environmentally friendly modes of transport. Therefore it is important to get people to leave their car and use a bicycle or walk. This does not mean that people should walk or cycle more, but that they should stop using a car on short trips. As we have seen earlier almost 30 per cent of car trips are shorter than 2 km.

It has been believed that special amenities for pedestrians and cyclists give more non-motorised traffic. However, it is not at all clear whether such amenities actually reduce the number of trips by car. Norwegian experiences so far does indicate that people who cycle do it more, or that more people cycle as a tour, but that the number of car trips does not decrease as a result.

This is probably due to the fact that there exists two very different purposes for walking and cycling, as a mode of transport to get from A to B, and as a transport mode where the trip itself is the purpose.

With more time we would have presented more experiences from the Netherlands, Denmark, Germany and Sweden.

4.4 Demography

4.4.1 Introduction

The demographic composition in a society is an important factor for estimating the travel demand. As seen in chapter 2.4 different demographic segments have different patterns of travel behaviour. For instance: Mobility of individuals peaks when they are in the 30s and 40s, and the elderly are the least mobile. Car driving rate is higher for men than for women. Single-person households are in general more mobile than married individuals in the same age group. The presence and age of children strongly influence its members' travel behaviour (Kitamura 1988).

In this review the focus is on trends related to age structure, household size and gender.

4.4.2 Age structure

There has been a decline in birth rates across all advanced countries. The most significant growth in population will be among the elderly (table 4.4.1). It is estimated that in Western Europe the proportion of persons over 65 years will increase from 13 per cent in 1985 to more than 20 per cent in 2020. For OECD countries, the number will increase by 50 per cent, from 98 million in 1990 to 147 million in 2020. Growth is particularly significant in the age group 80+ (Banister and Berechman 1993).

Table 4.4. Summary of the main Population trends, 1980-2000

Group	Laskett's ages	Trend	Comment
School leavers and young adults	1st age: 0-20	Growth of 10 % in the longer term	Decline has already taken place in 1980s and up to 1995
Working age adults	2nd age: 20-60	Small increase of 2%	Decline in 20-40 year age group in the 1990s, but growth in the 40-60 year age group
Age ofpersonal fulfillment	3rd age: 60-80	Stable over the next decade	Growth expected in this group in the longer term
Full retirement and dependency	4th age 80+	Growth of 25%	Major growth in the next 50 years

Source: Banister and Berechman 1993

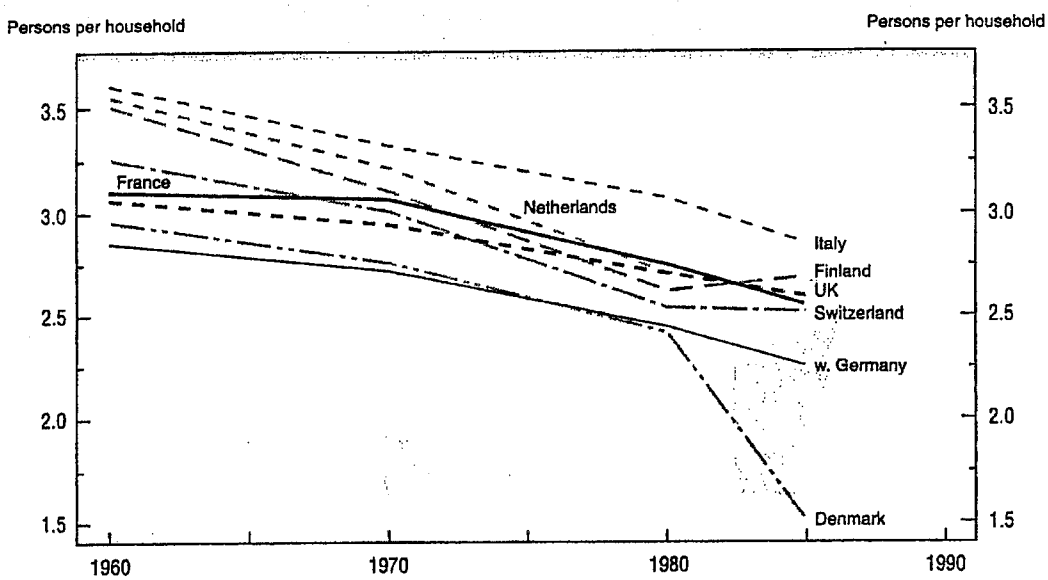
These changes are likely to have important impacts on demand patterns for all kinds of activities, including travel: Today's elderly is the first generation of retired people that has experienced mass car ownership and so can be expected to continue to be car oriented. According to Laslett (1990) a significant new group is emerging within the population; the third age of personal fulfilment. This group (aged 60-80) no longer has the complex responsibilities of earning a living and raising a family, it is reasonably affluent, and so has the money and time to spend on personal fulfilment. Much of these activities could involve travel.

Further, it is a tendency in many countries that the age of retirement is being reduced. This means that apart from the natural growth in the elderly population, the number of people in the retired age group will increase through early retirement, and Lasslet's third age will now cover the age range of 55-80, not 60-80.

In the age group of 80+ , where one expects major growth in the next 50 years, people may require special facilities and transport services, for example transport with wheelchair accessibility or room for a person to accommodate them. This group will not be able to drive and so will require public transport services or taxis, or chauffeur-driven private cars such as the service currently provided by many voluntary sector organisations.

4.4.3 Household structure

Over the last 30 years, the average household size has fallen in all European countries. (Examples in figure 4.4.2.) We see the same tendency in the US: A sharp decline in the average size of household, with increasing number of single-person household. The percentage of married couples with children is gradually declining, that of married couples without children is stable, and the fraction of individuals living alone steadily increase in all age groups (Kitamura 1988).



Source: Masser *et al.*, 1992.

Source OECD 1995: Masser et al 1992

Figure 4.5. Changes in household size

These trends may have important implications for travel behaviour. However, the direction of these implications is ambiguous. First, it has impact on the housing market, with an increase in demand for small housing units. If location in the suburbs, the number of trips generated and the length of trips will both increase. However, they may be located in the city centres, for instance through the subdivision of existing larger properties, which would implicate a travel behaviour pattern more based on public transport or perhaps walking. On the other side, one-person households and couples without children tend to have more trips, special social-recreation trips, than others (Kitamura 1988), and small household have fewer opportunities to share in trip-making and tend to make more journeys per day than those of big ones (OECD 1995).

4.4.4 Gender

The labour-force participation by women has been increasing (see chapter 4.6.2), resulting in an increasing proportion of two worker households with young children (Kitamura 1988). In most European countries, labour force participation has increased over the last 15 years due largely to the increase in the number of

working woman. As shown in chapter 2.4, differences in travel behaviour patterns between men and women can mainly be explained by social roles and differences in income. This indicates that the differences between gender regarding travel behaviour will fade, implicating a totally higher mobility rate. However, working women tend to have fewer working hours and they work nearer their homes, than men do (Hjorthol 1990). Men also have more fringe benefits connected to car use than women have. This means that «equality» in travel behaviour will not occur automatically when women enter the labour market.

4.5 Technology

4.5.1 Introduction

It is mainly two types of technology that are important in relation to personal transport.

1. Technology improving physical travel
2. Technology substituting physical travel

Technology improving spatial travel is directly related to improving the different transportation modes. This means cars, different types of public transport and bicycles. The main objects are energy efficiency, effective use of the infrastructure (roads), traffic safety, and comfort. Technology substituting spatial travel is what we refer to as information technology. The main object behind the development of this technology is to improve human communication independent of space. The tendency now is to improve spatial travel by using information technology.

4.5.2 Technology improving physical travel

Improving the transportation modes

Basicly the car is the same now as when Henry Ford produced T-fords before WW1. It is a four-wheeled private vehicle that gives room for one to five persons. But at the same time many aspects have changed. It can go faster, it uses less fuel per mile, it is more comfortable, it is safer and it is better and more equipped with new information technologies. This development makes the car drive more pleasant and enjoyable. The development of alternative fuels and alternative fuel vehicles makes driving car also more socially accepted. Further, the new information technology like mobile phones and mobile data breaks the isolation within the car by opening up for communication with the selected outside.

Whether these improvements induce car driving or not are difficult to say, but it is likely that it makes us drive a car with greater comfort compared to other transportation modes.

The main objective of the technological development of public transport has been to reduce the total time used for travelling from one place to another. There have been developments that have increased the speed between stations, and to reduce time spent on the stations, like improvement of ticket systems and making it easier to enter the vehicle. There have also been some improvements regarding comfort.

However, overall experience is that improvements first of all should be made in frequency and punctuality. (See also Ch 4.3.3.)

The result from the technological development within public transport is not that the proportion of users has been increasing in relation to users of car. However, it has been important for keeping the users.

Effective use of the road infrastructure

New technologies of information and telecommunication have the potential to render the existing infrastructure more effective. They can help to collect, process, combine and dispatch the various data concerning the road environment, status, traffic etc. The provision of information advice or guidance to the driver makes it possible to optimise traffic flow over space and time. One of the main objects in the DRIVE (Dedicated Road Infrastructure for Vehicles safety in Europe) program was related to these problems.

This kind of technology development is first of all useful to solve the internal problems of automobility like for instance congestion. The result is the same as for building more roads - it may create new traffic by lifting the lid off repressed demand due to lack of road capacity or inefficient management of traffic flow. (See also Ch 5.3.4.)

4.5.3 Technology substituting physical travel

The information society was a concept used to describe the society dependent on information technology. The technological possibilities were many and scientist and others had many suggestions about how this information technology would change both the sphere of production and our private lives. One idea was that this new technology would substitute spatial travel.

A Swedish study of international experiences (Nordplan 1995) concludes that it is not realistic to expect a decrease in human travel activities. What can be expected is a change in travel patterns..

The most promising field lies within the area of tele-commuting. In most OECD-countries one estimates that one out of four households now has a PC. With improved telecommunication, or just by using the existent, workers can sit anywhere (at home) and do their work. Studies reveal that some workers actually do this. In USA one expects a decrease in the number of worktrips of up to 15 per cent over the next 30 years due to tele-commuting. In Sweden up to 25 per cent of the work-stock works at home on their PC 10 hours a week or more (Nordplan 1996).

However, experience from the last century shows a parallel increase in the use of telecommunication and spatial travel. Tele-commuting may give fewer working trips, but an increase in the use of telecommunication would lead to a larger circle of acquaintances for the users, that in the end would lead to a an increase in need of travel. «Sooner or later the need for face to face contact would occur». The most likely consequences are that we would not travel more often, but over longer distances.

The problem though seems to be that the reduction in daily work trips seems to be substituted by longer trips or by other kinds of travelling. And the use of telex, electronic mail, videoconferences etc. seems only to supplement the traditional forms of contact.

4.6 Political and economic factors

4.6.1 Introduction

This part could contain an endless number of subjects. What we have done is to lift forward some well-known economic forces and some not so well known political ones. With the first we feel that too often the effect of economic growth is somewhat taken for granted. And we also observe that there is a strong covariance between growth, increase in real income and consume, including the buying and use of cars. However this covariance does not necessarily imply a cause-and-effect relationship.

4.6.2 Economic growth and mobility

The relationship between economic growth and mobility is somehow taken for granted (see Banister and Button 1993). But the real relationship is somewhat more complicated. Just showing that economic growth in the industrialised world and increased car-use follow each other over the last 30 years does not prove that one causes the other. A better indicator is probably to see what happens in periods of minor depressions in the economy, like in Norway after 1986, Sweden somewhat earlier and Denmark in the late seventies.

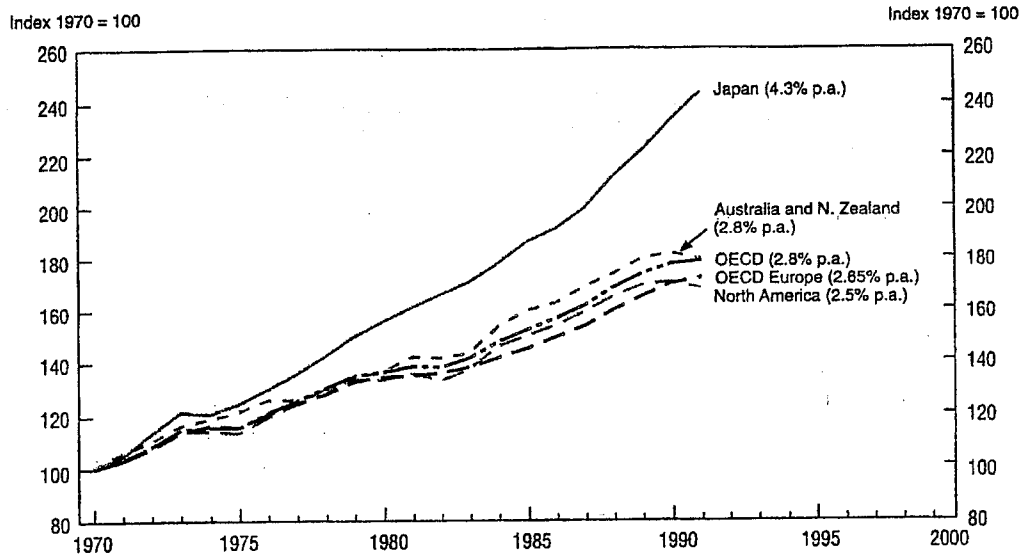
In these periods the number of cars stabilised or went down and so did the number of car-trips. But also in establishing these facts we somehow seem to miss what parts of growth or recession that are the basic causes. We can probably say that growth means activities, and many activities require travelling. In times of recessions we seem to drop some activities, especially those related to leisure. Whether unemployment actually means less travelling is not clear.

In the following we will look at some aspects of economic growth that we believe are of importance. A simple look at growth in terms of an increase in the production of values is not sufficient, especially because we more and more live in a service-economy.

4.6.3 Growth in income

The most important factor behind growth in consumption, which also includes buying a car, is the growth in income. This can be measured in various ways, from GNP (growing in the OECD countries by 2.5 to 4 per cent annually from 1970 to 1993) to the actual purchasing power of the population. In most European countries the increase in net income has been around 4-5 per cent annually over the last 10-15 years. With a distribution of income with not to many very rich or very poor, this rise in net income opens up for a similar growth i purchasing of goods. If we look at the number of cars per 1000 in these same countries, we find

very similar curves (OECD 1995, p. 35). But the increase in net income is somewhat higher than the growth in number of cars. This should point to some structural obstacles, like spacial and social structures and collective factors, and the fact that having a car requires a capital investment, may be of importance.



Source: Oecd 1993a

Figure 4.6. Trends in GDP in OECD countries

4.6.4 Prices on transport

Another factor pointed at by many experts is the low cost of car-use compared to other means of transport. If we look at the cost of petrol and the cost of buying and maintaining a car, the increase has been similar to the general rise in prices. But if we look at prices on public transport these have gone up much more, even though we find variations between countries.

4.6.5 Changes within the labour market

Travelling to work is a dominant part of daily activities. Participating in the labour market, and the structure of the labour market have implications for the amount we travel and probably, for the use of cars.

As we have said already there is a tendency for work places to be located further and further away from city-centres and other central locations (se chapter 4.2). This is a strong factor inducing car driving and is also made possible by the existence of cars.

Another important factor is specialisation and segmentation within the labour market. Combined with factors within the housing market this means that where we live and where we work is not decided by our possibilities of travelling from home to work. We buy a house in standing with money available and preferences

etc. and find a kind of work that we are educated for, or the other way around, and then we find means of getting from one place to the other.

4.6.6 Women at work

Over the last 20 years the number of people employed has been more or less stable in most European countries, but the share of the total population that are wage-earners is decreasing. This decreasing number is however only representative for the male part of the population. In Norway, from 1960 to 1990, the percentage of men over 15 years working, dropped from 83 per cent to 58. In the same period the percentage of women over 15 years working, went up from 25 to 29 per cent. (Historisk statistikk 1994). And if we look at the age group 16-74, we find an increase among women from 45 per cent i 1972 to 63 per cent in 1986. Since then the percentage has been stable.

In the UK female participation rates have increased by 12 per cent to 48 per cent (1976-85), while male activity rates have remained constant, at 75 per cent. The increase in female labour force participation has been particularly marked in the Mediterranean countries, such as Italy. (Banister and Berecheman 1993)

As a whole these figures should however not imply more travelling to work. And if we consider the fact that many women (up to 50 per cent in some countries) work part-time, we should actually expect fewer trips to work.

What is basically happening however is that women more or less are taking over men's travel pattern. With a higher household income due to two persons working, more and more households have two cars, to get back and forth to work, and to be able to attain to all the other duties, shopping, bringing children etc (see chapter 4.4.4 and 2.4).

So as much as more car-use is a consequence of changing economic factors, it is also very much a social phenomenon.

4.6.7 Company cars

Under this heading we can discuss many topics. We will however not discuss the general taxation on buying cars or petrol. Most of them may or may not work to reduce or enhance the stock of and the use of cars. Credit policies may also be of interest as they promote or try to limit consume of which the car is a dominant factor. What we will dwell upon below is questions related to how companies support their employees access to and use of cars. The subject is two-fold: company cars and car mileage.

Company cars take many forms; from cars owned by the company to be used only in work hours and on specific tasks to cars owned or leased by companies for full and exclusive use by employees. We actually do not know very much about this arena or market. What many experts feel is that these arrangements are unfair, not taxed enough and/or leads to excessive car-use. All this may be trough.

What we do know is that company cars are new cars and above average when it comes to size and price. What we do not know at all is whether the existence of

such arrangements actually induces more driving or if such cars exist because there is a real need for them. The truth is probably somewhere in between. At present, work is being done that will try to provide some answers, but results will not be available before the end of 1996. Tentative analysis shows that people with a company car are more heavy car users than the rest of the population.

From the fact that company cars are new and big can however be deduced some possibilities. We know that new cars pollute less than old ones and that new cars use less energy. With replacing the stock of cars we see that gradually the amount of fuel used per km decreases.

But opponents to this view say that since new (company) cars are larger and that car production also demands energy, the profit may be rather small. In many countries, like Italy, authorities try to use taxation to promote small cars. But such policies may also be hindered by the fact that companies are less sensitive to increases in prices than the average purchaser.

Every worker who uses a car for business purposes receives some kind of car-mileage. Critiques of such systems claim that car-mileage lead to use of a car when other transport modes could replace the car. This may very well be true, but the subject has not been studied at any extent. Others claim that car-mileage actually produces its own driving. Behind such viewpoints lies the fact that mileage probably exceeds the actual costs of driving and therefore is a more or less hidden income.

In Norway car-mileage is 3.05 NOK per km (up to 9000 km per year). The actual cost of driving are more difficult to obtain and depends on several assumptions, whether we talk of marginal or average costs, variable costs and costs that run without the car even being driven and whether we include capital costs etc. We can put up at least three different types of costs:

- The share cost of driving which in Norway (1995) runs to around 1 NOK per km.
- The variable cost of driving that includes all costs that varies with the number of km we drive each year. In Norway this amounts to 1.50 NOK per km
- The total cost of having a car which in Norway amounts to somewhere between 3 and 4 NOK per km.

It is probably not unfair, though some people would dispute it, to argue that mileage should at least cover variable costs. If we again look at the Norwegian example, we can say that mileage subsidises owners of cars with 1.55 NOK per km they drive in relation to their jobs. If this is a good reason to own a car and to drive it a little extra is an unknown fact. To argue for or against, we would need information about how much of the driving we do is related to work, and which are also paid for by car-mileage. But we can conclude that mileage, surely, makes it easier to own a car.

4.6.8 Policies related to location of activities

We have tried to find good analysis of different areas of politics that actually promotes car-use. These analyses seem to be lacking. Each year most governments produce a green book of all its environmental-friendly policies. They do not produce a black book. And political scientists have not, as far as we know, produced such a book on all the political measures that enhance car-use in their counties.

Several political measures are concerned with where people should work and live and how well people should live. These can be separated into measures that try to influence the relationship between urban and rural areas, between the centre and the periphery, and measures that influences the inner structure of different urban regions. Several of these measures interfere with how and how much people travel. For instance:

- In several countries policies have existed at least after WW2 that are directed towards maintaining "life" in distant regions, whether this is in Northern Norway, Eastern Russia, Western Ireland or Southern France. Such policies have very rational and legitimate foundations. But the unwanted consequences are most certainly increased use of private motor vehicles.
- In most of the after-war period increased housing standards have been an important political goal. This relates both to the size of dwellings and to the size of the area around each individual house. "A one-family-house with a garden" is somewhat everyone's dream, even politicians. But an urban structure with such residential qualities inevitably leads to more car-use for any purpose.

4.6.9 Extended opening hours

Over the last 10-15 years there has been a revolution in the way shops meet their customers. From 7 in the morning till 11 at night, or even all night long if you wish, people can shop most kind of groceries, and rent a film to go with it. Whether this creates more driving is not clear, but it surely helps to promote shopping-trips in that people do not have to plan. It seems as though people do both big tours to the mall for weekly purchases and the many daily tours for what was forgotten. Shopping trips are either done by car (the big ones or in combination with other purposes) or on foot to the local shop.

4.6.10 Planning measures that promote mobility

Planning according to building and planning laws and acts concerns mostly the location of activities and some of their substances. The following facts may lead to more car-use:

- Local and regional authorities try on a continuous basis to plan for location of future activities. In these plans environmental issues are very often included as important parameters. But real life development does not always follow the plans. Actual building is a result of a complex game between developers, local authorities and others. And in this game environmental considerations often loose even though good analyses of how and why are somewhat lacking.

- Cities in many countries have extended into neighbouring areas sometimes with great concern for the prevention of agricultural land. In Norway this has, over a long period, lead to what can be defined as scattered building. Such an urban structure also surely leads to more car traffic. Only over the last years have authorities tried to limit the role of agricultural interests to open up for other interests.
- It is well known that the existence of good parking is one important prerequisite for using a car. Trying to limit car-space at shopping centres, work-places and in residential areas have therefore been suggested on several occasions, both in concrete cases and as a planning rule. The fact of today is rather the opposite, that development plans and regulations set minimum standards for number of parking places, per dweller, worker, visitor etc. And these standards are high.

4.7 Cultural factors

4.7.1 Introduction

By cultural factors we mean factors that are related to beliefs, values and norms in a society. These general beliefs, values and norms are part of the ideology in the society and effect the institutions in a society. The consequences is that institutions like the family, daily life, labour market etc. may be organised differently in different parts of the world. In this context we are only concerned with beliefs, values and norms related to personal transport and specially related to the car.

As the car is an relative new and global artefact, we presume only small variations in the dominating ideology in modern societies. However it might be great variations between countries dependent on different types of economies and on different economic levels. There may also be great variations between groups within a society.

4.7.2 The ideology of automobility

Individual mobility, freedom, and personal pleasure are widely recognised as major rewards of automobility. There are fears that attempts to impose speed limits, to raise gasoline taxes or in any other way to limit the use of the car, will inhibit freedom and mobility. This collection of beliefs can be characterised as the ideology of the motorcar (Freund and Martin 1993).

The car is perceived as affording the driver a high level of freedom of choice as to when and by what route he or she travels, as well as the destination of travel. According to Freund and Martins (1993) the car represents an icon of freedom of movement and is seen as a great equaliser among citizens, and the degree of motorization of a country is often taken as a measure of its democratisation.

In the USA it is claimed that the preference for private vehicles is an expression of American individualism (US General Accounting Office 1989).

However, Freud and Martin (1993) also points out that, what is most frequently overlooked by those who uncritically espouse the freedom and mobility of driving are the social controls that any transport system brings with it. Speed limits, blood alcohol limits, driving tests and licenses, laws permitting the compulsory purchase of land for transport developments, compulsory vaccination (?), and the vast apparatus of customs and immigration are some examples (Adams 1981).

4.7.3 Modernity

The ideology of the automobility can also be studied as modernity (Berman 1987), i.e. as cultural perceptions based on what it is, and how it feels like to live in a modern society. In this context the car can be viewed as the essential symbol of what is modern.

Our modern lives constantly demand effective use of our time, and the more effective we are, the more can and must we have time for. In the modern society there is a scientific view of efficiency and time use, also in everyday life. In this perspective the car is an important tool.

Managing and performance is important in a modern society. It is what we do, not who we are, that are important. Hence, managing the car and all it's demands, can be seen as a ritual action in mastering and understanding the principles of the modern industrial society (Ehn in Heideken 1989). Not to be able to do this can give a feeling of alienation (Piersig 1981).

Another aspect of managing is the mastering of speed. Handling of speed requires 100 per cent presence of all our senses and in all our movements. One must be intensely conscious in a physical way, which gives us a feeling that we are alive and in control. According to Gripsrud and Johansen (1987), this feeling is important in modern society because the modern programme is to make life as simple as possible, solve all materialistic problems and prevent large emotional strains and dangerous situations. This contradiction makes car driving fascinating. (see also chapter 4.8.3).

4.7.4 The car as a private room

High speed and strain is a common feature of modern social life. As a contrast, the atmosphere inside a car, can in certain situations, be felt as a peaceful and quiet place. Some people can experience the solitary drive to and from work as a break/breathing space between confrontations at work and the obligations at home. One psychotherapist has even emphasised the car as a prominent place for doing one's psychological homework or self-therapy (Horowitz 1987). This privacy within the car is argued to be an important factor to understand the phenomenon of everyday car use (Andrèasson 1996).

The car is a semi-private sphere. We sit in our own «living room» and watch the world go by. Since we are on a private arena, we may do the most private things, like putting on make up, shave, listening to radio and to music. In relation to music, the car has been studied as a concert hall (Öblad 1996). The technology has also made it possible to combine private mobility, with productivity. With mobile

data and mobile telephone one can do some simple office work in the car, for instance when trapped in congestion.

The privacy within the car is also made for intimacy. The car might be the only place where family members are sitting together. This is an excellent opportunity to talk and sharing experience. Further, the car can be characterised as an institution for socialisation. The car defines the family, the social roles and leadership. The children sitting in the back seat, the parents in the front seats and the father driving. The father driving strengthens the impression that the man is ruling the family (Ehn 1989).

4.7.5 Dangerous, but useful

The statistics of accidents creates the perception that the car is dangerous. We know that it is hazardous to drive a car, and we try to explain this to our children. For small children the knowledge of cars may be the first meeting with the fear of death. On the other hand, socialisation to automobility starts very early in children's life (Hjorthol.and Vibe 1993.). They are driven to kindergarten, school etc., and they participate in the family trip to the supermarket and on holiday by car. Thus, the car is, in children's imagination, dangerous but useful.

We, that is the society, accept the risk related to automobility. We do that because (Elvik 1993):

1. The usefulness of the car is visible for both the society and individuals
2. The car is not a new phenomena, we know the causes and when we are exposed of risk
3. The risk is insurable in a insurance company
4. The legal and moral responsibility lies with the individual

4.7.6 Automobility in the mass-media

Ideologies operate most effectively when their assumptions become a taken-for-granted features of culture. They come to be taken for granted when they are embodied in various material and cultural forms. For instance, rush hour radio traffic reports reaffirm the centrality of the car and its «natural» place in our daily lives as the predominant, even the only reasonable, means of mobility (Freund and Martin 1993). Schiller (1993) suggests that these reports be treated as a form of auto advertising. The problems in focus in these programs and in mass media in general are usually seen from the perspective of the car driver - for example how difficult it is to be a driver because of parking problems and congestion. This approach creates a kind of anonymous solidarity/fellowship between car drivers (Gripsrud and Johansen 1987).

4.7.7 Car advertisements

According to Hagmann (1993), car advertisement has two functions. It is a model *for* the society and it is a model *of* the society. It is a reflection of cultural values and presents normative statements about these values by giving guidance for evaluation of behaviour.

Because cars more or less have a conform shape, it is not much to play on in marketing. Besides the car's effective or instrumental qualities by stressing price, quality, comfort, room/space, engine, stands the affective or emotional aspects central in car advertisements. According to Olle Hagmann's (1993) and Marit Hubak Karlsen's (1992) analysis of *car advertisements*, the car is related to individual freedom, joint adventures with your family and worshipping the nature. The car gives you, according to the car advertisements, the opportunity to control a technology and the elemental forces. The car means recreation and symbolises harmony, efficiency, predictability and independence. The car advertisements are furthermore a way of communicating the excellence of the car and the lifestyle that follows. We are tempted by safety, security, service, advanced technology, horsepower and a luxurious way of living.

Advertising together with other cultural forms promoting cars, contributes to create the meta product of the automobile (see chapter 5.4.1).

4.8 A diversity of factors

This chapter shows a diversity of factors influencing individual travel behaviour. Even so, there are probably more factors that are important which we are not aware of, or that are only on a vague hypothetical level.

It is difficult to judge the different factors up against each other. As far as we know, there have not been done any satisfactory studies taking all the factors in consideration. The «problem» is that the different social sciences have their main focus on different factors and variables, and they also have a different approach to the same factors. However, this diversity is an advantage and may be helpful to get a total picture of the field. The history of the scientific field of transport has developed in connection with the introduction of new social sciences in the field. The tendency now is that scientist are more open towards other factors than they traditionally have focused on.

5. Travel behaviour as individual action

5.1 Introduction

In chapter 4 we have presented major factors structuring individual travel. As pointed out, it is who we are (demography), the built surroundings, the network infrastructure (physical environment), and social values, norms etc. (cultural factors), that may effect our travel behaviour. These factors are all on a structural level. However, travel behaviour is done by individuals and must also be seen from an actor's point of view; from a bottom-up perspective.

Modal choice may be studied as social action. In this perspective the focus is the person who acts. One distinguish between actors in different situations, for instance by identifying the actor's goals, expectations and values, available means to gain these goals, the situation the actor is in, and the actor's knowledge about this situation; elements called the *action frame of reference*. Various disciplines within the social sciences focus differently on these elements. There is also variations within each discipline concerning the approach with which they understand the different elements.

In this chapter we will briefly show a selection of different approaches to individual actions that can be used in the understanding of travel behaviour and modal choice. First we will describe how individuals have the freedom to act reflexively within the given structure, then point out that modal choice and individual travel behaviour may be studied as different types of social actions, and last focus at modal choice as consumer behaviour.

5.2 The traveller as a reflexive actor

Factors on the structural level do have an impact on individual travel. However, it is not a one-to-one relation. The structures do not determine specific actions, but give room for variations. People do actually have the freedom to act within the structural framework, more or less as they like.

Human beings are reflexive and they have reasons for what they do, and we inhabit a social world permeated by cultural meanings. Social actions are dependent on the symbolic meanings with which we invest what we do.

The actions of all of us are influenced by the structural characteristics of the society in which we are brought up and live, at the same time, we create (and also to some extent alter) those structural characteristic in our actions. This gives the traveller the ability to change the structural conditions in which he or she acts. The duality of structure maybe understood as structuration theory (Giddens 1991).

According to Beck (1992) modernisation involves not just structural change, but a changing relationship between social structures and social agents. When modernisation reaches a certain level (reflexive modernity), agents tend to become more individualised, that is, decreasingly constrained by structures. In effect, structural change forces social actors to become progressively more free from structure. And for modernisation successfully to advance, these agents must release themselves from structural constraint and actively shape the modernisation process.

In relation to travel behaviour, this means that the elements of both the physical and social structure dealt with in chapter 4, mirror a meaning for the traveller, and that these meanings may vary form traveller to traveller. Hence, various travellers may act differently under the same structural conditions. Further, the theory of structuration indicates that the individual traveller by his' or hers actions may change the structures in which he or she acts. According to Beck and his concept of reflexive modernisation, the structural factors may loose their explainable force in the future, also in relation to individual travel behaviour. The focus on the actor and what is called the actor's personal environment (Bovy and Stern 1990), will probably be more important.

5.3 Modal choice as different types of social action

From a sociological approach, it is possible to distinguish four types of social actions: 1) *Instrumental action*, 2) *actions based on value rationality*, 3) *effectual actions*, and 4) *traditional actions* (Weber, ref. in Jary and Jary 1991).

Empirically it is possible to observe actions that are a mixture of two or more of three types of social actions. In relation to travel behaviour and modal choice, it is difficult to state what kind of human action we are talking about. There is also disagreements between social scientist about this. Most likely there exists differences between people and differences between trip purposes, whether modal choice is based on utility, value rationality, emotions or habits.

5.3.1 Modal choice as instrumental action

Instrumental action is defined as an action where the actor weighs the relative efficiency of different available means to an end, and sometimes also the ends themselves, seeking to maximise benefits. This implies a goal-mean rationality.

The travel or the various trips are means that ties together a person's various activities and can be seen as links between the different arenas on which he or she performs. These arenas may be the labour market, education and various leisure activities. The various arenas have different locations and therefore require travel. Travel and modal choice may in this context be viewed as an effective way of organising the daily life of individuals.

Rational economic action

In economy the main object is to develop mathematical models for human behaviour. These models must describe how people actually behave, they must be formulated independent of special circumstances, and they must result in a model formulation with variables that can be measured and with parameters that can be estimated. One assumption is that persons act rationally based on consistent and transitive preferences (Tretvik 1989). In transport research these models are usually used in studies of how the *total travel costs* determine the modal choice.

There are many theories related to human action that can meet the strict conditions of mathematical models used in economics. Theories based on psychology about decision making can for instance be described quite detailed. However, it has not yet been possible to translate these kinds of advanced theories into concrete models for travel behaviour that are practically useful. Nevertheless, it is clear that theories both from psychology and sociology have contributed to a greater understanding of the complexity in human behaviour, and to a certain extent to improve *model spesifications* within the frame of maximisation of utility (Tretvik 1989).

There are two main problems using these models of *rational economic action* in relation to travel behaviour. The first problem is related to the question of quantification. For instance doubt has been cast about the possibility of quantification and to put a price on qualitative variables like motives, cultural belonging etc. This leads to the second problem; the limited action frame of reference these models are forced to perform, i.e. expectations and values, can only in a very restricted way be taken in to consideration. Further, the assumption is that the actor has a total knowledge of all relevant information. This is not always the fact.

The advantage of using economic models in relation to travel behaviour is firstly to show how different quantitative factors (as car mobility, real prize of gasoline, car ownership per household, family income, distance to bus stop etc.) function together. Secondly, to show how quantitative alterations or changes in different variables effects other variables.

5.3.2 Modal choice and environmental care

With actions based on value rationalisation the act itself becomes the goal. The act is accepted as given, perhaps as a moral imperative. Environmental care is the most relevant value concerning individual travel behaviour.

There has been difficult to find empirical evidence that a person's environmental attitudes really effects his or hers actual travel behaviour or modal choice. Several studies do actually conclude that the choice between driving and using alternative transport is not decisively affected by environmental factors (Sælensminde and Hammer 1993, Widlert 1992).

Unger (1993) argues that the environment is a domain in which attitudes do not predict behaviour very well. She states that the environment is *a synthetic macro category* that does not fulfil the criteria that are necessary for strong associations

between attitudes and behaviour. One problem related to the study of the relationship between environmental care and human actions is that this concept may be defined and be understood in several ways. On a philosophical level one can identify several definitions dependent on different ethical schools and how one judges actions towards the nature (Ariansen 1992), and on an empirical level one can identify different set of attitudes (Stern 1992).

Social dilemma

Individual transport is an area where most of the problems are caused by individual actions. Situations where the individual have a choice between acting in self-interest or to act in the interest of the collective, are called social dilemmas (Messick and Brewer 1983).

In the study of simulated social dilemmas in laboratories they have found that many factors effects peoples liability to act based on self-interest or in the interest of the collective (Van Lange et al 1992). Examples are the size of the individual and collective benefits and costs, amount of people involved, the possibility of communication between the individuals (the prisoner's dilemma) and to what extent the individual identify with the collective community. One also finds that in situations where there is an expectation that all individuals would act in self-interest, there are actual persons who acts in interest of the collective (Caporael et al 1989). The persons value orientation and basic values of live may explain this individual difference.

In their study of choice between the automobile and alternative modes of transport as a social dilemma, Garvill and his colleagues (Garvill et al 1994) found that individual and collective values effects the assessment of the individual and collective consequences of a trip, and that these again effects the modal choice. Analysis of a general lifestyle survey also indicates a connection between environmental care and modal choice and car ownership profile (Berge 1996).

Factors effecting environmental attitudes

Not all accepts the environmental problems related to car driving. Knowledge about the risk concerning future problems is one essential factor for environmental care. Lavik (1990) uses the term *environmental ability* to describe factors affecting environmental attitudes. This environmental ability is mainly related to the understanding of the elements of risk.

The conditions for environmental ability is, among other factors, effected by how incidents and consequences of pollution are handled by the mass media. The perception of risk is also dependent of the person's social and cultural context (Ruth L. Love 1989, ref. in Lavik 1990). It is stated that this is more important for people's perception of risk than information presented as figures and statistics about environmental problems.

5.3.3 Modal choice based on emotions

Some would argue that most of our actions are governed by emotions - the emotion of well being. Consequently, modal choice is also governed by emotions.

Diekstra and Kroon (1995?) have made a summary of the most important psychological motives affecting driver behaviour:

- The car exceeds the limits of nature's own forces to move from place to place *(Auto-regulative capacity).*
- The car is a *reinforcement technique*. With the aid of the car, man is capable of claiming territory practically everywhere, by just driving there or by parking.
- When driving a car, man undergoes a *personal change.* Different motives and behaviour patterns may take over. In the car, the individual has an instrument, a *weapon* with which he/she may threaten the lives of other road-users.
- The car's potential *to impress* is an archetypal motive. The car is also a communicative product for *identity*. Different car types are associated with different personality typologies.
- *Antropomorphisation;* the car may be seen as a person, as a companion or even a friend.
- You belong to the community by having a car (se chapter c)and you belong to a sub-group by having a special car. The car itself is also a major source of communication. This means that the car has a social-cohesion function.
- Not infrequently cars have a kind of erotic effect on their owners.
- In addition to being an object of desire and vehicle of happiness, the car is a source of *stimulation for the central nervous system.* The sensation of speed, the sound of the car, the rhythm of the wheels and the continually changing lights and colours induce a trance-like state in some drivers.
- The car satisfy the need to structure one's day - an antidote to boredom, the quest for new excitement and stimulation, driving for the sake of driving.
- Lastly, the car fulfils the human need for protection and security. Familiar, warm and rocking gently back and forth, the car is the adult's womb, albeit a womb of metal.

Some of these motivations are deduced or have their origin in cultural factors (see chapter 4.6). Psychological motivations are difficult to verify. They are more or less unconscious, latent and not out spoken. However, this does not mean that they are false and that they should not be taken in consideration when discussing important factors linked to individual travel.

5.3.4 Modal choice - a habit

The so-called traditional actions are governed by customary or habitual practices. The alternative ways of acting is in some situations not considered because the pattern of behaviour is already decided upon. Repetitive behaviour like this is

described as habits or routines. These types of actions may originally be based on either a economical or a value rationality, or on emotions.

It is argued that habits are done more automatically than routines, and is less an object for the control of the person, i.e. smoking and nail biting. Routines are actions that are done frequently, and are more open for control. They are therefore easier to change. The use of car or public transport can be seen as routines like this.

Garvill and his collages (1994) stress the fact that there would never be total concurrence between values, attitudes and actions, because of habits and routines. These automatic choices are not necessarily effected by ones values, because attitudes and values may change without changing the behaviour. However, in the long run, this is an impossible situation for the actor. Over time the actor will either change his/her values and attitudes, or his/her behaviour. (Cognitive dissonans; Festinger 1957).

Ronis and collages (1989), and Gärling and Garvill (1993) point out the importance of routines in our daily lives. Routines and our former decisions (like buying a car) seams to be important regarding modal choice and the organisation of our day life.

5.4 Modal choice as consumer behaviour

Transport can be defined as a type of consumption. This means that modal choice is viewed as consumer behaviour and that the mode of transport is the product that is consumed.

5.4.1 The meta product of the automobile

Most consumer theories have a holistic view on products which means that a product is not only a physical object or a service, evaluated in relation to functional criteria. The product also has a symbolic dimension that is evaluated on the basis of emotional, psychological and sociological criteria (Linn 1985, Wilke 1990 and Mowen 1987). Some writers have even argued that the primary reason for buying many products is their symbolic values and not their functional benefits (Levy 1959). Others assert that consumers' personalities can be defined through the products they use (Tucker 1957). Various studies have, in fact, found a relationship between the self-image of a person and certain products that he or she buys. Products, for which such self-image/product-image congruencies have been found, include automobiles (Belk, Bahn and Mayer 1982).

Usually, when we talk about cars, symbolism and identity, we refer to the images of different car types and models. However, it is stated that not only is the type and model important as a symbol for peoples identity, but also (the use of) the car as such (Berge 1994). This indicates that the symbolic meaning, or the cultural conception, of the transport mode is one factor that might influence people's choice of transport in cities. This approach especially points out the importance of cultural factors in understanding modal choice (ch.4.7).

5.4.2 The car as a communicative product

Not all products are what we can call communicative products. The products that consumers use to communicate themselves to others have, according to Holman (1981), at least three characteristics. Firstly, they must be visible in use, i.e. their purchase, consumption, and/or dispositions must be readily apparent to others. Secondly, the product must show variability - that is, some consumers must have the resources to own a product while others do not have time, or financial resources to possess or use it. Thirdly, the product should have personalizability, which refers to the extent to which a product denotes a stereotypical or standardised image of the average user.

Regarding the first criteria, a person's modal choice *is* visible to others. It is visible that you are seen in your car, on the bus or on other public transport, and you often communicate your modal choice to your family, friends and colleagues in discussions or in other situations.

As to the second criteria, different modes of transport do show variability. A car is quite expensive to possess, it can be expensive to buy, the maintenance, insurance etc., is expensive, and petrol is also relatively expensive. Furthermore, not everybody can drive a car because you need a license. To obtain a license costs money, you have to be 18 years or more and you have to have a medical certificate. One might argue that in industrial or so called developed countries, some of these factors have lost their potential because the standard of living has made most people capable of buying a car and to obtain a driving licence. Nevertheless, these factors might still be in operation at least as a notion in people's mind.

The third criterion was that the product must denote a stereotypical or standardised image to the average user. There has been few studies focusing on the image of the automobile in relation to other transportation modes. However, one study from Oslo (Berge 1994) shows that there exist stereotypical or standardised images of both the users and the different modes of transport themselves. In general the car had the most favourable image.

5.4.3 Lifestyle: Segmentation of the consumers

One important aspect within consumer theory is that not all consumers are similar. Dividing consumers according to demographical variables is not seen as sufficient. The use of lifestyle segmentation is an important tool within this field. An analysis of a general lifestyle survey in Norway (Berge 1996) shows that each of the nine segments has its own modal choice profile. It indicates a connection between lifestyle and modal choice, car ownership, attitudes toward and interest in transport. The analysis also indicates a connection between environmental care and modal choice and car ownership. The differences between gender, age groups and people from urban and rural areas seen in other studies are only valid within certain lifestyle segments. Gender, age, and place of residence, are therefore not unambiguous factors of explanation.

5.5 Different approaches

As shown in this chapter there is different approaches to understanding travel behaviour from an individual perspective. We have not tried to describe all possible approaches, but only given some examples. The purpose has not been to evaluate different approaches up against each other, but to see that they are supplementary and that new perspectives may give new understanding of the phenomena of individual travel. The awareness of different approaches is especially important in relation to designing different measures for changing individual travel behaviour.

6. Effects of policies on individual travel behaviour

6.1 Introduction

The focus in this overview concerning policies is directed towards measures that effect individual travel behaviour. The focus will further be limited in the following two ways:

- We will focus on daily trips, that is to say short trips done by walking, cycling, using a car or going by some kind of public transport. And the setting will mainly be in urban areas.
- We will focus on such measures as have the explicit purpose of reducing individual travel or get people to switch from using a car, towards the environmentally more friendly transport modes, non-motorised or, given certain prerequisites, public transport. In the literature we see described long lists of possible measures. But not all of these have an explicit environmental background.

The different policies can be divided into two main categories:

- Land-use policies
- Transport policies

We will discuss them each in some detail and then move to an overview of some possible alternatives or combinations of measures that are necessary for obtaining certain goals. As a final part of this treatment we will discuss matters concerning implementation of policies.

6.2 Land-use policies

6.2.1 Measures to increase density

Such measures include both denser residential areas, revitalising inner city areas and focusing on knots in the public transport system. So far most cities in the OECD-countries have chosen the opposite strategy. In Norway a study of 13 cities shows an increase in built area of 136 per cent over 30 years, while the population only increased by 27 per cent (Miljøhåndboken 1996).

In the OECD-report (OECD 1995) several cities are mentioned that try to decrease density, especially in the inner city. Tokyo is mentioned as one example. But in all cities both work places and residential areas are located further and further from the city centre.

An upcoming discussion of means to increase density is visible, in Canada, Australia and other countries. And the Norwegian experiment with comprehensive land-use and transport plans focused to some extent on possible positive outcomes of a denser city. But here the conclusion was that such measures were difficult to obtain and at best, had a very long-term effect.

The obvious effect of shorter distances on chose of transport mode is shown in a diagram from Germany (OECD 1995:86). Similar figures can be given from other countries. But Norwegian travel data also shows a high degree of car-use on shorter trips. Nearly 30 per cent of car-trips are shorter than 2 km. This is a counterfact showing that with a car available people use it even for very short trips. A denser city will therefore not necessarily give fewer trips by car, but possibly, shorter ones.

6.2.2 Integrating land-use and public transport

As is well known policies have been chosen, especially in the Netherlands and in France to integrate locational policies with provision of public transport. The Norwegian experience with the type of planning mentioned above is so far not without contradictions. The most obvious fact is that public transport has a very weak organisation making it difficult to integrate the different kinds of planning.

In different cities both in Europe and USA referred to in the OECD-report (OECD 1995), the following strategies are being pursued:

- Concentrating high-density residential development near stations along public transport corridors.
- Creating or preserving a high density of trip-attracting activities in city centres.
- Placing new residential areas in places well serviced by public transport.
- Get developers to support the supply of public transport.
- Set guidelines for new development in relation to how accessible they are with public transport.

It is however hard to say if such measures actually are set in motion and if so, if they are successful in reducing car-use in the area.

6.2.3 Developing vital urban centres

The development of inner city areas show different trends in different parts of the world, from overgrowth in Asian cities to decline and depopularisation in European and American cities. Special measures are tried out to make city-centres more attractive, like pedestrian areas. Such measures do not necessarily restrict car-use. Parking restrictions in combination with a good supply of public transport seems to be the chosen solution in most cities.

Whether such policies actually work to reduce car-use in the inner city is not at all clear. Parking policies with high prices on public space often gives a high turn-over, and therefore room for more cars. The only type of car-users kept out are those who would like to drive to work and who does not obtain a free parking-place by their employer.

6.2.4 Containing urban development

Under this heading lies measures to contain urban sprawl by green belts and similar measures. Several cities, especially in Europe try to work with filling-in policies instead of opening up new areas for development.

More specifically urban authorities try to prevent the establishing of new shopping centres and business-parks. Whether or not such measures are successful is an open question. In Norway several protests have been launched against such development, on local level, regional and state level, and by road authorities as well as environmental agencies. But the experience so far is mainly that the argument for establishing new jobs weighs more heavily than arguments working for restricting the establishment of new activities attracting mainly car-users.

The establishments of subcentres close to public transport is one way of preventing car-use and at the same time provide alternatives for people who do not have access to the city-centre. Many examples of such sub-centres exist, but as for previously mentioned policies, evaluation as to their effect is not easily available.

6.2.5 ABC in Netherlands and policy guidance in UK

Special guidelines for restricting the free location of activities that attracts many visitors coming by car, has been introduced both in the Netherlands and in UK. So far these guidelines are radical examples of restrictive land-use. Whether they actually will produce less car-traffic is so far unknown.

6.2.6 Experiences with land-use policies

The actual effect of such measures as mentioned above are so far unclear. The reasons are several:

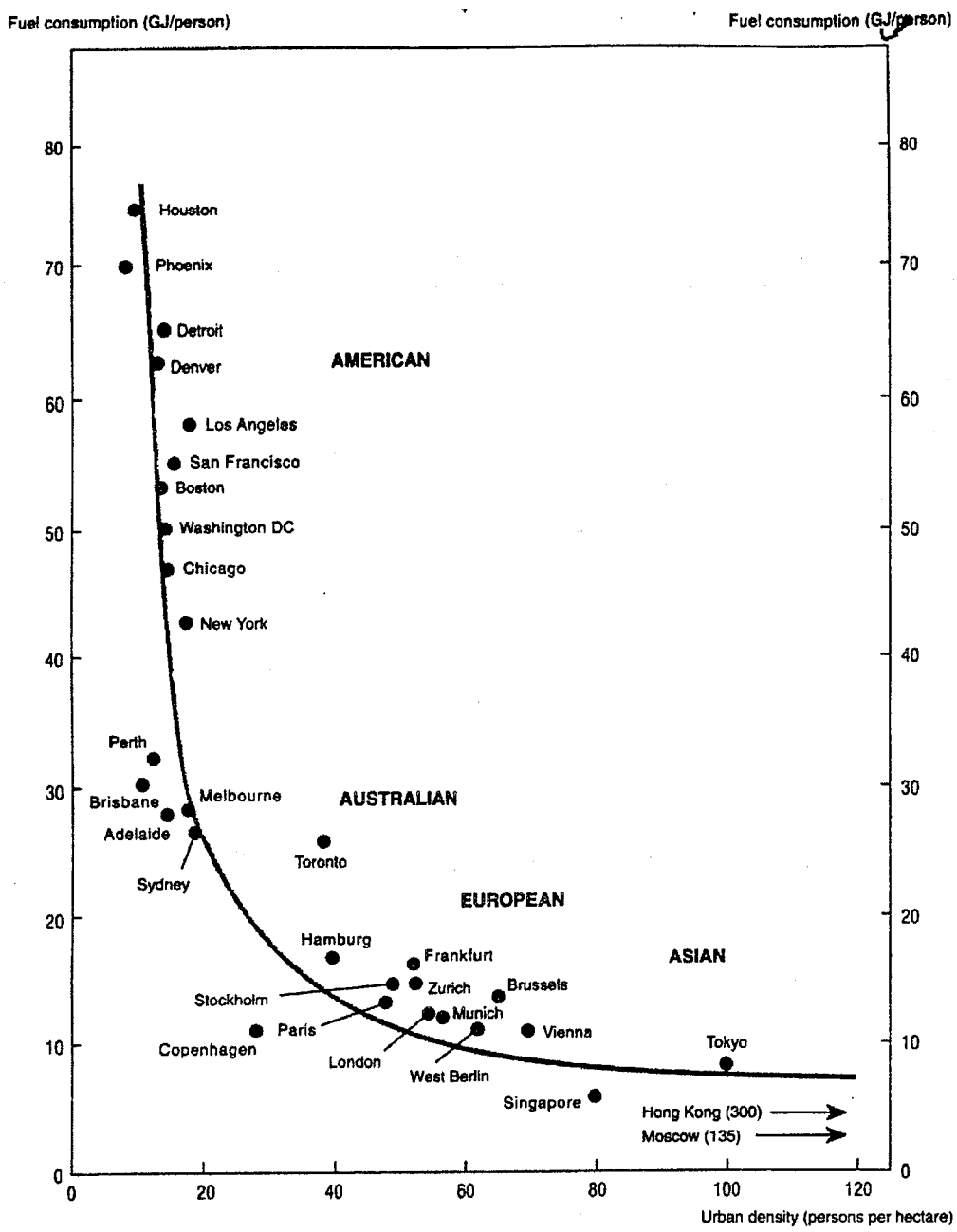
- Even though several cities in Europe and elsewhere introduces plans and over-all strategies that opens up for denser cities with less travelling, less car-use, more pedestrians and cyclists and more people travelling by public transport, the actual trend of development may be different. This is a natural result of the

fact that several interests influences and negotiates over the future of urban development, and environmental goals are always only one of several important goals for new development.

- Even though some measures actually are put through, the lack of evaluation is prominent. We therefore do not know exactly what the consequences are of a change in urban structure. The best knowledge available are so far obtained from simulation-models, e.g. from 10 Norwegian cities.
- A gradual change in urban structure may lead to a change in urban travelling, but this change is at best cover a very long-term change. We may not see effects of such changes for at least 30 years or more.

The OECD-report (OECD 1995) concludes:

The goal of sustainable development requires the combined application of reinforcing land-use and transport policies. This is based on the acknowledged weakness of most land-use policies when used in isolation, and also of the long time lag between the drawing up of metropolitan plans and their implementation through building permits.



Source: Kenworthy and Newman, 1989.

Figure 6.1. Fuel consumption by urban density

6.3 Transport policies

This section will be divided into four categories:

- Measures that seek to provide a better supply of transportation; better public transport, amenities for cycling and walking, and traffic management to increase capacity.
- Measures that seek to reduce directly emissions from traffic.
- Building new road-infrastructure.
- Road-pricing.

We will discuss them each under separate headings.

6.3.1 Public transport

Several measures to improve services and attract new passengers are possible and available:

- Improved frequencies
- Improved regularity
- More effective communication with passengers
- Provision of new LRT and underground systems
- Lower fare levels, including new electronic payment systems

According to the OECD-report (OECD 1995) improved systems that gives an increase in frequency and better regularity does not necessarily lead to more passengers. The main effect may only be to improve the standard for those who already use public transport for work and other purposes. In Norway, experiments with improved public transport, shows that higher frequency is the measure that works, if anything does (Norheim 1996).

But from these experiments, as well as from cities in other countries, more mileage of public transport may result in a net increase in pollution. If the new supply does not attract enough passengers who leave their car at home, the emission of pollutants will actually increase substantially. Such new supply must therefore only be introduced when we are certain that enough car-users will switch. A general increase in bus-mileage in Oslo gives f ex an increase in emissions. But specially designed bus-routes in Trondheim give an improved situation because enough travellers went from car to bus (Solheim 1994).

6.3.2 Cycling and walking

Many cities, especially in Europe (the Netherlands, Denmark, Germany etc.) have provided for easy use of bicycles in city-centres and in residential areas. In other countries, also in Canada and Australia, such amenities are being considered, and some places actually built. In these countries the percentage of travels that are done by bicycle are relatively high (7-8 per cent of all travelling). But the question still exists if new amenities actually give more use of a bicycle (ch. 4.3.4).

What we do know is that separate paths for pedestrians and bicyclist results in more casualties (Kolbenstvedt 1996).

The potential for using a bicycle should be substantial. As mentioned before a relatively high percentage (20-30 per cent) of car-trips are short, less than 2-3 kilometres, a distance that easily can be walked or cycled.

The main problem so far seems to be:

- The way new paths fit to the needs of possible users (shortest route etc.).
- The maintenance of the special paths, especially in the winter.
- The problems of topology and climate.
- The lack of co-operation between public transport companies and users of bicycles.
- The existence and comfort of other modes of transportation, i.e. the automobile.

We will still have to see, in the future, how new amenities are being built and whether they actually are being used. A reported strong increase in bicycling in Norway over the last 5-10 years may be explained by misinterpreting data or by answers that more reflect what people wished they were doing than by their actual behaviour.

6.3.3 Traffic restraint

Traffic restraint means here measures to limit car-driving generally, and not restraint as a traffic-management measure. The possibilities can be discussed under three headings:

- Polluters pay
- Limiting parking supply
- Limiting access to inner cities

That car-drivers should pay more than they actually do in order to cover the total costs they induce directly and indirectly, has been established as a fact in most European countries. But establishing this fact on a theoretical level is one thing. Putting it into a policy is somewhat different (Button 1993).

It has also been established that a substantial increase in prices possibly is the most efficient means to reduce car-traffic, both generally and in urban areas.

Road-pricing and increased fuel-prices are two possible ways of closing the gap between costs and what car-drivers pay. In some countries a special tax on fuel (the carbondiocside tax) was introduced in 1990, but the tax was small and the following increase in petrol-prices limited. It was however possible to examine the effect of such a tax in the city of Tromsø, were the CO2-tax came in combination with a local tax on petrol for financing road-building. The combined effect seemed to be in the order of 3 per cent decrease in car driving for every 10 per cent increase in petrol prices (Stangeby 1991).

User-payment on roads as a traffic-restraint measure has so far only been introduced in one city, Singapore. The experiences here are fully documented elsewhere. The urban toll in three Norwegian cities (Bergen 1986, Oslo 1989 and Trondheim 1992) was not introduced to reduce traffic, but to finance extensive new road-construction. Politically it is though important to stress that the toll-rings would not have been implemented if the only arguments for setting them up had been related to road-construction. The possible use of the toll-systems as traffic-restraint measures in the future and the use of parts of the income for public transport infrastructure was a necessity when the toll-rings where discussed politically (Solheim 1995).

The experiences so far is that the introduction of urban tolls as in Norway, has had some effect on the amount of car-traffic. In Oslo the studies showed that tolls reduced traffic by 6-8 per cent. The effect was greater in the east than in the western parts of the city. And trips outside of rush hours were effected most. From this we can deduce that trips where you pay yourself and each time you pass, are more «vulnerable» than trips performed in rush hours by drivers who have a season-card sponsored by their employer (Solheim 1992).

Limiting parking supply in general is a questioned method of restraining access with a car to urban centres. A general lack of parking space may mean people driving around looking for a place to park. High prices seem to be more efficient but maybe not in reducing car-traffic. The objective and the experience may actually be the opposite, that expensive parking gives high turnover which means room for more cars.

The main and big issue is probably to gain control over the parking space that employers provide for their employees, in city centres and elsewhere. Several travel-studies conclude that a free parking space at work is one of the main factors behind choosing a car for work.

Restricting access to city centres for cars have been tried out in many city (OECD reports Milan, Zurich, Rome, Seoul, Munich etc.). So far very little evaluation material seems to be available that shows the effects from such measures on car driving in the urban area at large. The banning of cars from the centre of old Italian cities may not have a great impact on the total pollution from car-traffic in the urban regions at large.

6.3.4 Traffic management

Traffic management means in general to try to get more capacity out of the existing road-network. This can possibly be obtained in several ways. Especially in North America and Japan there is a great belief in the role of road traffic telematics (RTI). In California they also work with solutions that means more people inside each car. Whether this results in fewer cars are so far dubious.

Telematics means better administration of traffic. This can be obtained by steering traffic by regulating speed, guiding traffic to alternative routes and in general to give information to drivers. Telematics also means better and quicker information to traffic managers; line-ups, accidents etc., and consequently a quicker response.

These systems do not however result in less traffic, but reducing congestion may give less pollution as a result. And fewer accidents is a very likely outcome.

Full surveillance and steering by means of computer systems is in the future somewhere, possibly some 30 years ahead.

Car-sharing and car-pooling means either picking up others while driving to work or joining in a system where participants take a turn at driving. The overall experiences from such systems (North America and Australia) are that so far they are not very successful. Some social scientists explain this by referring to cultural factors (see ch. 4.7.4.). But in combination with the use of HO-lanes, e.g. those reserved by buses in some European countries, the likelihood of reducing car traffic to and from work are a little larger.

6.3.5 Road building

There is an increasing understanding that new road infrastructure in urban areas as a sole measure only leads to more traffic (ch. 4.2.). The thought that more roads would give higher speeds, reduced traffic jams and less pollution seems not to find evidence in reality. More roads in general, mean more traffic. This does not mean that road building is not productive, but the point must be to introduce other measures as well, like closing the city centre, residential areas and so forth.

In Oslo, Trondheim and Stockholm the combined building of new roads with restrictions and urban tolls, may both provide for a better flow in traffic and a reduction in the total volume. But at present we don't actually know if that will be the final result. In Norway a lapse in the economy has had a halting effect on car-traffic. We do not know what will happen as traffic now has started to grow, again. And in Stockholm the Dennis agreement has still got a way to go before it is completed with roads and tolls and new public transport. And even longer before the whole package has been evaluated.

6.3.6 Direct measures to reduce fuel consumption

Over the last 20 years there has been an increase in energy-consumption of more than 3 per cent per year. The emission of CO2 is directly proportionate with the consume of carbon-based energy. As shown earlier (ch. 3), the emission of CO2 is directly responsible for a possible change in the global climate over the next 10-50 years

Fuel consumption can be reduced in different ways:

- By reducing the total amount people drive.
- By increasing fuel-efficiency in vehicles.
- By getting people to switch from larger to smaller cars.

According to OECD (OECD 1995) there is a strong relationship between fuel prices, length of driving per car and the average size of cars. Italy is at one end of the spectre with high prices, small cars and short length of annual driving, with the

US at the other end. Japan and Sweden are exceptions in different ways, probably due to the role of public transport (in particular; trains) in Japan, and dispersed location of activities in Sweden.

The question of specific taxes on petrol to reduce the amount of km driven is an important question in the future. I 1991 both Sweden and Norway introduced a specific tax on petrol amounting to about 10 per cent of prices at the moment. If we assume an elasticity of -0.3, this should give a reduction in petrol consumed of approximately 3 per cent. Experiences from Tromsø, with a local and national tax on petrol, support such an estimate. To reduce the consumption of petrol by 30 per cent (to a sustainable level), petrol prices will have to be doubled.

In the coming 20-30 years an excepted increase in fuel-efficiency of 10-15 per cent are expected. Various assumptions have to be fulfilled to make this happen. The present stock of cars has to be turned in at a certain rate per year. It is also necessary that people do not switch to larger cars. In Norway there is a tendency for new cars to be company-cars (35-50 per cent) and these are larger than privately owned ones. But the share effect of technological development, enforced by regulation, seems to be in the area of 10-15 per cent.

If people were suspected to drive smaller cars, the same measures (special taxes on large vehicles and taxes on petrol) would have to be introduced. The problem here, as already mentioned, lies with the extensive use of company cars. In Norway, the sale of large cars are, for 90 per cent or more, limited to companies/company owners. The question of how such cars are taxed for private use is significant.

6.3.7 Standards and levels for noise and pollution

There has been a significant increase in demands pointed towards accepted noise from engines and exhaust. But the effect of such measures has been limited. The reason for this is mainly that the ways that cars are driven do in fact change, due to higher speed and quicker acceleration. The problem with noise from tyres, including studded tyres in some countries, is an additional one. But still stricter rules are expected to reduce future noise. The question of whether noise is a sustainability problem is however an open one.

Emissions of CO, hydrocarbons, lead and NOx have been reduced to some extent over the last 10 years, and the international goals have more or less been met, especially for the first three. The emission of NOx in Norway was reduced from 1987 onwards due to the catalysator. The great questions in the future is related to how technicians can remove problems related to cold start, improve the functioning of the catalysator and to how fast the stock of cars will be replaced.

6.3.8 Towards a conclusion

There are mainly two points that need to be mentioned as a conclusion:

- Differences between different countries concerning what kind of overall policies they seem to choose.
- The fact that no country seems to have found the good solution that both have the wanted effect on environmental problems and at the same time is realistic as a political measure.

In the past it is probably true to say that some countries focused on traffic management, increasing the capacity of the road-network. This was especially true for the US and Japan. In European countries there seem to be some agreement now, that new road-capacity and better management only leads to more traffic. A change in policies is necessary if a better environment, a sustainable environment, is to be obtained.

It also seems to be an experience that positive measures, improved technology and a better supply of public transport are the easiest measures to get a political backing for, but that restrictive measures are the only ones that really work.

We can therefore conclude that a combination of restrictive measures and a better supply is necessary to reduce the amount of travel and give a good service for those being priced out. The question of the effect of land-use policies is still an open one.

6.4 Future policies and implementation

As a starting point for the following discussion it should again be remembered that a reduction in car-traffic and/or a shift from car driving to more environmentally friendly modes of traffic is an overall goal. It is also important to stress again that with the present trend, the expected growth in car-traffic in the OECD-countries are estimated to 50 per cent or more over the next 25 years. Some experts give even more «optimistic» prognosis. More than 100 per cent growth over the 30-35 years is not very unlikely in some European countries (Button 1993). At present the yearly increase in vehicle-km in Norway is over 3 per cent.

The further possible results of present policies are less use of public transport, bicycles and our own legs. The problem with annoying noise will increase to some degree while local pollution (CO, Nox etc.) probably will be reduced, due to technological development. The greatest environmental problem will be emissions of CO_2 and the (very probable) resulting global heating. Some experts also point to the problem of overconsumption of land for traffic purposes.

6.4.1 Finding workable policies

We will here focus on those measures that may have a direct impact on the total amount of energy consumed, as this seems to be the main environmental issue in the future. Several experts and politicians stress the need for new and

comprehensive policies to meet the challenge of reducing a mobility that is at present growing. In the OECD-report (OECD 1995) a three-stage strategy is set up to reach the goal, if possible:

- Adoption of best practice policies. This means to apply already known measures from different parts of the world, especially cities in Sweden, Switzerland and Germany. Measures include limiting urban sprawl, location of activities near public transport facilities, limiting car parking at work, limiting road investments, and providing better facilities for cyclists and pedestrians. Further, increase fuel taxes and tighten regulations on emissions from vehicles, and introduce urban tolls with the clear aim of reducing the amount of traffic in the city.
- This strategy is not expected to have a great impact on total traffic, but will limit other environmental problems, like noise, emissions of CO and Nox. The problems related to energy and land-consumption will not be solved by such measures.
- OECD stresses the need for innovations. In "Strand 2" they list possible areas of new measures that opt for cities to be reconstructed back to the urban village, to work for better and faster public transport and to implement higher taxes on energy consumption.

This is one of the planning situations described by Christensen (1975). Dividing the «world» into four by means of two dimensions, goals and means to reach these goals, we get the following possibilities:

	Goals:	
Means:	Clear and without conflicts	Unclear and/or with built-in conflict
Known	Simple programming (1)	Defining, limiting and negotiating (2)
Unknown	Experimenting (3)	Chaos with any possible solution (4)

Figure 6.2. Different planning situations (after Christensen 1975)

The simple situation is placed in (1) where the only problem is to find the right amount of measures applied. In (3) we need experimenting with new solutions, while all goals are set and agreed upon. In (2) the problems lies not in finding the right solution, but trying to define, limit the range and probably negotiate towards a possible common goal. The fourth situation is the toughest one. Here we both need to work on goals, negotiating, and we need to experiment to find the right solution to the unknown or conflicting goals. This situation can well be described as chaos and very often asks for a charismatic leader who can handle the situation.

We will not try put clearly the work for sustainable urban travelling into one of these categories. It probably will be best described as belonging somewhere between 3 and 4. OECD (OECD 1995) places it in 3, but that may be too optimistic. Looking at all the conflicting goals, category 4 may be better suited. But then maybe, it really lies in category 2, and what we really need is a work on goals, while the means to reach these goals are well known.

And in "Strand 3", the strategy for sustainable development, the fuel tax solution is stressed again. This conclusion really shows that our discussion above is clearly necessary.

This way of thinking meets with two problems; will the selected measures really work, can we live with the other consequences they will induce on people, and are they in any way possible to implement. In the following we will shortly discuss the problem of implementation. The problems of what will be the real working solutions and what their consequences will be, will be brought up in a later stage of this work. We feel that the great challenge lies in the border between thinking in terms of simple economics and applying other approaches.

6.4.2 Some Norwegian experiences with comprehensive planning

In 1989 the Norwegian government initiated a process where local and regional government in the 10 largest cities worked together producing plans that were to include both land-use and transport problems, and also seeing different modes of transport in combination. The background for these new plans was the Brundtland-comission and the new goal of sustainable development.

Looking back at the process it can both be seen as a failure and as a success (Lerstang 1993). The failure lies in the fact that even though most local authorities chose the scenario of sustainable development, the actual measures chosen are those that means more road-construction and a continuation of the present trend towards more car-traffic. The reasons found in the evaluation projects points to the different strength of the participating organisations and the resources available for different purposes.

The success was mainly related to new ways of working together locally, with both local and regional bodies of municipal, county or national status. This co-operation was said to be continuing in most cities and the focus is more and more towards environment as a basic premise for local planning. Whether this will lead to drastic changes of trends in the future is impossible to say.

6.4.3 The problem of implementation

A well-known model for the process and problems of implementation is presented below (Van Meter and Van Horn 1975) (figure 6.3.). The question of who dominates the agenda is not explicitly stated in the model, but is emphasised as of great importance by most political scientists. And can partly be deducted from prevailing general conditions. The heavily discussed consequences of global heating may at present not be clear enough for the necessary measures to be implemented.

The starting point is the goals related to the political measures in question and resources backing it. For the implementation to be successful the goals have to be clear and without built-in conflicts and have a well-known empirical relationship to the measures. The necessary resources also have to be available.

On the organisational level three aspects are of importance; the functioning of the implementing organisation, its relationship to other organisations and the present dominating social and economical ideologies, political backing etc. Two important aspects are emphasised concerning the working organisation, its homogeneity (goals and professions) and its resources. In the field of transport and environment the organisations related to the building of infrastructure are much stronger than those maintaining environmental interests. The same goes for the interests that promote car-use. There is also a considerable problem in relation to getting different organisations to co-operate. The field is marked by several sectors and level of government that do not necessarily function well together.

At present environmental questions play a central role in political debates, but of even greater importance are those related to employment and economic growth. The field is therefore packed with conflicts. Health is a much clearer field of politics both concerning goals and measures to reach the stated goals.

The prevailing attitudes of the implementers are also of importance as seen when organisations originally set up for the purpose of building infrastructure are asked to maintain environmental interests. Or when organisations with built-in conflicting interests are asked to choose a clear path (like national governments or local municipalities).

The most interesting perspective may actually lie in looking at organisations and forces existing outside the sphere of public bodies and politics. And in discussing whether the present trend may also include contradictory forces to the prevailing growth in car-use.

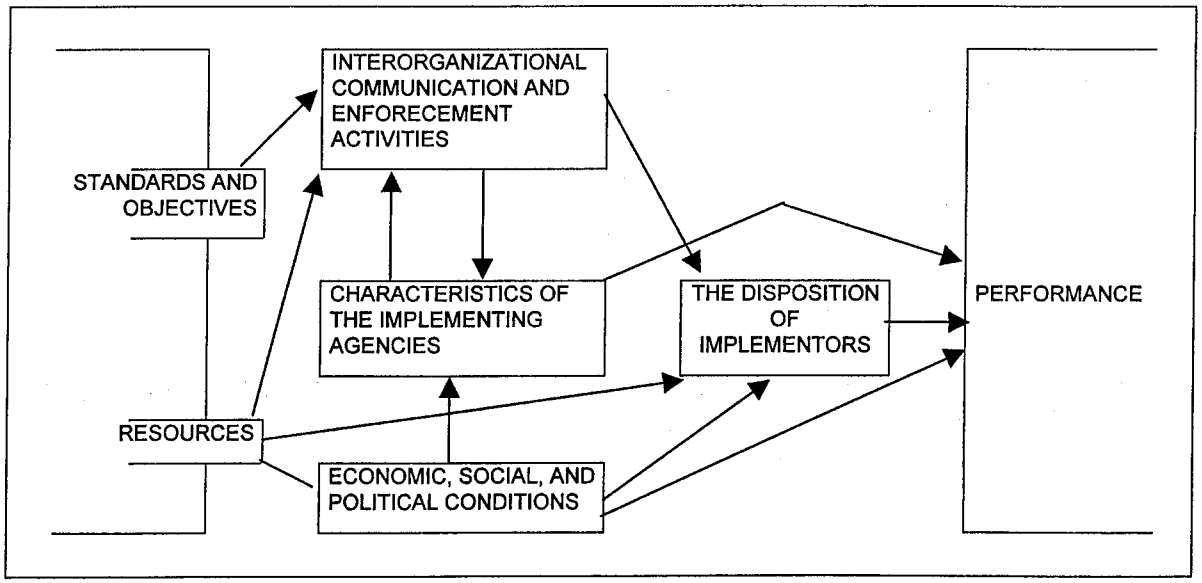


Figure 6.3. A model of implementation

7. Are sustainable cities utopia

7.1 Introduction

This chapter is a direct continuation of chapter 6 where we discussed solutions presented in an OECD-report (OECD 1995) and focused on some aspects of implementation. In this chapter the main focus is on politics, power and structures og power and conflict. We will discuss what is meant by sustainable development and which potential agencies work for or against that goal. First we will focus on the problems of using a classical planning approach. Oil companies and the car industry are in some contexts being presented as the big bad wolves in promoting an increased use of cars. We will discuss how powerful such agents really are. Finally we will comment on the necessary power basis of successful policies.

7.2 A classical planning perspective

In his report Tengström (1995) sets out to identify forces that works for or against a sustainable development. His way of approaching this subject is very similar to the classical planning perspective:

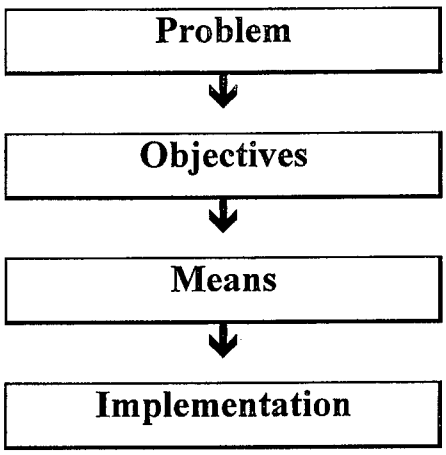


Figure 7.1. A classical planning process

This figure is important and convenient to pinpoint obstacles to a successful analysis of a task or policy. And all these also have to be fulfilled in an actual planning or implementation process.

As Tengström very correctly points out the problem of working towards a sustainable development lies within all four boxes:

The problem is not high up on the agenda. Even though UN's climate panel has received some interest, the problem of global heating is somewhat abstract and distant somewhere in the future. For example in Norway it reaches news headlines when winters are especially warm or cold, when heavy rain falls over an extended period or when storms hit the west-coast. The same is probably true in other countries. The task is two-fold: Establish the truth about what awaits us in the future, establish how serious such a development is for human society and finally, establish possible policies to reach an alternative future. So far we have not reached final conclusions on any of these problems. At least not to the extent that everybody feels it in their bones that something has to be done (see also ch. 5.3.2).

Objectives are not clear. This can be formulated on several levels. First of all the main objectives related to emissions of CO2 are not completely clear. International estimates range between a limited growth and 60 per cent reduction. And even though several countries argue for a decrease, the probable development with today's policies is an increase. In addition, several other objectives interfere, some that has to do with sustainable development and some that obviously do not (see ch. 6). This makes discussions and negotiations difficult.

Means are not clear or well known. We have discussed this problem earlier in this report. The fact is however that we know a lot about possible ways to go. The main problem is that many of the most radical ones have not yet been tried out (like a 100 per cent increase in petrol prices) and that they are surely impossible to implement within today's political climate. What may be the solution is to focus on measures that involve agents with opposing goals and see how they can both fulfil their needs.

Implementation is not a promised success. This has to do with the above mentioned problems and also with the fact that resources and power is missing. To be successful policies have to be backed by agents that are powerful.

Tengström discusses all these problems and also possible solutions to them. We find his proposals somewhat lacking or incomplete. Below we will discuss alternatives to his way of thinking. Tengström has a strong belief in intellectual discourse. This way of thinking is partly based on the German sociologist Jürgen Habermas. A thorough presentation of planning and politics based on Habermas' ideas is given in Sager (Sager 1994). Sagers point is that most planning meets with situations where goals are unclear or contradictory and where means are not known. In such situations a process of negotiations are more to the point than trying to calculate rationally what the solution should be.

But such negotiations (rational discourse or solving controversies by discourse) do not in themselves overcome the two problems of conflict and power. The problem is the existence of what old chairman Mao Tse Tung called basic contradictions and to the problem of asymmetry of power (see ch. 7.4.2.). The outcome will then be decided by force, the most pure form of physical power, or by what the powerholders posses in terms of money, knowledge etc.

According to Tengström (and many others within today's social sciences) implementation is made difficult by the problem of the nation state. Today the nation state is both to small and to large. For the problem of global heating the nation state as a deciding agent is to small. For local environmental problems the

nation state is to large. Protest groups on the other hand functions very well as they participate in raising local problems. But on a world level, such agents seem to be missing, at least as very successful ones. WWF, Greenpeace and others participate in setting the agenda, but they are most successful when the work with concrete (and often, local) problems.

Two alternatives to solving conflicts by intellectual discourse can be pointed to; the overall powerful agent and the harmonious solution. The first presupposes a "dictator" (hopefully enlightened) as presented by Plato some 2500 years ago. We don't think such a solution is acceptable to anyone. The second points to solutions where all participating agents agree on the same political measures. Such a solution must probably be found in the small area between what is acceptable within the market, the political sphere and also technologically. We will return to this utopia later in this chapter.

7.3 Growth, equity and the environment

In an article in Futures (Masser et.al. 1992) possible paradigms for the future is presented. The empirical basis consists of a presentation of answers given by European experts on important questions related to a preferred or likely future. Our interest lies however in the description of possibilities:

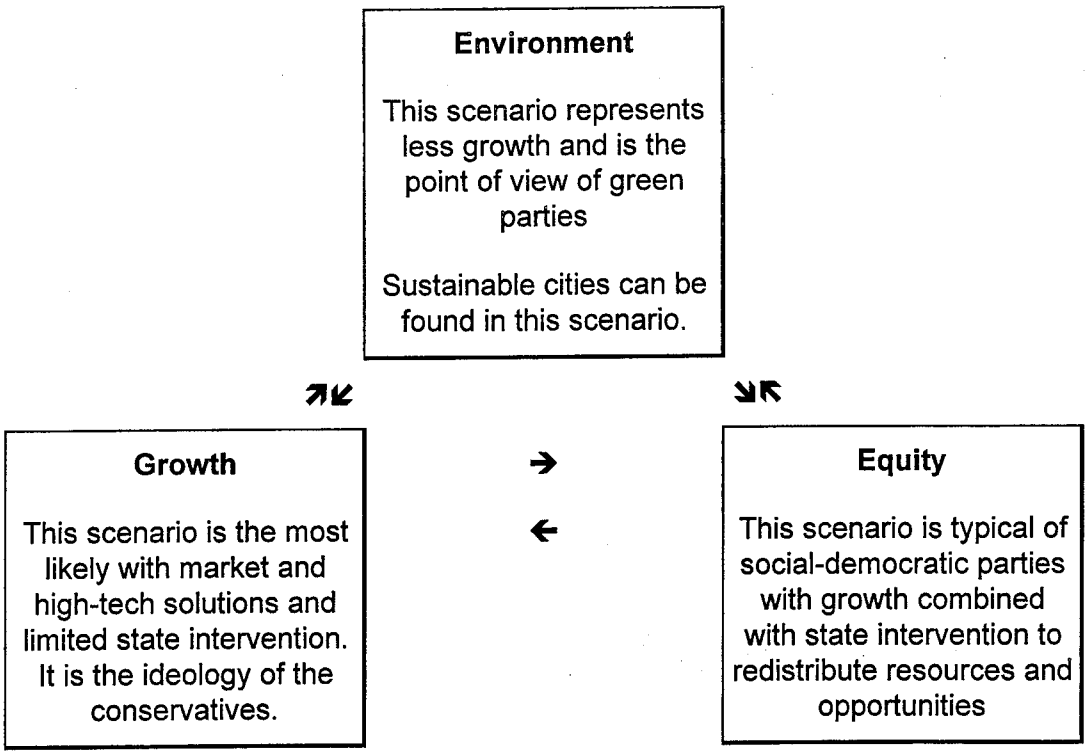


Figure 7.2. Three scenarios for the future (Masser et.al. 1992)

According to the interviews conducted, most experts prefer a future somewhere between environment and equity, with restricted growth. The most likely development according to the same experts can be found much further to the left in this figure. The quality of Masser et.al. is that they both make the different scenarios rather concrete and that they pinpoint the political and economical forces that works for different future possibilities.

The most likely *development* means;

- A highly mobile society based on car-use
- Freight transport based on roads
- Congestion and transport-generated pollution
- Continuing urban sprawl
- Further increase in the number of singles, and life-styles based on the needs of singles.
- Further economic concentration
- etc. etc.

The most *preferred* scenario means;

- Restrictions on car-use and a renaissance for public transport
- Freight transport on roads restricted and more based on railways
- No increase in use of fossil fuels. Heavy taxes on car-ownership and petrol.
- Denser cities and support for smaller cities and peripheral regions.
- Support of life-styles based on solidarity.
- Support to alternative technology and high taxes on luxury.
- etc. etc.

Not all the connections between different aspects of development are obvious. New information technology may e.g. help the environment. And the development towards smaller households may also support a greener environment. The reason we have for saying this is:

- Massers analysis shows very clearly that a basic problem is connected to the political situation as being a triangular conflict rather than a simple left vs. right conflict.
- A great deal of environmental problems in the OECD-countries is a direct consequence of equity; the spread of consumer goods (including cars) and the increase in housing standards for a majority of the population. It is not a conflict between the rich and the poor, but a conflict of interest between dominant values of a majority of the population. It was well stated by Winnie the Pooh when asked to choose between milk and honey.
- A proper analysis will reveal conflicts both between growth and a sustainable development and between a traditional equity-ideology and the environment. In their analysis Masser et al seem to drop the present and future conflict between the red and the green. In many European countries this conflict is as marked as the conflict between the blue and the rest.

- A change in paradigm will have to build alliances both to the right and to the left. In some countries we can see examples of such when old liberal parties work together with new leftist groups for environmental solutions. The resistance against EC in Norway and some other countries is typical of such alliances.

7.4 Agents in conflict

Unsolved conflicts between agents are often the reason why policies are not being implemented. We can separate between various kinds of conflicts, and will comment on the fact that they all need different solutions. Sager (Sager 1991) lists the following types:

- *Relational conflicts* where the main question concerns the parties involved and how they perceive each other. Mainly of course, the perception is of a negative kind, it is a question of lack of trust. Conflicts like this are of a very unproductive kind and difficult to solve.
- *Dataconflicts* where the main question concerns what are the truth, which are the facts. Such conflicts may be difficult to solve, especially if they exist in combination with relational conflicts. "I don't believe in you because I don't trust you." In such situations a common understanding of the "world" has to be established before negotiations can start.
- *Conflicts of values are* also of an unproductive kind. As Fisher and Ury say in "Getting to Yes" (Fisher and Ury 1982): Don't argue about basic values." The main thing about values is to respect other peoples' and don't give away your own.
- *Conflicts of interests* are of the most productive kind. The participants agree upon the value of a certain good and they meet to find a way to share in the enjoyment of them. Such conflicts are the best foundation for negotiations. Often other kinds of conflicts can be redefined as conflicts of interests. But parties have to be willing to give in order to get. The main advice is to find alternatives that give benefit to all parties involved.

A discussion of the process around the Dennis-package in Stockholm may be a good description of different kinds of conflicts and how they can be solved (Ingo 1995). The same can be said about the process around the Oslo-package which are actually implemented (Solheim 1995).

The first case, and it may well be remembered that the Dennis-package has not so far been implemented, is a good example of how a situation of multiple actors and alternatives can be limited to a situation with few actors and possibilities to negotiate with all parties involved gaining something from the process. This was Dennis' grip, that he excluded all but the three most influential political parties and that he managed to set up choices where all three had something that they wanted and something they didn't want. The three actors were the social democrats, the liberals and the conservatives. The three "aspects" were a by-pass-road, an inner ring road and urban tolls. By combining the three actors in different alliances it seemed possible to implement all three aspects (Ingo 1995).

In the Oslo case, the important thing is to understand why the toll-system was actually implemented (Solheim 1995). The main reasons for the success was:

- Agents interested in heavy road building got their money, even though some kept arguing against and wanted more government funds.
- Agents interested in alternatives to cars got promises that 20 per cent of the complete package should go to public transport infrastructure.
- Agents interested in restrictions on car use, saw that the toll-system had future possibilities even though the present system is only structured to optimise income.

At present there is an ongoing discussion in Oslo and on a government level to introduce time-differentiated prices with higher prices during peak-hours. Whether this will turn out as a politically possible solution is hard to prophesy about at present.

7.5 The question of power

In the social sciences the question and definition of power has been going on for as long as they have existed. The first definition said something like: Power is the ability to get people to do something else than they wanted, or to stop them from doing what they want. But this definition is limited. First of all it is restricted to relational power and secondly it does not dwell on the question of legitimity.

In the question concerning the power of car-industries and other important corporations, we could start with a discussion of whether "they" make us do something we don't want - buy cars and drive them. Or whether their main influence is on what kind of cars we buy. But to discuss that we would have to know what people really want, and that we don't.

In theories on power there are often said to be two schools, the structural school and the conspiratorial school. In the first power by structure is focused on as the basic source, while as in the second, relationships between social agents are in focus. Below we will try to combine these.

Sager (Sager 1994) defines power in the following way:

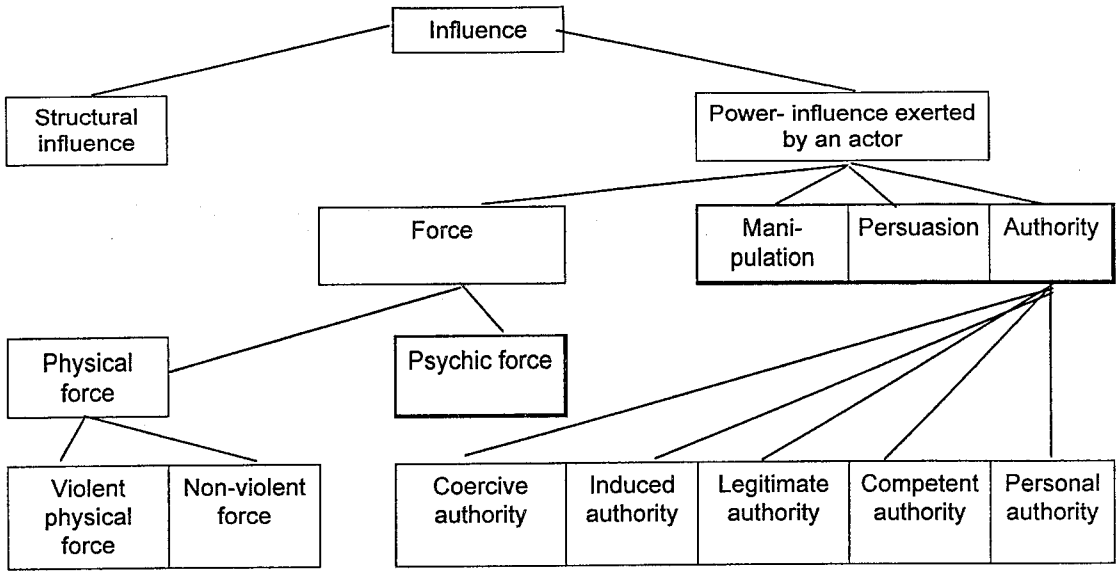


Figure 7.3. A model of different kinds of power (Sager 1994)

Structural influence and power

The model does not start with power, but with influence, as a more general phenomenon. This notion is then divided in two, structural influences and power. Structural influence is a built-in systemic property, within or between organisations or institutions. It is not self-evident what this actually means. Some would argue that for power to exist, there have to be agents exerting it. And some would say that structural influence lies within legitimate authority, power that is made by rule (Galtung 1969). This part will mostly be left out in the following discussion, as we will be more interested in specific agents. But it may well be used two describe extremely asymmetric resource situations.

Another aspect of structural influence may be termed material structure. The idea stems from Sartre but is further developed, and implies that man-made physical structures such as roads, buildings etc. represents power. They obviously effect our behaviour in many ways, directly or indirectly (see also ch. 5.2).

"Development" probably always lies somewhere between structural influences and the work of specific agents. Very often those who favour the present trends argue against the possibility of changing the direction, and those who doesn't favour it argue for the responsibility of some agents (economical, political) and the possibility of changing the direction by especially political agents. The question is whether e.g. road building is a phenomenon directly influenced by important power groups in each specific case or a general part of a growth tendency.

Our conclusion in chapter 4 was that mostly, increased car-use happens due to growth, in money and activities based on the use of cars. The main driving force is therefore of a structural kind.

The most interesting kind of power exerted by agents lies probably within the scope of manipulation, persuasion or authority. We will now turn to these.

Manipulation

Manipulation consists of withholding information. Deliberately the agent in power holds back information that is important for the other party. This may consist in concealing important facts about cars (like Ralph Nader pointed out in the sixties, when he revealed the fact that cars had built-in unsafety mechanisms and also technical solutions that meant a shorter life for cars than what was possible).

Most advertising may be termed manipulation, while most political practice may be termed persuasion. But with advertising we probably know this. We see advertising more as entertainment than as providing real information. We don't really believe that a specific car will give us a totally new life. It does, however, have influence on the image that we have of cars (see also ch. 4.7.7).

Persuasion

The whole point in persuasion is to get the respondent to accept the standpoint of the "controller". Whether this happens or not depends partly on our feelings towards the controller, e.g. politicians trying to sell the necessity of new roads, increased gas-production in the North Sea to replace coal in other parts of the world etc. And it depends on how well the message is constructed.

The legitimity of the controller is really a question of authority (see below). The question concerning the quality of the message is somewhat different. The fact is probably that we believe in messages sent by people we trust. We know that the world is complex and that nobody contains the whole truth. We therefore have to find somebody that we can identify with and trust.

According to Sager and his sources, persuasion is impossible in a situation where every participant has full knowledge. This however never happens. We therefore always end up in situations with incomplete knowledge. And in situations like that we have to build our actions on trust or the opposite, mistrust. Controversies or intellectual discourse about finding the best solution, like in Tengströms recommendations are therefore probably impossible in most cases. We end up in one or more of the different types of conflict mentioned above.

Authority

Authority is mainly the legitimate existence of a political ruling system. In most OECD-countries this consists in democratic elections of peoples representatives. Leaders get their power by rules, written in laws, procedures etc. or by established routines.

Other agents, of course, also influence these representatives by voters through elections or through polls, by influential agents through lobbying etc., etc. But mostly they are working in an on-going negotiation process with other politicians

within the system. This process is described by political scientists as muddling through (Lindblom 1965).

The three main kinds of authority is said to be; authority based on legal principles, authority based on knowledge and authority based on personal characteristics, the charismatic leader.

To come to grip with illegitimate authority, let us look at the following figure:

	Legitimate	Illegitimate
Sustainable	This is the ideal situation. Democracy is working according to the rules and we move towards a glorious future taking care of our children's happiness.	The example of the enlightened dictator comes easily to mind, or the charismatic leader who solves all contradictions. The main thing is that we seem to be less critical to these solutions.
Non-sustainable	This is probably what happens and will continue to happen. Roads are being built to improve the economy and reduce unemployment, if possible. A majority of the population does not want sustainability if they know the consequences, maybe?	When believing in a theory of conspiracies, this is what we are looking for and hoping for. But mostly it is not the case?

Figure 7.4. Legitimate and illegitimate lobbying towards sustainability

7.6 An industries influence

It is probably not possible to answer a question concerning whether the car-industry and the oil companies directly promote the ownership and use of cars. In several studies by Tengström and others, the direct link is mostly not shown. Most critics point to the parallel development of certain phenomenon, but not necessarily to cause-and-effect type of links.

Tengström (1995) refers to American examples of how car companies have bought up public transport companies and closed them. However, it must have been with some consent from the public who have stopped using the system and from political agents, who didn't want to pay for the service. Further examples will be mentioned below. We also see opposite tendencies, of new established public transport in USA, of neglect of public transport in Europe that cannot be explained by any actions from car companies and by strong support to public transport in Japan in spite of a very strong car industry.

The best examples of actual lobbying are probably of three kinds:

- Promoting new infrastructure; new roads etc.
- Resisting restrictions to car-use; higher taxes on car-ownership and use.
- Generally promoting car-use by advertising in the mass media.

Volvo and Scan Link

An example of direct involvement in highway construction can be found in Sweden. But the start lies somewhere else. In the beginning of the 80th's the head of Volvo, Per Gyllenhammer, took an initiative to get European industrialists to work for better infrastructure in Europe. This was part of an initiative to strengthen Europe in the competition with USA and Japan. Gyllenhammers ideas was as follows:

- To improve the road and rail connections between the Nordic countries and the rest of Europe, also known as Scan Link, from Oslo to Hamburg.
- To build a connection across the English Channel for both road and rail.
- To build a system of extra fast trains between European cities.

In several ways Gyllenhammer tried to promote Scan Link, both with Swedish authorities and governments in other Nordic countries. But the big jump happened when the ship-building industries in Uddevalla were closed down in 1984 (Falkemark 1991). The Swedish government was looking for replacements to the faltering ship-builders. Volvo came to rescue and offered to open a new plant in Uddevalla.

The term for doing this was the building of a new motorway south of Uddevalla, between Uddevalla and Göteborg. In addition they demanded some tax relief with their investment. The new road was built in spite of the fact that road authorities had not made it an item high up in their priority list.

But the decision was made within the legitimate elected assemblies. So what is wrong? According to Falkemark a decision can be termed democratic in two ways:

- If a majority of the population agrees with the decision. In the case of the Uddevalla motorway, 70 per cent of people in the region did think that the decision was reasonable.
- If the decision is made according to certain rules; the correct body makes the decision, the decision is in accordance with laws and procedures and the decision makers have access to relevant information. These rules define what we have earlier termed as legitimate.

We may therefore draw from this example the experience that lobbying is accepted if decisions are being made according to democratic rules. This conclusion does not however take into consideration the asymmetry of power, a question of who defines situations and who gets their will through.

Public transport in Los Angeles

Several informants have pointed to the case of LA where a consortium of business interests (rubber, fuel and vehicle production) in the 30th's bought up and dismembered the streetcar system. The film "Who framed Roger Rabbit" is about this case.

The role of the trolley in suburbia has been subject to several studies (Jackson 1985 and Bass Warner 1962). In USA and Europe these underwent three stages in their development:

- Their first construction was in many cases directly handled by developers to ensure that the people moving to the suburbs should have some kind of transportation.
- In the early stages the trolleys where subsidised by developers. When these wanted to increase fares, the public often took over, or the systems were closed down.
- As more and more people changed from trolleys to cars and as the bus became a serious competitor, the need for subsidies increased, were not always met and services were reduced or shut down completely. In some cases this was probably done directly by some interests, but in most cases this happened with political consent.

The role of General Motors

According to an informant (Amy Rader, Inregia, Stockholm) working previously for General Motors the operations of such an organisation works in different ways. According to the same informant there are few studies of direct lobbying activities:

They seldom "sticks their neck out on infrastructure projects".

Their main lobbying activity seems to be directed towards policies that may effect them more directly; negatively in terms of regulations and positively in terms of direct support.

The organisation is so big that different parts of it may lobby for opposing views.

The car-industry in Brazil

According to another informant (Chris Zegras, International institute of energy conservation, Washington D.C.), in Brazil, during the 60th's the promotion of domestic auto manufacturing resulted in urban policies aimed at restricting bus movements, closing trolley lines and the building of urban highways. It is however not said whether this development was decided on by legitimate political representatives and what the role of lobbyists where.

This general decline in public transport services and reduction in public financial support can even be found in Norway with no car-industry. In Norwegian cities the support to transport companies from authorities has now declined to less then 10 per cent of total income (Oslo exempted, but also declining).

The role of automobile organisations and other interest groups

The strongest and probably most active lobbyists in promoting car-friendly solutions are the car-drivers associations. We all know them from public debates when suggestions come up on higher fuel prices or new taxes or tolls on roads. They go invariously against the suggestions. And of course they do. This is their role. And they also speak for huge groups of car-drivers.

In many countries we also find organisations that work directly for better infrastructure. In Sweden they have Svenska vegföreningen. Other countries have something similar.

In a democratic society such organisations are legitimate. The problem arises when spokesmen for such bodies have a direct and undemocratic relationship to political decision makers and therefore can influence decisions without the public knowing what happens. This may more and more be the case, but naturally we don't know.

This is what happened with Scan Link and with the streetcars in LA. But we have not been able to come up with other examples.

There is a general theory and a name for a type of society where there is a strong and formalised connection between power holders inside the economic and the political sphere. Such societies are called corporate societies. The most extreme examples are Nazi Germany and wartime Japan. But political scientists will claim that all western capitalist democracies have corporate characteristics. When this happens out in the open (like the Prime Minister gathering corporate leaders) there is nothing wrong about such co-operation. It is when real decisions are made in such meetings in secrecy and outside of the parliamentary system, that something is wrong.

The role of local protest

Many environmentalists and also social scientists hoping for alternative development to the one supported by leading politicians in co-operation with the economic leadership, point to grass-root movements for hope. But even though such organisations have done serious and promising work over the last 20-30 years, we should look at their results before we speak of them in relation to solving global threats.

When such movements have worked with success it has been in relation to concrete cases, that means local threats; new highways through residential areas, parking spaces on children's playground, the cutting down of threes, building of power plants etc. etc. Several analyses have been carried out on why some of these actions have been successful and some others have failed.

Local actions were a more prominent part of the 70th's than of today. In a study of some of these groups in Norway (Kolbenstvedt 1978) the following conclusions were made:

- 1 out of 4 groups was actually successful, while 1 out of 4 were completely unsuccessful. 2 out of 4 managed to have some influence on the plans.
- Even though only a small part are wholly successful, their work may in general lead to a rise in consciousness about the possibility of influencing authorities and developers.
- The main problem for local groups is the strategy used by authorities to demand realistic alternatives.
- Changes in original plans are often made due to other forces than the local action groups.

7.7 Real solutions demands real agreement

A good example on how to solve conflicts is presented by the Norwegian political scientist, Arild Underdal (Underdal 1983). As we said previously about conflicts, to be "solved" they have to be transformed into conflicts of interest and any solution have to give something to all participants. Underdal uses much of the same figure as Masser. His analysis concerns why international negotiations some times fail. We shall not present all the reasons he mentions. Our main point is covered by the figure below:

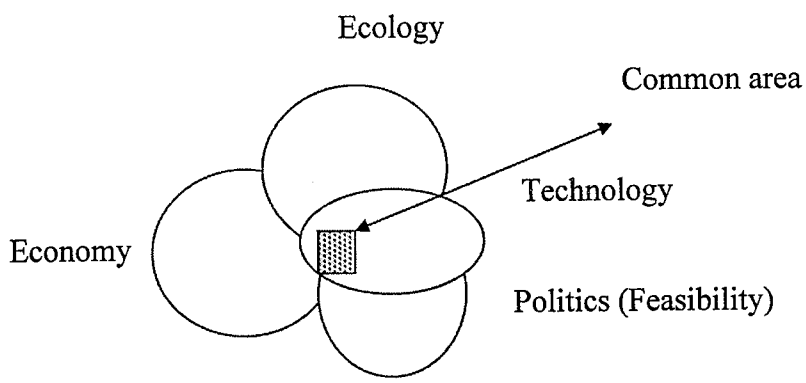


Figure 7.5. The problem of finding possible solutions

Within each circle lies the following:

- Within economy lies the question of profit, that is the possibility of providing a good or a service that can be the basis for profit in short or long term.
- Within ecology lies the question of what is sustainable.
- Within technology lies what is possible within known technology
- Within politics lies the question of what is possible, or feasible. With today's dominant ideologies, what can be successfully tried out politically.

Underdals main point is that any solution that exists outside of the small area that is common for all four circles is likely to end up as a failure or to simply not be implemented. To be a success solutions have to be profitable, technologically possible, sustainable and politically acceptable. Flyvbjerg (Flyvbjerg 1992) calls this the power-basis of any successful plan.

This picture is somewhat simplified. In addition we also have to take into consideration the strength that each circle has. The interests or power groups behind each is not of equal strength.

From this treatment we can probably list measures that will prove to be a failure or a success. Our list is based on measures mentioned in chapter 6. Our discussion is also based on the fact that we seem to experience that positive measures are much easier to implement than negative ones, but that the only ones that really help, are measures that restrict car-use directly.

Positive measures

These are of three types;

- Support for *pedestrians and cyclists,* which at present seems to be a very popular solution also involving the sale of new bicycles. The main obstacle seems to be situations when amenities for non-motorised traffic comes into conflict with space for motorised traffic. So far few examples points to success for bicycle-lanes on these occasions.
- Support for *public transport* is declining as we have already mentioned, with some exemptions for light rail in some European countries. The reason for this may vary from country to country, but there is a constant conflict between spending money on roads and spending money on public transport, or at the local level, there is a conflict between public transport and other areas of political; mainly health and education.
- *Technological solutions* within automobile and fuel production. These are the most favoured solutions, especially as long as they are not forced upon us to fast. Some believe in technological solutions for all problems, as others think that no problem can be solved on a technical level.

Negative measures

The most "popular" negative measures are related to:

- *Road-pricing*. This measure is the popular one among economists. It does not exist anywhere in the world even though it is being debated in some countries. The urban tolls in Norway are not road pricing, but the possibility of introducing some kind of road-pricing in Norway is surely a possibility. But it will not be possible if only introduced to reduce traffic. Somehow car-users and the industry must get something back for such solutions to be possible, politically.
- *Fuel- or car-taxes*. This is the solution put forward in the OECD-report (OECD 1995), and they even talk about the necessity of a 100 per cent increase.
- Stop in the *construction of new road capacity*, especially in and around cities.

All such measures will most likely be strongly opposed by important agents within car and fuel production. It will probably also be hindered by two of the three powers in Massers figure (see figure 7.2.), those working politically for growth and those working for equity. At present we therefore see such measures as very unlikely.

Land-use measures

As seen in chapter 5, many see denser cities as a way of reducing our need to travel. The question is how such solutions work in relation to politics:

- First of all, such solutions are of a long-term kind. Changes in the built environment will always only effect a small part of the population, as most of the material structure will exist for 100 years or more.
- Secondly, the experience with trying to block new developments outside of cities, and based on availability by cars, are not positive. It is hard to argue against the establishing of new work places. And it is difficult to control, by law and politics, the forces of the market.
- Thirdly there is an equity problem as more and more people want and can afford a better housing standard. But as the tendency goes towards smaller and smaller households, the need for new and spacious housing may decrease and a drift back to inner city areas becomes a possibility.
- Fourthly there is a problem with "filling-in" in more sparsely populated parts of cities. This is a very slow process and the obstacles set up by the existing and possibly wealthy part of the population are numerous.
- And finally we can not be certain whether a denser city will lead to less travelling by car. As we have said before, it may lead to shorter distances, but not necessarily, fewer trips. People use cars on even very short trips.

A kind of conclusion

In opposition to the belief in discourse, we have above represented the role of "realpolitiker". In doing this we have most of all focused on the fact that all solutions need a firm power-base. In doing this we end up with the problem that most "necessary" policies that we promote as experts are outside the realm of real politics. What we have presented above are the policies we believe have a chance to be implemented. But when such a discrepancy between what is possible and what is necessary exists, does that mean the end of the world? Who knows.

Or to site what the English historian Eric Hobsbawm (1994) says at the end of his 20th century history:

What I have written cannot tell us whether and how humanity can solve problems it faces at the end of the millennium. -- It can tell us how little we know, and how extraordinarily poor has been the understanding of men and women who took the major public decisions in the century. -- It can confirm what many have always suspected, that history, among other things, is the record of the crimes and follies of mankind. It is no help to prophesy.

8. Epilogue: Maybe the problem will disappear

8.1 The role of the expert

In this final chapter we feel the necessity of shortly discussing two problems before we try to look further into the future:

- The role of the expert in deciding on what is right or wrong.
- The role of the expert in deciding what is possible or necessary.

The first problem has been of vital interest to researchers ever since Oppenheim and friends invented the atom bomb. The moral issue can be summed up in the simple question: Can experts formulate goals or do they have to limit themselves to the job of clarifying "what ifs"?

Our point of view is that experts have no more the right to formulate political goals than any other citizen. We have to accept that we live in a democratic society where elected representatives, at least ideally, make decisions. Our roles as experts is therefore limited to mainly two tasks:

- If goals are given; which means should be selected in order to reach these goals? This is probably the most important task and the discussion about sustainable cities and how we should get there are well within this task.
- If goals are given; are these goals clear and without built-in contradictions? The goal "sustainable cities" can surely be criticised for being unclear and full of conflicts.

We do not always accept these limitations. We help to formulate goals in situations where our roles should be to shut up and listen. Or at least wait for a while.

We are well aware of the fact that these points of view are not uncontroversial. But we also feel the necessity to vouch for the truth (even though it doesn't exist) rather that what we think a future society should look like.

Experts also very often take on the role of warning about a problematic future. We say that if so and so continue to happen, some kind of disaster will be the outcome. This is obviously within the role of the expert, but a very difficult one. We might be wrong and we might have some interest in presenting some specific picture of the future. Especially these days, as our experience is that more and more research are financed by powerful interests on a project to project basis, it is of interest to researchers either to be nice (give them what they want) or scream out loud (to set the agenda and receive interest and possibly, money).

Experts also often have to deal with the task of presenting solutions that are both possible and acceptable from a political point of view, and sufficient given the goal that has been set up. This is a very difficult task. Our role should ideally be restricted to discuss what is necessary, given certain goals. We some times take on more responsibility than we can handle. Or we forget that experts exists that can say things about political processes. In the following we will draw on some of this expertise.

8.2 Heaven and hell

These days there is a BBC-program running on Norwegian television called Heaven and hell. The program is about the new computer technology and what it does to the lives of human beings. It is about Cyberspace and if and how Cyberspace replaces "real" space. Experts talking about power books, Internet, new organisation of work, a new power structure, or rather lack of structure. This is followed by videos of New York or London traffic, double-decker buses, yellow cabs, rows of cars and human beings, or rather, pedestrians crossing the streets. All the motorised vehicles look like dinosaurs in the connection.

The pictures induces a sample of mixed feelings:

- That the future is a place very difficult to foresee.
- That what is now may be gone in some not so far away future.
- That shit happens.
- That technology is what we make out of it, but that it is hard to control.

We will end this part by trying to foresee some alternative future.

8.3 About changes

Over the last 100 years we have seen an endless row of changes, mainly due to technological inventions.

- In 1895 we got the electric streetcar. This revolutionised European and American cities. We were no longer confined to areas we could reach by walking. After very few years, travelling over land by higher speeds than 6 km/hour became something available for most people. And very consciously the prise for this new amenity was kept at a very low level.
- In Europe, the development that lead to the car becoming a means for mass-transport, started only 30 years ago.
- The personal computer is only 10-15 years old. One of the authors of this report got a PC as late as in 1986, as one of the first among the researchers at the institute. Today we get new ones every two or three years. And they get smaller and smaller and more and more powerful.
- In 1996 this institute got e-mail and was liked to Internet. Today we hardly want to communicate with people who are not "tuned in". And very suddenly,

over the last couple of months "everybody" gives their e-mail address (newspapers, TV-programs, individuals). And almost daily there are articles in the papers on how to get information on Internet.

The speed of all these changes should induce respect. And most of all that respect should include all we don't know about the future. Most of our visions 30 years ago about the present have not come through (we don't wear plastic cloths) and few envisioned correctly what actually have happened. In some ways the changes have come faster than expected. But probably what changes the least is the way we as human beings live our lives.

This knowledge should also induce respect about how difficult it is to control the present or the future, by political means or otherwise. The most important part of post-modernistic thinking is probably that the old, modernistic belief in knowledge and political power coupled with the belief in progress is dead. But that also means that the chance of politically steering the world away from the abyss some foresee, is just as difficult.

But such a view of politics, or lack of political possibilities, have to take into consideration the fact that human beings, as consumers, also functions as citizens. The way we behave in a market may have stronger political effects than the way we behave when we cast our votes.

Some see the present environmental problems as a result of both market and governmental failures. What that really means is hard to get by. Or it leaves a responsibility to markets and governments that doesn't belong there. The only possible solutions are those that both function within the market and within politics. We here choose to not see the present ideology of extreme market liberalism. As long as politics exists the market will always be regulated, but with more or less strength.

We feel that probably the most interesting aspect about Internet (and maybe also private cars) is the democratic one. They are hard to stop when everybody "wants" them. It would be extremely undemocratic to suddenly set a high price for them.

8.4 The object becomes superfluous

It must seem strange to set a subtitle that opens up the possibility that the car, as we know it becomes superfluous. It is especially strange in a situation where most experts foresee a 100 per cent increase in Western Europe over the next 20-30 years. What the increase will be in Eastern Europe, Asia and Africa, nobody knows. To understand our point we have to focus on what function the car has for most of us, namely to rid us of the limitations created by living in space. By travelling at higher and higher speeds we cover more and more space. 100 years ago the average distance we travelled over one day was 1 km. Today that distance is around 37 km and it increases.

But if we look at digital travelling, our coverage of space is somewhat without limits. Yesterday one of us travelled 200 km by car in 3 or 4 hours. Within that same period the other one had contact with Washington DC, Brazil, Stockholm etc. etc.

Some have said that the car created suburbia and atomised the world. A possible hypothesis is that Cyberspace will link us together again. But it is far too early to even dream of testing such a future possibility.

We have to consider the fact that very few of us spend one hour a day in the car out of pleasure. What we have to consider is the possibilities of replacing the car by other means of travelling, by foot or bicycle, by public transport, and most of all digitally in Cyberspace.

The only obstacles that stops us from replacing the car by other types of travelling is our need for physical contact with others and power structures that want us to behave in special ways, to control us or out of fear of loosing that control.

We don't know how much of today's travelling by car can be replaced in Cyberspace or by other means of transportation. But they certainly look cleaner and less strenuous. We have discussed this earlier, in chapter four, and maybe with some scepticism.

8.5 The activity gets replaced

Travelling out of necessity

Out of today's travelling by car, maybe 60 per cent is out of necessity and 40 per cent is out of some kind of free choice. By necessity we mean that the activity we travel to is something we have to do, work, bringing children, shopping etc. And we also include the fact that other means of transportation doesn't exist or would take up too much time. Within free choice we both include activities that we don't really have to do or where the car isn't really necessary. We could drop the activity or travel otherwise.

In this final discussion of activities we will separate those that we just have to do and those that are not so necessary. In doing this we will also look at to special groups within the population. The young ones, who represent what shall become, and the old ones, who represents today or yesterday and who are of a growing number.

The main part of our travelling, and probably the least pleasurable, is related to school, work, bringing and fetching children, shopping and so on. This is what we term necessary or compelling travelling. Up until now this kind of travelling has increased to some degree, but most of all, each trip gets longer, and more and more often it is done by car because of changes in how work-places are located.. We don't really know what will be the future of these trips. But we know for certain that the activities will continue to exist, even though their form may change. Maybe many of us, as we have stated earlier, we will gain some new freedom to be able to renounce from some of these trips because the separation of work and home will be abolished. Some (who doesn't want to let go of control, or who, for some reason, have the need to get away from home) fear such a development and some see it as a new kind of freedom. Whatever our feelings are, the possibilities will be greater and greater and may imply the greatest revolution in urban life since the invention of electric street cars 100 years ago. Of course we are referring to the use of information technology.

Travels for fun

Some see the coming leisure society as the real force behind how we arrange our lives and also how and how much we travel. Over the last twenty years it is also true that, on average, the number of hours we have each day that can be termed as leisure, increases. But the main reason behind this increase in leisure time is the rising number of elderly people in western society. And so far this newfound leisure time among old people are being spent at home in a good chair in front of the TV.

The main question in the future is what will happen when the post-war generation (now around 50) will reach retirement. They are well educated, they own a car and they are less homebound than previous generations. Will they end up in front of the "Telly" or will they continue an active life based on travelling. Of this we know nothing. And so far they are mostly working more then ever.

It is young people who experience some increase in leisure-time. And it is also the young who have an active social life based on travelling. But mostly the trips they do is not car-based. They are urbanites who meet down town, and they go there by public transport, even though they don't always pay. From a travel perspective these groups have been subject to very few studies. We take it for granted that they will be socialised into the same car-culture as their parents (us), but do we really know that.

What we do know is that their lives is spent on cafés in the city-centres where they don't use a car, or that they are busy seeking risk and new experiences. But unlike us they probably don't find this by driving a fast car or MC along bumpy roads, like James Dean, Marlon Brand or James Bond. More and more their need for mastering will find its outlet in loneliness in front of the PC, hanging from a mountain-side, breathing under water or dancing the night away to extremely noisy music. It is important to notice that all the risk-activities performed by today's young demands technical equipment that is hard to master.

So maybe the car will end up as nothing more than a transport-mode and not as a carrier of culture. It will still be in use, but maybe not with same ferocious clinging as today or in the past. And with that it may be replaced.

Literature

Adams, J. 1981
Transport planning: visions and practice. London, Routledge and Kegan Paul

Aizen and Fishbein. 1980
Understanding attitudes and predicting social behaviour. N.J., Prentice-Hall, Englewood Clipps

Ajzen, I. 1989
Attitudes, personlity and behaviour. Ballmore, Buckingham, Open University Press

Andréasson, H. 1996
Vanebilisters behov av att vara ensamma vid bilkjøring. A presentation on the VTI Conference in Linköping

Ariansen, P. 1992
Miljøfilosofi. En innføring. Oslo, Universitetsforlaget

Banister, D and Berechman. 1993
Transport in a unified Europe. Amsterdam

Banister, D and Button. 1993
Transport, the environment and sustainable development. London

Bannister, D and Berechman, J. 1993 (eds)
Transport in in a unified Europe. Policies and challenges. Amsterdam, Elsevier Science Publishers B.V.

Bech, U. 1992
The risk society. London

Belk, R W, Bahn, K D and Mayer, R N. 1982
Development recognition of consumption symbolism. *Journal of Consumer Research 9, June 1982*

Berge, G. 1994
The battle of images. Cultural conceptions of different transportation modes in Oslo. Paper presented at RC21 ISA XIII World Congress of Sociology, Bielefeld. Oslo, Institute of Transport Economics. TØI working paper TP/741/94

Berge, G. 1996
Lifestyle and modal choice. Unpublished report

Berge, G. 1996
Not yet published analysis of lifestyle and travel behaviour. Oslo, Institute of Transport economics

Berman, M. 1987
Everything that is solid melts into the air. Translated to Swedish: Allt som er fast förflygtigas. Lund, Studentlitteratur

Bermann, M. 1987
Allt som er fast förflygtigas. Lund, Studentlitteratur

Bjørnland, D. 1989
Vegen og samfunnet. Oslo, Vegdirektoratet

Bourdieu, P. 1984
Distinction: Critique of the Jugdement of taste. Cambridge, Howard University Press

Bovy, P H L and Stern, E. 1990
Route choice. Wayfinding in transport networks. Dordrecht, Kluwer Academic Publishers

Button, K. 1993
Transport, the environment and economic policy. Aldershot

Cervero 1991 (ref i Øystein Engebretsen)

Christensen, K. 1985
Coping with uncertainty in planning. JAPA

Jary, D and Jary, J. 1991
Collins dictionary of sociology. Glasgow

Coporael, L, Dawes, R M, Orbell, J M and van de Kragt, A J C. 1989
Selfishness examined: Cooperation in absence of egoistic incentives.
Behavioral and Brain Sciences 12, pp 683-699

Davis, S C. 1995
Transportation energy data book 15. Tennessee, Oak Ridge National Laboratory

Diekstra, R F W and Kroon, M C. 1995
Cars and behaviour, psychological barriers to fuel efficiency and sustainable transport.

ECMT. 1990
Statistical trends in Transport 1965-1987, Paris

ECMT. 1991
Prospects for east-west European transport. Paris

Elvik R. 1996
Økonomiske verdsetting av velferdstap ved trafikkulykker (Economic Valuation of Reduced Risk of Traffic Accidents). Oslo, Institute of Transport Economics. TØI rapport 203/1993

EU Green Paper. 1992
The impact of transport on the environment. A community strategy for «sustainable mobility». COM (92) 46 final, Commission of the European Union, Brussels

EUROSTAT. 1986
Paritès de pouvoir d'achat et PIB rèel. Luxembourg

EVED Stab für Gesamtverkehrsfragen. 1988
Système d'inicateurs de coûts et d'avantages sociaux des transports en Suisse. Bern

Falkemark, G and Westdahl, P. 1991
Att offra västkusten. Stockholm

Festinger, L. 1957
A theory of cognitive dissonance. Evanton, Ill.

Fisher, R and Ury, W. 1982
Getting to Yes. London

Flyvbjerg, B. 1992
Rationalitet og makt. Bind 1. København

Fransson, Davidson, P, Marell, A og Gärling, T. 1993
Miljövetenhet. Begrepsdefinitioner, mätmetoder och tidigare forskningsresultat. Umeå universitet, Transportforskningsenheten

Freund, P and Martin, G. 1993
The ecological of the automobile. Institute of Policy Alternatives of Montreal, Black Rose Books

Galtung, J. 1969
Violence, peace and peace research. *Journal of Peace Research, 6, 1969*

Gans, H. 1962
The Urban Villagers. New York

Garvill, J, Latila, T and Brydsten, M. 1994
Livsvärden och val av transportmedel. Umeå universitet, Transportforsknings-enheten

Giddens, A. 1991
Modernity and self-identity. Cambridge

Gripsrud and Johansen. 1987
Racing & cruising - en samtale om bil, kultur og moderne tider. Artikkel i: *Samtiden 1987:6*

Hagmann, O. 1993
The swedishness of cars in Sweden. Paper presented at seminar in Trondheim 1993: The Car and Its Environment

Heideken, C. 1989:
Trafikk (Antologi). Stockholms Stadsmuseum

Herrestad, L, Nilsson, P K, Jensen, O K and Krogstad, K M L. 1995
Cyklens potensiale i bytrafik. Copenhagen, Vejdirektoratet, Trafikksikkerhet og Miljø. Report 17

Heutzinger, H and Tussaux, B. 1989
Verhekrsmobilität und Unfallsrisiko in der Bundesrepublik Deutschland. IVT

Hivert, L. 1991
In: *A Billion Trips a Day.* Salomon et al (eds). Kluwer Academic Publishers

Hjorthol, R. 1995
Transport i by '95. Trondheim

Hjorthol, R. 1990
Kvinners arbeidsreiser. En viktig premiss for offentlig planlegging (Women's work trips - an important precondition for planning in the public sectors). Oslo, Institute of Transport Economics. TØI report 72/90, with English summary.

Hjorthol, R and Vibe, N. 1993
Dagliglivets reiser i større byer (Daily travel in urban areas). Oslo, Institute of Transport Economics. TØI report 214/93, with English summary

Hjorthol, R and Nielsen, G. 1984
Hva påvirker sykkelbruken i Norge?. Oslo, Institute of Transport Economics. TØI working report 15.1.84

Hobsbawm, E. 1994
Age of extremes. London

Holman, R H. 1981
Product as communication: A fresh appraisal of venerable topic. In: Review of Marketing, Enis, B M and Roering, K J (eds). Chicago, *American Marketing Association 1981, pp 107-119*

Horowitz, M J. 1987
Det perfekte lønnkammer. Artikkel i *Samtiden 6/1987*, opprinnelig trykt i Los Angeles Times

Ingo, S. 1995
Traffic policy negotiations in Stockholm. *Current Issues in Planning, vol 2 1995.* Aldershot

Jackson, K. 1985
Crabgrass frontier. New York

Japan Road Association. 1990
Road Handbook. Tokyo

Karlsen, M H. 1992
Den forførende bilen - En analyse av markedsføring som sosioteknisk handlingsfelt. Oslo, Senter for teknologi og samfunn. STS-rapport nr 16, Juni 1992

Kitamura, R. 1988
A look ahead - year 2020. Washington D.C., Transportation Reseach Board, National Reseach Council. Special Report 220

Kolbenstvedt, M. 1978
Lokale aksjonsgrupper (with English summary). Oslo

Kolbenstvedt, M. 1996 (ed)
Miljøhåndboka. Institute of Transport Economics. (In printing).

Korver, W, Klooster, J and Jansen, G R M. 1993
In: *A Billion Trips a Day*. Salomon et al (eds). Kluwer Academic Publishers

Kosi, K. 1989
Les principales tâches du transport routier au Japan in Dèfi et overture sur l'avenir. Paris, OECD

Laslett, P. 1990
A frech map of life: The emergence of the third age. London, Weidenfeld and Nicholson

Lavik, R. 1990
Det vanskelige valget. Lysaker, Statens Institutt for forbruksforskning. Arbeidsrapport nr 14

Lerstang, T. 1993
Mellom fag og politikk. Oslo, Institute of Transport Economics. TØI report 224/1993, with English summary

Levy, S J. 1959
Symbols for Sale. *Harvard Business Review, 37, 1959*

Lindblom, C. 1965
The intelligence of democracy. New York

Linn, C E. 1985
Metaproduktet og markedet. Lillehammer

Linster, M. 1989
Faits et chiffres de base in session ministèrielle sur les transports er l'environnement. Paris, CEMT

Love, R L. 1989
Environmental pollutants and norm building. Establishing norms for radon risk management. Presented at the annual meeting of the Rural Sociological Society, Seattle, Washington, August 1989

Maffesoli, M. 1996
The time of the tribes. London

Masser, I, et al. 1992
From growth to equity and sustainability. *Futures, 6/1992*

Messick, D M and Brewer, M B. 1983
Solving social dilemmas. A review. I: L Wheeler & P Shaver (red) *Review of pesonality and social psychology. Vol 4, pp 11-44*. Beverly Hills, CA, Sage

Michaels, L. 1995 (?)
Mitigation options in the transport sector. OECD Report 21

Ministry of Environment. 1988
St meld nr 46 (1988-89), Miljø og utvikling - Norges oppfølging av Verdenskommisjonens rapport

Morikawa 1989
Incorporating stated preference data in travel demand analysis. MIT, Cambridge, Mass.

Mowen, J C. 1987
Consumer Behaviour, 1987, 193. N.Y., Macmillan Publishing Company

Nielsen, G and Vibe, N. 1989
Drivkrefter bak trafikkutviklingen i byene (Determinants of traffic development in urban areas). Oslo, Institute of Transport Economics. TØI report 44/1989, with English summary

Nisbet, Robert A. 1967
The sociological tradition. London

Norheim, B and Stangeby, I. 1996
Fakta om kollektivtrafikk. Oslo, Institute of Transport Economics. With English summary

Norheim, B and Stangeby, I. 1993
Bedre kollektivtransport. Oslo, Institute of Transport Economics. TØI report 167/1993

OECD. 1991
Historical statistics 1960-89. Paris

OECD. 1991
OECD in figures. Supplement to OECD Observer no 170

OECD. 1985
Historical statistics 1960-83. Paris

OECD/ECMT. 1995
Urban travel and sustainable development. Paris

Orfeuil, J-P and Bovy, P. 1993
European mobility is different. A global perspective. In: *A Billion Trips a Day*, Salomon et al (eds), Kluwer Academic Publishers

Orfeuil, J-P and Salomon, I. 1993
Travel Patterns of the Europeans in Everyday Life. In: *A Billion Trips a Day*, Salomon et al (eds), Kluwer Academic Publishers

Orfeuil, J-P. 1983
Structure urbaine er consommation d'énergie. Le cas de Toulouse. INRETS, Arcueil

Piersig, R. 1981
Zen and the art of motorcycle maintenance. Gorkij Books

Pucher, J. 1990
A comparative analysis of policies and travel behaviour in the Soviet Union, Eastern and Western Europe and North America. Article in *Transportation Quarterly, July 1990*

Sager, T. 1994
Communicative Planning Theory. Aldershot

Sager, T. 1991
Planlegging med samfunnsperspektiv. Trondheim

Salomon, I, Bovy, P and Orfeuil, J-P (eds). 1993
A Billion Trips a Day. Kluwer Academic Publishers, Dortrecht

Schiller, P. 1993
Turn Off the Traffic Rap! *Auto-Free Press 4 1993:6*

Solheim, T. 1995
The toll-ring in Oslo. *Current Issues in Planning, vol 2 1995*. Aldershot

Solheim, T. 1994
Kollektivt og forurensende. Oslo, Institute of transport Economics. TØI report 245/1994, with English summary

Solheim, T. 1992
Bompengeringen i Oslo. Oslo, Institute of transport Economics. TØI report 126/1992, with English summary

Stangeby, I. 1991
Innføring av drivstoffavgift i Tromsø. Oslo, Institute of Transport Economics. TØI working paper 968/91

Stern, E and Tretvik, T. 1993
Public transport in Europe: Requem or revival? In: *A Billion Trips a Day.* Salomon et al (ed). Kluwer Academic Publishers

Stern, P C. 1992
Psychological dimensions of global environmental change. *Annual Review of Psychology, 43, pp 269-302*

Strassenverkehrstechnik. 1990
Verkehrkonzepte für Innerstädte. 6/1990

Sælensminde, K and Hammer, F. 1993
Samvalganalyse som metode for verdsetting av miljøgoder.(Conjoint analysis as a method of assessing environmental benefits - Pilot study). Oslo, Institute of Transport Economics. TØI report 184/93

Tengström, E. 1995
Sustainable mobility in Europe and the role of the automobile. Stockholm. KFB-report 1995:17

Thomson, J M. 1977
Great cities and their traffic. London

Tjade, A. 1989
Arbeidsreiser som trafikkunderlag for jernbane til Hurum flyplass. Oslo, Institute of Transport Economics. Working paper TRU/77/89

Tucker, W T. 1957
Foundations for a theory of consumer behaviour. N.Y., Holt, Reinhart and Windston

U.S. DOT. 1990
National transport statistics. Washington

Underdal, A. 1983
Causes of negotiation failure. *European Journal of Political Research 11/1983*

Unger, S. 1994
Apples and oranges. Probing the attitude-behaviour relationship for the environment. *The Canadian Review of Sociology and Anthropology, 31 (3) 1994*

van Lange, P A M, Liebrand, W B G, Messick, D M and Wilke. 1992
Introduction and literature review. I: W Liebrand et al (red) *Social Dilemmas, pp 3-28.* Oxford, Pergamond

van Meter and van Horn. 1975
The policy implementation process. *Administration & Society, vol 6, nr 4, 1975*

Ward, B. 1963
The menance of urban explotion. *The Listener, vol 70, no 1807 pp 785-787.* London, British Broadcasting

Warner, S B. 1962
Streetcar suburbs. New York

Weber, M. 1922
Economy and society: An outline of interpretive sociology. N.Y., Bedminster Press

Wildert, S. 1992
Kan livsstilar och värderingsförskjutsningar bidra till att förklara kollektiv-trafikens utveckling? Solna, Sweden, Transportforskningsberedningen, SIFO

Wilke, W L. 1990
Consumer behavior. John Wiley & Son

Wit and van Gent. 1986
In: *A Billion Trips a Day.* Salomon et al (eds). Kluwer Academic Publishers

Wood, D. 1992
The power of maps. New York, The Gulford Press

Öblad, C. 1996
Bilen som konsertlokal - Ett sätt att leva med bilar och musik. Paper presented at VTI-conference 1996, Linköping

Sist utgitte TØI rapporter

Tittel	TØI Rapport
Hverdagslivets reiser. En analyse av kvinners og menns daglige reiser i Oslo	391/1998
Kollektivtransport. Praktisk evalueringsveileder for tiltakspakker i byer	388/1998
Betydningen av mobiltelefonbruk for ulykkesrisiko i trafikken	387/1998
Bilers alder og ulykkesrisiko	386/1998
Kvalitetskontrakter	385/1998
Persontransport 1985-1995	384/1998
Report on the second phase of the OECD project Environmentally Sustainable Transport (EST) Case study: The Greater Oslo Area	382/1997
Transport og lokalisering i byområder - En integrert transport- og arealbruksmodell	381/1997
A Framework for Cost Benefit Analysis of the Dutch Road Safety Plan	380/1997
Transportinnholdet i produksjon av varer og tjenester i Norge	378/1997
Hva koster helse-, miljø- og sikker-hetsproblemer i næringslivet det norske samfunn?	377/1997
Massetransport ved byggeprosjekter	376/1997
Persontransport i arbeid	375/1997
Fra vegstubber til strategi og helhet?	374/1997
Bygdeturisme i Norge	373/1997
Nasjonale turistveger i Norge. Intervjuundersøkelser 1995 og 1997.	372/1997
Unge føreres risikoutvikling: Evaluering av endrede regler for føreropplæring og førerprøve klasse B	371/1997
Attitudes towards walking and cycling instead of using a car	370/1997
Short Trips in European Countries	369/1997
Analyse av fotgjengerulykker i Oslo	368/97
Trafikksikkerhet for sporvogn i Oslo	367/1997
Livsstil,miljøbevissthet og transportatferd	366/1997

This report can be ordered from
Institute of Transport Economics
P.O.Box 6110 Etterstad • N-0602 Oslo