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The Limits to Traffic Volume Growth

**The Content and Procedure of Administrative Futures Studies
on Finnish Transport CO₂ Policy**

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The Limits to Traffic Volume Growth

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Foreword

“...the mass of experience and collected information was not co-ordinated, and speculation followed different lines in different schools of thought, which had little in common except confidence in their own doctrines and a hearty contempt for the theories of others. The conflict of voices was stimulating but extremely confusing, and the ordinary man really did not know whom or what to believe.” (Hugh Tredennick)

At first glance, the quote above could describe the present discussion surrounding climate and transport policy which forms the content of this study. In fact, the text describes the intellectual climate of Athens five centuries before Christ, according to Tredennick (1955, 7). In his editorial introduction to Plato's *The Last Days of Socrates* Tredennick (1955, 7-8) concluded that in such an era the voice of a prophet was badly needed, meaning a prophet that would lead the way to true knowledge and true values instead of opportunistic relativism. When considering climate policy debate in the last decade the name of the prophet was not Socrates but the community of the Intergovernmental Panel on Climate Change (IPCC).

The main message of this thesis is that there are other possibilities than opportunistic chaos based on relativism or an objectively good policy based on genuine prophecy. The existence of different views on relevant policies does not necessarily lead to opportunism, relativism or confusion. The different views themselves can be analysed, placed and understood with regard to a theoretical framework, as well as respected and sometimes even accepted simultaneously.

The research process of this thesis originates from 1991 when I joined a group consisting of Merja Tolonen, Markku Lehtonen and Harri Ajomaa for a course of Group Training on Environmental Research Work within the subject of Environmental Protection at the University of Helsinki. The training was guided by professor Pekka Nuorteva who is a distinguished environmental entomologist and ecotoxicologist. Professor Nuorteva was worried about the obscure preliminary research targets of our group, which focused on the limitations of the current Western world-view and was trying to envision a more sustainable one. Nevertheless, after fruitful debate he allowed us to proceed with our plan.

We were lucky to receive guidance from Markku Turtiainen, the professor of Environmental Economy and Land Use Planning. He suggested that we should start our crusade against the dominating world view by focusing on the limitations of the world view of the Finnish Road Administration (FinnRA). Markku Lehtonen started a little earlier than the rest of the group by evaluating public participation in the Muurla-Lohjanharju road project. He found out that the road project was based on traffic forecasts, which formed the basis for time-saving calculations and cost-benefit analysis. Markku suggested that I analyse the traffic forecasts in detail and thus I began my career as a futurist on transport issues and the process resulting in this thesis.

When working as the university assistant at the section of Environmental Protection in 1993-1997 I concentrated on teaching and writing a basic course text-book with Kati Berninger and Risto Willamo. During those years the research process moved very

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slowly forward and professor Martin Lodenius showed some patience in this regard. Receiving a post as a researcher at Finland Futures Research Centre (FFRC) in 1998 gave me the opportunity to put more effort into my research. I wish to thank my bosses Tarja Meristö, Markku Wilenius and Matti Kamppinen at the FFRC for kind support and help in applying funding and for allowing me the peace and quiet to concentrate on research. The intellectual climate of the FFRC has been extremely stimulating and Anne Arvonen's, Päivi Salonen's and Anne-Mari Vilola's kind help has enabled me to concentrate more on research and less on bureaucratic issues.

During the last ten years I have received kind support and helpful critical comments from a number of other persons in addition to the ones mentioned above. They are; Markus Amann, Janusz Cofala, Kerstin Cuhls, Nils Halla, Zbigniew Klimont, Pekka Korhonen, Jari Paldanius, Martti Mäkelä, Mikko Ojajärvi, Veikko Salovaara, Wolfgang Schöpp, Timo Simojoki, Richard Slaughter, Esa Tulisalo, Raisa Valli, Riitta Viren, Ove Wolfgang. Tarja Meristö played an important role in the study design of the disaggregative policy Delphi. Olli Hietanen's contribution to the Futulogic method was essential in writing Article IV. Professor Pekka Kauppi encouraged me, among other things, to participate in the Young Scientists' Summer Programme at the International Institute for Applied System Analysis (IIASA). Judith Hammond (article I), Kurt Andersson (articles II-IV) and Paul Hayes (summary) have helped me revise the language of the thesis. I would also like to thank Armi Niemi for her efficient work in transcribing the interviews.

I wish to separately mention the people who have made invaluable comments on the manuscript of the summary. Although, many of the good comments have not been dealt with in sufficient detail thanks are due to Juha Kaskinen, Kati Kiiskilä, Martin Lodenius, Pentti Malaska, Ilmo Massa, Juhani Tirkkonen, Markku Wilenius, Risto Willamo and the pre-examiners Osmo Kuusi and Rauno Sairinen. In addition Anita Rubin was always there to help me when I had a question in mind and I often called her for advice. I wish to especially thank Ripa Willamo, 'the Nostradamus of Viikki', for his kind support and inspiring methodological discussion throughout the ten years. Not to mention Esa Tulisalo, the undiscovered philosopher of chemistry, whom Paracelsus himself would have envied.

The work has received funding from the Finnish Road Administration, The Ministry of Transport and Communications, The Academy of Finland and The Henry Ford Foundation. I am grateful to them, because without their support this thesis would not have been finished.

Finally, I would like to thank my wife Hanna, who has supported me constantly and has also participated in the work by transcribing interviews. She pushed me to my desk when I did not work efficiently and pulled me away from my desk when I worked too intensively. My daughter Maija has participated in recycling the pre-print drafts as drawing paper, thus relieving, a little, the disturbingly heavy 'ecological rucksack' of the thesis.

In Vantaa 19 December 2001,

Pete Tapio

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Correspondence of Article IV: P. Tapio is the corresponding author in Article IV, having done most of the work and almost all of the writing. Tapio wrote the review of typologies and the section of empirical analysis alone. Developing the Futologic method was a mutual product. Hietanen also made several series of comments on the philosophical interpretation of the typology.

1 Research Design

1.1 Futures Studies and Administrative Planning

An interplay between futures studies and environmental policy has been going on since the late 1960's. The discussion has evolved somewhere between the neomalthusian growth criticism of *eg.* Ehrlich and Ehrlich (1990), Meadows *et al.* (1972) and the cornucopian growth promotion by *eg.* Simon (1980) and the World Commission on Environment and Development (Our Common... 1987; see also Bad News... 1980; Dunlap 1983). A lot of intellectual effort has been expended in the effort to form consistent scenarios that could lead to a sustainable future. A vast amount of scenario work has been conducted in the context of climate policy as well by the Intergovernmental Panel on Climate Change (IPCC).

Although futures studies as an academic and international domain of research and policy making has usually included environmental aspects in its studies, an impressive amount of environmentally relevant futures studies have been practised external to this domain. In fact technical administration constantly uses methods of futures studies in its future planning. In climate policy and transport policy studies these two domains seem to have become more aware of each other and seem to offer fruitful debate about what they could learn from each other (OECD 1997; Cohen *et al.* 1998; Banister *et al.* 2000). The obvious reason for this is that the conventional wisdom of ever growing traffic volume and carbon dioxide emissions has led to increasing environmental problems, which challenge 'business as usual' thinking (Banister *et al.* 2000).

In particular the domain of technical administration might learn some relevant knowledge about scenario tools combined with methods of public participation and thus the wider scope of issues under consideration. The more academic general futures studies domain in turn might learn to focus its work more precisely and gain important in-depth knowledge in order to formulate its grand theories of globalisation, modernisation, general evolution and different strategies of dematerialisation and immaterialisation when attempting to combat the problems of ecological scarcity.

1.2 Objectives of the Study

Following the challenges mentioned above, the general task of this thesis is to examine the futures studies of transport administration in relation to the goals of participatory democracy and environmental protection. The goal of participatory democracy is attached to the procedure which is used in administrative futures studies. The goal of environmental protection is attached to the output of administrative futures studies being contextualised by climate policy. The administrative futures studies form the object of the research and the academic futures studies form the theoretical basis for analysis, evaluation and innovation. The more detailed research questions of the study can be expressed in two blocks:

1) Futures studies in transport administration

- a) How were the futures research processes concerning Finnish transport administration organised in the 1990's?
- b) What types of results were gained?
- c) What kind of operational criteria can be said to provide good administrative futures research base for transport in terms of increasing democracy and making the output more environmentally sound?

2) An alternative, more participatory way to perform futures studies on transport

- a) If the futures research process was organised in a more participatory and disaggregative way than before, then what kind of output would follow?
- b) What are the empirical lessons learned from this kind of alternative process?

Two blocks of empirical material were collected according to the two blocks of questions. The first block was examined in the light of futures study reports and the planning documents of specific cases from transport administration. Three 'best practice' cases, concentrating on road transport, from the early 1990's were analysed thoroughly and form the core of analysis. Furthermore, the analysis was complemented by scrutinising the reports of three national transport futures studies carried out in 1995, 1997 and 1999-2000, as I wished to observe changes over time.

The second block of material was gathered for the purpose of analysing the views of interest groups on the future of the economy, transport and environmental issues in Finland. The experiment was framed by the critical challenge of climate policy (see chapters 2.2 and 2.3). The main questions asked were: What kind of views are presented regarding the probable and preferred futures of GDP, road traffic volume and CO₂ emissions from road traffic in Finland for the years 1997-2025? The three variables are chosen because they have correlated strongly from the late 1970s to 1996 and make an illustrative starting point for the analysis (see figure 2.6 and chapter 2). To see the variables connected or de-coupled in the future has implications for the theoretical positions one takes on dematerialisation and immaterialisation.¹ The quantities presented imply different shades of growth optimism versus growth pessimism. A two-rounded disaggregative application of the Delphi method is performed to form the scenarios. A more general Delphi study on Finnish climate policy was conducted by Wilenius and Tirkkonen (1997). It had a somewhat similar participatory idea but no quantitative indicators.

The background data for the Delphi is gathered from the years 1970-1996² and the future scenarios are constructed on a similar time scale, namely the years 1997-2025. The time frame is long enough for known prototype technologies to gain a significant market share and is also compatible with the time scale that covers the social and environmental impacts of building a new transport infrastructure. The adopted time scale aims at a balance between the underestimation and overestimation of the possibilities for social change.

¹ There are different definitions of dematerialisation and immaterialisation (eg. Heiskanen and Jalas 2000, 5). Dematerialisation here means that the material throughput of certain material service is reduced and in this study it means a decoupling of road traffic volume and CO₂ emissions of road traffic. Immaterialisation here means the dematerialisation of the total economy, for example in this study it would show in the decoupling of GDP and road traffic volume.

² 1996 was the last year available in winter 1998, when the background data was collected for the first Delphi round.

The research questions include normative as well as descriptive aspects. Another division in this thesis is made between the procedure and the content. They have been separated as clearly as possible throughout the study. The normative aspects are attached, as far as was possible only to the discussion (chapter 6), not the forming of the theories (chapter 3) nor the analysis of the study material. The operational criteria result from a review of work on the subject, empirical analysis and philosophical discussion. The descriptive analysis focuses on the substance and form of the futures research processes. Very little effort has been made to assess the relevance or plausibility of the statements concerning the future of traffic. The study will hopefully contribute to filling in the current gap between the more praxis oriented traffic scenarios and the theoretical literature of environmental policy.

The design of the study can be expressed as a scheme of “trilateral scientific activity” developed by Galtung (1977, 56-65). The scheme has been slightly modified and is presented in figure 1.1.

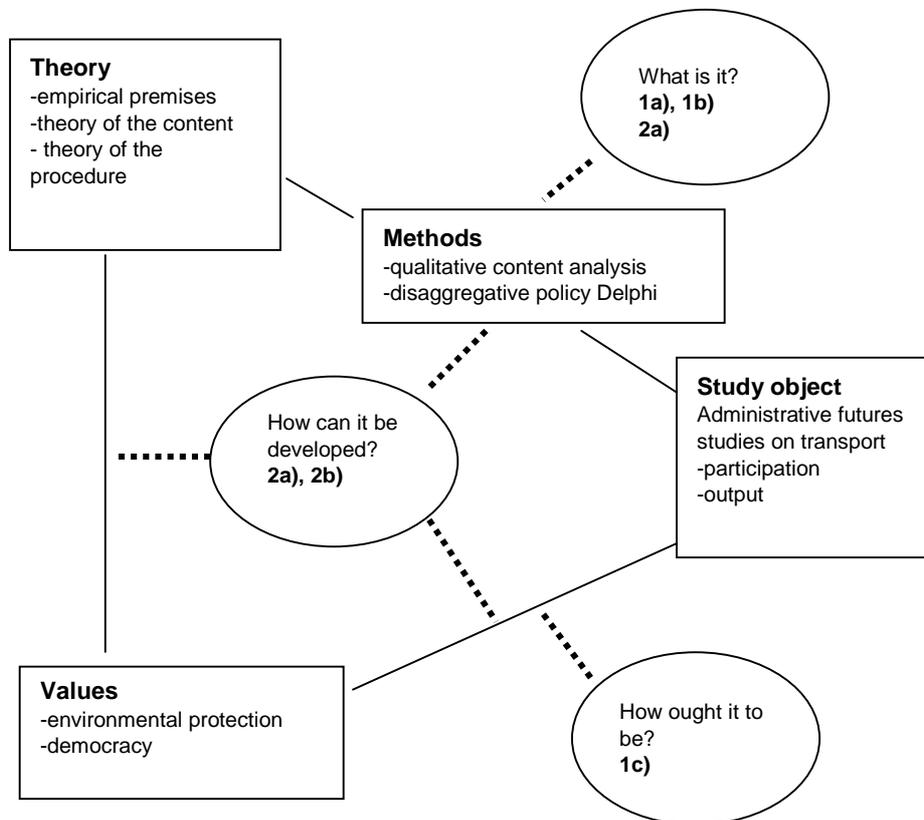


Figure 1.1: The design of the study as a scheme of trilateral scientific activity (modified from Galtung 1977, 56-65). The numbers relate to the research questions (see above).

1.3 The Structure of the Thesis

The report follows mostly the standard natural scientific order. The societal context and empirical premises of the study are dealt with in chapter 2. The theoretical framework of environmental policies (the content) and futures studies paradigms (the procedure) is presented in chapter 3. The study material and methods are described in chapter 4 including some more general methodological aspects. Chapter 5 briefly presents the empirical results of the study. Finally, some more general discussions are included in chapter 6. Sub-chapter 1.4 will place the study in the context of previous empirical social scientific studies on transport policy and transport administration.

The two blocks of study materials are not analysed one by one but they are broken down to the general phases of the study so that chapters 4-6 have two clear sub-chapters. However, the dichotomy of the procedure and the content in chapter 3 is separated from the dichotomy of the study material.

During the research project four articles have been written which are attached to the end of the dissertation. Article I contains the method of qualitative content analysis specifically tailored for this study and the results of the analysis of the use of futures studies in the three cases from the beginning of the 1990's (research question 1a). A discussion of operational criteria for a more participatory process is included at the end of article I (research question 1c). It also includes a preliminary simple version of the procedural theory which is further elaborated upon in article IV. Article II includes the results of the Delphi study in relation to the substantial framework (research question 2a). It includes a short description of the methodological procedure as well but the full details of the Delphi process are dealt with in article III, including a review of the methodological debate on the Delphi method (research questions 1c and 2b).

Article IV is the most abstract and presents the procedural theory in detail. The article includes a review of other procedural typologies used in futures studies and concludes that a more detailed typology is needed to answer the research questions about alternative processes in futures studies. The article also gives a short description of the Futulogic method, which was used to form the procedural typology and is excluded from the summary. A more detailed version can be found in the reference (Tapio and Hietanen 2001). The new typology of the procedural theory is introduced in chapter 3.2. Article IV includes the results of the development of the process of futures studies within transport administration in the 1990's (research question 1a).

The theory of environmental policy strategies presented briefly in article II is elaborated upon in a rather long chapter 3.1 in order to place the responses to the Delphi study in a more general framework. The development of the output of the futures studies of the transport administration in the 1990's has not been published before (research question 1b). It is summarised in relation to the procedural aspects in the final sub-chapter of the thesis (figure 6.2), which brings us back to the general task of the study in addressing the relation of the environment and participatory democracy to transport planning (research questions 1c and 2b).

The standard method of writing the report has made the summary rather long and it includes some monographic features. In the social sciences the summary articles seem to be rather theoretical and include only a few direct aspects of the articles (eg. Wilenius 1997; Rubin 2000). I have stuck to the standard however, because as a whole the total of the study has proceeded in a straightforward logical way, which had earlier been somewhat obscured when separated into articles.

1.4 Relation to other Social Scientific Research on Transport

Transport research seems to have been a domain of transport engineering and geography for a long time (Button 1993, 1-3). Since the 1970's social scientific research made on transport seems to have made some progress, especially in transport economics. In relation to transport engineering, geography and transport economics any 'softer', or hermeneutic social science can still be considered marginal. Social scientific research in the field of transport seems to have surveyed traffic behaviour instead of providing a theoretical interpretation other than Ajzen and Fischbein's. For example the selected proceedings of the 8th World Conference on Transport Research, published in four volumes in 1999, includes 191 papers in English. Almost half of those could be considered to have a 'soft' social scientific approach based on the title but a closer look at the articles leaves only some 17 papers in this category (see Meersman *et al.* 1999a; 1999b; 1999c; 1999d).³ The flow of engineering and economic equations on the other hand is massive.

Softer social scientific research can be found in at least six disciplines: 1) combination of environmental sociology and environmental policy approaches, 2) architectural urban studies with applications of planning theory, 3) transport history, 4) transport psychology, 5) geography and 6) futures studies. In this study a combination of approaches 1) and 6) is applied with some traces of 2) and 4). Transport history and transport geography are beyond the scope of this research.

In addition to the scientific disciplines above at least five problem oriented types of research have clear connections to the approach and content of this study. They are: 1) Attitude surveys on transport; 2) research on the physical environment of transport; 3) wider social scientific analysis of transport policy; 4) research on the planning process of transport administration. 5) Futures studies on transport have been made both in the categories of 3) and 4) but here they are dealt with separately because they are the special research object of this study. I will next make a short review of the five problem oriented approaches emphasising the research made in Finland.

1) Attitude Surveys on Transport

Liisa Uusitalo (1986) begun the era of environmental sociological attitude surveys in Finland. Since then a lot of environmental attitude surveys have been replicated with similar general questions concerning economic growth *versus* environment, which is

³ Of course, the categorisation of a huge amount of diverse papers is problematic. Another restriction of the conclusion is that the conference had a total of 893 presentations (Meersman *et al.* 1999a, xlii), so it is also possible that many soft social scientific approaches were disapproved of in the selection process.

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probably adopted from the surveys conducted in the US as indicators of a “new environmental paradigm” (NEP). Uusitalo herself has argued for surveys concentrating on more specific areas. A wave of environmental attitude surveys emerged in the early 1990’s focusing on energy (eg. Nurmela 1990), agriculture (eg. Tauriainen and Tauriala 1991), forestry (eg. Tuomola 1993), recreational areas *etc.*

Environmental attitude surveys focusing on transport have been scarce in Finland, notable exceptions being the works of Moisander (1996) and Järvelä *et al.* (2002). Internationally, they can be found more frequently in the domain of transportation research (eg. Socialdata 1992a; 1992b; Taylor and Brook 1998; Jensen 1999). There has been an obvious gap between the directly related transport attitude surveys and the more general attitude surveys.

Some general environmental attitude surveys have included a few questions that focus on transport policy on a national level and a local level (eg. Haavisto and Lankinen 1991; Sairinen 1996; Taylor and Brook 1998) but the effect on actual travel behaviour has not been measured satisfactorily. Kiiskilä has partly filled the gap between environmental and transport attitude surveys and traffic behaviour studies by interviewing experts in the field and making a survey which included a distinction between general and transport specific values and attitudes as explanatory factors of traffic behaviour (Ministry of Transport... 1999d; 2000b).

For some reason the division between material and non-material growth has not been included in the questionnaires of the attitude surveys referred to above. Maybe this feature has its origin in the NEP tradition. The three key variables adopted in this study are sensitive to the issue.

Opinion polls on transport infrastructure policy have been scarce in Finland. There have been some that focus on specific issues such as the Pasilanväylä urban motorway planning scheme (see Case 2 in article I; Ajomaa *et al.* 1993). Another study was conducted on the TIE 2010 policy (see FinnRA 1991, 5-6). A problem in these transport policy opinion polls was the narrow of posing alternatives. The respondents could only state a preference for or against the whole TIE 2010 policy and in the Pasilanväylä case the respondent could only vote between two courses for the motorway, not between wider transport policy alternatives.

Socialdata (1998) made a national opinion poll in relation to the Eurobarometer studies, which did include questions concerning the preference for different traffic modes in transport planning. However, the framing of the questions was so obscure that it is almost impossible to find out what was actually measured. A more valid approach was used by Anderson *et al.* (1998). They measured attitudes towards general aspects and more detailed measures at the local level.

The author is not aware of any thorough opinion polls that focus on interest groups instead of individuals considering transport CO₂ policy in Finland. A similar gap internationally has been detected by Tengström (1999, 194). The author has found only one reference even close to this approach (Nijkamp *et al.* 1998, 223-244), but that actually focused on individual experts, whose disciplinary background was analysed. Malkki (1993) interviewed representatives from four interest groups about the CO₂ policy for transport,

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which was an important starting point for the design of the Delphi study in this research despite the popular nature and small scale of her article. A general climate policy study, for interest group representatives in Finland, was conducted by Wilenius and Tirkkonen (1997) without quantitative indicators.

2) Research on the Physical Environment of Transport

Geography, regional structure, urban structure and other physical infrastructure have been important explanatory factors for road traffic volume. There has been a vast amount of work made on these mechanisms in transport engineering, transport economics and geography internationally (eg. Jansen 1993, 114-122; Beuthe and Nijkamp 1999; especially Vickerman 1999; Bristow *et al.* 1999; Simmonds and Still 1999) as well as in Finland (eg. Lahti and Harmaajärvi 1992; Matinheikki 1996; Pesonen *et al.* 1999).

Rather than repeating the tradition in this study, it seems more relevant to go beyond the physical explanatory factors, and ask; where do they come from? What kind of social factors and processes lie behind regional centralisation, urban sprawl and car use? What kind of future development on these issues can be anticipated in the field of transportation?

3) Wider Social Scientific Analyses of Transport

Some work focusing on the environmental history of Finnish transport has been published in the 1990's. Sauna-aho (1991) analysed Finnish transport policy in the 1970's and 1980's with some emphasis on exhaust gas emissions, not however carbon dioxide emissions, nor was any connection made between traffic volume and the environment. Seppinen (1992) made a review on the history of Finnish transport policy from the mid 19th century to 1990. However, environmental issues were given a marginal emphasis. The third volume of the massive research project on the history of Finnish road transport and Road Administration (FinnRA) was published in 1995. The report included a chapter on the environmental aspects of transport policy discussion in the 1960's to the first half of 1990's with a short reference to climate change and carbon dioxide emissions (Masonen 1995, 252). Virrankoski (2001) has recently written a slightly more thorough review article on the environmental history of road transport post WW2 concluding that the risk of climate change was the issue that raised the discussion of traffic volume onto the political agenda.

An analysis of the power relations between the organisations trying to influence Finnish transport policy was conducted by Ruostetsaari (1995). It would be interesting to place the interest groups of the Delphi study into Ruostetsaari's power hierarchy in order to analyse the abilities of the different interest groups to fulfil their ideas of the preferable future. Unfortunately Ruostetsaari's hierarchy includes organisations like the government and parliament which are not included in this study. An important group in Ruostetsaari's hierarchy, the Ministry of Treasury dropped out in the first Delphi round. Furthermore, Ruostetsaari did not make any distinctions between the lobbying groups of different transport modes. These features would make the use of the hierarchy both invalid and unreliable.

Two studies on transport environmental policy are of special importance to this study. Sairinen *et al.* (1997) made a wide analysis of the environmental policy of Finnish

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Road Administration based on a framework from Jänicke's (1988) work. The framework was used to analyse the monitoring of the environmental goals stated by the Second National Transport Committee by Ajomaa (1997). The substance framework of this study (3.1) is partly constructed from the work of Sairinen *et al* (1997).

4) Research on Transport Administration

This doctorate thesis stems from a modest tradition of studies focusing on the processes of transport administration, formed from the subjects of Environmental Protection Science and Land Use Economics at the University of Helsinki in the 1990's. More specifically, we focused on analysing and evaluating:

- FinnRA traffic forecasts based on the framework of futures research (Tapio 1992; 1996; this report),
- FinnRA project evaluation methods (Leskinen and Valve 1991; Leskinen 1994) and the organisational reformulation of FinnRA (Leskinen 1994) based on the framework of institutional environmental economics and critical-pragmatist planning theory,
- Public participation in the Environmental Impact Assessment (EIA) process (Karvinen, 1993) and road transport planning in general (Leskinen *et al.* 1989; Lehtonen 1991; Ajomaa *et al.* 1993; Leskinen 1994; Leskinen and Paldanius 1995) based on the positional analysis of Söderbaum (1986; 1992) and the framework of energy policy analysis by Paldanius (1992),
- Public participation in national transport policy (policy EIA) (Tolonen 1993) based on the process oriented framework of EIA by Leskinen *et al.* (1991) which nowadays would probably be called integrated assessment (IA) (see *eg.* Jäger 1998; Rotmans 1998; Cohen *et al.* 1998, 346-348).

The EIA framework of Leskinen *et al.* was later partly used by Kaskinen (1998) in his analysis of the Turku – St Petersburg (E18) road planning scheme and Olli (1996) in analysing EIA for several road projects. An integrative approach which seems not to fit the categories presented above is the research made by Valli (1998). She performed a soft systems analysis for the EIA processes of transport but also general transport policies. Another study difficult to categorise in terms of its planning phases was made by Narsakka (1996). This focused on some aspects of the procedure, organisation and substance of regional sustainable development.

Internationally, the focus on public participation in transport and land-use planning has been increasingly emphasised, either as a goal or for analysing empirical experiments (Beatley *et al.* 1994; Kato and Ieda 1999; Camagni *et al.* 1999; Hajer and Kesselring 1999). Integrated assessment and strategic environmental assessment has been adopted widely as concepts in transport planning studies. However, the actual content used in IA proposals and experiments may, for example, vary from promotion of a traditional neoclassical aggregative cost-benefit analysis to phenomenological philosophy (see Toth & Hiznyik 1998; Gühnemann and Rothengatter 1999; Zeitler 1999).

5) Futures Studies on Transport

There were several types of futures studies made on transport in recent years. As an introduction to the more detailed theoretical and empirical analysis presented in chapters 3.2 and 5 it should be noted that international development has moved from traditional business as usual mathematical modelling (see *eg.* Kokkarinen 1991; IPCC 1996c, 683-

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691; Schafer and Victor 2000) to the so-called what – if studies. The business as usual models have been criticised for being insensitive to the anticipation of societal change (Nijkamp *et al.* 1998, 143-144). The main criticism however has been their ineffectiveness as a planning tool: If a business as usual future development is taken as a basis for transport planning, transport planning will make the business as usual come true (Cohen *et al.* 1998; Höjer and Mattsson 2000). This phenomenon is known as the “predict and provide” approach or a self-fulfilling prophecy (see Goodwin 1997).

A second way to do futures studies is to adopt the what– if approach in which one outlines a business as usual and several alternative policy scenarios, or in de Jouvenel’s (1967, 55) terms, primary and secondary forecasts. Policy scenarios can be formed starting from varying policy measures or varying policy goals (Julien *et al.* 1979, 6-7; Hirschhorn 1980). One example of starting from the goals is the backcasting framework, developed by Robinson (see 1990). This is used frequently nowadays in transportation futures studies, for example the Environmentally Sustainable Transport project (EST) by the OECD (1997) and the Policy Scenarios for Sustainable Mobility (POSSUM) for the European Union (Banister *et al.* 2000). The arrival of backcasting in transport futures studies has been briefly described by Banister *et al.* (2000, 112-115). It seems that most scenario studies in the transportation field are still made by using existing mathematical models and varying policy measures (*eg.* Acutt and Dodgson 1998; Cassir *et al.* 1999; Chiquetto and Blackledge 1999; May *et al.* 1999; Pesonen *et al.* 1999; Bowman 2000).

A third way to make futures studies on transportation issues is a soft participatory approach. No rigorous models are built and the alternative policy scenarios are produced by the participants’ heuristic images of the future. The methods in this category include for example participatory planning, futures workshops, opinion polling and the Delphi method, which is applied in this study. The Delphi method has been used to; envision the probable future of information systems within road transport (Svidén 1988), the impact of information system measures on transport (Höjer 1998), walking (Tolley *et al.* 2001), and the probable impact of transport infrastructure construction on the urban structure (Still *et al.* 1999). In their Delphi bibliography, Gupta and Clarke (1996) reported over six hundred Delphi publications of which only eight included transport in their titles. A review produced only one Delphi report on the subject of the relationship between economic growth, transport volumes and CO₂ emissions from transport measured on a relative scale (Karmasin and Karmasin 1999).

In summary, the added value of this study for environmentally oriented transport research is hopefully in providing an interdisciplinary social scientific study with the following scarce characteristics:

- A participatory approach to making future scenarios,
- interest group opinions instead of individual opinions,
- systematic data sensitive approach in forming alternative scenarios,
- a clear distinction between immaterialisation and dematerialisation in opinions,
- an interpretation of futures studies and transport with regard to general theories of environmental policy and futures studies.

2 Empirical Premises

2.1 The Limits to Economic Growth?

The world economy has been growing rapidly since the 1950's. The gross world product (GWP) increased five-fold between 1950-1994 in real terms (Figure 2.1). Economic growth has undoubtedly brought many good things with it. In economically more developed countries average life expectancy has grown rapidly, people are healthier than fifty years ago as science and technology has prolonged the human life span, the more severe works are made by machines and the average leisure time has increased.

However, some critique of the continuous rapid growth of the world's population and economy was first presented by Thomas Robert Malthus and David Ricardo in the 18th and 19th century. Since the publication of *The Limits to Growth* report to the Club of Rome (Meadows *et al.* 1972) the critical discussion has been re-ignited. Economic growth has brought with it negative side-effects, especially environmental problems such as pollution and resource scarcity. They argued that; as long as economic growth is based on the increasing use of natural resources then the effects of increasing pollution on the environment would exceed the world's limits to growth in the 21st century. The follow-up study *Beyond the Limits* (Meadows *et al.* 1992) concluded that mankind has already exceeded the limits of ecologically sustainable development.

The Club of Rome Reports faced strong criticism as did Malthus in his time. According to the critique economic growth need not to be based on increasing material consumption and does not necessarily lead to increasing pollution. Several environmental indicators seem to have improved rather than worsened in more developed countries since the 1970's. The worst state of the environment seemed to be found in the less developed countries in the late 20th century (Simon 1980; Our Common... 1987; UNEP *ref.* Bartelmus 1994, 21; Brown *et al.* 1997, 97, 103; Jänicke and Weidner 1997; Haukioja & Kaivo-oja 1998).

The so-called environmental Kuznets curve⁴ suggests that at first, economic growth is based on the increasing use of natural resources and thus increases pollution, but at some point there will be enough money for increasing investment in less environmentally harmful ways of production. The Kuznets hypothesis has clear features of the Maslowian needs hierarchy, where people's first concern is to fulfill their own basic material needs but then go on to fulfill more non-material needs e.g. creativity, social status, aesthetic enjoyment and an improved environment.

The Limits to Growth report was also criticised for not recognising the human ability to learn from mistakes by improving technology. Technical development is essential in

⁴ The original Kuznets curve is applied to the distribution of income. Simon Kuznets (1966) suggested that economic growth in a developing country first leads to increasing uneven income distribution but after a certain level further growth induces more even income distribution (see also Todaro 1994, 154-157). The same idea has been applied in environmental economics (*eg.* Munasinghe 1996, 5-6) and empirically tested by for example Ekins (1997) and Haukioja & Kaivo-oja (1998).

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reducing emissions and, for example, industry in economically more developed industrial countries pollutes less than in less developed industrial countries (eg. Simon 1980).

The criticism seems to be right in its argument although the target is wrong, since both *The Limits to Growth* and *Beyond the Limits* did in fact recognise these alternatives. However, it is not the purpose of this study to find out what Meadows *et al.* did write and what they did not write. It is more important that there are pollutants that have not so far followed the environmental Kuznets curve (Ekins 1997; Opschoor 1997, 281; Haukioja and Kaivo-oja 1998; Seppälä *et al.* 2001).⁵ A cluster of them is formed by the increasing greenhouse gas (GHG) emissions, which most probably result in global climate change.

The most important of the human induced greenhouse gas emissions are carbon dioxide (CO₂) emissions, which closely followed GWP values between 1950-1980 and increased only slightly slower than GWP between 1980-1995. (Figure 2.1.) Tackling the increasing CO₂ emissions is probably the most critical environmental challenge for transport policy (see Banister 1998, 10; Nijkamp *et al.* 1998, 33, 42, 112; Banister *et al.* 2000, 119-125; IPCC 2001b, 189-203; chapter 2.3).

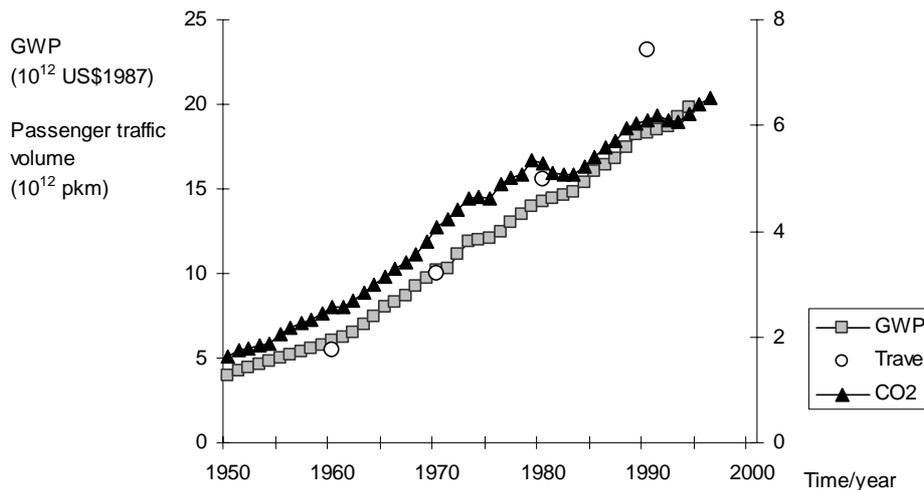


Figure 2.1: The Gross World Product⁶ in 1950-1994 (UNEP 1998), the Global Anthropogenic Carbon Dioxide Emissions in 1950-1996 (CDIAC 1999) and Global Motorised Passenger Transport Volume in 1960, 1970, 1980 & 1990 (Schafer 1998, 476). The carbon dioxide emissions here consist of fossil-fuel burning, cement manufacture, and gas flaring. For example forest depletion and desertification is not included.

⁵ As a matter of fact, the per capita basis for calculation is somewhat misleading because, regarding the ecological environment, the total volume of emissions is more important (eg. Sun, 1999).

⁶ All the GDP and GWP values presented in this study are expressed in real terms. Real terms are more important than the relative terms, because inflation diminishes the real change of production. Another choice is that market exchange rates are used instead of purchasing power parities that make the prices of different national economies comparable. This is done because the prospects for the future are solely focused on Finland and there is no need for the comparison of international price levels. GDP in market exchange rates was also one of the key background variables of the whole study.

2.2 Global Climate Change and Climate Policy

The climate of the Earth changes due to radiative forcing, which is defined as “...the perturbation to the energy balance of the Earth-atmosphere system” *i.e.* a movement away from the energy equilibrium of the climate (IPCC 1996a, 3). When the Earth absorbs more energy than it emits climatologists call the phenomenon positive radiative forcing which is popularly called global warming. The radiative forcing agents consist of solar radiation, the reflected and scattered solar radiation (*i.e.* planetary albedo), aerosols and radiatively active trace gases, which are more usually called the greenhouse gases (GHG). (IPCC 1990a, 41-68.)

Different GHGs have different abilities to absorb infrared and microwave radiation because they have different numbers of energy levels in their molecules. For example a methane (CH₄) molecule has more energy levels than a carbon dioxide (CO₂) molecule and therefore can perform the excitation of energy levels in more ways and can absorb the radiation quanta of many wave lengths. When both the capacity of absorption and the concentration of different GHGs are known their forcing can be calculated by Wm^{-2} .

The GHGs have also different lifetimes in the atmosphere. Thus the relative importance of different GHGs is described as global warming potential⁷ which takes into account the different timescales in relation to immediately released carbon dioxide. Based on global warming potentials on a timescale of a hundred years the most important of the GHGs is water vapour, the second is CO₂, then CH₄, halocarbons and nitrous oxide. (IPCC 1990a, 41-68.)

The natural greenhouse effect on the atmosphere was discovered by Jean Fourier in 1827. The possibility of human induced global climate change, due to the increased emissions of greenhouse gases caused by fossil fuel burning, was first discovered by Svante Arrhenius, 1896. Regular measurements of GHG concentrations were begun in the late 1950's in Mauna Loa, Hawaii. Based on the results Keeling calculated an average annual growth rate of 4% for global GHG emissions in the period 1958-1972. (Wilenius and Tirkkonen 1997b, 126-127.)

According to Wilenius and Tirkkonen (1997b, 127) the first landmark of climate policy was the conference “Study of Man's Impact on Climate” (SMIC) in Stockholm in 1970. The next important step seemed to be the first climate conference organised by the United Nations Environment Programme (UNEP) and the World Meteorological Organisation (WMO) in Geneva 1979. Although there still was no detectable sign of global warming the conference declaration appealed for precautionary measures to prepare for it. No declarations for GHG emission control were made, however. The critical push in putting climate change on the agenda of international politics was made by the Brundtland commission in its famous report *Our Common Future* (1987, 174-177).

The United Nations General Assembly decided to found the Intergovernmental Panel on Climate Change (IPCC) in 1988, which was organised by UNEP and WMO. The

⁷ Global warming potential is usually abbreviated GWP, in this study GWP stands for gross world product.

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purpose of IPCC was to provide international scientific assessment of the "...magnitude, timing and and potential environmental and socio-economic impact of climate change and realistic response strategies" (UN General Assembly, Res. 43/53, 1988, quote from Wilenius and Tirkkonen 1998, 292). The first assessment report of IPCC was published in 1990 (IPCC 1990a; 1990b; 1990c) and soon IPCC achieved a hegemonic position in climate change and climate policy discussion (Tirkkonen 2000, 80-87).

The first assessment report⁸ concluded among other things that the IPCC had detected a global mean surface air temperature rise by 0,3 °C to 0,6 °C but it was unclear whether the change was due to natural variation or also included human impact (IPCC, 1990a, xii). Although no reliable empirical sign could be agreed on, the panel declared it to be certain that anthropogenic GHG emissions would have an effect in the future. Further, the report stated that the CO₂, CFC and N₂O emissions would require immediate reductions in their emissions that result from human activities by over 60% in order to stabilise their concentrations at 1990 levels. Methane emissions were recommended for reduction by 15-20%. (IPCC 1990a, xi.)

The second assessment report (SAR) of the IPCC was published in 1996 (IPCC 1996a; 1996b; 1996c). A cautious analysis of the difference between the human effect and the natural variation of radiative forcing was made. The report repeated the statement that the global mean surface air temperature had increased 0,3 °C to 0,6 °C since the late 19th century. A novel conclusion was that "...[t]he balance of evidence suggests a discernible human influence on global climate" (IPCC 1996a, 4). Rather ironically, no emission reduction targets were presented, although the SAR report was in fact more confident about the role of anthropogenic emissions than the first assessment. However, the SAR report did suggest a reduction target of over 60% in some calculations aimed at stabilising the CO₂ concentration at 450 ppmv until the year 2100 (IPCC 1996a, 84-85; see also OECD 1997, 99). However, it did not state that 450 ppmv would be an adequate target.

Cohen *et al.* (1998) stated that the discourses of climate change and sustainable development has become rather separated. Although IPCC was established at least partly due to the effect of the report of the Brundtland Commission, one has a hard time trying to find the concept of sustainable development in the IPCC reports. The sustainability discourse though has also included climate change discussion, resulting in the UN Framework Convention for Climate Change (UNFCCC) at the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992. As a consequence a series of conferences of parties (CoP) were established to achieve global commitment to explicitly defined emission targets.

The CoP-3 held in Kyoto succeeded in producing the so-called Kyoto Protocol, which included quantifiable emission targets for six GHGs not included in the Montreal Protocol⁹: CO₂, CH₄, N₂O, hydrofluorocarbons (HCFC) perfluorocarbons (PFCs) and sulfur hexafluoride (SF₆). A total of 38 industrial countries committed themselves to

⁸ The first assessment report is usually abbreviated FAR, in this study FAR stands for the method of Field Anomaly Relaxation.

⁹ The Montreal Protocol aims at protecting the stratospheric ozone layer by reducing some CFC and other halocarbon emissions.

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explicit emission targets presented as percentages of the 1990 emissions measured in CO₂ equivalents. The current European Union (EU15) countries are committed to a minus 8% reduction to be accomplished in the commitment period of 2008-2012. (Kyoto Protocol... 1997; Bach 1998.)

Finland belongs to the 'bubble' of EU15 countries but the Finnish government was willing to commit only to a more modest zero target (Vehmas *et al.* 1999). However, considering radiative forcing, it is more important to achieve a target than stating it. Luukkanen *et al.* (2000) used two data sets in order to anticipate which countries have succeeded meeting their targets so far, namely the UNFCCC data from CO₂ emissions 1990-1997 and International Energy Agency data 1987-1997. They calculated logarithmic trend extrapolation for 1998-2010. According to Luukkanen *et al.* (2000, 33) the countries could be divided into four groups: 1) Those facing difficulties in achieving the target: The Netherlands, Belgium, Austria and Denmark; 2) Those with some problems: Finland, Italy, UK, Germany; 3) Low problems or possible sellers¹⁰: France, Ireland, Luxembourg and Sweden; 4) Probable sellers: Greece, Portugal and Spain. It can be concluded that without a change in CO₂ policy or another severe economic depression Finland will have problems in even achieving the modest target, the business as usual "carbon gap" being 8-10% depending on which data was used (Luukkanen *et al.* 2000, 21-22).

The introduction will be finished with a short review of recent developments concerning CoPs and IPCC although it is important to keep in mind that they were not available when the empirical material of this study was gathered. The summaries for the policymakers of the IPCC Third Assessment Report (TAR) were published when this manuscript was being written in summer 2001 but the comprehensive report remains beyond the scope developed here.

The TAR provided a sophisticated summary with precise caution given regarding the differences of uncertainty contained in different statements. The main conclusion was, that "... [t]he warming over the past 100 years is very unlikely¹¹ to be due to internal variability alone, as estimated by current models. Reconstructions of climate data for the past 1,000 years... also indicate that this warming was unusual and is unlikely to be entirely natural in origin." (IPCC 2001a, 10). The range of warming was now considered to be from 0,4 to 0,8 °C with a 95% confidence rate. The model calculations suggested that "...most of the warming over the last 50 years is likely to have been due to the increase in greenhouse gas concentrations." (IPCC 2001a, 10).

The TAR presented a slightly more precise declaration of possible emission targets and their requirements than SAR. The stabilisation of atmospheric CO₂ concentration to 450 ppmv would require the reduction of anthropogenic CO₂ emissions below the level of 1990 "within a few decades". Thereafter CO₂ emissions should continue to decrease steadily and eventually decline to "a very small fraction of current emissions". TAR

¹⁰ The analysis by Luukkanen *et al.* was extended to analyse the prospects for emission trading, hence the concept of seller here.

¹¹ In the Summary for Policymakers (IPCC 2001a, 2) the wording was attached to "judgemental estimates of confidence": virtually certain meant >99% confidence, very likely 90-99%, likely 66-90%, medium likelihood 33-66%, unlikely 10-33%, very unlikely 1-10% and exceptionally unlikely <1% confidence. What was exactly meant by judgemental estimates was not explained.

summary did not however explicitly declare that 450 ppm would be the relevant target. TAR also presented scenarios for the future, where the mean global surface air temperature rise varied from 1,3 to 5,8 °C in the period 1990-2100. (IPCC 2001a, 14.)

Because CoP-3 could agree on emission targets the CoPs were supposed to go further by agreeing on some key international measures. CoP-6 was held at the Hague in Autumn 2000 and was filled with discrepancies and failed to achieve a consensus on critical issues, such as emissions trading, the calculus of carbon dioxide sinks and the political position on the vast CO₂ emission reduction achieved in Russia called “hot air”, as it was due to economic recession. The CoP-6 was continued in 2001 in Bonn without the USA and made an agreement that providing carbon sinks can be calculated as negative emissions. The future prospects for the climate treaty seem far from predictable because the US withdrew from the Kyoto protocol and moved away from the other umbrella countries (especially Australia, Canada and Japan) which are left somewhere between the EU and US. (Tirkkonen *et al.* 2002.)

To sum up, in autumn 2001 the Kyoto target for industrial countries was still –5,2%, the EU was committed to an –8% emission reduction and Finland to a zero target. After CoP-6 these figures included the measurement of sinks. The IPCC stated that it was very likely that human induced climate change has begun and according to statistics CO₂ emissions from transport were rising.

2.3 Climate and Transport

2.3.1 Some Global Trends

Global climate policy is facing the problem of increasing CO₂ emissions from transport; especially from road and air transport. Traffic was responsible for about 20-25% of the CO₂ emissions worldwide, in the European Union (EU15) and in Finland in the 1990's (IPCC 1996b, 683; Eurostat 1999, 81; Ministry of Transport... 1999a, 3).¹² In the EU15, CO₂ emissions from traffic increased more rapidly in 1985-95 than CO₂ emissions from other sources (Eurostat 1999, 81).

Figure 2.2 illustrates that in the EU15 countries the CO₂ emissions from traffic clearly increased from 1985-1996, whereas other sectors of production and consumption have been able to maintain the CO₂ emission level of 1985 or even reduce it.

The rather linear growth of global motorisation in 1976-1996 can be seen in Figure 2.3. The figure indicates that the increase in the total automobile stock may have started to level off in North America and Europe whereas the highest growth rate of the 1990's can be found in Asia. In spite of the high growth rates of the population in Africa there is, so far, no sign of countries there following the high mobility of the more industrialised world in absolute terms.

¹² The estimates of the share of CO₂ emissions from traffic were 22% for world in 1990 (IPCC 1996b, 683), 26% for the EU15 in 1995 (Eurostat 1999, 81) and 20% for Finland in 1997 (Ministry of Transport... 1999a, 3). The CO₂ share of traffic is relatively low in Finland because of energy intensive forestry and metal industries and a relatively high proportion of fossil fuels in energy production (Wahlström *et al.* 1996, 194).

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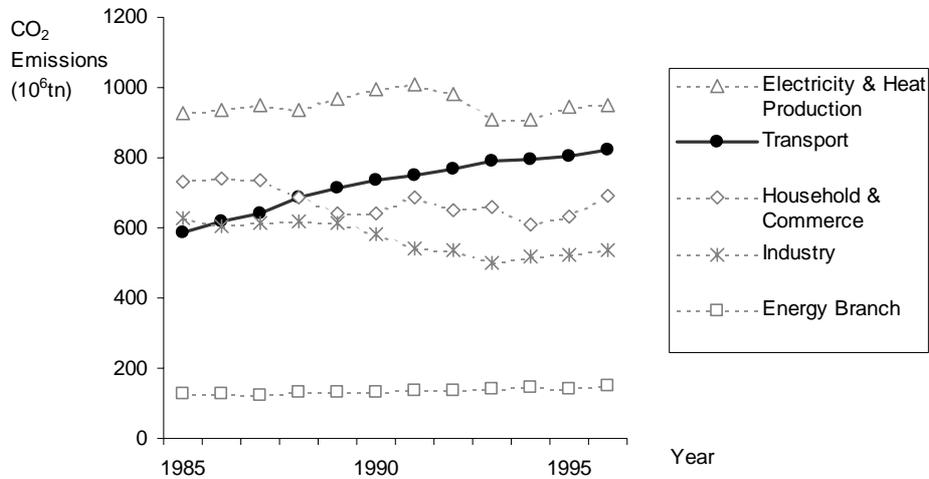


Figure 2.2: CO₂ emissions from fossil fuels by sector in the EU15 countries 1985-1996 (Eurostat 1999, 81; 2000).

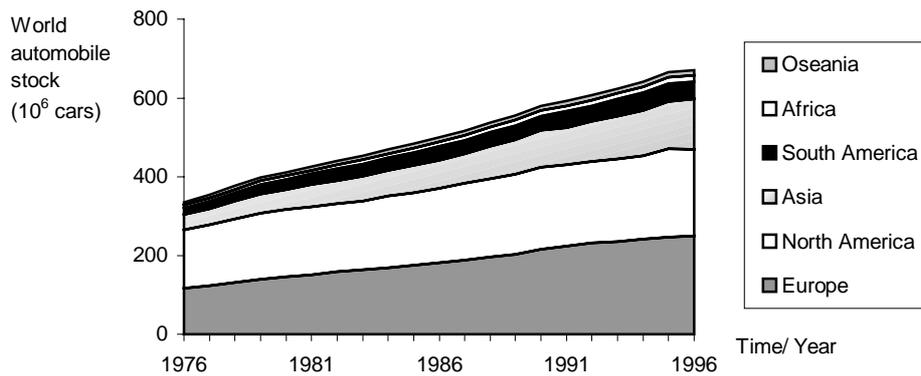


Figure 2.3: Total automobile stock in world areas 1976-1996, including light and heavy duty passenger cars, buses, vans and lorries (Ministry of Transport... 1999b, appendix p. 38).

Despite technological development the CO₂ emissions from transport followed the increasing traffic volumes from 1986-1995 in the current European Union (EU15) countries as well as in the United States and Japan. People have been buying bigger cars and the number of passengers in vehicles has decreased due to increased income and a more individualistic life-style. The market share of road freight transport has also increased as smaller units are delivered just in time. (IPCC 1996, 690; Banister 1998, 11-12; ECMT *ref.* Lampinen 1998, 9; Eurostat 1999, 10, 38, 56, 81; Tapio 2000a, 6-7; IEA 2000, 15-27.)

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The importance of transport in climate policy seems to be increasing. No easy solutions can be expected, because technical measures have been insufficient and changes in modal split and the growth rate have been seen as restricting individual freedom in modern culture. (Haavisto and Lankinen 1991; Socialdata 1992a; 1992b; Tengström 1992, 21-24; Lankinen 1995, 25-28; Banister 1998, 2, 13; Gillespie *et al.* 1998; Jensen 1999). A few years ago Martin Jänicke and Helmut Weidner (1997, 308) even concluded that “At present the integration of environmental and transport policy does not seem to be functioning anywhere”.

2.3.2 Climate, Traffic and Economy in the EU

Due to technical development, the fuel efficiency of vehicles should improve leading to expectations of stagnation or a decrease in CO₂ emissions. However, this effect has been overruled by at least three factors in the EU15 countries. First, the passenger traffic volume has increased even faster than the gross domestic product (GDP)¹³ between 1970-95. At the same time freight transport volume has increased approximately at the same rate as GDP (figure 2.4). Second, the volume growth has been most rapid in motorised road transport and air transport, which produces more CO₂ emissions per passenger kilometre and tonne kilometre than rail transport and soft modes. (Nijkamp *et al.* 1998, 17; Eurostat 1999, 10, 38, 56; Bouwman 2000, 94-97.) Third, people have been buying bigger cars with more powerful engines which consume more fuel.

The total effect has been that the CO₂ emissions from transport in general and road transport specifically have increased even faster than passenger kilometres and tonne kilometres between 1985-1990, and at the same rate between 1990-1995 (Figure 2.4; Eurostat 1999, 10, 38, 56, 81). According to a study conducted for the European Conference of Ministers of Transport (ECMT), even the CO₂ emissions per vehicle kilometre did not seem to decrease in Western Europe between 1985-95 (Figure 2.5; ECMT *ref.* Lampinen 1998, 9).

Road traffic accounted for approximately 85% of the CO₂ emissions from traffic in the EU15 countries in 1985, 1990 and 1995 (Eurostat 1999, 81). The figure does not take into account the fossil fuel burned for electricity production for rail transport, but even if it did, the figure would still be approximately 80% (*ibid.*, 80). Although airplane traffic has increased more rapidly than GDP in the last decade it seems adequate to concentrate on road traffic as the main source of traffic related CO₂ emissions for the next few decades.

¹³ The GDP values in this paper are presented in real terms and market exchange rates.

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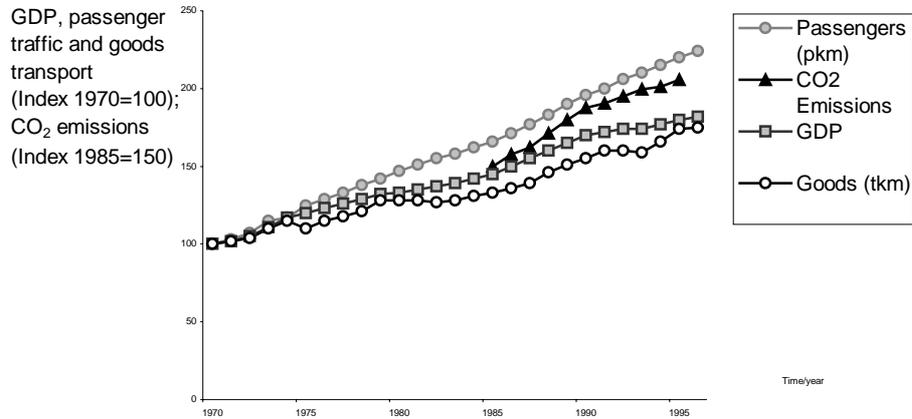


Figure 2.4: GDP, passenger traffic and goods transport 1970-1996 and CO₂ emissions from traffic in 1985-1995 in EU15 countries (Eurostat 1999, 10, 81)

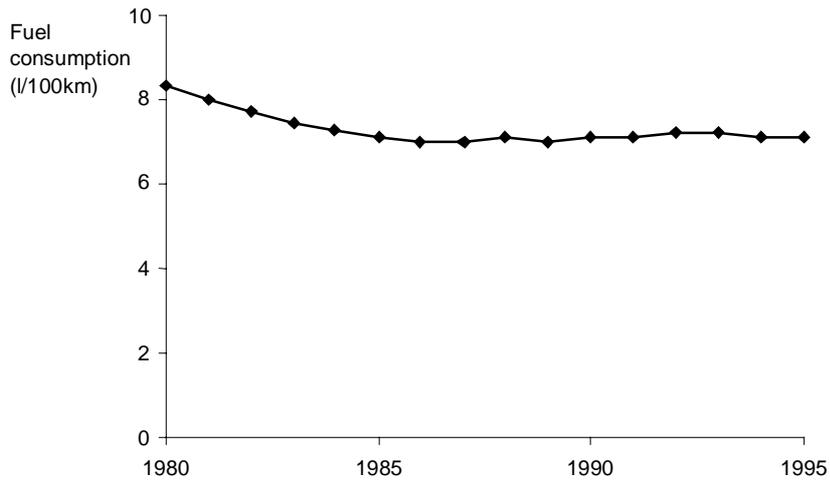


Figure 2.5: The weighed average fuel consumption of new passenger cars in seven countries: Germany, Austria, Belgium, France, Italy, Great Britain and Sweden from 1980-95 (70% of the European markets) (ECMT ref. Lampinen, 1998, 9)

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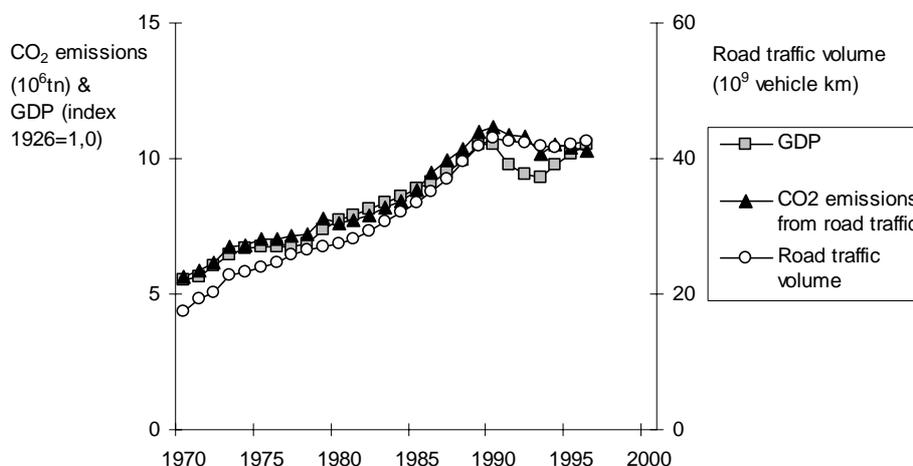


Figure 2.6: The volume of and CO₂ emissions from road traffic, and the GDP of Finland 1970-96 (Mäkelä 1997; FinnRA 1997; Statistics Finland 1997)

2.3.3 The Finnish Case

Finland has followed approximately the same pattern as the EU15 average considering CO₂ emissions from traffic. Some special features compared to other EU15 countries should be mentioned, though. Traffic volumes have been increasing at a moderately slower rate, almost according to GDP values. The average fuel consumption of private cars did not decrease in Finland even in the early 1980's, which makes the relation between GDP and CO₂ emissions from traffic the same as the EU average. There was a strong correlation between GDP, road traffic volume and the CO₂ emissions of road traffic from 1978-1996 in Finland (Figure 2.6).

Another special feature of Finland was the economic recession in the early 1990's, that was deeper in Finland than the average in the EU15 countries (Figures 2.5 and 2.6). It was partly a follow on to the overheating of the economy in the late 1980's. Another factor was the collapse of the Soviet Union, which also cut Finnish exports to Eastern Europe.

A separation of road traffic volume and CO₂ emissions from road traffic would be an example of dematerialisation. The decoupling of GDP and road traffic volume would be an example of immaterialisation. Despite all the developments in vehicle technology and the discussion of non-material economic growth, post-industrialism, the third wave, decoupling and decarbonisation, little empirical evidence of such developments, if any, could be found in Finnish transport from the late 1970's to 1996. (See Toffler 1981; Bell 1987; Peake 1994; Baum 1995; Goodwin 1995; Banister 1998, 1-2; Tengström 1999, 205-207; Hinterberger and Schmidt-Bleek 1999).

2.4 Public Participation in Environmental and Transport Planning

The growth of traffic and the building of new heavy infrastructure has caused many environmental problems, in addition to carbon dioxide emissions. The change in the physical and social environment of people's daily life-world has been so massive that it has provoked resistance by local people, environmental NGO's and some transport planners on a number of occasions internationally as well as in Finland. (Bookchin 1981, 66-76; Sauna-aho 1991, 168-169; Masonen 1995; Mogridge 1997; Goodwin 1998; Taylor and Brook 1998; Kaskinen 1998; Valli 1998, 60-62; Tengström 1999, 98-100).

Technical administration responded to the public pressure by increasing public participation in community planning (eg. O'Riordan 1983, 256-258; Beatly *et al.* 1994; Masonen 1995; Kaskinen 1998). In Finland, Road Administration (FinnRA) was the first administrative organisation to develop institutional participation at the beginning of 1990's (Masonen 1995). Forestry is another field where increasing participation was applied in the 1990's due to many conflicts about the use of old forests in the late 1980's and early 1990's.¹⁴

Several phases of transport planning have been studied in relation to increasing participation, such as problem formulation, environmental impact assessment (EIA), project evaluation and the more technical planning (chapter 1.4). The aim of this study focuses on trying to create a more democratic and environmentally sound transport planning procedures via futures studies methods for transport administration. Futures studies are essential in the problem formulation phase, where the most important decisions regarding traffic volume, modal split and CO₂ emissions are usually made. The forecast volumes are used in time-saving calculations and in this way affect the results of cost-benefit analyses which in turn have an effect on transport project priorities.

¹⁴ Järviöskö (ref. Massa 1999, 23) has stated somewhat cynically that environmental social scientists are called for only when some societal projects face surprisingly strong criticism. The increase of environmentally relevant social scientific research on transport in the beginning of the 1990's can be understood as an example of this phenomenon.

3 Theoretical Framework

The theoretical framework of the study consists of two typologies of schools of thought with regard to futures studies on transport and the environment. The first typology presented in chapter 3.1 focuses on the content: What kind of alternative policy strategies are there to combat environmental problems? Five schools of thought are constructed based on a review of several previously written typologies. The specific theoretical task of this study is to apply the strategies to the field of transport and climate policy, especially the three key indicators of GDP, road traffic volume and CO₂ emissions from road traffic. The typology is a continuum of growth pessimism to growth optimism and the schools of thought present different positions towards dematerialisation and immaterialisation.

The second typology presented in chapter 3.2 focuses on the procedure: What kind of alternative ways of organising futures studies are there in terms of citizen participation? The procedural typology is based on the discussion going on in the field of futures studies and seven schools of thought are formed using logical analysis. The seven procedural schools of thought form a continuum from technocracy to citizen participation and hence include different roles for professionals. The procedural typology is formed with sensitivity to the philosophical discussion on the role of values and knowledge in decision-making.

3.1 The Content of Environmental Policies

3.1.1 The Limits to Growth Debate

The debate on the limits to the economic growth has been traced back to at least the sixth century B.C. The debate was powerfully fuelled by Thomas Robert Malthus' famous article *An Essay on the Principle of Population* which was first published in 1798 (Malthus 1976). Malthus suggested that the potential for the population growth was geometrical whereas the potential of growth of food production was only arithmetical. This would cause serious 'misery and vice' in the future because the factors restricting population growth would be diseases, famine and war. The principle of population would prevent the 'future improvement of the society' which was the promised claim of the enlightenment era.¹⁵

Malthus' (1976, 111-115) policy suggestions included land reform, a shift from luxury production to farming and from foreign trade to local farming. In the later editions of his essay, Malthus revised his opinions about the human capacity to learn and also recommended postponing marriage to a phase when a man (*sic*) can afford to support his children. He also favoured better education for the poor. (Malthus 1976, 132, 136-137.)

¹⁵ According to Appleman (1978, xiv) similar ideas had already been presented already by Confucius and Plato and according to Meadows *et al.* (1972, 25) by Han Fei-Tzu in 500 B.C. Malthus (1978, 18) himself referred to David Hume, Robert Wallace and Adam Smith.

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Malthus provoked severe, wide and partly misinformed criticism from the liberal market-oriented domain as well as from the Marxist literature – as can be found in the collection of texts edited by Appleman in the reference (Malthus 1976). Some of the most relevant counterarguments were:

- Human beings can learn from experience and are creative in solving problems (eg. Godwin 1976; Mill 1976),
- the development of science and technology will (and does) improve the agricultural production faster than population growth (eg. Engels 1976),
- the problem of poverty and famine is not connected to the growth of population but to the uneven distribution of wealth and food (eg. Boyarski 1976).

The late-modern environmental debate exploded in the early 1970's and was greatly induced by the *Limits to Growth* report for the Club of Rome (Meadows *et al.* 1972). The debate had clear features of the pro and con Malthus debate that had gone on for almost two centuries. The report included several runs of the World model with varying assumptions about natural resource reserves, fertility and mortality rates of population, capital investment *etc.* The general conclusion of the report was that the material economy of the world was growing exponentially, (*i.e.* at an accelerating rate) and that this could not go on for more than a century, unless the economy became less material oriented, pollution levels were cut, and population growth levelled off. The report did not enforce the Malthusian claims of a shift from luxury production to farming. According to the report, services and other forms of production that do not require large material flows nor induce pollution could continue to grow indefinitely (Meadows *et al.* 1972, 175).

The Limits to Growth report also provoked severe criticism which was in line with the arguments posed to Malthus. An argument was raised that Malthus was proved to have been wrong since the earth already carried about four billion people in the early 1970's compared to maybe one billion in the early 19th century (Appleman 1976, xxv). The development of science and technology in agricultural practise had been far beyond what Malthus had expected. Why would the development stop now and why would technical development in agriculture not be applied to the use of other environmental resources as well? These growth optimist views have been given different labels, for example 'technocentric' (O'Riordan 1983, 11-12) 'cornucopian' (Miller 1988, 17-19), 'promethean' (Dryzek 1987, 20), 'human exemptionalism' (Dunlap 1983) and the 'treadmill' approach (Baker *et al.* 1997).

Environmental discourse has gone through several qualitative and rhetorical changes. The discourse has become wider concerning space and discipline: from the local, concrete and natural science oriented questions to the more global, abstract and interdisciplinary questions. One line of development is from the narrow nature conservationist point to the pollution debate and onto the limits to growth debate and further onto sustainable development and ecological modernisation discourses. The development and substance of the discourse has been described more thoroughly by McManus (1996) and Cohen *et al.* (1998; see also Mol 1996). The more focused point of this chapter is to further define the positions between the neo-malthusian and cornucopian approaches to environmental policy and construct a set of scenarios of the presented typologies. I will emphasise continental European discourse, since McManus (1996) and Kula (1998) have made impressive reviews of the Anglo-Saxon discussion.

3.1.2 Review on Typologies of Environmental Policy

There are different ways to categorise environmental policy strategies. The Norwegian philosopher Arne Næss (1976, 99-115) saw two main alternatives to cornucopian material growth oriented business as usual scenario, namely *shallow ecology* and the neo-Malthusian *deep ecology*. By shallow ecological movement ('grunne økologiske bevegelse') he meant small adjustments to the business as usual course of development by developing cleaner 'hard technology'. The centralising of communities and the globalisation of markets would continue as well as the increasing complexity and specialisation, all of which are the main characteristics of hard technology. People's values toward nature would still be utilistic.

The deep ecology movement ('dype økologiske bevegelse') would in turn develop 'soft technology' with a shift to more decentralised communities and increasing self-regulation. Soft technology would mean that most people could understand the technical functioning of devices that were made in simpler ways and industrial production would be partially replaced by craftsmen. This contains some features related to of turning the wheel back to pre-modern society in the deep ecology school of thought. Also the centralised hierarchical power relations would be changed and fewer levels in administration and product chains would be adopted. People's values toward nature would become more respectful. (Næss 1976, 16-20, 99-115.)

German policy scientist Martin Jänicke (1988, 14-16) made a typology which was less dualistic and more praxis oriented than Næss' view. Redefining a distinction originating partly from Gerau, Jänicke introduced four strategies in environmental policy that form a continuum from reactive to anticipatory environmental policy:

- Remediation and the compensation of environmental problems ('Reparatur und Kompensation')
- Applying end-of-pipe technology ('Entsorgung')
- Ecological modernisation ('ökologische Modernisierung')
- Structural change ('Strukturveränderung')

Compensation means that the people suffering from environmental problems, *eg.* noise, forest decline, location of a waste site *etc.*, would get monetary compensation for the harm. Remediation in turn would mean returning the environment back to the state it used to be, *eg.* gathering oil spills. Applying end-of-pipe technology means, for example, desulphurising industrial plant exhaust gases and waste incineration. According to Jänicke, noise walls would also present this kind of environmental policy measure. Ecological modernisation in turn means that industrial processes and products would be designed in a way that is less harmful for the environment. This strategy would include more efficient energy and resource use, recycling and for example less noisy engines. The fourth strategy, structural change, means that environmentally more harmful production and consumption patterns would be restricted. There would be a clear change in human behaviour. Jänicke (1988, 15) mentioned energy saving, a low waste producing economy and change in the modal split as examples.

Jänicke's point in the first two reactive policy strategies was that production technology and consumption would be of the business as usual type and only measures that ameliorate the consequences of production and consumption would be taken into account. The anticipatory strategies aimed at deeper changes in the production and consumption

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processes. It is tempting to conclude that adopting the anticipatory strategies would be better for the environment, but Jänicke (1988, 16) stated that a mixture of the different strategies would prove to be most promising (see also Scimemi 1988, 28-29; Willamo 1997, 91-92).

Jänicke's work encouraged some environmental sociologists in Finland in the 1990's to further develop the categories of environmental policy (eg. Massa 1995, 12-17; Jokinen 1995; Sairinen 1996; 2000) and especially redefine the concept of ecological modernisation.¹⁶ The broadest distinction so far has been presented by Sairinen¹⁷ (1996, 28-38), whose six strategies included:

- Nature conservation ('luonnonsuojelu')
- Dilution of emissions ('päästöjen alueellinen ohjaus')
- End-of-pipe policy ('puhdistus- ja suodatinpolitiikka')
- Preventive environmental policy ('ennakoiva ympäristöpolitiikka')
- Ecological modernisation ('ekologinen modernisaatio')
- Ecological fundamentalism ('ekologinen fundamentalismi')

Nature conservation means that some parts of nature would be left free of economic activity. There is a clear connection to the so called dual models of economy, where some parts of nature are utilised strongly and other parts are left untouched. The dilution of emissions means that emissions are led as far as possible from the environmental type protected, for example by building higher chimneys for combustion gases or longer sewers offshore. Sairinen's end-of-pipe policy is synonymous with that of Jänicke's. (Sairinen 1996, 30-34.)

Preventive environmental policy in Sairinen's (1996, 30, 34-35) framework seems to mean the same as ecological modernisation in Jänicke's article, whereas ecological modernisation for Sairinen means a comprehensive societal strategy that would include the ecologisation of the whole of society and not just technology. It also includes some structural changes in production and consumption patterns as does Jänicke's concept 'structural change'. An ecological tax reform would be adopted and all the institutions of society would be reconsidered from the ecological point of view. Reflexivity would increase and society would have better control of its direction. (Sairinen 1996, 35-37.)

Ecological fundamentalism in Sairinen's typology seems to be similar to Næss' concept deep ecology. Sairinen (1996, 38) states that the main point of ecological fundamentalism is that the industrial form of production is regarded as the origin of environmental problems, whereas the point in the other strategies is to modify industrialism and the welfare state. He saw that ecological fundamentalism has two different subviews, one emphasising more participatory democracy (as in Næss) and another suggesting an eco-

¹⁶ Jänicke seemed to change his view on the relevance of this framework after empirical case studies conducted in the 1990's. Instead of further developing the categorisation presented here, he argues, the choice of instruments does not have a very crucial role in a successful environmental policy. According to him, even the choice of a strategy is not as important as the general setting of a policy situation that constituted of structural framework conditions, situative context, the structure of problems and the economic resources. (Jänicke 1997, 4-8.) The changes can also be seen in his and Weidner's texts, since they do not refer to this distinction in the analysis of the empirical cases (Jänicke and Weidner 1995; 1997). However, in this study the focus is on the strategies and the older framework is applied.

¹⁷ In addition to Jänicke's texts Sairinen (1996, 29) refers also to the works of Ekhart Hahn & Udo Simonis, Joseph Huber, Gert Spaargaren & Arthur Mol and Pekka Jokinen.

totalitarian system. Finnish fisherman and author Pentti Linkola (1986) has promoted the latter view, arguing for the material standard of living of the 1930's with the technology of the 1860's for Finland.

Sairinen left out the compensation of environmental problems as a strategy form and merged the concepts ecological modernisation and structural change presented by Jänicke. Sairinen also introduced the concept ecological fundamentalism as a more radical strategy, which in fact makes the chain back to Næss' distinction complete. Later he has withdrawn ecological fundamentalism from the typology (Sairinen 2000, 70-83), thus presenting merely a framework of temporal development than an analytical strategic continuum.

The merging of the concepts of ecological modernisation and structural change, or rather ecological structural change *i.e.* 'ökologische Strukturwandel', seems to be an important issue in the academic literature of ecological modernisation (Huber 1995, 60-69; Mol 1996). Sairinen shared the view of 'the father' of the concept Joseph Huber, who has argued against the suggested differences between them (Huber 1995, 60-69).

Huber's one example concerns traffic: one way to make the distinction is to regard an improvement in fuel efficiency as ecological modernisation and a shift in modal split as structural change. Huber (1995, 63) called this arbitrary categorisation which commits reductionist violence against the social scientific complexity of the concepts.¹⁸ The argument may be correct, however, it is irrelevant from the more empirical, and practical transport policy point of view. For example, improving fuel efficiency and modal split are indeed different kinds of environmental policies and they are hotly debated transport strategies (Peake 1994; Ewers 1996; Poppinga 1996; OECD 1997; Tengström 1999; Ministry of Transport... 1999c). Any relevant concept of environmental policy should reflect relevant environmental policy debates. If the meaning of the concept of ecological modernisation is pushed ever wider it will finally lose its capacity to discern entities and will become empty rhetoric similar to that of 'sustainable development' (Jokinen 1995, 331; McManus 1996, 53-54).¹⁹

Kaivo-oja (1999) presented another category of scenarios starting from the discussion of environmental and developmental economics, paying attention especially to the works of Stiglitz (1992, 250-252) and Karshenas (1994). He altered three macro factors between scenarios – potential economic output *per capita*, environmental stock *per capita* and equity in social policy. His distinction included a total of six scenarios:

- Deep ecology
- Strong sustainable development
- Weak sustainable development
- Boomsday
- Doomsday
- World Bank policy tunnel

¹⁸ Some promoters of ecological modernisation simply do not deal with the possibility of dividing the wider interpretation of ecological modernisation into structural change and narrow ecological modernisation although they recognise the problem of concept flexibility (*eg.* Weale 1993, 75-79.)

¹⁹ Jokinen (1995, 328-331) also presented an empirical case of the air pollution prevention debate in Finland that clearly indicated, that there are at least three types of environmental discourses. One seems to promote the business as usual industrial society, one can be considered to be in line with ecological modernisation and one with structural change.

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Kaivo-oja's deep ecology seems somewhat similar to Næss'.²⁰ Economic output per capita would decrease or stagnate whereas environmental stock per capita would increase strongly and society would become more equal. Strong sustainable development means that all the three factors would increase whereas in weak sustainable development equity would suffer. However, no examples that illustrate the concrete difference of the scenarios are presented. (Kaivo-oja 1999, 142-143.)

Boomsday means an economy with a strong output and the exploitation of the environment. At a certain turning point, however, there would be more money to invest for more environmentally sound technology and also the environmental stock per capita would increase. In other words, the Boomsday scenario follows the environmental Kuznets curve (see *eg.* Munasinghe 1996, 5-6; chapter 2.1). After a while, equity would also improve because there would be enough welfare to distribute. Doomsday in turn means that all the three factors would get worse: economic output would deteriorate as well as the environment and equity. Finally, the World Bank policy tunnel means a scenario where the exploitative phase of the boomsday scenario could be abated. The result would be environmentally stable moderate economic growth with a strong emphasis on equity. (Kaivo-oja 1999, 144-145.)

Compared to the other environmental policy typologies presented, Kaivo-oja's deep ecology equals approximately Næss' deep ecology and Sairinen's ecological fundamentalism. Boomsday can be understood as shallow ecology. The World Bank policy tunnel seems to be close to the idea of ecological modernisation presented by Jänicke. Strong sustainable development might be understood as structural change. Weak sustainable development seems to be a pessimistic view of the strong sustainability strategy, not a separate strategy. Doomsday is not included in the other categories, although it probably has been the unfortunate reference scenario in all environmental policies since Malthus.

Sustainable development includes a fairly slow economic growth in Kaivo-oja's framework. This differs from the sustainable development defined by the Brundtland Commission, namely more rapid economic growth in both industrial and developing countries than business as usual. As high as an annual 3% growth in GDP *per capita* was suggested for developing countries and a 3-4% total annual GDP growth for industrial countries by the Brundtland Commission. (Our Common... 1987, 49-52, 89-90, 169.) Although the figures presented are not exactly comparable this is much faster than business as usual. Between 1970-1994 the total Gross World Product (GWP) average annual growth was 2,8% and the world population increased from 3,8 billion to 5,7 billion, which made the average annual GWP per capita growth 1,1% (Brown *et al.* 1994, 99; UNEP 1998). It seems that the Brundtland commission view of sustainable development could best be characterised as a boomsday scenario (see also McManus 1996, 52).

²⁰ However, Kaivo-oja's (1999) and Karshenas' (1994) interpretation of deep ecology differs a little from Næss' interpretation of it. Næss (1976, 145-155) stated that the volume of economic output measured by GDP is an irrelevant factor considering the environment and from this point of view stopping the growth of GDP is not a goal nor a measure to achieve good quality environment. From the practical suggestions made by him, a stagnation or decrease of GDP in industrialised countries would be a probable consequence, though.

Parts of the typologies presented above are quite abstract. Also, the concept of ecological modernisation has contradictory meanings in Jänicke (1988) and Sairinen (1996). The operationalisation of the abstract concepts into practical policies seems to be a special task. An attempt to do that is presented in the next chapters.

3.1.3 Five Scenarios on the CO₂ Policy for Traffic: An Introduction

In this study, a typology of five theoretical scenarios of environmental policy applied to transport is used:

- Business as usual (BAU)
- Economic and technological optimism (ETO)
- Ecological modernisation (EMO)
- Structural change (SC)
- Deep ecology (DE)

The typology is adopted from the works of Næss (1976, 16-20, 99-115), Jänicke (1988, 14-16), Sairinen (1996, 28-38; 2000, 70-83), and Kaivo-oja (1999), as presented in the previous chapter and is supposed to describe the possible strategies in environmental policy. The typology is complemented with some aspects of Wilenius and Tirkkonen (1997) and Baker *et al.* (1997, 8-18) as well. It is used as an interpretative framework to analyse the response to climate change made by transport administration and transport policy interest groups. The hypothetical scenarios are elaborated as concretely as possible in order to be of operational relevance and they are illustratively projected onto the development of the three key indicators of GDP, road traffic volume and CO₂ emissions from road traffic in 1997-2025.

Business as usual describes the reference scenario, where little or no adjustment to the past policies is made. Economic and technological optimism describes a scenario where high economic and traffic volume growth rate is connected to fast technical development. In the Ecological modernisation scenario there is also some change in human behaviour and a modal split would be seen. The starting point of the structural change scenario is, that climate protection would require stopping traffic volume which could be accomplished with simultaneous high economic output. Deep ecology is a radical scenario, that would require great changes in Western life-style.

The scenarios form a gradient from the free-market based cornucopian environmentalism to the neo-Malthusian growth criticism. McManus (1996, 56) has posed relevant criticism of these kinds of linear typologies due to the failure to encompass the diversity of approaches.²¹ However, when making alternative scenarios, the scenarios should contribute holistic images of the future and include the same factors in order to be referential to each other (see *eg.* Wilson 1978, 226-227; Julien *et al.* 1979, 36, 43; Schwartz *et al.* 1982, 148; Rotmans 1998, 158-160).

All the scenarios except the business as usual are expected to meet the goals of the Kyoto protocol, where the EU15 countries committed themselves to reducing the CO₂ emissions

²¹ McManus (1996, 57-66) presented a typology of nine diverse approaches to sustainable development: Brundtland commission, free-market environmentalism, market interventionism, steady-state theory, smaller-scale advocacy, eco-feminism, eco-Marxism, 'mirror nature' and the constant natural capital stocks criterion.

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by 8% from the base year 1990 between 2008-2012. Finland has a target to maintain the 1990 level of CO₂ emissions in 2010, including the traffic sector as well (Ministry of Transport... 1999a, 1).

Although the basis of this study is qualitative and heuristic in nature, the theoretical scenarios are projected into a quantitatively measurable state. The figures presented are not based on mathematical model calculations but are merely illustrative examples of what the qualitative theories might mean in practise. Some figures of the key factors, such as the private car density, average annual car kilometres and traffic volume have been tested to maintain the internal consistency of the scenarios. The approach is rather unorthodox with regard to both quantitative and qualitative scenario building traditions but has a well-grounded rationale, which is explained in detail in chapter 4.3.2.

The exact curves were drawn manually by the researcher before the cluster analysis of the responses of the Delphi study in spring 1998, which makes them in principle independent from the data. It is of course possible, that pre-knowledge of the interest group views (*eg.* Malkki 1993) and Road Administration forecasts might have had influence on the drawing. This would bear a less crucial methodological aspect because the point is not to empirically test hypotheses, but to provide a framework for the interpretation of the results.

The key factors present an analytical but rather bare-boned sketch of the problematique of the relations between economy, traffic and environment in the different environmental policy strategies. Thus the analysis is extended to other factors as well in order to construct more holistic scenarios with reference to the strategies. The other factors are here called background factors. Their status is not that of independent variables in a formal statistical sense, rather they illustrate the totality of the discourse of a chosen environmental political school of thought extended to transport issues.

All of the scenarios have the assumptions of an ageing population and a stagnating population curve with practically no net increase in population²². This is the same assumption as the demographic forecast by Statistics Finland that was used in the Finnish Road Administration (FinnRA) national road traffic forecast for 1995-2020 (FinnRA 1995, 65). The business as usual scenario (BAU) is more thoroughly presented and argued than the other theoretical scenarios, because it represents a reference point for all the others. The BAU is framed in terms of FinnRA forecasts 1990 and 1995, thus it also reflects some of the study material. However, the FinnRA forecasts were not used when the future development of the key variables in the BAU scenario were drawn up. The formation of the theoretical scenarios was almost purely a heuristic exercise.

As Schwarz *et al.* (1982, 147-148) have written, the choice of the variables that are varied between different scenarios is crucial to the relevance of the scenarios. When making policy scenarios, at least part of the varied factors should be different kinds of policy measures. Major background factors that are altered between the scenarios in this study are as follows:

- the relation of material versus non-material production and consumption
- regional structure and urban structure
- transportation infrastructure

²² The figures used are 5.15 million in 1996, 5.3 million in 2015 and 5.2 million in 2025 (FinnRA 1995, 65).

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- technical development of vehicles
- fuel and vehicle taxation
- people's values

3.1.4 Business as Usual (BAU)

In the business as usual (BAU) scenario the future would reflect the past development of 1970-1996. The Finnish economy would be based fairly strongly on material growth, especially the metal and forest industry. As the economy would grow, people's income would increase and they would spend the extra money on, among other things, buying and driving more private cars. No significant new policies to restrict this trend would be used and no change in the prevailing individualistic human values is expected.²³ Only minor technical improvements concerning the CO₂ emissions of traffic would occur.

In this business as usual scenario, only the policy and the values of society are extrapolated, not the variables. Instead of pure mathematical extrapolation, a slight stagnation of the three curves would occur in the business as usual scenario. The CO₂ emissions trend would stagnate earlier and more clearly than the road traffic volume, which in turn would stagnate earlier and more clearly than GDP (Figure 3.2). Concerning traffic, the BAU scenario is framed by the baseline forecasts of the Finnish Road Administration (FinnRA 1990; 1995).²⁴

The stagnation needs explaining. The dip in the GDP curve of Finland in the early 1990's is regarded as a sign of a slight drop in the long term growth speed. Substantial explanation can be found in the collapse of Russian and some other Eastern European economies in the 1990's. It is also assumed, that the economic boom of Finland in the late 1980's was a sign of overheating. These assumptions are, of course, questionable and differ for example from the views presented by FinnRA (1995, 75). Adopting FinnRA forecasts for 1996-2020 and extrapolating it for 2020-25 would give the total growth of GDP approximately 100%.²⁵ Here a more moderate growth is expected, namely 80%, which equals an average 2% annual growth in real terms.

One important reason for the stagnation of road traffic volume is that the theoretical maximum of private car density is estimated to be 550-600 cars per 1000 inhabitants, because only 60% of the population are capable of driving a car (Roos and Altshuler *ref.* FinnRA 1990, 73; FinnRA 1995, 131). According to the baseline forecast of FinnRA (1995), the private car density would increase from 380 in 1996 to 510 cars in 2020 per

²³ Schafer and Victor (2000, 198) go as far as concluding that there is a "natural selection of modes" which inevitably will determine the switch to faster modes everywhere in the world.

²⁴ There are differences between FinnRA (1990, made in 1989) and FinnRA (1995) forecasts. The 1989 forecast was more growth oriented and suggested higher car density, 550 private cars per 1,000 inhabitants for 2010 whereas the 1995 forecast suggested 510 for 2020. The theory behind the forecast is more clearly explained in FinnRA (1990). The FinnRA (1995) forecast also contributed two alternative scenarios for the baseline scenario, namely a market oriented scenario and a sustainable growth scenario. The former is close to the ETO scenario presented in this paper and the latter seems to be located between the EMO and SC scenarios.

²⁵ This figure consists of 3.5% annual growth for 1995-2000, 3% for 2000-2005 and 2% for 2005-2020 and is applied from the forecasts produced by the Ministry of Treasury, VATT and ETLA (FinnRA 1995, 75).

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1000 inhabitants as more and more people can afford it due to economic growth (FinnRA 1995, 128-131; Ministry of Transport... 1999b, 85).

Even with a fairly steady growth of income and an even distribution of the additional income, the poorest quintile of households would have a high threshold for buying a car (FinnRA 1990, 54; FinnRA 1995, 131). The latter FinnRA (1995, 128) forecast suggested also that there is a fraction of people who do not want to own a car. The price of a car is relatively high in Finland compared to the other EU states, of which only Portugal and Denmark had higher prices in 1993 (FinnRA 1995, 83). This would probably limit the growth of car density as well. It is assumed that the private car density of Finland of approximately 540-560 cars per 1,000 inhabitants in 2025 would be compatible with the BAU scenario.

According to FinnRA (1995, 110-115) the average annual car kilometres would probably decline from the 19,000 km of the mid 1990's in Finland to the level of 18,000 km – current in the more automobilised countries. This development is questionable, because the declining rate of average annual car kilometres turned to a steady state in 1985-96 in Finland and even to growth in countries like Denmark, Netherlands and the USA (Figure 3.1). Thus, it is assumed that according to the business as usual policy and values the average annual car km would not decrease anymore. It might even rise a little, when the car density would come closer to the saturation level. A figure of 20,000 km is compatible with the road traffic volume in the BAU scenario.

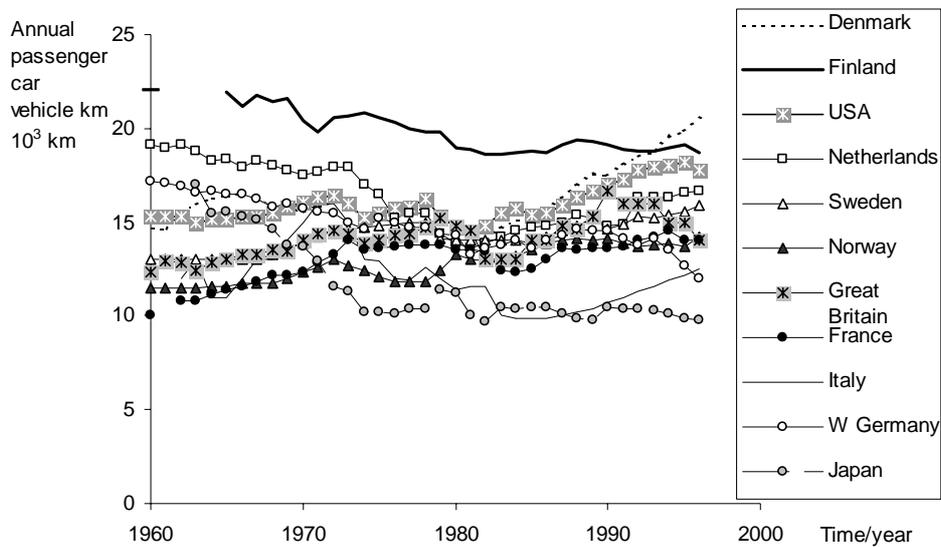


Figure 3.1 Average annual passenger car kilometres per vehicle in selected industrial countries 1960-96 (TRRL, IRF and VDA ref. Ministry of Transport... 1999b, appendix p. 22-23)

The CO₂ emissions per vehicle kilometre would decrease in the BAU scenario due to the improved efficiency of the engines and the stagnation of the growth of car weight. The impact of the technological development would be only slight because in the BAU scenario people would keep on buying cars with more engine power. On the goods

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transport side, smaller units would be transported just in time, which would prevent emissions per tonne km from decreasing. (FinnRA 1990, 69-70; FinnRA 1995, 75; Lampinen 1998; Banister 1998, 11-12.)

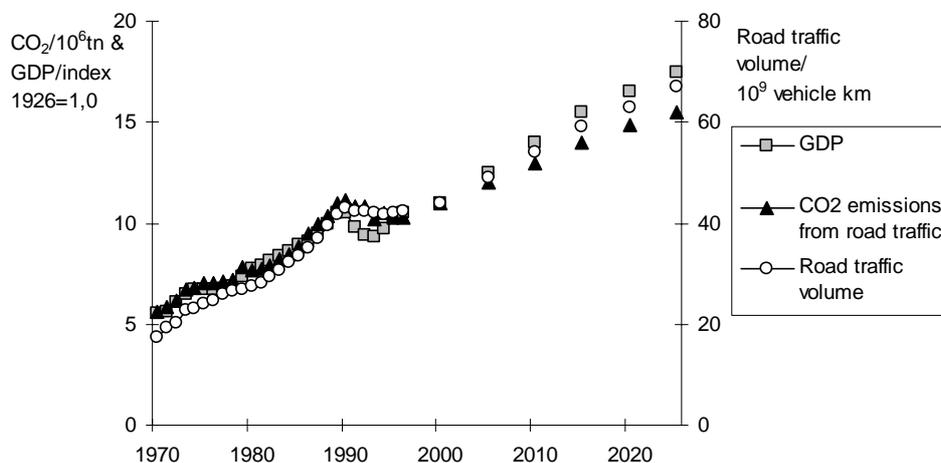


Figure 3.2 The volume of and CO₂ emissions from road traffic and GDP in Finland 1970-1996 and in the Business as Usual scenario for 1997-2025

The economic values and the values of freedom to move individually would dominate in the BAU scenario. Environmental values would not represent a significant role as the *laissez faire* approach to climate change is adopted. The future development of GDP, road traffic volume and CO₂ emissions from road traffic in the BAU scenario is illustrated in Figure 3.2.

3.1.5 Economic and Technological Optimism (ETO)

The economic and technological optimism (ETO) scenario is based on the idea that a high growth rate in the economy will accelerate the development and application of more environmentally sound technologies (Simon 1980; Kaivo-oja 1999, 143-144). GDP and road traffic volume would continue increasing as they have been doing in the past without any stagnation. The CO₂ emission curve would stay at the level of the 1990's and drop slightly at the end of the period (Figure 3.3).²⁶

Substantial arguments in the BAU scenario predicted a levelling off of road traffic volume. Furthermore, technology has been developed in the past already, but there has been no significant improvement in fuel efficiency. Why would it change in the future? There is room for other arguments as well, which claim that no stagnation of road traffic volume would occur and still CO₂ emissions from road traffic could be reduced.

One point criticises the expected saturation level of private car density. There could be demand for several cars per person for different purposes, e.g. a little car for commuting to work and a bigger car for longer holiday trips. Also, the senior citizens

²⁶ It is interesting that a fraction of less than 10% of the Danish respondents really regarded the environmental problems of car use as negligible (Jensen 1999, 29).

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of the future might be healthier and wealthier, enabling more of them to drive a car than is expected in the BAU scenario (Banister *et al.* 2000, 43).²⁷ Also, with the use of information technology the safety of ageing drivers could be better guaranteed. In the ETO scenario the private car density in Finland would rise to approximately 590-610 private cars per 1,000 inhabitants and the fraction of people not wanting a car would be more marginal than in the BAU scenario.

The computerised transport managing systems (telematics) would prevent traffic jams and improve the efficient use of road capacity, especially in goods transport but also in passenger traffic (*eg.* Rillings 1997; Svidén 1999). Also, more new lanes for motorways and major streets would be constructed than in the BAU scenario. This would probably increase travel speed and access to further places and therefore result in more average annual km per car. A figure of 22,000 km per car per year is assumed to describe the ETO scenario.

Technological development would produce better fuel efficiency in the ETO scenario. This is also encouraged politically by decreasing the taxes for buying a new car. A decrease in fuel consumption from the 8 l/100 km in 1996 to 5 l/100 km would take place in passenger cars with traditional combustion engines. Also, new technologies are an important part of the ETO scenario. As an indicator the market share of hybrid electric vehicles, electric cars and later on hydrogen cars would increase to approximately 20-30% in 2025 from the few vehicles in 1996. Similar ideas have been presented by Svidén (1999) and Wouk (1997).

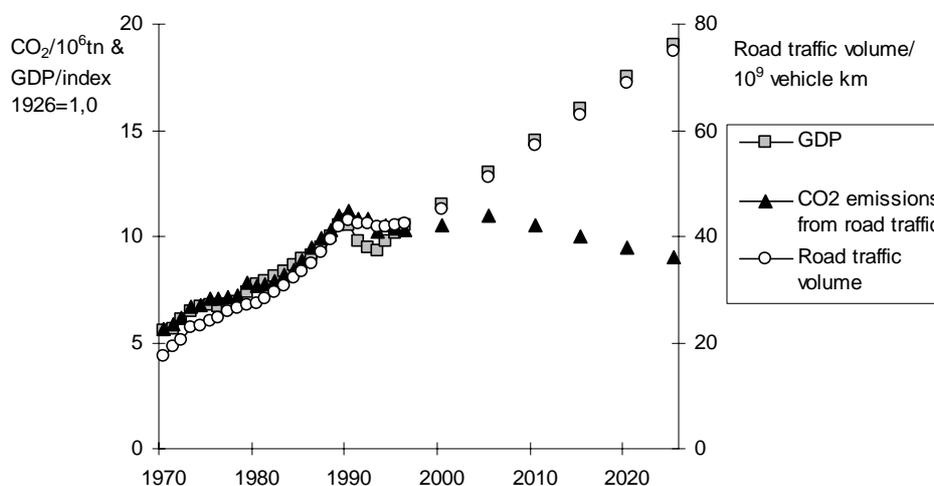


Figure 3.3 The Economic and Technological Optimism scenario

The urban structure would be more dispersed in the ETO scenario than in the BAU scenario. This is due to the mechanism that more people would want to live in single family homes than blocks of flats, which is difficult in densely populated areas. This in turn would be unfavourable for public transport, resulting in a reduction of its market share. (See Nijkamp *et al.* 1998, 38-39; Gillespie *et al.* 1998.)

²⁷ However, the analysis by Fowkes *et al.* (1998, 43) on UK data did not support this argument.

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The economic values and the values of freedom to move individually dominate in the ETO scenario, as well (see *eg.* Jensen 1999, 26). But there is a different, more respectful attitude towards the environment than in the BAU scenario, although the risk of climate change would not be taken very seriously.

3.1.6 Ecological Modernisation (EMO)

Ecological modernisation (EMO) is a difficult scenario to formulate in a concrete manner (Sairinen 1996, 18). Some features of it are clearer than others. The main point is that people's values would become more respectful towards the environment and the environmental impacts of all actions would be more carefully assessed by societal institutions as well as by individuals (Mol 1996). Technology would be more environmentally oriented in the EMO scenario than in the ETO scenario (Weale 1992, 75-76; Sagar 1995; Mol 1996, 316). In the ETO scenario the environmentally favourable qualities of new technology would be merely a by-product of the general developing process.

The growth of GDP would be similar to the BAU scenario. Because of the longer term profit horizon, GDP would grow slower than in the ETO scenario. This would probably slow down the rate of diffusion of new technology to the markets because the income rate would increase slower as well. A comparison of nine cost curve studies is made in the IPCC (2001c, 200) TAR which illustrates this point further.

The growth of the traffic volume would continue in the Ecological Modernisation scenario, but less steeply than the GDP and less steeply than the volume in the BAU scenario. This would be a consequence of a rising share of people planning their trips and using public transport, a point derived from Mol (1996, 318). The effect cannot be seen very dramatically in the road traffic volume because the modern individual lifestyle would still produce a lot of mobility (Berge *ref.* Tengström 1999, 216). Compatible to the ideas of ecological modernisation, the private car density would grow to the level of the BAU scenario, 540-560 private cars per 1,000 inhabitants, but the average annual car km would be a little less, approximately 18,000 km.

A change in production structure to a less material oriented production would result in a stagnation of the growth of tonne km in freight transport, but it would also result in increasing vehicle km because the units for transport would be smaller. Some of the freight would be transferred from road to rail due to environmental reasons, but the technical feasibility of rail to transport smaller units in a decentralised regional structure would be poor. Thus, the net substitution effect would only limit the growth of road transport measured by vehicle km.

CO₂ emissions would decrease slightly from the level of the 1990's in the EMO scenario. Although the average fuel consumption would be greater than in the ETO scenario due to longer vehicle life-cycles, the lower road traffic volume would produce less carbon dioxide. The net effect of these contradictory factors, compared to the ETO scenario, would be close to zero.

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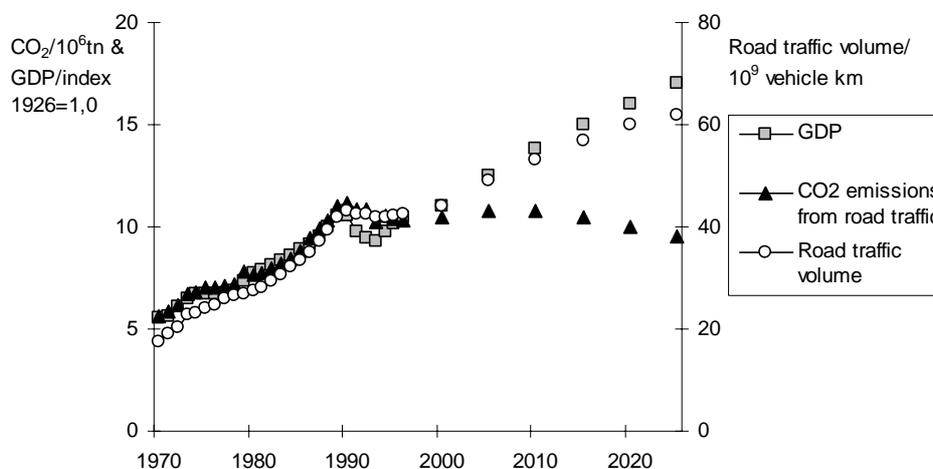


Figure 3.4: The Ecological Modernisation scenario

Telematics would play a major role in the EMO scenario as well – both in passenger traffic and goods transport. In addition to the ETO scenario, some actual physical traffic would be substituted by telecommunications. This would concern especially international air traffic but domestic road traffic as well. (Banister *et al.* 2000, 94-95.)

In the ecological modernisation scenario, there is a clear statement that economic, social and environmental values can be fulfilled at the same time (Mol 1996, 314). This is illustrated by the relationship of the key variables in Figure 3.4.

3.1.7 Structural Change (SC)

The structural change (SC) scenario starts from the idea that the material intensive production and consumption structures should be changed in order to achieve environmental sustainability (Jänicke 1988, 14-16). In passenger traffic that would clearly mean a modal shift from private cars and flights to bicycles, walking and surface public transport. As for freight transport, a change from road to rail and waterborne modes is expected. These starting points have an implication for urban infill, because a dense urban structure is more suitable for public transport than a sprawl area. The dense structure would also generate less traffic volume. (Eg. Goodwin 1998, 114; Nijkamp *et al.* 1998, 206; Tengström 1999, 205-207.)

As only the structure of the economy would be changed, a somewhat questionable assumption is made that the growth of the GDP would be similar to the EMO and BAU scenarios. The qualitative change would give no new burst to the economy in the SC scenario.

Although the total passenger traffic volume would still increase somewhat in the SC scenario, the road traffic volume would stay at the same level as in the 1990's. This would be a consequence of the required modal split. As for freight, the shift from road to rail would be a difficult one, because of the small units that would stem from the qualitative

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change in production (see Banister *et al.* 2000, 16). There would be less bulk to transport and more high-tech products. The centralised regional structure and dense urban structure would still probably offer some potential for trade-off (see 'Image I' scenario in Banister *et al.* 2000, 141).

As a consequence of the environmental emphasis on the development of technology, transport policy and individuals' choice of traffic mode, the CO₂ emissions of road traffic would be reduced significantly from the level of the 1990's.

In the SC scenario, telematics would play a minor role in passenger traffic, because the prevention of traffic jams by increasing the road capacity is seen to increase traffic volume in line with the constant travel time budget theory (see Mogridge 1997; Schafer 1998; Kitamura *et al.* 1999). In freight transport it would be applied more thoroughly. Several policy instruments would be adopted more strongly than in the EMO scenario in order to affect a real change in travel behaviour: fuel taxation, monetary and regulatory subsidies for surface public transport, parking restrictions for private cars, speed limits *etc.*

In more concrete terms, these factors are assumed to produce approximately 17,000 annual average private car km per year. The drop is not very great from the other scenarios described above, because the restrictive private car policy would raise the threshold of buying a car and less low-use cars would be bought. The private car density in Finland would thus be 440-460 private cars per 1000 inhabitants in the SC scenario.

In the structural change scenario, a contradiction is seen between increasing mobility and environmental values. There is a clear trust in the compatibility between economic and environmental values however (Figure 3.5).

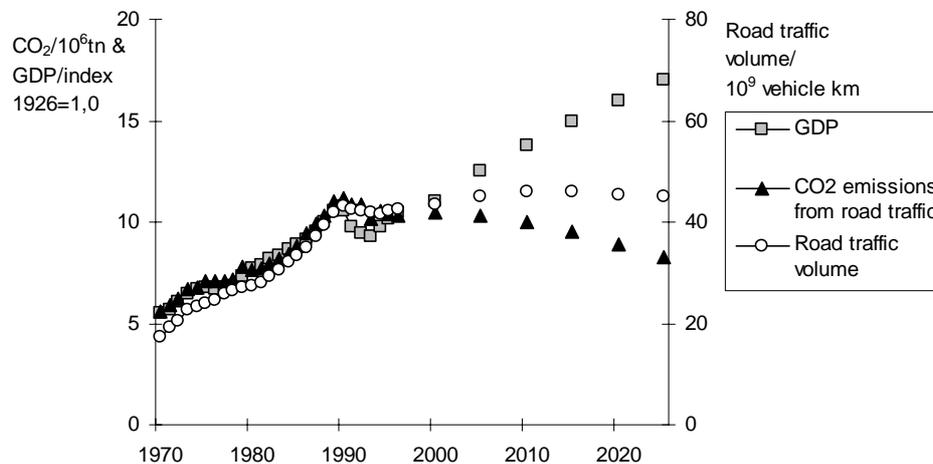


Figure 3.5 The Structural Change scenario

3.1.8 Deep Ecology (DE)

The background idea of the deep ecology (DE) scenario is that the growth of environmentally harmful ways of production and consumption should not only be stopped

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but even decreased in industrialised countries (Næss 1976, 16-20). As for passenger traffic, this would mean a drop in private car driving and flights. In freight transport this would mean some decrease of total tonne km and a clear decrease in road transport volume. (Tengström 1999, 207-210.)

A scenario like this would probably stop the growth of GDP as well although this was not the target for Næss (1976, 145-155). If an increasing share of people would value a simple life and social relations more than shopping for goods, it is assumed that there would be only minor GDP growth if any.

Road traffic volume would also decrease clearly. The justification for this goal is that there is little evidence of the success of the technical development in the past, concerning GDP, road traffic volume and the CO₂ emissions from road traffic (chapter 2.3; Nijkamp *et al.* 1998, 89-112).

As the income rate would not grow and might even decrease some, people would buy less new cars. In consequence, the car industry would have less profit to invest in improving technology and the car stock would get older. These factors would lead to a slower reduction rate of CO₂ emissions per vehicle km than in the previous scenarios. A clear change to car-sharing, smaller cars and 'eco-driving' would occur, though (Tengström 1999, 208-209). Thus, the total CO₂ emissions of road traffic would decrease faster than the road traffic volume.

In the DE scenario, the risk of climate change would be taken very seriously and it would include the idea that western countries have already exceeded the limits to growth. The reduction of road traffic volume would be achieved in part by increasing fuel taxes, but the main measures would be norms and physical changes – more streets would be closed off to private cars and stricter speed limits would be implemented than in the other scenarios. More emphasis would be placed on the surface public transport and on the infrastructure for bicycling. The passenger kilometres would drop slightly as well. (Tengström 1999, 207-210.)

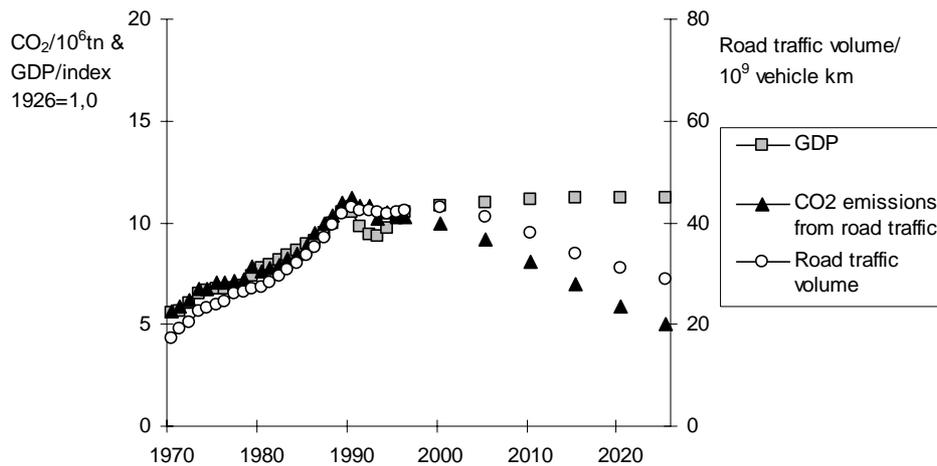


Figure 3.6 The Deep Ecology scenario

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As the DE scenario sees centralised systems as an important reason for environmental problems, a more decentralised form of living would be adopted (Næss 1976, 107-109). From the community criterion an emphasis of small towns and villages can be derived. Compact towns are more consistent with the goal of reducing car traffic than small villages and sprawl areas. Næss did not make this distinction, which is a possible pitfall of the scenario.

A figure of 370-390 private cars per 1,000 inhabitants is assumed in the DE scenario, which equals the car density of the mid 1990's in Finland. Decreasing the average annual car km to *circa* 15,000 km because of the calmer life-style, the high fuel prices and other policy measures favouring public transport would perhaps be compatible with the ideas presented above.

Some anti-modern features can be seen in the deep ecology scenario. Living a simple life is valued and economic growth is seen to be the principal cause for environmental problems. The distinction between material and non-material growth is not accepted because there is not enough evidence of non-material growth. Increasing mobility is not seen as increasing freedom but merely increasing the obligation to move. (Næss 1976; Tengström 1999.)

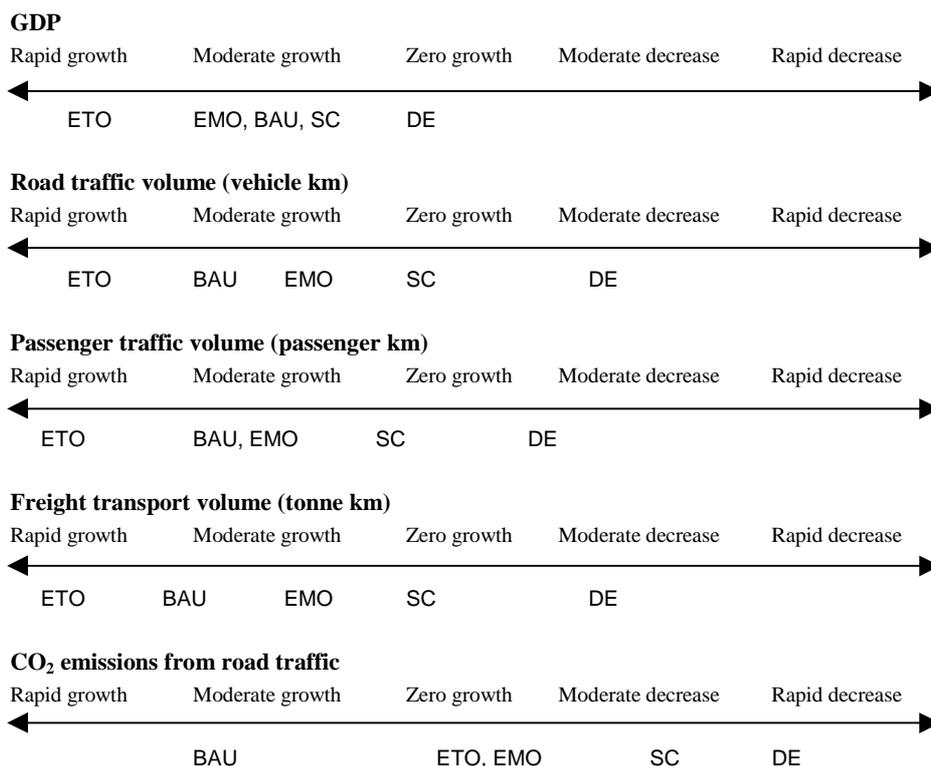


Figure 3.7 The positions of the scenarios in relation to the key factors (BAU=business as usual; ETO=economic and technological optimism; EMO=ecological modernisation; SC=structural change; DE=deep ecology)

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The characteristics of the substantial theoretical scenarios can be summarised into a set of continuums. The positions of the scenarios in relation to the key factors are illustrated in Figure 3.7 and the background factors in Figure 3.8. When interpreting the futures studies reports regarding transport administration and the transport policy interest groups in chapter 5, the main focus is on the three key variables, GDP, road traffic volume and the CO₂ emissions from road traffic. The other factors mentioned in figures 3.7 and 3.8 provide some helpful support for the analysis, however.

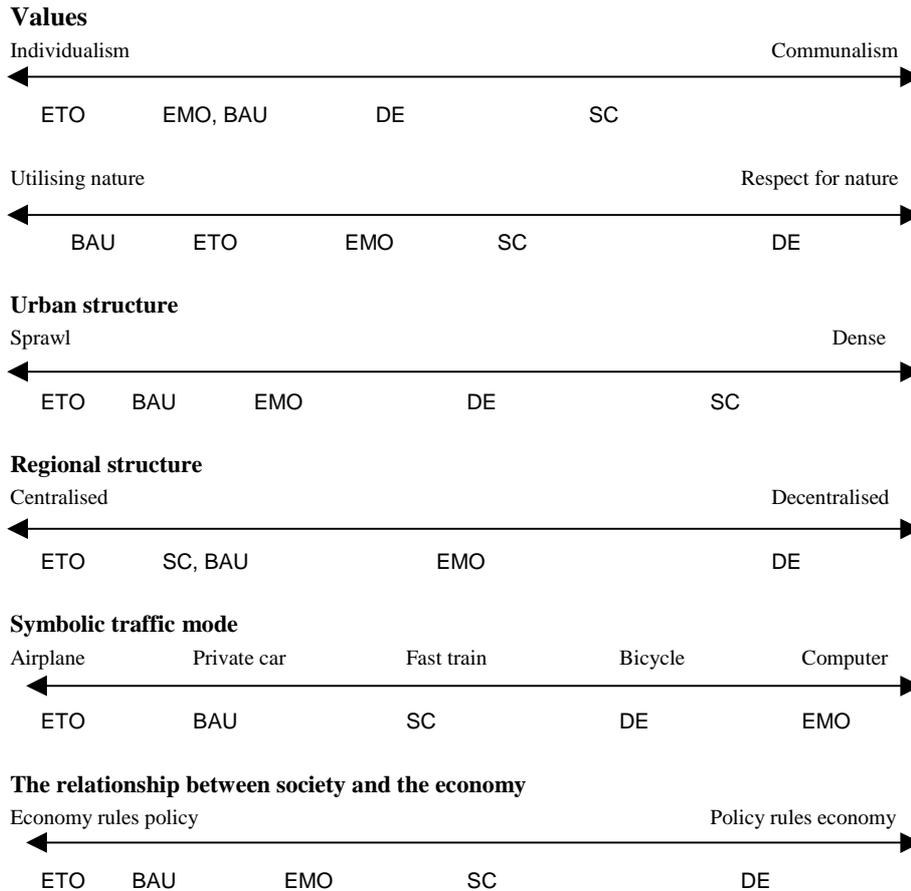


Figure 3.8 The positions of the scenarios in relation to the background factors (BAU=business as usual; ETO=economic and technological optimism; EMO=ecological modernisation; SC=structural change; DE=deep ecology)

3.2 Participation in Policy Making Processes in the Context of Futures Studies

The theory of the content of environmental policy strategies in the previous chapter consists of a typology of schools of thought and the same applies for the procedural theory. The procedural typology is formed mainly based on the discussions in the

domain of futures studies. It does not present a general description of schools of thought in futures studies but merely focuses on participation and the role of professional futurists in a policy making process. The typology will serve as a frame of reference in analysing participation in the futures studies of transport administration.

The typology of the theory of the content in the previous chapter was formed on the basis of a literature review of the discussion set in the domain of environmental policy, which then was applied to make a measurable continuum where the schools of thought were placed in relation to each other. The procedural theory in this chapter is formed the other way around: first a measurable continuum is formed based on logical analysis and then the formed schools of thought are given interpretations with reference to philosophical discussion and futures studies practices. The rationale behind this choice is that a review of the available typologies in the domain of futures studies did not produce a sufficiently detailed typology applicable to the empirical analysis (Article IV).

Dahl (1971, 98-101) detected a flood of typologies concerning political systems in the 1960's, when politology was in its rapid expanding phase. The lively discussion of typologies in environmental policy seems to have experienced this phase of typology flood in the 1980's and early 1990's (see chapter 3.1). Futures studies seems not to have entered an oversupply phase yet at least with regard to its application in decision-making.

3.2.1 Forming a Typology of Schools of Thought

The construction of the typology starts from breaking down long term planning and decision-making into three main phases:

- 1) formation of the alternatives (problem formulation, production of policy alternatives and forecasting the impacts of the alternatives),
- 2) evaluation of the alternatives,
- 3) making the decision.²⁸

Another point of interest is the roles of different actors involved in the process. The main actors involved in the process can be divided into three groups as well (see *eg.* Gál and Fric 1987, 679):

- a) decision-makers (politicians, managers, judges and other formal authorities are abbreviated "dec" in the following text),
- b) professionals (futurists, consultants, administrative officers, researchers and other content experts, abbreviated "pro" in the following text),
- c) the public (governmental and non-governmental interest groups as well as individual citizens and media, abbreviated "pub" in the following text).

²⁸ The distinction of the phases could be broken down into more phases as well, for example separating the first phase to problem formulation, production of alternatives and forecasting the impacts. Then the open space of logically possible schools of thought would be increased from 7^3 to 7^5 *i.e.* from 343 to 16 807 hypothetical schools of thought. Further distinction would hardly include important philosophical implications but would make the analysis too complicated to be illustrative.

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As any of the actor groups can be positioned in any phase alone or with any or all of the others, it follows that there are seven alternatives for each three phases. It also follows that there are $7^3=343$ logically possible schools of thought (see article IV for a more detailed presentation).

Cutting the Logical Possibility Space

Some criteria are needed to exclude the less relevant schools of thought, or rather the ones that are not of concern in this paper. Riner (1987, 318) provides one criterion in his continuum of “‘Softer’, more qualitative, synthetic” vs. “‘Harder’, more quantitative, analytical” objectives and methods in futures research. Another tool is adopted from Tapio (1996), namely the gradient from technocracy to citizen participation. These two continuities seem to converge rather than cross each other.

The line of samples from the logically open space can then be formed by starting from extreme technocracy (*pro – pro – pro*)²⁹ moving towards and including decision-makers and next the public. The other end of the continuum consists of extreme direct public participation (*pub – pub – pub*).

Theoretical Interpretations

There are obvious connections within the formed seven schools of thought about the roles of different actors in a long-term planning and decision making process to the epistemological, methodological and social philosophical debate found in futures research as well as philosophy. This discussion is next used as a framework for interpreting the above mentioned concrete ways of defining the roles of different actors in a long-term decision-making process. The role of (expert) knowledge and values in making policy recommendations is especially analysed. Aspects of planning theory are also added to the analysis to further define the approaches to participatory democracy. Some international experiments in transport futures studies are given as examples of how these schools of thought may be applied. The analysis is focused on the logical connections rather than the socio-historical context of the schools of thought which is important but beyond the scope of this thesis (see *eg.* Rubin 2000).

3.2.2 Comtean Positivism

In the first school of thought it is assumed that the whole decision making process will be carried out by professionals. The professional forms the alternatives, finds out the most probable one which is then implemented as a fact in the more detailed planning process. Implicitly, the professional has then also made the most important decision. The school can be presented in the abbreviated form of (*pro – pro – pro*).

²⁹ The abbreviations of type (*pro – pro – pro*) presented in this chapter mean that the first pro refers to the first phase of the process of formation of alternatives, the second to the phase of evaluation of the alternatives and the last pro to the phase of making the decision. If several actors participate in the same phase they are combined with an & mark, as in (*pro – pro&dec – dec*).

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The Comtean positivist philosophy would serve as the most adequate supporting argument for this rationale.³⁰ The main line of argument is that with sufficient research professionals will find out the invariances of society the same way natural scientists find out the laws of nature. In this way decision-makers can adapt to the natural laws of society. No value consideration or democracy is needed. (Comte 1974, 410-437, 459-473; Töttö 1996, 62-64).

Among futures researchers the positivist school of thought is often criticised but seldom defended and not even explicitly stated. However, numerous practises have been organised according to the positivist principle, such as the role of national and global transport and energy forecasts in various countries (Kraus 1987; Kokkarinen 1991; Batty 1994; Gühnemann and Rothengatter 1999; Schafer and Victor 2000). In transport futures studies the positivist school has faced increasing criticism in the last decade, often called a 'predict and provide' approach (Goodwin 1997; Banister *et al.* 2000; Höjer and Mattsson 2000).

The approach is similar to the concepts of probable by Amara (1981a), the technical interest of knowledge by Sandberg (1975), Slaughter (1982) and Mannermaa (1986), descriptive futures research by Mannermaa (1986; 1991), the predictive-empirical approach of Inayatullah (1990), extrapolation by Masini (1993) and positivism by Bell (1997) as described in article IV. Also the concept of prediction reasonability by Kuusi (1999, 116) includes a similar idea.

Comte himself did not favour statistics but direct empirical observations. However, his philosophy was imported to the United States by the logical positivists of the Vienna circle. It was then adopted to legitimise the American empiricistic tradition in the social sciences, which relied heavily on mathematical tools. (Turner 1992, 1510-1511). Thus trend extrapolation and other types of deterministic mathematical modelling have both historical and epistemological connections to Comte's thinking. Another connection to positivist futures research can be traced back to Rostowian unilinear developmental theory (Rostow 1960).

3.2.3 Optimistic Humanism

The second school of thought states that professionals formulate the possible alternatives and also evaluate the alternatives. The final decision-making is left to the decision-makers (*pro – pro – dec*).

This approach seems to have connections to the "critical realism" stated by Wendell Bell (1997a; 1997b). According to him futures researchers should not only outline possible alternatives but also assess which one of the alternatives is best (Bell 1997b, 1). The justification for this task is that values are supposed to be able to be evaluated objectively. Bell seems to think that (liberal) democracy is one of the objective values and therefore decision-makers are supposed to make the final decision (Bell 1997a, 236). This line of argument has one problem that Bell seems not to have solved yet: If

³⁰ Here Comtean positivism is meant rather than the logical positivist school of thought of the Vienna circle, which did not concentrate on making rules for making policy recommendations. Another well-argued source would be naturalistic value-objectivism which has been harshly criticised by Beck (1986, 31-32).

the goodness of a given alternative is already objectively assessed by the futurist what is left for the decision-maker to decide upon?

Not many practices of futures studies follow this school of thought. A tryout is Bell's own work in applying Keekok Lee's 'epistemic implication model' for the analysis of which future alternatives are truly good. Lee (1989) has made a program for social ethics based on a "naturalistic" and "rational" analysis of, and the conclusions from the laws of thermodynamics. Some applications of cost-benefit analysis might be regarded as practical tools for rational evaluation (see *eg.* Williams *et al.* 1999; Hayashi and Morisugi 2000).³¹ The rational planning doctrine in planning theory seems to strive for the same goal as well (*eg.* Friedmann 1973). Bell's approach seems unique with regard to the five other typologies reviewed in chapter 1, but this approach might have been connected to the predictive-empirical approach of Inayatullah (1990), the evolutionary futures research by Mannermaa (1991) and extrapolation approach of Masini (1993) (see article IV).

3.2.4 Pluralistic Humanism

In the third school of thought the professional forms the alternative futures, the decision-maker evaluates them with the help of the professional and the decision-maker chooses one alternative (*pro – dec & pro – dec*).

There is an interesting philosophical difference between this approach and the optimistic humanism described above as at least Malaska (2001) and Hietanen (2001) have noted recently. The approach implies that there are no objective values to conduct the evaluation. A connection can therefore be established with the Humean 'guillotine' i.e. values and knowledge ought to be separated and decisions cannot be made on the basis of knowledge alone (Hume 1989, 415, 457).³² Also Popper (1962, 378, 383-396) spoke for a more open society with less respect for authorities and criticised strongly historicism, i.e. determinism (Popper 1960)³³. von Wright (1983) has formed principles of deontic logic, "technical norms", that can be seen as a compatible basis for this school of thought. The purpose of applied scientists is then to analyse and produce means to certain ends, i.e. 'if you want to achieve that goal, you should take this kind of action'.³⁴

³¹ Cost-benefit analysis has also been criticised of anti-democratic features (*eg.* Nyborg and Spangen 2000).

³² Hume (1989, 415) declared: "Reason is, and ought only to be the slave of the passions, and can never pretend to any other office than to serve and obey them." Hume is maybe more famous for his promotion of *a posteriori* reasoning to *a priori* reasoning, i.e. being 'the father of empiricism', but this feature of his philosophy is not of primary concern here (see *eg.* Hume 1949, 42-50).

³³ We have the ideas of Popper and Bell in different categories although Bell explicitly states that his critical realism is in line with that of Popper's. The reason is that Bell is in favour of objective values that can and should be evaluated by the logical analysis of objective observable criteria. Popper (1962, 387-388) did claim in line with Bell that a policy discourse should not end by accepting different contradictory statements equally good, but a critical discussion should always be continued. But this is different to saying that one policy is objectively better than another. Popper (1962, 386) seems to emphasise an incremental process of trial and error rather than that of logical proof. This separation is not perfectly satisfactory, however.

³⁴ This idea could also be formed as '*pro – dec – dec*', but the forming of technical norms is partly evaluation and thus '*pro – pro & dec – dec*' seems more adequate.

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The idea is present in the 'what...if' approach in futures studies (Schwarz *et al.* 1982, 37-40)³⁵, or 'secondary forecasts' as de Jouvenel (1967, 55) called them. Scenarios are typically made for this purpose, where the futures researcher makes the scenarios and the decision-maker is supposed to choose one, or in some cases several. The French school of *la prospective* includes similar features as well (Godet 1986; de Jouvenel 1996, 7). In transport futures research the approach is manifested in the backcasting experiments which were increasingly used in the late 1990's (OECD 1997; Nijkamp *et al.* 1998; Banister *et al.* 2000). In these experiments the futurists themselves evaluated the scenarios, but based on explicit targets made by policy makers.

The approach is similar to Mannermaa's concept of scenario paradigm and almost similar to Amara's concept of the possible, Slaughter's practical interest of knowledge and Inayatullah's cultural-interpretative approach. In addition Masini's vision-oriented approach and Kuusi's (1999, 116-117) option reasonability seem to encompass this school as well (see article IV).

3.2.5 Polling Democracy

A step to a more participatory direction would be the scheme in which a professional forms the alternatives and the evaluation of the alternatives is based on, for example, the weighing of criteria by decision-makers and surveying public opinion. The form of the gathering data of opinions, say, by questionnaires or computer programmes is performed by the professional. The final decision is made by the decision-maker (*pro – pro&dec&pub – dec*).³⁶

The relationship between values and knowledge is similar to the pluralistic humanism described above. The emerging assumption in this paradigm is that maybe the parliamentary democratic system is reacting too slowly or in a biased way towards citizens' changing values and attitudes. That is why an inquiry into public opinion is needed to complement the contribution of the decision-maker (Coates 1996, 71; Tapio 1996, 466-468; Slaton and Becker 2000, 202-203)³⁷.

This approach is highly logical but the author is not aware of many empirical experiments made in the discipline of futures studies. Some public hearing procedures of the Environmental Impact Assessment (EIA) processes in the US as well as televoting might be understood as examples (Slaton and Becker 2000). Some decision analysis and risk assessment methods include the weighing of the consequences of the alternatives and calculating the subjective optimum alternative (*eg.* Buehring *et al.* 1978; Kamppinen *et al.* 1995, 57-78). In transport futures studies Nijkamp *et al.* (1998, 206) have made an experiment of this kind but the evaluators were transport experts instead of representatives of the public. It seems more common to measure public

³⁵ The 'what...if' concept includes other kinds of definitions. For example Ravetz (1997) defines it as an approach that focuses on highly uncertain impacts of an action which cannot be modelled or otherwise predicted, *i.e.* what if something goes wrong.

³⁶ Another way to form this school of thought could be '*pro – pro&pub – dec*', which would perhaps underline the polling aspect better.

³⁷ Coates (1996, 71) reminds us that poorly constructed polls are less worthy than no information at all.

attitudes towards specific transport policy measures than wider transport scenarios (eg. Lankinen 1995; Anderson *et al.* 1998).

This school of thought is on the borderline of Amara's possible, probable and preferable. Mannermaa's scenario paradigm, Inayatullah's cultural-interpretative epistemology and Masini's vision approach also encompass this school of thought. Furthermore Kuusi's (1999, 117) commitment reasonability includes similar features. However, it is difficult to determine whether it could be placed in Bell's category of critical realism because of the emphasis on 'what people *think* is right' instead of 'what *is* right'. (See article IV.)

3.2.6 Critical Pragmatism

In this approach the basic assumption of the professional's capacity to outline the 'real' possible alternative futures is abandoned. The professional is only helping decision-makers and the public to form alternatives, which they themselves consider relevant. The evaluation of the alternatives is made through public discussions between the decision-maker and the public and the final decision is made by the decision-maker (*pro&dec&pub – dec&pub – dec*).

The philosophical point is that the separation of knowledge and values is not seen as possible at least when forming recommendations. Because all knowledge relevant to decision-making is seen as theory-, interest- and value-laden, the division of labour in forming technical norms is not considered functional. Thus it is best to invite the public to the beginning of the process as well. The position has been suggested clearly at least by planning theorist John Forester (1993, 1-14, 24-35, 124-125) from whom the concept of critical pragmatism is adopted here. The approach combines the doctrines of pragmatist philosophy and critical theory. The goal of consensus is not adopted here. A package of acceptable rules of social discourse is usually recommended in the critical-pragmatist tradition such as the ideal communication³⁸ of Apel and Habermas (Habermas 1977, 38-40; 1981, 97-169; 1982, 369-452; Thompson 1982; Apel 1990).

This kind of approach has been practised quite often in futures research, for example in future workshops (Jungk and Müllert 1987; Dator 1996), scenario workshops (Meristö 1991) and visionary leadership (Malaska and Holstius 1999). Also the Delphi method can be applied in a way that supports such rules for argumentation (Turoff 1975, 88-89; Kuusi 1999, 83, 131-132; Article III). Recently Keskinen (1999, 248-252) has developed a model of 'porous decision making' emphasising organised public participation in the information society. The author is not aware of many applications of this kind in transport futures studies although increasing participation in transport planning has been seen as a goal in a number of publications (Valli 1998, 167-169; Banister 1998, 9; Camagni *et al.* 1999).

³⁸ Several concepts have been used in different stages to mean the rules of acceptable discourse developed by Apel and Habermas, such as the ideal speech act, undistorted communication, universal pragmatics and transcendental pragmatics. A closer analysis of the criteria and concepts is not of concern in this paper, however.

Of the typologies presented in Article IV, the school seems to be similar to Sandberg's, Slaughter's and Mannermaa's hermeneutic/practical interest of knowledge and Inayatullah's cultural-interpretative approach and falls under the category of Masini's vision approach and Kuusi's (1999, 117) commitment reasonability. It seems to be on the borderline of Bell's critical realism and post-positivism.

3.2.7 Relativistic Pragmatism

The next approach abandons the belief in the professional's capacity to organise the process of forming the alternative futures as well, and 'reduces' her/him to an ordinary citizen. Another way to put it is suggesting that, in a sense, all citizens are professionals concerning the decisions affecting their own life. The decision-maker and the public form the alternatives as well as evaluate them and the decision-maker makes the final decision (*dec&pub – dec&pub – dec*).

Philosophically the difference between this approach and the previous critical pragmatism can be understood as the difference between the positions of Jürgen Habermas (*eg.* 1981) and Richard Rorty (1980, 343-344, 377-389; 1982, 173-174). Habermas believes in a systematic organised discussion following the principles of the ideal speech act whereas Rorty believes in a relativistic non-systematic discussion, because he cannot find any universal truth in a rigorous process.³⁹ Rorty's influences come from Quine (*eg.* 1960, 23-25).

It is a little difficult to imagine examples for this school of thought in the futures studies domain, although self-organised futures workshops might serve as a case. Some methodological connections to this approach might be found in the methods of story-telling, purely heuristic scenario writing, communication camps and causal layered analysis (Inayatullah 1998; Viherä 1999, 351-352). In transport futures studies relativist pragmatism seems lacking at least in the academic domain but one might imagine it to be found in for example deciding on small local roads where there are no special needs nor an administrative capacity for expert futurists. This school of thought has qualities of Inayatullah's critical-post-structural approach, Masini's utopia, Sandberg's, Slaughter's and Mannermaa's emancipatory, Amara's preferable and Bell's post-positivism (see Article IV).

Relativism has been criticised as leading to nihilism by Popper (1962, 381-382) and later Bell (1997a, 236). They thought that if no moral position can be considered better than another people could act any way they pleased and might oppress each other without grounds. That line of thought is logically possible but not the only one. One might as well claim that because there are no generally approved criteria for goodness, we must have democratic society to decide upon what kind of laws and norms we need

³⁹ Calling this and the former school pragmatism has some problems, because the concept originates from Charles Sanders Peirce who was not a relativist but was in favour of the realist theory of objective truth (*eg.* Rescher 1977, 77-78; Niiniluoto 1987, 47-49; Peirce 1998, 353-357). The concept of pragmatism was made famous especially by William James, whose thinking included more relativistic subjective aspects and are of concern here (James 1916, 37-54; Niiniluoto 1987, 48-50).

to live in. In fact, the second view is usually promoted by relativists (Rorty 1980; 1982; Article I).⁴⁰

3.2.8 Democratic Anarchism

To complete the chain, in the last school of thought all the phases for outlining the alternatives, evaluating the alternatives and the final decision are made by the public. In other words direct public participation would occur and the situation could be termed anarchism or an ideal democratic civil society (*pub – pub – pub*).⁴¹

Philosophically, the last school of thought seems to present an extreme version of relativism, where anything goes as an argument because there cannot be any substantial nor procedural principles to guarantee a good decision. Some connections can be traced back to the thinking of Paul Feyerabend (1993, 18-19) who supported the ‘anything goes’ principle for all inquires. He also disfavoured argumentation rules and preferred an open process (Feyerabend 1993, 268-270). And, like Rorty above, he also insisted that his rule, or rather anti-rule, would lead to a more democratic society (Feyerabend 1993, 12, 251).

But is there a philosophical difference between this democratic anarchism and the former two pragmatist schools of thought? The extreme relativist anarchist school seems to include a metaphysical claim that reality itself includes many truths, not only different interpretations of one truth as the pragmatists argue (Feyerabend 1993, 270).⁴² There is no logical connection between the theory of truth and theories of participatory democracy, but this assumption makes the gradient complete from the strictest analytical positivist thinking to the loosest heuristic relativism. A second reason for the separation is Rorty’s argument against the ‘anything goes’ type of discourse (Rorty 1982, 166).

Extreme relativistic thought and anarchism can seldom be found in the texts of futures researchers. Some traces of it can be found in for example utopian texts,⁴³ science fiction literature and movies (see Wark 1996). Of the typologies reviewed in Article IV, Inayatullah’s critical-post-structural epistemology, Masini’s utopian approach and Bell’s post-positivism seem to be closest to these ideas and Amara’s preferable premise seems to encompass also the most radical version of relativism.

⁴⁰ Rorty (1982, 166-168) did not call himself a relativist because for him it was the name of the ‘anything goes’ principle.

⁴¹ Anarchism can be interpreted in two ways: First, it can be seen as an overly individualistic and egoistic enterprise. Second, it can be seen as a form of communicative civil society where social life-world has been emancipated from distorting institutions. The latter perspective is adopted here, hence the pre fix of ‘democratic’. Both views can be presented in the ‘*pub–pub–pub*’ form.

⁴² The position has connections to the Leibnizian metaphysics called “monadology”, as well (Leibniz 1985, 215-271).

⁴³ For example the utopia of ideal communism was meant to emancipate citizens from the “realm of necessity” by communally planning highly productive material production. The high productivity was supposed to result in the reduction of working hours and lead to the “realm of true freedom” *i.e.* leisure time reproduction (Marx 1972, 820). However, Marx’ epistemology was positivist, not extreme relativist. It is fair to note that also a more relativist and non-deterministic new left branch of Marxism developed in the 20th century (see *eg.* Haila and Levins 1992, 225-235, 241-242, 252).

3.2.9 Summary of the Typology

The purpose of this sub-chapter 3.2 was to form several schools of thought within futures studies as tools for policy-making. The different definitions of the role of professionals, decision-makers and the public was examined in a long-term planning and decision-making process. The logically possible space of schools of thought totalled 343 possibilities and the space was cut with a gradient from extreme technocracy to extreme public participation. Thus seven schools of thought were formed which were further connected to futures research practices (Table 3.1) and to typologies of futures studies paradigms presented through the work of the other reviewed authors (Table 3.2; Article IV).

Table 3.1: Seven paradigms for the roles of professionals, decision-makers and the public in a long-term decision-making process

Phase of process School of thought	Formation of alternative futures	Assessment of desirability	Final decision-making	Examples of methodological applications	
Comtean positivism	Professional	Professional	Professional	Deterministic models	 <i>Analytical, non-participatory</i> <i>Heuristic, participatory</i>
Optimistic humanism	Professional	Professional	Decision-maker	Epistemic implication model	
Pluralistic humanism	Professional	Professional & decision-maker	Decision-maker	What-if models	
Polling democracy	Professional	Professional & decision-maker & public	Decision-maker	What-if models including opinion polling	
Critical pragmatism	Professional & decision-maker & public	Decision-maker & public	Decision-maker	Future workshops	
Relativistic pragmatism	Decision-maker & public	Decision-maker & public	Decision-maker	Story telling, heuristic scenario writing	
Democratic anarchism	Public	Public	Public	Science fiction	

Finally, the seven schools of thought can be interpreted in the light of the philosophical discourse on the role of knowledge and values in making policy recommendations. Philosophically, the seven schools of thought seem to form a gradient from strict, analytical, deterministic, value- and knowledge objectivistic positivism to loose,

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interpretative, non-deterministic, value- and knowledge subjectivist relativism. (Table 3.3.)

Table 3.2: A meta-map of six typologies of futures studies paradigms in relation to the new typology: An analysis of the differences and similarities^a

	Amara 1981	Sandberg 1975 Slaughter 1982 Mannermaa 1986	Inayatullah 1991	Mannermaa 1991	Masini 1993	Bell 1997
Comtean positivism	Probable	Technical	Predictive- empirical	Descriptive	Extra- polation	Positivism
Optimistic humanism	Probable, possible & preferable	Technical	Predictive- empirical	Descriptive & Evolutionary	Extra- polation	Critical realism
Pluralistic humanism	Possible & preferable	Hermeneutic/ practical	Cultural- interpretative	Scenario paradigm	Vision	Critical realism
Polling democracy	Possible & preferable	Hermeneutic/ practical	Cultural- interpretative	Scenario paradigm & Evolutionary	Vision	Critical realism
Critical pragmatism	Preferable	Hermeneutic/ practical Emancipatory	Cultural- interpretative	Scenario paradigm & Evolutionary	Vision	Critical realism
Relativistic pragmatism	Preferable	Hermeneutic Emancipatory	Cultural- interpretative	Evolutionary	Utopia	Post- positivism
Democratic anarchism	Preferable	Emancipatory	Critical-post- structural	-	-	Post- Positivism

^a The connections relate only to questions about forming alternatives, evaluating the alternatives and making the decision as well as the views on knowledge and values in forming policy recommendations (see Tables 3.1 and 3.3). The six typologies present other characteristics which are outside the scope of the map, such as theories of change, a futurist's individual morals, theories of social development, perceptions of time *etc.* Thus, this table should not be regarded as a complete summary of the typologies of futures studies paradigms.

The two gradients from technocracy to citizen participation and from objectivism to relativism seem to have a tendency to converge. However, based on a closer analysis we have to conclude that this convergence is not inevitable. Different philosophical positions can lead to the same practical social conclusions and from the same philosophical starting points it is possible to end up with different practical conclusions. This happens because in order to establish the connection one must explicitly or implicitly also apply some other social premises. For example, extreme relativism can lead to nihilism or to democratic public participation, depending on the other premises (see Tapio and Hietanen 2001).

It is important to keep in mind that the new typology of schools of thought does not describe different schools of thought in applying futures studies in science but in policy making. The new typology can be used as a tool for the analysis of empirical policy

processes. In chapter 5.1, the framework will be applied to analyse the role of futures research in environmentally relevant transport planning in Finland. The disaggregative Delphi study is an example of critical pragmatism (chapters 4.2 and 5.2; Article III).

Table 3.3: The role and essence of knowledge and values in making policy recommendations within the different schools of thought

School of thought	Knowledge and values in policy recommendations
Comtean positivism	Recommendations are derived from objective knowledge, values are not needed.
-----	<i>---- the line between determinism and indeterminism ----</i>
Optimistic humanism	Recommendations are derived from objective knowledge and objective values.
-----	<i>---- the line between value objectivism and value relativism ----</i>
Pluralistic humanism	Recommendations are derived from objective knowledge and subjective values.
Polling democracy	Recommendations are derived from objective knowledge, including knowledge on subjective values.
-----	<i>---- the line between epistemological realism and relativism ----</i>
Critical pragmatism	Recommendations are derived from intersubjective knowledge and intersubjective values.
Relativistic pragmatism	Recommendations are derived from subjective knowledge and subjective values.
-----	<i>---- the line between argumentation and 'anything goes' ----</i>
Democratic anarchy	Recommendations cannot be derived at all because knowledge is biased and values are too subjective.

4 Methodological Questions

The theoretical framework presented in chapter 3 was used to make interpretations of the use of futures studies in transport administration (see chapter 5.1; article I) and the more participatory approach (see chapter 5.2; article II). A multifaceted methodological toolkit has been applied in this study to establish connections with the actual empirical world and the theoretical apparatus. The following two approaches were used:

- A qualitative content analysis of the literary planning and policy documents of transport administration was made and extended with comments from the futurists and to a lesser extent participatory observation (chapter 4.1).
- A two-rounded disaggregative application of the Delphi method where the first round material was gathered by a questionnaire and second via an interview. The quantitative material was grouped by a cluster analysis and qualitative arguments were attached to the clusters. (Chapter 4.2.)

The methods and materials are described in detail in articles I and III; the Delphi study questionnaire and the form of the interviews are attached as appendices I and II. In this summary I will point out the connections between the methods and the theoretical framework, some methodological characteristics and the problems of the approaches.

4.1 The Planning and Policy Documents of the Finnish Transport Administration

4.1.1 The Sampling and Description of Material

Three cases were sampled for the analysis of the role of futures studies in transport administration. All the cases were performed in 1989-1993.

- *Case 1: Road project Muurla-Lohjanharju.* The Muurla-Lohjanharju case dealt with planning motorway connections between Helsinki, the capital, and Turku, a major city in south-western Finland. There were environmental conflicts in Lohja, a town along the planned route. To react to the citizens' movement, the Finnish Road Administration (FinnRA) experimented with *positional analysis* (see Söderbaum 1986; 1992; Lehtonen 1991) in planning and organising citizen participation.
- *Case 2: Road project Pasilanväylä.* The Pasilanväylä case dealt with planning an urban motorway in Helsinki. A private consultancy group organised an exceptionally cautious participatory planning process with several public hearings, three opinion polls and public debate between 1991-1993. The consultant who made the futures study was also in charge of the more detailed technical planning on the basis of the process if the project had been carried out.
- *Case 3: TIE 2010 policy.* The Traffic and Automobile Stock Forecast 1989-2010 (PALA 89) was made for a national road network policy TIE 2010, and its results were used in many major projects in the early 1990's, eg. the car density assumption in the Pasilanväylä case. The work of PALA 89 was conducted in the Research Centre of FinnRA whereas the TIE 2010 policy included broader participation within FinnRA.

The analysed primary documents are summarised in appendix I because this information is not available in article I. The documents represent reports from futures

studies and the more general planning documents, in which the results are applied. The primary documents make up approximately 700 pages. Two secondary sources are also used in cases 1 (Lehtonen, 1991) and 2 (Ajomaa *et al.* 1993) shedding light on the wider participation issues.

The three cases represent best practise within FinnRA at the beginning of the 1990's in terms of citizen participation and technical know-how in transport engineering. The cases were chosen together with the other members of the research group and road administration officers. The availability of the secondary sources was an important sampling criterion. Because the cases were not sampled randomly the average planning practices of FinnRA could be organised in a more arbitrary, explicitly interest-laden or less sophisticated way.

4.1.2 Qualitative Content Analysis

The planning and policy documents of Finnish transport administration are analysed by qualitative content analysis According to Lindkvist (1981, 37) there are six different roles the researcher can play when analysing texts, slightly modified here:

- 1) Immanent presentation with the intention to let the text speak for itself,
- 2) analysing the text in order to uncover elements of the text in relation to external theoretical factors,
- 3) an objective presentation aiming at neutralising emotive meaning,
- 4) immanent criticism focusing on inconsistency in the text,
- 5) developing interpretations to make the text better and,
- 6) a textual criticism with a point of departure in the conceptions and questioning of other systems.

Lindkvist (1981, 37) stated that content analysis is mainly concerned about the first three roles and regards the last three prohibited. In this study the qualities of the planning documents are approached with the roles of 2 and 3.⁴⁴ This is made in order to observe the real substance and process of the practise of futures studies in transport administration through the text, instead of rhetorical claims for *e.g.* sustainable development.⁴⁵ The content analysis is made using nine questions inspired by the works of Amara (1981a), Schwarz *et al.* (1982) and Julien *et al.* (1979). The questions and their connections to the theoretical discussion in chapter 3 are dealt with in the following section. The method focuses more on the procedure and less on the content, which was pinned down to measurable figures already in the theoretical chapter 3.1.

⁴⁴ Lindkvist restricts the concept of content analysis to quantitative analysis, focusing on the mass media, but there is no reason to limit the approach to this narrow definition (see Rosengren 1981).

⁴⁵ If the planning documents state for example that a wide range of future alternatives are dealt with but the variation will in fact be within one theoretical scenario presented in chapter 3.1, it will be concluded contrary to the document that a narrow range of future alternatives is dealt with. An immanent discourse analysis might only emphasise what the text producer wishes (see Leskinen 1994). However the contents of the documents are taken seriously instead of, for example, interpreting them with the as critical as possible or *ut diabolus bibliam* (like the devil reads the bible) principle (see Töttö 1997, 46-47).

The method

- 1) *How is the method chosen?* The first question enquires about the kind of method chosen and how the choice is made. The traditional debate has concerned itself with qualitative vs quantitative methods. A more relevant point seems to be whether the choice of the method is questioned or not (Schwarz *et al.* 1982, 1, 138). Any change in purposeful action requires the questioning of existing methods of action.
- 2) *What is the ontological structure of the method?* The second question focuses on the ontological structure of the method – are the different parts of the method closed or is there feedback between them? (Julien *et al.* 1979, 124-125; Schwarz *et al.* 1982, 134). Philosophically, the question focuses on the debate between Cartesian atomism and Aristotelian holism (von Wright 1986, 48-50). From an environmental policy point of view the question focuses on whether environmental problems pose a challenge to existing production structures, as in the SC scenario, or if they can be solved by technical measures as in the ETO scenario (see chapter 3.1).
- 3) *How are the explanatory factors chosen?* The third question defines the in-built role of decision making in the method. If all the explanatory factors are external to decision-making, decisions are expected to have no effect on the development (Schwarz *et al.* 1982, 147-148). Philosophically this point focuses on the debate between determinism and indeterminism and determinism would imply comtean positivism (see chapter 3.2).

The use of the method

- 4) *How is the development of the explanatory factors chosen?* The answers to the fourth question tell us whether the accepted trends of the explanatory factors question the current business as usual trends or not (see chapter 3.1). They also clarify what kinds of trends are taken for granted and what factors are altered. The question seems to be similar to question three, but this question highlights the distinction between a method and its use. (Schwarz *et al.* 1982, 147-148).
- 5) *How many policy alternatives are there?* The fifth question focuses on the number of different policy alternatives, not the alternatives in general. If there are alternatives, are the altered explanatory factors external or internal to decision making? (Schwarz *et al.* 1982, 117, 147).
- 6) *Who chooses the alternatives?* The sixth question attempts to discover who formulates the relevant alternatives. Is it regarded as a task for professionals or is it a matter of broader participation? (see chapter 3.2) For example the school of pluralist humanism suggests that this is the task of value conscious professionals who should make explicit the kinds of values involved in the alternatives (Amara 1981b, 68; Schwarz *et al.* 1982, 148, 154-155). The question discerns pluralistic humanism and polling democracy from critical pragmatism and the latter schools.
- 7) *To what extent do environmental problems affect the choice of the development of the explanatory factors and the formulation of alternatives?* The seventh question provides a picture of how environmental problems affect the future development of the explanatory factors and the formulation of the alternatives. Are they seen as being like any other factor whose explanatory influence should be tested

statistically with historical data, as is the case in business as usual forecasting and comtean positivism? Or are they regarded as possibly important policy arguments whose significance in people's minds should be voiced through an opinion poll as in the school of polling democracy? Or are they regarded as policy arguments whose significance should be clarified in a systematic (critical pragmatism) or unsystematic (relativistic pragmatism) participation process? (See Leskinen and Valve 1991, 19; chapter 3.2.)

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- 8) *What is the attitude to the results of futures studies?* The eighth question deals with the in-built 'attitude' of the planning and decision making process towards the results of futures studies (Schwarz *et al.* 1982, 124-125). Are the results treated as empirical facts as in comtean positivism and optimistic humanism? Or are the alternatives viewed as objective and reliable but the choice between the alternatives as value-laden as in pluralistic humanism? Or are both the formation of alternatives and the choice between them considered interest-, theory and value-laden as in the schools of critical pragmatism and relativistic pragmatism? Or are all results produced by the futures study seen as overly subjective and even arbitrary as in democratic anarchism?
- 9) *By whom, how and when are political decisions made?* The ninth question attempts to find the actual decision-maker in the whole process (Amara 1981b, 67). Are essential decisions made explicitly or implicitly? Is decision-making viewed as the task of professionals or politicians or do citizens have access to the process as well?

4.1.3 Do Planning Documents Reveal the Actual Planning Process?

When focusing on planning documents a question can be raised, if the focus distorts the results? Is the actual planning process in fact made differently as the documented one? The phenomenon has been detected at least by Sayer (1984) and Salminen (1992, 100-101) in his analysis of the bilateral developmental aid from the Ministry of Foreign Affairs. Foreign affairs include more classified material but it is possible to have the problem in domestic road administration as well. Two methods attempt to avoid this situation by collecting comments from the futurists in the cases and using secondary material provided by Lehtonen (1991) and Ajomaa *et al.* (1993).

The results of the methods and their use were first published in Finnish (Tapio 1992). The draft of the analysis was sent to the futurists employed in the cases, who commented on the draft and corrected some misinterpretations of the literary study material. An error was made that the discussions with the futures researchers were not documented and therefore cannot be used as primary study material. However, it can be said that the analysis did not represent the views of the futurists themselves in all cases. Although the analysis was rather critical in terms of its substance and semantics it was published by FinnRA.

The obvious reason for the counter criticism of the study was the evaluative criticism posed to the work of the futurists themselves. Probably also there was the conflict of

schools of thought between comtean positivism and the more participatory approach of pluralist humanism and critical pragmatism promoted in the evaluation of one of the cases. But it is also possible that the planning documents do not report the actual process (see Tengström 1999, 18-19). When similar studies will be made in the future, documented interviews with the planners and some other participants are essential. But there is also a normative aspect: it is reasonable to suggest that the planning documents should reflect the actual process.

4.1.4 The Problems and Benefits of Cross-Cut Sampling

The cross-cut sampling method was applied where one phase of the cases was scrutinised. It gives a clear and rather precise picture of where the research object was at the time of the sample but gives no idea where it came from nor where it proceeded afterwards (see Schwarz *et al.* 1982, 149-151). The road projects have evolved through the decades in different phases in cases 1 (Lehtonen 1991; Kaskinen 1998) and 2 (Ajomaa *et al.* 1993) and it could be concluded that as long as a road's construction has not begun the discussion and planning of it will go on.

It would also be interesting to observe some temporal development of national futures studies to see if they evolve over time. Therefore, the material collected at the beginning of the 1990's could be complemented with reference to recent developments in the late 1990's regarding futures studies in Finnish transport administration in chapter 5.1. The extra material is a rather weak signal of change because no actual concrete project level planning documents are analysed.

4.2 A Disaggregative Delphi Study Based on Transport Interest Groups

4.2.1 The Sampling and Description of Material

An example of a more participatory process following the school of critical pragmatism was experimented with in the Delphi study. The purpose of the application was to produce alternative scenarios, which would be relevant from the point of view of the interest groups of transport and environmental policy.

The Delphi method is traditionally regarded as a last resort method where individual experts make estimates of the probable future when precise models are lacking, a multitude of views is present or a change in the phenomenon under study is intuitively expected. (Linstone and Turoff 1975, 4; Riggs 1983, 90; Rowe *et al.* 1991, 236-237; Ziglio 1996, 3-4; Rotondi and Gustafsson 1996, 39-40; Mannermaa 1999, 149). A multitude of views and an anticipated change is particularly present in the climate policy of transport at all societal levels (OECD 1997; Ministry of Transport 1999a; IEA 2000; Banister *et al.* 2000).

The Delphi method is an iterative process consisting of at least two rounds and the purpose between the rounds is to give panellists feedback from the previous rounds. The rounds are usually given anonymously in order to avoid the background

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organisation having effect on the plausibility of a statement. The ideal is that the best argument should win and in traditional Delphi a consensus would be regarded a success. (Linstone and Turoff 1975; Ziglio 1996, 3-6; Mannerman 1999, 149.)

This study focuses on three key variables, namely GDP, road traffic volume and CO₂ emissions from road traffic for 1997-2025 (see chapter 1.3.3). Instead of individual experts the interest group views on the probable and preferable development of the three variables are asked for. Instead of one consensual future a set of scenarios are supposed to be built based on the quantitative statements and qualitative arguments supporting the statements. (See Article III.)

Delphi critique often remarks that in applications little effort is put into the reliable selection of the panelists (Sackman 1975, 20-23; Hill and Fowles 1975, 182; Linstone 1975, 582-583). The often used co-nomination tends to result in a biased sample, because experts apparently co-nominate colleagues that represent similar schools of thought. Cuhls (2000) suggested that co-nomination is a good start, but certain basic background factors, such as sex, age and professional background, should be checked before the Delphi manager can safely stop looking for new panellists. She also suggested the scanning of publications, institutions and public databases relevant to the study object to get reliable samples. For example, the panel of a recent Delphi study "The Future of Mobility" consisted of 96% men, only 14% of whom were under 40-years old (Karmasin and Karmasin 1999, 68, 70). Similar rates seem to be typical (see Kuusi 1999, 82.)

The Delphi panellists were selected in a somewhat unusual way. Instead of individual experts, the participants were representatives of fourteen interest groups that have an interest in the transport and environmental policy of Finland. Relevant administrative offices of transport and the environment were approached as well as the lobbying groups of different transport modes, plus groups that have an economic or ideological interest on transport issues. The organisations represented the following categories:

- Traffic administration
 - Ministry of Transport and Communications
 - Rail Administration
 - Road Administration
- Environmental administration
 - Ministry of the Environment
- Local administration
 - Helsinki Metropolitan Area Council/Transportation Department (manager's own view)
- Lobbying groups of different traffic modes
 - Bus Transport Federation (bus transport),
 - Automobile and Touring Club of Finland (passenger car users),
 - Traffic League (surface public transport and soft modes),
 - Traffic Policy Association Majority (soft modes)
- Other groups with economic interest
 - The Confederation of Finnish Industry and Employers (interest in freight transport),
 - Finnish Oil and Gas Federation (interest in fuel production, manager's own view),
 - Finnish Road Association (road construction),
 - Transport Workers' Federation (trade union for eg. road haulage drivers and bus drivers)
- Environmental group
 - Dodo-The Living Nature of the Future (a group of young students)

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The Ministry of the Treasury, the car import organisation and an older environmental group the Finnish Nature Conservation Federation dropped out in the first round because of lack of time and/or a feeling that their views would be presented by some of the other panellists. Water and air transport related interest groups were not involved, because for geographical reasons they do not often compete with road traffic in Finland. The lack of an air transport interest group can be considered slightly biased.

The categories of science, politics, mass media and legislation are not represented, politics because of probable severe biases in small samples and the others because they are not actively involved in the ordinary committee work of transport politics.⁴⁶ The disaggregative Delphi method is supposed to provide a novel approach between committee work and expert polling in which the future of transport will be a systematically discussed and new visions for future will be outlined to enrich the argumentation basis (see Cuhls 1998, 19-20). The approach is an example of option reasonability in Kuusi's (1999, 125) framework.

The representatives of the organisations were sampled systematically by making a phone call to the operational top managers of the organisations. After that the organisation was free to work in its own way to appoint a representative or representatives. Some managers participated themselves whereas some delegated the task to their subordinates, who were phone-called as well. Three organisations appointed two representatives and some of the other respondents may have asked their colleagues or bosses for a second opinion.

The representatives of three other organisations changed between the rounds, one because of a lack of personal familiarity to quantitative approach, one because of retirement and one because of a change of employer. The change of opinion of these three organisations between the rounds was not different from the other organisations. The respondents were asked for their organisation's view on the most probable and the most preferable future. This is in line with the Policy Delphi applications (Turoff 1975, 87; Ziglio 1996, 7-8; Turoff and Hiltz 1996, 65-66).

4.2.2 What is the View of an Organisation?

Anonymity is usually maintained among Delphi panellists in order to bring out more honest views without having to be afraid to lose face or a job. On the other hand, individuality and anonymity have been claimed to be reasons for the lack of commitment consequently resulting in high dropout rates, scarce written arguments and hasty "snap-judgments" instead of cautious consideration and a thorough analysis of the issue (Goldschmidt 1975, 45-48, 52-54; Webler *et al.* 1991). One solution worth a try could be to ask the panellists to act as representatives of their organisations instead of as individual experts. The author has not seen references suggesting this. In this study organisational representation was experimented with, mainly because the application was designed to improve the process of typical committee work where participants do represent their organisations.

⁴⁶ A comprehensive list of societal systems could include politics, administration, legislation, science, religion, economy, mass media and social activism (see Tapio and Willamo 2001, 12).

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Focusing on the organisations instead of individuals brought out interesting features. Some representatives protested that their organisation did not have official quantitative statements on the carbon dioxide emissions of road traffic or GDP. They were told that no official declaration was asked for, merely well argued estimates and evaluations. This sufficed for most participants but two managers admitted only to representing their own views instead of the organisation's. Some respondents complained that their own view differs from what they regarded as the organisation's view. In these cases the organisation's view was asked for anyway.

It was not the focus of the study to analyse the average opinion of an organisation. It might differ significantly from the organisation's opinion, because organisation is something other than just a sum of its individuals. There seemed to be a gender based selection in the organisations, since only two women as opposed to twelve men were gathered by this method.

4.2.3 Disaggregative Policy Delphi

Applications of Delphi have been criticised for ignoring and not exploring disagreements, which could generate artificial consensus (Hill and Fowles 1975, 184; Linstone and Turoff 1975, 6; Turoff 1975, 84; Sackman 1975, 48-52). In this study, the goal of achieving consensus between the participants was not adopted. Instead, a set of alternative long-term traffic and environmental policy scenarios were produced.

This type of non-consensual, or disaggregative, Delphi has been applied already in the 1970's (Schwarz *et al.* 1982, 13; Preble 1983, 85). In addition, consensus seemed to be a rather unimportant goal in the large national technology foresight studies conducted via Delphi in the 1990's (Kuusi 1999, 231; the conclusion is less clear reading Blindt *et al.* 1999). Arguments for a more disaggregative Delphi have been stated by other Delphi users as well (*eg.* Turoff and Hiltz 1996, 77-79; Wilenius and Tirkkonen 1997).

The central characteristics of the traditional and the disaggregative Delphi are gathered in table 4.1. The table includes other special features of this study in relation to traditional Delphi as well. Traditional Delphi can be considered an example of Comtean positivism whereas this study is an example of critical pragmatism in terms of the typology of the procedural theory (chapter 3.2).

The answers of the three key variables, GDP, road traffic volume and the CO₂ emissions from road traffic, were grouped by cluster analysis. The idea of using cluster analysis in Delphi studies has been presented at least by Turoff and Hiltz (1996, 72). Clustering methods do not require random sampling unless they are used in verifying a theory, because they can be understood only as tools to group similar cases together (Dubey and Jain 1979, 238; Milligan 1998, 121).

The choice of the hierarchical clustering method is an exhaustively discussed topic in the literature of classification. The deeper one gets into this discussion, the less agreeable criteria one gets. There have been a number of validation studies on artificial data sets, where the true number of clusters is known. Then the different methods have been used and the recovery percentage of the methods compared (Milligan 1996). The only obvious

agreement seems to be, that the nearest neighbour (*i.e.* single linkage) method should not be used unless the clusters are supposedly of chain shape (Henrion *et al.* 1988, 36-71; Milligan 1996, 357-358).

Table 4.1: The Comparison of traditional Delphi and disaggregative Delphi and the additional characteristics of this study

Feature	Traditional Delphi	Disaggregative Delphi
Similarities		
Ideal	The best argument wins	
Transparency	Anonymity of arguments	
Iterativity	Multiple rounds	
Differences		
Philosophy	Consensus	Dissensus
Goal	Accurate prediction	Alternative scenarios
Feedback	Median and interquartiles	All responses and key arguments
Statistical test	Eg. Analysis of variance between rounds	Eg. Cluster analysis
Additional features of this study		
Case	Individual professional	Interest group
Transparency after the study	Anonymity is retained also after the Delphi rounds	Anonymity is limited to the argument phase
Form of data	Questionnaire	Questionnaire and interview

Henrion *et al.* (1988, 71) went as far as suggesting running the analysis with all available clustering methods and pick up the one that makes sense. From the standard Popperian deductionist point of view adopted in statistical science, this would be circular reasoning (Popper 1969, 3-21). But from the more Newtonian inductionist point of view adopted in many technical and qualitatively oriented social sciences, experimenting with different methods would also seem as a relevant strategy, because of the Dewian “learning by doing” background philosophy (Dewey 1999).

From this basis, and taking into account that the purpose of the clustering in this study is just to group a wide range of 24 responses together, the furthest neighbour (*i.e.* complete linkage) clustering method was chosen. Another consistent choice would have been the between groups (*i.e.* average linkage) method, which was tried for comparison to the furthest neighbour method with the first Delphi round data. There were no theoretically relevant differences between the methods with the data.

Besides the decision of clustering entities, the choice of a measure of association is essential (Everitt 1983; Milligan 1996, 354-355). The simple Euclidean distance is chosen because the variables are on a relative scale. The cases have a reasonably similar shape to the different variables, which also supports the choice. No variable standardisation is conducted, nor weights put on different variables. This emphasises the differences and similarities of road traffic volume because the volume numbers are greater than the CO₂ and GDP numbers. The choice is consistent with the emphasis of traffic in the scenarios. It

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can also be assumed that because the respondents are interested mainly in transport issues, road traffic volume is for them the familiar reference to which other variables are related. It is easy to agree with the general idea that the purpose of analysis is to simplify enough but not too much. The problem is to define what is enough and what is too much. In this study the purpose is to simplify as little as possible in order to keep a wide range of policy alternatives inside the Delphi process as stated above. Futures research literature often recommends that two alternatives should not be formed, because it implies a preference of one alternative over another. Also, there are limits to the human capacity to outline alternatives; often seven alternatives are regarded as the maximum relevant number of scenarios (Robinson 1990). Schwartz *et al.* (1982, 147-148) state that 3-6 scenarios is the most common. Mannermaa (1999, 66) suggests 3-5 scenarios. However, three is problematic since the decision-maker could easily prefer the middle one.

More recently, major scenarios have been constructed on the differences of some key parameters and further divided into sub-scenarios based on less important parameters, which is an illustrative way to increase the capacity to handle alternatives (*eg.* Nakicenovic *et al.* 1998, 5-10, 63-95; Ministry of Transport... 2000). Also, scenarios can be built by making scenarios of factors external to decision-making and then cross-matrixing them to the scenarios of the object system, which are more decision-making oriented (Meristö 1991, 112-127; Tapio 1992, 49; Framtida transporter... 1992). Such a hierarchy is not made in this study because the Euclidean association measure and scale of variables already emphasise road traffic volume as the most important variable and because all the three variables are dependent on decision-making.

In addition, external substantial theoretical categories could be used in deciding the choice of the number of clusters (Dubes and Jain 1979, 236). In the theoretical part of this research, five scenarios were produced (Tapio 2000a), and it seems sensible to make a comparison between the clusters found in the cluster analysis and the theoretical scenarios. The comparison will be made in chapter 5.1.

On the other hand, if the sampling of different interest groups is representative, the clustering method is supposed to reveal the real structure of traffic and environmental policy views. The possibility should be respected regardless of the expected behaviour of decision-makers or theoretical categories. This is a difficult methodological dilemma for which it is hard to find reasonable solutions.

The dendrogram in Article III (Figure 2) provides a well argued choice between three, four, six and ten clusters, with four and six being the most apparent ones. The choice of five clusters is possible but it would have given a very imbalanced cluster size. Regarding all the criteria referred above and the wide range of original responses, maybe cluster numbers of three, five and ten should be excluded. We were left with the option of four or six clusters, six giving a wider range of clusters. Derived from these criteria, the most relevant number of clusters seems to be six.

4.2.4 An Analysis of Qualitative Arguments with Reference to Quantitative Clusters

Although the fundamental ideal of Delphi is that the best argument should win, in actual applications arguments have not had a central role (Scheele 1975, 218; Turoff 1975, 88-89; Kuusi 1999, 83). To get more in-depth arguments the second Delphi round in this study was conducted by semi-structured interviews.⁴⁷ The interviewee is systematically asked to comment on the arguments presented by estimations of lower and upper curves than their own responses. The respondents are encouraged to give arguments supporting their view and are allowed to change their answers from the first round on the basis of the arguments of the other respondents. This is a similar feature to the “Argument Delphi” developed by Kuusi (1999, 128-134; 223-224), originating partially from the argumentation rules of van Eemeren *et al.* (1996).

Normally thematic interviews are conducted by a neutral or sympathetic role of the interviewer. The argumentative role of the Delphi moderator immediately leads to doubts of bias originating from the explicit and implicit ways in which the contra-arguments are presented by the interviewer. Four ways to ameliorate this effect were employed: a) in the beginning of the interviews it was made clear that the method includes presenting other panellists’ contra-arguments; b) the interviewer tried to isolate himself from the arguments by expressions such as “often a contra-argument is stated to the point you are making that...”; c) in the earlier interviews the interviewer also presented hypothetical contra-arguments based on written texts and eight years experience in the transport field; d) in the later interviews the cumulative total chain of arguments and contra-arguments presented on a certain issue was dealt with. The interviews lasted from 1,25 hours to 4 hours and the total amount of tape-recorded material lasted approximately 35 hours.

The methodological concern in making the interviews rational well-argued discussions seemed to be successful. A lot of in-depth arguments were produced, such as reference to specific research or statistics and revelation of the social theory of mobility behind the answer *etc.* These are difficult to get with a questionnaire or an interview without contra-arguments. The interview strategy adopted in this study has features of ethnographic decision-tree modelling, although here decisions were not computerised to a yes/no dichotomy (Gladwin 1989). Another connection can be made to the grounded theory approach where the material is classified into categories and differences and similarities within the categories are examined (Strauss and Corbin 1990, 109-111).

As a rule, exploratory thematic interviews should be made first and then, based on the interviews, a more exact questionnaire for the next round(s) should be formed.⁴⁸ This

⁴⁷ There is a continuum from informal to formal interviews presented as a series: in-depth interviews, thematic interviews and structured interviews. The approach of this study falls between thematic interviews and structured interviews. Thematic interviews originate from the “focused interview” of Merton and Kendall (1946). Merton (1987, 556) himself would have preferred the concept “focused interview”. It is interesting that Merton and Kendall presented the focused interview as a systematic pre-treatment, post-treatment method where the objective treatment was known by the researchers. However, their approach seems to have been evolved as a symbol of inductionist inquiry where formal methods and objectivist epistemology have been denied.

⁴⁸ The rule is not recommended by Hirsjärvi and Hurme (2000, 26-33), however. They state that the research problem is more important than any methodological principle and present five equal approaches: 1) first

would clarify concepts, improve the relevance of the questionnaire and increase motivation to participate. There are three reasons to break the rule in this study. First, the starting point of the study, *i.e.* the three curves in Figure 1.6, was so illustrative, that respondents were expected to be motivated to answer. Second, the respondents had a high motivation because they worked directly with the issues. Third, why conduct argumentative interviews if there are no process borne arguments or statements to argue about?

4.2.5 Theoretical Interpretation of Delphi Results

Delphi users have often been criticised for the lack of theoretical understanding of the methodological procedure and less often for the lack of theoretical framing of the substance (Scheele 1975a, 216-217; Hill and Fowles 1975, 188; Bell 1997, 270). The harshest conclusion has probably been stated by Bell (1997, 270): “So far, Delphi researchers use, create, test or know precious little – if any – social theory.”

This critique is overly harsh. The philosophical and theoretical foundations of the Delphi procedure have been considered often and in depth. To mention a few; Scheele (1975b) made an effort to place Delphi in the context of phenomenological epistemology. Mitroff and Turoff (1975) presented five philosophical inquiry systems and also stated that Delphi has a role to play in all of them, but that the applications might be different from each other. Rowe *et al.* (1991) placed Delphi in the context of judgment and decision-making theories in business administration, while Kuusi (1999) developed a “general theory of consistency” as a philosophical framework and analysed how Grupp tested certain theories about technological paradigms. There are also obvious connections from Delphi to Habermasian “undistorted communication”, but they are impossible to analyse in detail here (see *eg.* Habermas 1981, 97-169; Forester 1993).

However, actual testing of social theories with Delphi applications is not as common. In this study the responses are interpreted in the light of the theories of content of environmental policy (see chapter 3.1).

4.3 Balancing between Different Approaches

Efforts to solve the research problem have led the author to consider many different methodological approaches, which in turn produced fruitful analysis but balancing between the approaches caused also a few more methodological problems and critical debates with some commentators. Six problematic methodological continuums from the adopted approaches are dealt with in this sub-chapter:

- Natural scientific to social scientific,
- qualitative to quantitative,
- inductive to deductive,
- objective to subjective,
- descriptive to normative,
- past to future.

qualitative then quantitative; 2) first quantitative, then qualitative; 3) iterative process; 4) both methods at the same time but with different respondents; 5) both methods at the same time with one respondent.

4.3.1 Natural Scientific and Social Scientific Approaches

There has been quite some discussion about the essential need for interdisciplinary analysis of environmental problems and their solutions. Two approaches can be outlined: First, a strong claim for theoretically breaking down the borderline between natural scientific and social scientific research has been presented (Willamo 1997; Hardin 1998; Kates *et al.* 2001). For example Massa (1999, 280) has considered this claim idealistic and suggested that there should be stronger interdisciplinarity within social sciences before attempting to unite natural and social scientific research in any strong sense.

Second, a weak claim can be presented that there should be a problem oriented connection between natural scientific and social scientific approaches in concrete cases. The second approach has been an aim for example of IPCC, but as Cohen *et al.* (1998) note most social scientific research within IPCC has been made rather narrowly under condition of the general circulation models (GCM). It seems that the only social scientific discipline that has been able to adapt to the requirements of the GCM's is neoclassical economics (Cohen *et al.* 1998). Sadly enough, this has made the GCM's rather deterministic and narrowed the range of alternative strategies to combat climate change. Cohen *et al.* (1998) concluded that when social scientific research on the climate is submitted to a natural scientific approach, it somewhat ironically loses its relevance in terms of climate protection.

In recent transport futures studies the weak claim for interdisciplinarity has tried to get itself taken seriously (*eg.* Nijkamp 1998; Banister *et al.* 2000).⁴⁹ In these studies, natural scientific results regarding the climate have been taken as a starting point without any scientific analysis of their credibility. The rather technical CO₂ emission statistics of transport have not been questioned either but attempts to connect them to the human scientific view of the response strategies, without any reductionist claims of approach on behalf of the GCM approach have been made. Nijkamp *et al.* and Banister *et al.* seem to have succeeded in softening and complicating the rather mechanistic and societally naïve transport forecast tradition.

In this study the nature – society interface is approached from a qualitative social science point of view. The connection of the qualitative theoretical environmental policies to CO₂ emissions has been established heuristically. Although the connection is questionable, non-formal and probably unlinkable to any GCM, it may have some theoretical relevance and interpretive power.

4.3.2 Qualitative and Quantitative Approaches

In the 1980's it was typical that qualitative social scientific methodological guides warned social scientists against quantitative methods which would lead to quasi exactness (von Wright 1986, 112), naïve empirism, positivism or 'survey idiotism' (see

⁴⁹ The approach of this study is interdisciplinary within social sciences following the suggestion of Massa above. It includes strong elements of futures studies and environmental politology, and some traces of philosophy, environmental economics, environmental sociology, planning theory and transport research.

Töttö 1997, 15). In the late 1980's and 1990's the qualitative school ameliorated such harsh views and quantitative analysis was partly suggested to complement qualitative analysis (eg. Alasuutari 1998, 38-58; see Kaskinen 1998, 46).⁵⁰ A few years ago Töttö (1997) wrote a thought-provoking book *Diabolous Positivism* ('Pirullinen positivismi') where he criticised the dogmatic features of qualitative research methodological discussion. This sub-chapter relies heavily on Töttö's text.

The social scientific methodological discussion has been, at least since Auguste Comte (1974) somewhat jealous of natural science, whose concepts seemed clearly defined and the objective laws of nature seemed to be there for the researcher to grasp. Social science in turn was seen as obscure and underdeveloped in theoretical and methodological terms filled with problems originating from the complexity of humans and society. Comte proposed that social scientists should start working as natural scientists: form theories and make empirical research to test hypotheses and thereby reveal the 'natural' development of society for to make positive politics. (Comte 1974; see Töttö 1996.)

Comte did not believe in a mathematical description of society although he had a mathematical education himself. However, positivism was adopted as a legitimising metaphor by the American empiricists during the second world war when the so-called logical positivists of the Vienna Circle emigrated to the USA (Turner 1992). The empiricist tradition relied heavily on statistical tools. From the 1960's to the 1980's this methodological positivism faced increasing criticism which suggested that it merely stuck to common sense explanation instead of a theoretical understanding of the results. (Rosengren 1981; Töttö 1996; 1997, 14-15)

In Scandinavia the critique of methodological positivism started in the early 1970's among social scientists. The first wave of critique was Marxist in origin and its main target was the non-theoretical application of methods.⁵¹ The critique went on to claim that the problem was actually survey-methodology representing vulgar positivism and used (incorrectly) Paul Lazarsfeld as a straw man. The prevailing methodological state was seen as Kuhnian 'normal science' which was supposed to be cured by a scientific revolution, *i.e.* philosophical and (Marxist) theoretical critique. (Rosengren 1981, 10-12; Töttö 1997, 12-17.)

A second wave of criticism offered alternative tools for empirical research. When the life-style research tradition was established in the late 1970's and early 1980's qualitative research, mainly thematic interviews, was applied to better reveal the essential features of people's lives. (Töttö 1997, 21-23.)

The critique of positivism was based on the distinction that saw nature and culture as separate research objects. The unique human characteristics were consciousness, meaningful action, language and history (Andersson 1982, 35-38). The critique concluded that the different characteristics also lead to different methods of

⁵⁰ According to Rosengren (1981, 14) the gap between quantitative and qualitative approaches was wider in Finland than in other Nordic countries.

⁵¹ Andersson's (1982) critique of positivism was however targeted at Marxism. Sintonen (1987) made a sarcastic comment on the positivism discussion by stating that there was only one problem: nobody volunteered to be a positivist.

application. Simply: humans should be understood hermeneutically and this understanding would require the use of qualitative methods. Nature in turn could be explained as an invariance and it could be studied by using exact quantitative methods. (von Wright 1970; Andersson 1982⁵²; Leskinen 1994, 12-14; Töttö 1997, 23-24.)

The slide from hermeneutical understanding to the claim for qualitative methods is however a *non sequitur* fallacy in argumentation, 'it does not follow' (van Eemeren *et al.* 1996, 68). There is no logical necessity for grouping quantitative methods with positivism and qualitative with hermeneutics (Töttö 1997, 24-25; Bryman 1999). Using, for example, a what-if type of decision analysis model would include the assumption of conscious decision making. In this study the key issues of dematerialisation and immaterialisation are discussed within the quantifiable terms of GDP, road traffic volume and the CO₂ emissions from road traffic. Cluster analysis is used to group similar types of conscious reasoning, argumentation and meaningful responses together. The approach encourages different interest groups to participate in making a definition of problem and its solution process. This is hardly positivistic, deterministic nor treats humans as material things.

4.3.3 Inductive and Deductive Approaches

The philosophical debate between empiricism and rationalism has gone on for centuries. Essentially the difference is that idealists think that human *a priori* thoughts are the principal source of information (*eg.* Kant). Consequently direct, objective observation of the research object is impossible, because the observer has preliminary prejudices and theories about the study object. Empiricists in turn think that direct, objective *a posteriori* observation of the study object is possible and is the norm in science (*eg.* Bacon and Newton). The two approaches can be observed in the debate between the methods of hypothetico-deduction and induction. The former suggests deriving hypotheses from a theory and then making empirical tests to verify or falsify the theory (*eg.* Popper). The latter starts from gathering data with as few prejudices as possible and then deriving theories from the results (*eg.* Newton). (Niiniluoto 1983, 118-137.)

Deductionists have been arguing that inductionists in fact do have preliminary ideas of what they might find and hence might only find their own implicit prejudices in the study material. Inductionists in turn argue that hypothetico-deduction would be closing one's eyes to the possibility that something unexpected might be found, for example Alexander Fleming would probably never have invented penicillin had he been strictly following the hypothetico-deduction principle. An attempt to balance between these two approaches is often called abduction. Abduction proceeds by starting from preliminary theoretical assumptions yet remains constantly sensitivity to any new ideas that might come out of the analysis of the study material. Then the theory is reformulated to become more precise and the researcher takes a closer look at the research material to see if the theoretical interpretation was in fact correct. (Niiniluoto 1983, 154-156; see Strauss and Corbin 1990, 111-112.)

⁵² Despite his strict dichotomic divide between positivism and hermeneutics, Andersson does not equate quantitative methods with positivism.

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The method of qualitative content analysis (chapter 4.1) applied in this study was formed according to the abduction process as described above. A preliminary idea of the distinction of determinism and indeterminism (or voluntarism) was employed for the analysis of the planning documents of the transport administration. The preliminary idea produced some analytical text, to which colleagues posed comments. In line with the comments⁵³ a more specific set of nine questions was then formed on the basis of the text already produced. Then the material was approached again more systematically with the nine questions. Afterwards the procedural theoretical framework was divided into three schools of thought as described in Article I and further developed into seven schools of thought described in chapter 3.2.

The Delphi study was made using a hypothetico-deduction approach. The theories of the content of environmental policy were then projected⁵⁴ onto the hypothetical scenarios of the three key variables, GDP, road traffic volume and the CO₂ emissions from road traffic (chapter 3.1). However, this is not hypothesis testing in a strict statistical sense, because cluster analysis requires random sampling if used for the testing of hypotheses. A more hermeneutic or inductionist way to put it is to say that the clusters produced by cluster analysis were interpreted in the light of the hypothetical scenarios. What was not inductionist, was that the hypothetical scenarios were formed before cluster analysis. The reader may wonder whether this was a methodological error or an intelligent way to combine the benefits of the different schools of thought.

It seems that when the sampling situation is unique, as in interviews, the hypothetico-deductive method works well. On the other hand, when the study material does not depend on the actions of the researcher, as with the analysis of documents, the abductive way seems to be relevant.

4.3.4 Objective and Subjective Approaches

Some discussion has been made of the subjective and objective elements of the research in general, and social scientific research in particular. Three differing tendencies can be distinguished: The objectivist approach suggests that all the subjective elements of a study must be eliminated as far as possible (*eg.* Bacon; see Haila and Levins 1992,). The relativist approach states, that efforts for objectivism are doomed because scientists make subjective assumptions and interpretations during the research process and all a researcher can produce is a social representation of the study object (*eg.* Feyerabend 1975; Galtung 1977). An approach which could, maybe best, be called realism argues that subjective assumptions and interpretations do effect the results but if the assumptions and the basis of interpretation are made explicit, the outcome will in fact be more objective than in the objectivist school (Töttö 1997, 11-12).

⁵³ This helpful recommendation was given by Jari Paldanius and Merja Tolonen.

⁵⁴ It has been disturbingly difficult to select the methodologically correct verb for this action. Relevant candidates have been derive, specify, operationalise and apply. None of these seem to capture the essential idea which is why the procedure is explained in detail here.

It was a habit of environmental sociologists in Finland in the 1990's to commit themselves to so-called social constructionism as it was supposedly an alternative to the objectivist approach to handling social problems.⁵⁵ Social constructionism has been divided into two forms; strict constructionism and contextual constructionism. The former states that all social problems are social constructions and the latter states that social problems have objective reality but their interpretation of what is considered more and less problematic always includes a struggle of social definition (see *eg.* Kaskinen 1998, 16-17; Massa 1999, 161).⁵⁶ Although new sociological 'isms' spread fast from the USA to Finland, there seems to be nothing new in this concept when compared to the older philosophical debate referred to above.

In this study the realist (or contextual social constructionist) approach is used. The reported confidence rates about human induced global warming are taken seriously, the importance of CO₂ as a GHG is taken seriously, the planning documents of transport administration are taken seriously, the responses of the interest groups are taken seriously. The argumentative interviews of the Delphi study were made by focusing on argument's content not its discursive rhetoric, *eg.* jokes or the 'psychology' of contradictory statements. But this does not mean objectivism nor naïve empiricism. The respondents assumptions about *eg.* the mechanisms affecting travel behaviour are subjective. The responses were interpreted in the light of the rather subjective hypothetical scenarios and other things of importance in the interviews might have been missed.

4.3.5 Descriptive and Normative Approaches

A debate closely related to the objective *vs* subjective dilemma is the distinction between descriptive and normative research. Four different approaches can be outlined: First, the logical positivist school of thought of the Vienna Circle thought that research should be value neutral and therefore only descriptive. No policy recommendations could be derived from research results. Second, Comtean positivism in turn claimed that by making objective descriptive research of society one would also gain knowledge of the naturally and objectively good policies (see chapter 3.2.2).

Third, Humean guillotine states that normative policy recommendations cannot be derived from descriptive knowledge but stem from the domain of values and emotions. This view has been established in the what-if type of analysis of pluralist humanism suggested by *eg.* von Wright (see article IV). The fourth approach is the pragmatist (or social constructionist), where descriptive analysis is seen as impossible, because the values and norms of good research determine what are seen as adequate research problems, adequate methods and adequate theoretical background for the of analysis. Thus all problem oriented research is said to be normative (*eg.* Feyerabend 1975; Rorty 1980; Hahtola 1992; Haila and Levins 1992).

⁵⁵ Social constructionism can be seen as originating from three domains: First, the anthropological approach of Douglas (1989) who rephrased some of the thoughts of Émile Durkheim; second, the studies of social problems (*eg.* Blumer, 1971); third, the sociology of knowledge by Berger and Luckmann. Thanks to Juha Kaskinen for this comment.

⁵⁶ The principles of contextual social constructionism are also inherent in Willamo's (1997) analytical model of environmental protection although no connection to the 'isms' was made by him.

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Following the views of Max Weber, the majority of social scientists seem nowadays to be convinced that both the comtean positivist and logical positivist schools of thought are inadequate starting points for research (Bell 1997b, 68). However, it is important to keep in mind, that although some phases of the research process include normative aspects, other phases of it can be descriptive, even objective in relation to the normative choices made before and after (Töttö 1997, 11-12).

In this study the focus on climate change and climate policy include clearly normative aspects. There is no objective reason to select climate change instead of *eg.* loss of biodiversity, environmental noise or urban air quality as the important environmental problem to be analysed (see Haila and Levins 1992). This also implies the normative approach is needed as a solution not only for the research problem but also for the problem of climate change and the risk of more severe climate change. An alternative response might be for example the view that climate change could be a welcome event for farmers in Scandinavian Lapland, the Finnish natural oak (*Quercus robur*) population *etc.*

The choice of the substantial theoretical framework is normative, because all the presented strategies rely on certain values and theories instead of neutral descriptions. However, it is important to notice that they rely on different values and theories, which makes the adopted approach an example of value pluralism. It seems that value pluralism is a more important feature of a futures study and the study of environmental protection science than an apparent value neutrality.

Also the disaggregative analysis of the study material has normative aspects, because it implies that the goal of consensus is not adopted. If the goal of consensus would have been adopted it would have been a normative choice as well, regardless of being the standard approach. Analysing the actual contents of the planning documents and the Delphi responses is also an effort as much of descriptive and objective analysis as is possible in relation to the theoretical framework. Whether comtean positivism is criticised or not, it is irrelevant regarding analysis as to whether the transport administration's planning documents represent comtean positivism or not.

4.3.6 Past and Future Approaches

The last problematic borderline is the one between the past and the future. Futures researchers have used a lot of intellectual effort to determine whether futures studies can be regarded as a field of science as the future does not exist and therefore it cannot be directly observed (de Jouvenel 1967; Amara 1981; Malaska and Mannermaa 1985; van Vught 1987; Mannermaa 1991; Masini 1993; Slaughter 1996; Bell 1997a; Rubin and Kaivo-oja 1999, 353-355; Rubin 2000; Malaska 2001). In the conference *The Quest for the Futures* in Turku, June 2000, Matti Kamppinen made the sober point that futures researchers seem to be the only ones who are disturbed about this. For example a limnologist may make forecasts about the future development of a lake, but although the future state of the lake does not exist, s/he does not feel the need to ask him/herself whether this approach is scientific or not. These kinds of what-if contemplations seem to present a normal feature of science.

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Whether futures studies as a whole can be regarded as scientific or not is not of concern in this thesis. The results of this study do not make claims for future events as such but are descriptions of empirical material from the past and present. The material discusses future events and presents images of future but its contents can be analysed just like the contents of other texts and interviews can (see Bell 1997a, 111; Rubin 2000, 14-15).

The procedural theory is adopted mainly from the field of futures studies. The use of the procedural theory does not make any claims for the future either. It is an interpretative framework for analysing actual social processes and for placing the Delphi study in to a theoretical perspective. Whether the more participatory ways to make futures studies are scientific or not is also not a relevant question in this study: they are regarded as different ways to organise planning and decision-making processes, not as organising scientific research.

5 Key Empirical Results

This chapter presents the key empirical results of the study. First, the three cases of the futures studies in transport administration from the beginning of the 1990's are summarised in sub-chapter 5.1.1. The sub-chapter is very brief, because the cases are analysed in detail in Article I and the development of the futures studies in transport administration seems to be of more relevance than the rather static picture of the early 1990's. The information is thus complemented with a more thorough analysis of recent development in sub-chapters 5.1.2 and 5.1.3. The results of the Delphi study are presented in chapter 5.2. Although the results of the Delphi study are presented similarly in article II, the experimental role of the approach as an alternative more participatory way to produce scenarios asks for a detailed presentation in this summary.

5.1 The Development of the Futures Studies of the Finnish Transport Administration in the 1990's

5.1.1 The Early 1990's

As described and analysed in detail in Article I, the planning documents of the Finnish Road Administration at the beginning of 1990's presented an example of Comtean positivism in the way futures research was carried out and applied in the wider context of planning and decision-making. In cases one and three deterministic mathematical models were used and in case two the what-if type of model was used in a deterministic manner.

There were alternative developments for road traffic volumes in cases one and three, however, they were not formed by varying factors internal to decision-making. In case one the alternatives were generated by varying road traffic volume directly as some kind of sensitivity analysis. In case three the GDP assumption was varied. Case two presented only one growth figure, which seemed to represent slight growth optimism instead of the business as usual development.

Only the business as usual estimate of the most probable future estimated by the futurists was used in the planning process and the results of the futures studies were not questioned in the planning process. The results were treated as factual inputs to aid time saving calculations further applied in the cost-benefit analysis. Public participation was organised in the EIA process but traffic volumes were excluded from the problem definition discussion. In sum, the approach was a rather pure example of comtean positivism. (See Article I.)

5.1.2 The Mid 1990's

There are signs that the futures studies of transport administration changed in the 1990's, at least on the national level. FinnRA published a follow-up to their PALA 89 forecast in 1995 (FinnRA 1995), which included three alternative scenarios: "business as usual", "market driven" and "sustainable growth". The qualitative background

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factors of the different road traffic scenarios were presented in tabular form (FinnRA 1995, 154-160). The actual model calculations were presented by varying the annual average car km to 18 000 km, 24 000 km and 15 000 km, respectively; and passenger car density to 510, 420-480 and 480 cars per 1000 inhabitants, respectively (FinnRA 1995, 160). Freight transport figures were not varied between the scenarios. The business as usual of FinnRA was a little lower than the BAU of the theoretical scenarios presented in chapter 3.1, the market driven scenario was similar to the ETO scenario and sustainable growth could be characterised as a scenario between EMO and SC.

The scenarios were produced by the futurists within FinnRA and because alternative policy scenarios were offered to decision-makers based on the what-if analysis, the approach could be characterised as pluralist humanism. However, the different scenarios were not offered to decision-makers without guidance, because the business as usual forecast was elaborated upon much further than the other two scenarios. The appendices present the business as usual estimates for the regional road districts without any alternative figures being used on that level. These characteristics lead to the conclusion that although the futures study itself was made following the what-if principle, the actual role of business as usual forecasts in the planning process did not change. Therefore the FinnRA 1995 forecast as an institutional element could be categorised as belonging to optimistic humanism which implies that professionals make statements about which alternative should be chosen.⁵⁷

In the late 1980's and 1990's several transport administrators and researchers outside the administration suggested that the transport system should be dealt with as a whole, a wider set of factors should be taken into account and more policy alternatives should be offered when making futures studies of transport (eg. Koskinen 1989; Tapio 1992; Kokkarinen 1992; Sairinen *et al.* 1997, 90-92; Ministry of Transport... 1997, 15; Valli 1998, 32). One conclusion of the discussion was that the Ministry of Transport and Communications took the initiative on the matter. First, the *Visionary process* was carried out in 1997, then the *Traffic Scenarios 2025* project in 1999-2000. Both cases will be analysed shortly based on their technical reports and the final reports where the strategies of the ministry were presented. The author belonged to the organising group and working group of the *Traffic Scenarios 2025* project, which made some participatory observation possible as well.

The Visionary process was conducted to develop a process to produce a vision for the transport system. It was made using four cases of available 'best-practice' mathematical what-if models. One was a national macro-model focusing on long distance trips, another case consisted of two models combining land-use and transport interface in the Helsinki metropolitan area. Another model focused on Oulu, the growing city in the Northern Finland and one focused on Hämeenlinna, a medium-sized town in Southern Finland, and its surroundings. The cases were calculated by private consultants and guided by administrative officers in the ministry. The models were used to calculate a business as usual scenario and three alternative transport

⁵⁷ This does not mean that the professionals would themselves promote optimistic humanism, on the contrary seems to be the case (see Kokkarinen 1992). Instead, the role of the forecasts in the whole transport planning process seemed to be the point.

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policy scenarios⁵⁸: 1) Market driven, 2) regional and social equity driven and 3) environmentally driven. (Ministry of Transport... 1997, 26-29.)

The alternative scenarios had similar assumptions about the economic growth rate and the government's budget for transport. No wider life-style issues, structural changes in the economy nor different regional policy options were dealt with (Ministry of Transport... 1997, 21). The results gained made little difference in terms of the traffic volumes of the different modes. Compared to the business as usual development, which was called 0-vision, the passenger car market share of trips was +1 %-unit in the market driven scenario, -2 %-units in the regional and social equity driven scenario, and -8 %-units in the environmentally driven scenario (Ministry of Transport... 1997, 34-35).

It is impossible to relate exactly the relative change in the trip share presented in the report to the road traffic volume numbers which are the base indicators of the substantial theory (chapter 3.1). Some estimates can be calculated, because the 0-vision includes a 40% growth in road traffic volume between 1996-2020.⁵⁹ This makes it a 'BAU plus' scenario. The market driven vision presents the BAU scenario, the equity vision could be characterised as an 'EMO minus' scenario and the environmental vision would be similar to the EMO scenario.

The visionary process continued by making an evaluation of the different policy goals presented in the governmental committee reports. The goals were discussed in seminars within the ministry and by interviewing representatives in the sector's of transport administration and the Confederation of Finnish Industry and Employers. A questionnaire for transport experts was also made to assess the weight given to the different goals (Ministry of Transport... 1997, 24). It was not reported how this was made and who were regarded as experts. However, relying on the expert poll and the discussion within the ministry, another scenario called "Target transport system" was specified.

The target transport system scenario was a combination of the three alternative visions. The impact of the vision was -4%-units to the market share of passenger car trips to be divided equally between surface public transport and soft modes. Referring to calculations given in footnote 59, it seems to represent the EMO scenario.

The visionary process could be characterised as pluralist humanism in the sense that it pursued and formed several alternative policies and involved several groups participation in the decision making process. However, the evaluation of the goals was completed by expert analysis, which implies that some traces of the school of

⁵⁸ The report writes about visions instead of scenarios although there is little difference between their quality and the FinnRA 1995 scenarios.

⁵⁹ Assume that the total passenger traffic volume in 1996 was $65 \cdot 10^9$ passenger km and the passenger traffic volume of passenger cars was in 1996 was $50 \cdot 10^9$ passenger km (Ministry of Transport... 1999.). Assume also that the growth rate of total passenger traffic was 40% from 1996-2020. Then the passenger traffic volume for passenger cars in the four alternative scenarios would be 73 in 0-vision, 74 in the market oriented vision, 71 in an equity vision and 66 in the environmental scenario. These can be presented as relative growth rates of 46%, 48%, 42% and 32%, respectively. These figures are not directly interchangeable with road traffic volume figures but they give some opportunities for interpretation.

optimistic humanism can be found as well. The output performed with slightly less variation than the FinnRA 1995 scenarios and thus presented a somewhat incremental view of the range of possible policies.

5.1.3 The Late 1990's

Whereas the visionary process relied on one external scenario in each transport policy scenarios, the *Traffic Scenarios 2025* project was carried out to form wider scenarios of the factors affecting transport. The project was part of the LIIKE research programme which was carried out to gain coherence in the way administrative transport scenarios were made (Ministry of transport... 2000a, 1). It was performed by a group of consultants without economic interest in technical transport planning.

Instead of mathematical models an application of the scenario workshop method was used, it presented a more communicative and less formal approach (see Meristö 1991). Several methods were used under the umbrella of the scenario workshop: working groups, a Delphi study and two participatory seminars for interest groups. Thematic expert interviews were performed on three specific less investigated topics, namely air transport, soft modes and, values and attitudes relevant to transport behaviour. The Delphi and the expert interviews were used to gather possible future developments of the relevant factors, which were then gathered into a morphological matrix.

The international scenarios were formed based on the reviewed literature, global scenarios made by Shell and the World Business Council for Sustainable Development (WBCSD) and scenarios for Europe made by Meristö similar to scenarios made by the Forward Studies Unit of the EU (Ministry of Transport... 2000a, 16-24).

A more specific set of traffic scenarios was formed as well in connection to the European and global scenarios. Altogether four seminars for the interest groups were carried out, where the scenarios were outlined, criticised, rephrased, grouped and new scenarios formed (Ministry of Transport... 2000a, 26-28). This feature would make the *Traffic Scenarios 2025* project an example of critical pragmatism. However, the discussion did not start from *tabula rasa* as the first outline of the traffic oriented scenarios was made based on reviews of previous studies made by one of the consultants⁶⁰ (Ministry of Transport... 2000a, 25). Although the scenarios were substantially changed in the course of the project and the final scenarios were different from the first outline, this feature gives the exercise aspects of polling democracy as well.

The final traffic scenarios were grouped under characterising headlines, which were called 'scenario channels' in the report (Ministry of Transport... 2000, 9, 34-36; Table 5.1). No direct road traffic volume figures were presented but quantitative estimates of passenger transport and freight transport were specified to concretely illustrate the

⁶⁰ I made the review, and the theoretical scenarios presented in chapter 3.1 are the result of the review. Thus there are traces of circular reasoning behind the analysis of the *Traffic Scenarios 2025* project with the substantial theories. However, it is important to relate the comparison of the *Traffic Scenarios 2025* project to the other projects mentioned above. Because no verification of theory is presented here, the immanency does not represent a methodological error.

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differences between the scenarios. Also GDP and the CO₂ emissions from all transport modes were presented in a quantitative manner for the purpose of illustration. (Ministry of Transport... 2000a, 70-73; Table 5.1.) This makes the comparison of the scenarios of the Ministry to the theoretical scenarios of chapter 3.1 reasonably possible.

Table 5.1: Some relevant variables of the scenarios of the Traffic Scenarios 2025 project (measured here as percentages of change with reference to 1996 values) (Ministry of Transport... 2000a, 57, 67)

Scenarios	GDP	Private car traffic volume	Truck freight transport volume	CO ₂ emissions of total transport
<i>Scenarios of economic growth</i>				
A: Business as usual	+60	+30	+45	+15
A+: Slight improvement in performance	+65	+25	+35	+5
B: Market-driven optimism	+90	+45	+65	+0
B-: Uncontrollable material growth	+100	+60	+80	+35
<i>Scenarios of structural change</i>				
C: Decentralising information society	+60	+20	+35	-5
D: Centralised qualitative growth	+60	+10	+15	-20
<i>Scenarios of changed values</i>				
E: Ecological way of life	+10	-10	-20	-40
<i>Collapse scenarios</i>				
E-: Collapse of society	-20	-30	-30	-25
<i>Scenarios of technological leaps</i>				
(no detailed scenarios)	-	-	-	-

According to the numbers presented in table 5.1 scenario A would be described as a ‘BAU plus’ scenario with reference to the theoretical scenarios of chapter 3.1. A+ would be similar to EMO, B similar to ETO, B- could be described as ‘BAU minus’, C would be a decentralised version of EMO, D similar to SC, E similar to DE and E- could be described as ‘DE minus’. In fact, the project of the ministry included a wider range of scenarios than even the presumably wide theoretical framework of chapter 3.1.

The scenarios produced in the Traffic Scenarios 2025 project were used in forming the transport strategy of Finland called *Towards Intelligent and Sustainable Transport 2025* by the Ministry of Transport and Communications (2000c). None of the scenarios was adopted as such but an attempt to construct a combination of A+ and D done within the ministry. In the strategy, different variables had different time scales. The passenger car traffic volume was said to grow by some 20% from 1996-2025, lorry freight transport volume by approximately 55% and GDP faster, by some 35% from 1996-2005 (Ministry of Transport... 2000c, 13). It was specified that “...it shall be taken care, that the GHG emissions of transport in 2010 will be at the level of 1990 at most.” [my transl.] but the figure on the same page suggests some 10% growth in CO₂ emissions for the same period (Ministry of Transport... 2000c, 20). These figures suggest that passenger traffic was dealt with by an ‘EMO plus’ approach and freight transport with a ‘BAU plus’ approach, in qualitative terms even traces of the SC

scenario can be found. Some inconsistency in the different parts of transport policy can therefore be observed.

The same difference in tone can be found in some qualitative aspects of the text as well, for example the chapter about passenger traffic that contemplates mostly a change in modal split. Whereas the chapter on freight transport discusses promoting the free market, a better land transport infrastructure to harbours and increasing information technology to improve logistics with no reference to traffic volumes (like in SC) nor different modes (like in EMO) (Ministry of Transport... 2000c, 10-15).

The procedural development of the futures studies of the transport administration in the 1990's can be summarised as follows (figure 5.1): In the beginning of the 1990's it presented comtean positivism, then moved towards a mixture of optimistic humanism and pluralist humanism in the middle of the decade. At the end of the decade, a mixture of polling democracy and critical pragmatism was experimented with.

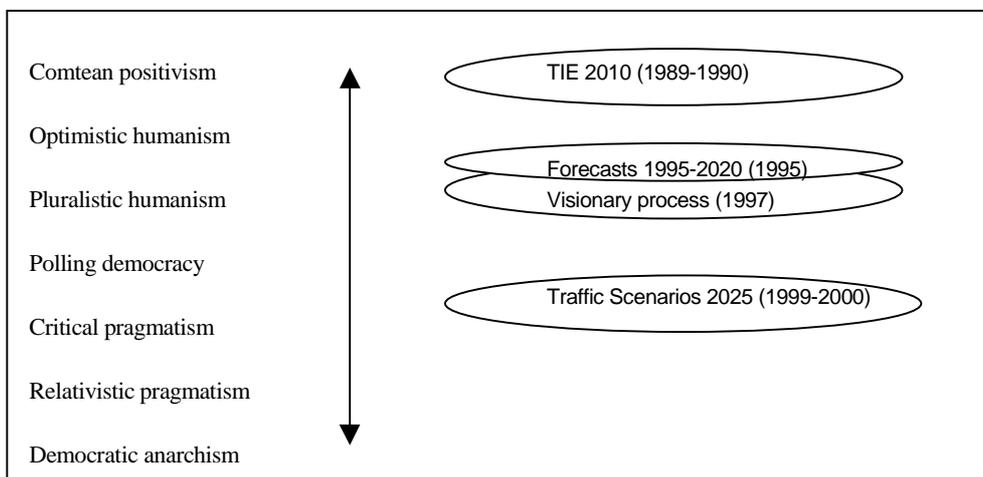


Figure 5.1: The development of the procedure of Finnish national transport futures studies in the 1990's

5.2 Results of the Disaggregative Delphi Study

This chapter presents the results of the alternative, more participatory method of making a futures study of transport in the form of a Delphi study. The process is an application of critical pragmatism (see chapter 3.2.6). The chapter includes the respondents' views from the second Delphi round about the probable and preferable futures of GDP, road traffic volume, and CO₂ emissions from road traffic in Finland in 1997-2025. The quantitative clusters are complemented with the respondents' qualitative arguments. The same data was partly used in the Traffic Scenarios 2025 project of the Ministry of Transport and Communication (2000a; 2000c) but not in such a systematic descriptive manner.⁶¹ This chapter presents the more academic and rigorous analysis of the Delphi material.

⁶¹ The scenarios of the Ministry included the participation of the organising group and the interest groups in the forming of scenarios, the results of three sub-projects and some common sense were also used to fill in some of the

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Based on the cluster analysis six clusters are discussed in the chapter each in a sub-chapter. First the cluster centre of a cluster is reported as the arithmetical mean of the 2025 values in relation to the 1996 values. Then, the responses grouped in the cluster are specified and variation within the cluster is presented.⁶² The common plot of the cluster is presented based on the qualitative arguments presented by the respondents. If the qualitative arguments include contradictory statements, this is reported as well. Finally, the cluster centres are presented in relation to the nearest theoretical scenario (see chapter 3.1) for the whole period from 1997-2025 in figures 5.2-5.5. The means and variation indices (range and SD) of the clusters are summarised in table 5.2.

Standard MANOVA and ANOVA tests as well as discrimination analysis cannot be used to test whether the differences between clusters are real but would present circular reasoning (Dubes and Jain 1979, 247; Milligan 1998, 366-367). Medians for the total data are presented in Article II, but are not presented here because it would imply a goal of consensus and contradict the value pluralist approach in this study. In order to avoid tactical response the respondents were told that means would not be calculated.

5.2.1 Cluster One: 'Business as Usual Plus'

Cluster one is based on the idea that the GDP and the road traffic volume would grow at the same rate as before (GDP 60% and volume 55%) and the CO₂ emissions from road traffic would increase at a slower rate, by 15% (Figure 4). Cluster one includes four responses to the probable future and one to the preferable future (STYprob, AKTprob, DODOprob, RHKprob, STYpref). The variation indices of cluster one reveal that the similarity of the responses is stronger concerning road traffic volume than the two other variables (Table 5.2).

The respondents gave several qualitative arguments supporting this development. The growth of the GDP was explained by the high competitiveness of the Finnish economy in the late 1990's. No great changes from previous patterns of the past were expected concerning the growth rate, or the prevailing materialist values. One respondent in this cluster thought that the Finnish EU membership would be a growth factor and another thought that it would slow down the growth rate in the future.

The main argument for the growth of the road traffic volume seemed to be the urban sprawl, which was expected to continue. The sprawl was seen to result from people's desire to live in single family houses and land use planning that would force this trend.

gaps of the scenarios. A critical analysis of consistency was made as well and quantitative numbers were adjusted after analysis. (Ministry of Transport... 2000a, 26-32, 70.)

⁶² The abbreviations of the responses are presented following the Finnish names of the organisations in the form of *eg.* 'STYprob' where 'STY' is the organisation (Finnish Road Association) and the post-fix 'prob' refers to being an estimate of the probable future. A statement concerning the preferable future is abbreviated 'pref'. The abbreviations of the other organisations are as follows: LM =Ministry of Transport and Communications; RHK=Rail Administration; TL=Road Administration; YM=Ministry of the Environment; YTV*=The personal opinion of the operative manager of the Transportation Department of the Helsinki Metropolitan Area Council; LAL=Bus Transport Federation; AL=Automobile and Touring Club of Finland; LILI=Traffic League; ENE=Traffic Policy Association Majority; TT=The Confederation of Finnish Industry and Employers; AKT=Transport Workers' Federation; DODO=Dodo – the Living Nature of the Future.

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Also shops would aggregate to supermarkets moving away from community centres. Urbanisation was thought to generate more leisure trips to the countryside, such as visiting parents and grandparents and summer cottages. The ageing population was expected to be healthier and wealthier in the future, which would also generate more private car traffic. Some respondents in this group argued that the private car is still a status symbol for many Finns.

The arguments for the slower growth of the CO₂ emissions from road traffic mainly concerned technical development. Some ambivalence could be seen, as some respondents thought their CO₂ emissions curve to be optimistic whereas some thought it to be pessimistic. No great policy measures towards the restriction of CO₂ emissions were assumed. RHK, AKT and DODO regarded the development of cluster one as not preferable and STY as preferable, which seems to explain the optimism-pessimism dilemma.

In figure 5.2, cluster one is compared with the theoretical business as usual scenario (BAU). The GDP and the road traffic volume curves are almost identical to BAU, but some technical improvement is expected concerning CO₂ emissions.

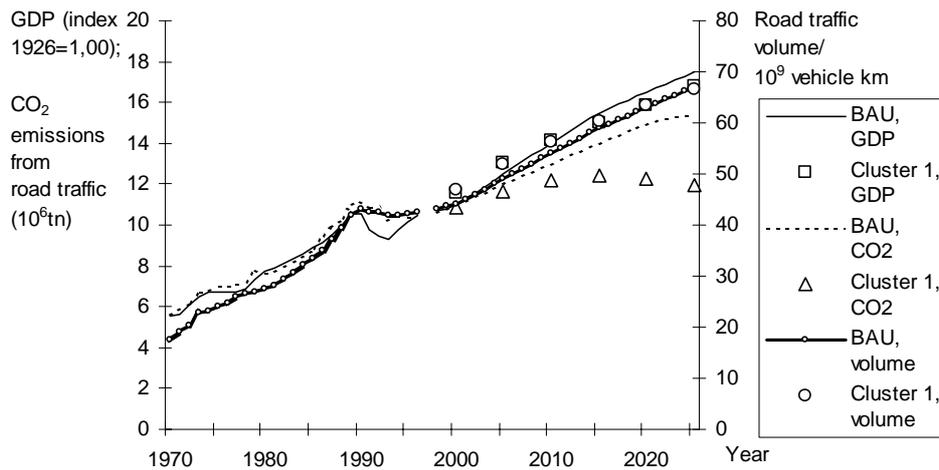


Figure 5.2: Comparison between the business as usual scenario (BAU) and cluster one.

5.2.2 Cluster Two: Ecological Modernisation

In cluster two GDP would increase by 65%, but road traffic volume would increase at the slower rate of 35%. The CO₂ emissions would stay at the level of 1996 until 2025 (Figure 5.3). Cluster two includes six responses of a probable future and three of preferable future (YMprob, YTV*prob, TLprob, LMprob, LALprob, ALprob, LMpref, RHKpref, AKTpref). The variation of the road traffic volume and the GDP within cluster two is larger than in cluster one, whereas the variation of the CO₂ emissions is smaller (Table 5.2).

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According to the respondents of cluster two, the globalisation of markets would result in the continuous high growth rate of the economy in China and South-Eastern Asia and later on in Russia, which would have effect on Finland as well. One respondent also mentioned South America as a high growth area in the future. Information technology would continue to burst onto the economy, and Finland was seen to possess high competitiveness in this sector.

The respondents that considered the development in cluster two preferable argued that high GDP growth is essential to pay back governmental debt and decrease unemployment. One respondent regarded a more even income distribution as preferable and thought that there would be more to redistribute, if the growth would be fast (AKT). Another thought, that the tax rate is too high in Finland and that a high growth rate would allow some relief (LM). The representatives of RHK stated that a moderate stable growth is one starting point for their organisation. The environment was not seen as a restriction to the growth rate presented in cluster two.

However, one response that was grouped together with cluster two had qualitatively different views compared to the others concerning GDP growth (AL). The respondent stated that the world population would increase at a rate that would affect the depletion of the environmental resources, which in turn would slow down consumption and affect Finnish exports. Information technology would have a marginal growth effect because the markets are mainly in the developed countries, and there would not be a great deal of potential for dematerialisation. However, the service economy would increase. These factors would produce fairly slow growth. The organisation produced the lowest estimate for GDP growth in the cluster (see Table 5.2).

In cluster two, different views concerning the future urban structure were presented. The respondents that regarded the development of cluster two as probable, and saw traffic volume as being connected to the urban sprawl. The respondents that considered cluster two preferable, saw urban infill connected to the volume figures presented. The latter group stated that lower road traffic volume growth would be preferable, but this was the lowest realistic estimate. Urbanisation was seen to slow down traffic volume growth as a net effect although the respondents agreed that some extra passenger traffic would result from leisure trips to countryside.

The arguments concerning the travel behaviour of the ageing population differed from that of cluster one. Respondents in cluster two thought that in the future elderly people will be used to passenger cars, but they would still drive less than middle aged people, resulting in a negative net effect on road traffic volume. Some respondents thought that the private car is losing its role as a status symbol and information technology would take that role. The saturation of car density would happen before 2025 because of the slight value shift towards non-material values and changes in demographic factors.

The taxes on car ownership and car use were thought to stay relatively high in the cluster two responses. Some subsidies for surface public transport were seen as important. Infrastructures for bicycles and walking would be built better as well. Improving logistics and industrial dematerialisation would restrict the growth of road freight transport.

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The arguments concerning fuel efficiency seemed similar to cluster one. The CO₂ emissions per vehicle km presented in cluster two would be the same as in cluster one, which indicates that the difference concerns traffic volume between the clusters. Many respondents mentioned the deal between the EU and the car industry organisation (ACEA) that would drop the fuel consumption to 5,8 l/100km regarding new passenger cars by 2008. Most respondents did not present a significant market share for cars using alternative energy sources. One respondent anticipated an approximate share of 10% for electric or hydrogen cars by 2025, though (YM). Stricter speed limits were also mentioned to restrict the growth of CO₂ emissions. The growth of engine power was expected to saturate. One respondent expected, or rather considered preferable, a European wide CO₂ taxation (RHK).

In figure 5.3, cluster two is compared with the theoretical ecological modernisation scenario (EMO). The GDP and the CO₂ emissions are the same as in the EMO scenario but the road traffic volume would increase faster. Less technical improvement was expected in cluster two than in the EMO scenario.

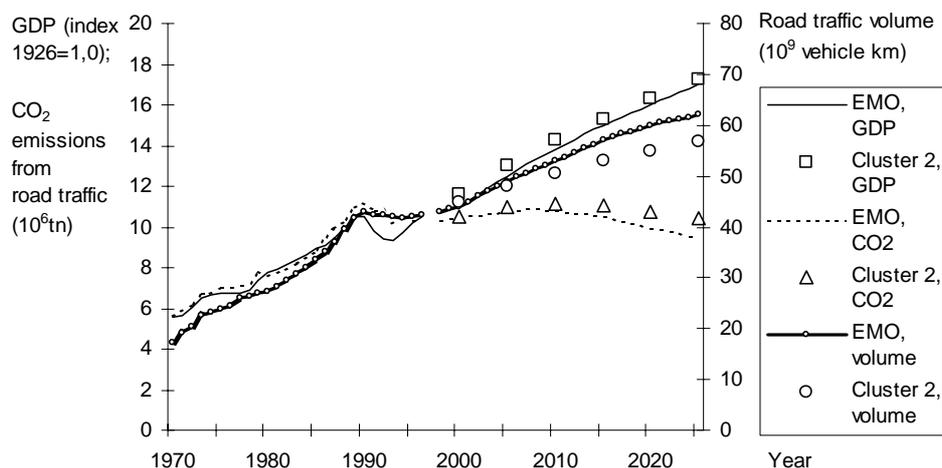


Figure 5.3: The ecological modernisation scenario (EMO) and cluster two.

5.2.3 Cluster Three: 'Modest Structural Change'

Cluster three contains a slower growth of GDP, 30%, and almost no growth in road traffic volume, 5%. The CO₂ emissions would slowly turn to decrease by around 10% (Figure 5.4). Cluster three includes two responses of a probable future and one preferable future (LILprob, ENeprob, ALpref). The variation in the road traffic volume and the CO₂ emissions in cluster three is larger than in clusters one and two. The variation in GDP on the other hand is smaller than in cluster three (Table 5.2).

According to the responses, environmental problems would constrain the growth of the economy. Also, non-material values would become more important in the future. Two respondents were suspicious about the positive impact of information technology on the economy, because Finnish information technology (IT) firms could move production

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abroad or IT enthusiasm was seen as exaggerated. One respondent (ENE) expected dematerialisation due to the IT. The service economy was emphasised by all three, although AL and LILI seemed suspicious about the potential for non-material growth of the GDP. One respondent (ENE) stated that the growth in GDP could be slower due to less wars or other non-preferable forms of production in the future.

In cluster three, urbanisation was regarded as a factor in decreasing road traffic volume. Also, urban infill was expected to result in a no-growth situation as surface public transport would gain more market share. Whether this would increase or reduce traffic to the countryside was not agreed on. AL and ENE expected more traffic going to summer cottages, whereas LILI saw a decline in this trend as young people would be more interested in urban surroundings, eg. parks and beaches.

Congestion was seen, by LILI and ENE, as a driving force for making policy that would be directed in a more public transport friendly direction. They expected, for example, that the tax allowance for working trips by private car would be abandoned. AL, in turn, considered that urban infill and the changing values of people would restrict road traffic volume growth and did not make any policy recommendations to restrict car use.

A clear feature of the responses in cluster three was the assumption of a more relaxed lifestyle. People were expected to search for peace and silence in contrast to their more hectic working life. Also, the consumption of services would increase. This would mean a stagnating traffic volume growth as well, especially for passenger car traffic, which was referred to as something people would be fed up with or even as old-fashioned. Freight transport was mentioned only in one response declaring that better logistics would constrain the growth of deliveries.

As for CO₂ emissions from road traffic, a not very significant improvement in fuel efficiency was expected (the responses varied a lot, see Table 5.2). LILI was the most critical, and argued that an improvement in fuel efficiency was not probable, because oil industry and car industry are too closely connected. Also, the EU norms would not be effective because the norm test is not applicable to cold climate countries like Finland and people would still be buying bigger and bigger cars. ENE and AL expected more improvement in fuel efficiency. AL also promoted eco-driving due to the better education of drivers and car salesmen concerning the choice of a car and driving habits. Future car buyers would desire more beauty and more space but not more engine power. ENE simply regarded the combustion engine as old-fashioned.

5.2.4 Cluster Four: 'Optimistic Structural Change'

Cluster four includes a high GDP growth, 90%, but almost no growth in road traffic volume, only 5%, and a clear decrease in CO₂ emissions by 40% (Figure 5.4). Cluster four includes no responses of a probable future but four responses of a preferable future (LALpref, TLpref, YMpref, YTV*pref). The variation of the road traffic volume is larger than in clusters one to three, but the responses seem to be close to each other in terms of the CO₂ emissions from road traffic (Table 5.2).

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The responses in cluster four were clearly non-material growth oriented and represent a more optimistic version of cluster three. Contrary to cluster three, strong, stable GDP growth was regarded as improving the quality of life. Respondents considered the goals of a good quality environment and GDP growth compatible. Stable growth was also regarded as a requirement for the abatement of the negative externalities of economic action.

The road traffic volume was seen as an indicator of the material economy and therefore further growth was not recommended. The respondents thought that the current level of mobility in Finland was high enough for a good quality of life and low enough to provide good opportunities for a reduction in emissions. Further growth would bring more congestion, accidents and emissions. Clear potentials for the rationalisation of production and the logistics of delivery were seen in the better use of information technology. This would improve the efficiency of the economy and therefore allow investments in more profitable areas than transport.

According to the responses, the most important factors for stopping road traffic volume growth were urbanisation and urban infill. These were considered to favour public transport. Fast trains were expected to compete with passenger cars and aeroplanes on longer trips and buses on shorter trips. Also pedestrian and bicycle traffic was emphasised for short distances. Some freight would be shifted from road to rail as well.

The respondents presented several policy instruments for the mode shifts, including slower speed limits, higher fuel taxes etc. Also, changes in people’s lifestyles were regarded as preferable and essential for the development described by the cluster.

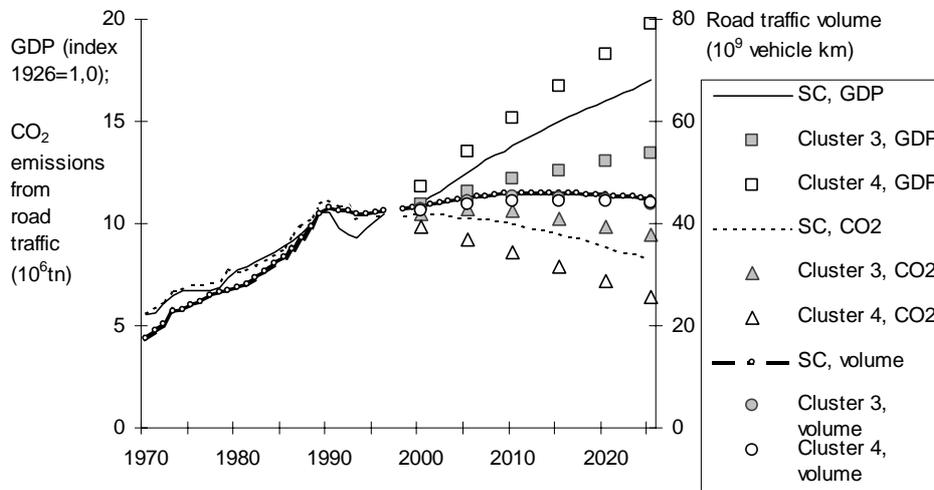


Figure 5.4: The hypothetical structural change scenario (SC) and clusters 3 and 4. (The road traffic volume of cluster three is exactly the same as cluster four and cannot therefore be seen well in the figure.)

The respondents expected a clear improvement in fuel efficiency and therefore a reduction in CO₂ emissions from road traffic. One argument was that the climate policy debate has only recently begun and that fuel efficiency improvement will be seen more clearly in the

future. Two respondents in cluster four had a view of a 20-30% market share for vehicles from alternative energy sources in 2025 (YM and YTV*).

Figure 5.4 compares the hypothetical structural change (SC) scenario and clusters three and four. All have in common the idea that road traffic volume would (or should) stay at the level of the 1990s. A surprise was that there seems to be two variations on this idea, cluster three seeks low growth and a modest improvement in eco-efficiency and cluster four a high growth and eco-efficiency.

5.2.5 Cluster Five: 'Radical Deep Ecology'

Cluster five contains a slow negative GDP development of 10%, and a steep decrease in road traffic volume by 60% back to the level of the late 1960's. Also CO₂ emissions would decrease steeply by 80% (Figure 5.5). Cluster five includes no responses of a probable future but two responses of a preferable future (DODOpref, ENEpref). The range of the variables can be seen in Table 5.2.

According to the answers of the respondents in cluster five, the material standard of living is already high enough in Finland. Further growth would require more working hours and a more hectic lifestyle, which were seen as too high a cost for the growth. GDP also includes unnecessary and non-preferable production such as weapons and unnecessary luxury goods like snow mobiles *etc.* The respondents regarded a calmer and a more peaceful lifestyle as preferable. This would produce a good quality of life but less GDP. A more even income distribution would improve the situation of the poor and shorter working hours would decrease unemployment even in the zero growth GDP economy.

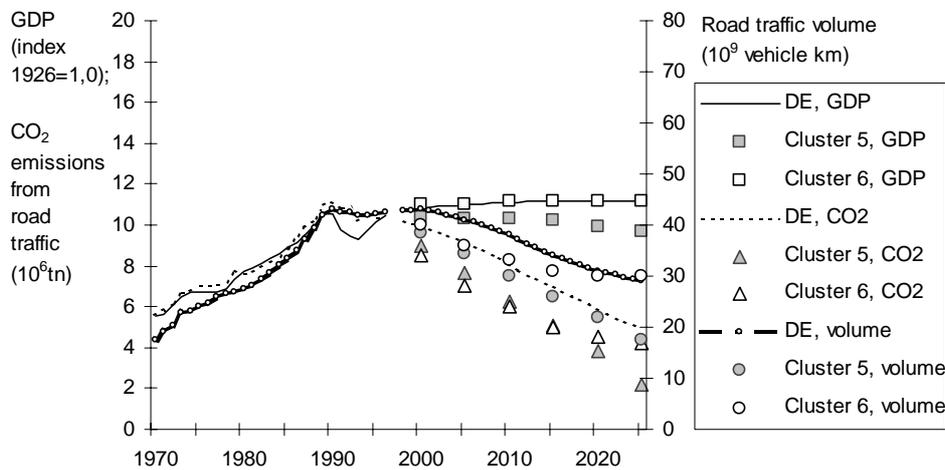


Figure 5.5: The hypothetical deep ecology (DE) scenario and clusters five and six.

The respondents anticipated great potentials for immaterialisation via information technology. For example, new displays could challenge paper, which would clearly drop the freight transport volume in Finland. Telecommunications would also have a good potential for substituting real traffic.

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The responses in cluster five included urbanisation as a factor that would decrease traffic volume, although there were differences: ENE stated that the rapid movement to the Helsinki capital region should be stopped and small villages and life in the countryside should be emphasised, whereas DODO was more city oriented. Both hoped for growth for small towns, though.

The respondents considered urban infill preferable and essential, especially for pedestrian and bicycle traffic, which were strongly emphasised. The construction of supermarkets would be restricted and local shops emphasised. Aesthetically more attractive cities and public transport vehicles would enable people to enjoy life in the cities instead of travelling away to summer cottages as often as possible. DODO stated that the generation that has been born in cities and towns will have more urban leisure time activities than nowadays, which would decrease leisure traffic to countryside. In cluster five, there would be a clear price upheaval for road traffic and flights as well.

As for CO₂ emissions from road traffic, a more rapid development in technology was preferred than in the probable future stated by the respondents. This would mean electric cars and hybrid electric vehicles at first, then even solar vehicles (mainly Southern countries). Car taxation would strongly prefer lighter and smaller vehicles. Figure 5.5 compares the deep ecology (DE) scenario with clusters five and six.

5.2.6 Cluster Six: 'Steady State Deep Ecology'

Cluster six is a slightly less radical version of cluster five, having very slow GDP growth of 5% for the whole period, and a clear decrease in traffic volume by 30%. Also, CO₂ emissions would clearly decrease by 60% (Figure 5.5). Cluster six had only one response of a preferable future, LILIpref. The values for 2025 are shown in Table 5.2.

The respondent in cluster six criticised GDP for measuring everything in monetary terms, which they regarded as wrong in principal. They believed that the quality of life could improve without monetary growth as well.

To reduce road traffic volume, the respondent presented urbanisation and urban infill as important factors. People would be more interested in parks and beaches than summer cottages. The people who spent time in summer cottages would rent a car instead of owning one. According to the respondent, values are already changing as the car is losing its role as a status symbol to computers and mobile phones.

Also, more subsidies for surface public transport were recommended, but not to the countryside for lines that have only few customers. Instead, money should be put into cities and intercity connections. This would reduce costs and bring more customers. Another point of emphasis would be more and better bicycle lanes.

Stopping climate change is one principle of action of the respondent organisation and therefore steep reductions in the CO₂ emissions from road traffic volume were considered preferable. Technological development was expected to be more rapid than before, because CO₂ emissions were seen as rising in the policy agenda internationally as well as nationally.

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Table 5.2: Variation indices of the clusters.

Cluster/ Variable	Value ^a 1996	Mean value 2025	Range of 2025 values	SD 2025	SD as per cent ^b 2025
Cluster one: business as usual plus					
Responses: STY ^{prob} , AKT ^{prob} , DODO ^{prob} , RHK ^{prob} , STY ^{pref} ^c					
GDP	10,5	16,8	(16,0 ; 19,2)	1,39	13%
Road traffic volume	42,5	66,7	(64,5 ; 70,0)	2,05	5%
CO ₂ emissions from road traffic	10,3	11,9	(10,3 ; 14,6)	1,93	19%
Cluster two: ecological modernisation					
Responses: YM ^{prob} , YTV ^d ^{prob} , Tl ^{prob} , LM ^{prob} , LAL ^{prob} , Al ^{prob} , LM ^{pref} , RHK ^{pref} , AKT ^{pref}					
GDP	10,5	17,3	(14,1 ; 19,2)	1,63	15%
Road traffic volume	42,5	56,6	(51,2 ; 59,0)	2,7	6%
CO ₂ emissions from road traffic	10,3	10,4	(9,2 ; 11,6)	0,88	9%
Cluster three: modest structural change					
Responses: LIL ^{prob} , ENE ^{prob} , Al ^{pref}					
GDP	10,5	13,4	(13,0 ; 14,1)	0,61	6%
Road traffic volume	42,5	43,2	(40,0 ; 46,0)	3,33	8%
CO ₂ emissions from road traffic	10,3	9,4	(7,5 ; 11,8)	2,16	21%
Cluster four: optimistic structural change					
Responses: LAL ^{pref} , TL ^{pref} , YM ^{pref} , YTV ^d ^{pref}					
GDP	10,5	19,8	(18,0 ; 21,6)	1,59	15%
Road traffic volume	42,5	44,1	(40,0 ; 50,0)	4,25	10%
CO ₂ emissions from road traffic	10,3	6,4	(5,1 ; 7,6)	1,09	11%
Cluster five: radical deep ecology^e					
Responses: DODO ^{pref} , ENE ^{pref}					
GDP	10,5	9,7	(9,3 ; 10,0)	-	-
Road traffic volume	42,5	17,5	(15,0 ; 20,0)	-	-
CO ₂ emissions from road traffic	10,3	2,2	(1,9 ; 2,5)	-	-
Cluster six: steady state deep ecology^e					
Response: LIL ^{pref}					
GDP	10,5	11,2	-	-	-
Road traffic volume	42,5	30	-	-	-
CO ₂ emissions from road traffic	10,3	4,2	-	-	-

^a GDP is measured as an index where the value of GDP_{mer} in real terms in 1926 is 1,0. Road traffic volume is measured in 10⁹ vehicle km and CO₂ emissions from road traffic in 10⁶ metric tn.

^b SD is also presented as a percentage because it makes the variation of the three variables more comparable.

^c The label 'prob' stands for probable future and 'pref' for preferable future.

^d The response of YTV is the operative manager's own view, not the organisation's.

^e Clusters five and six included only one or two cases and therefore no variation indices were calculated for them.

6 Discussion

Transport seems to be the most difficult field of climate policy. No immaterialisation and only a little dematerialisation can be detected in the trends of the past few decades. Increasing air traffic and road traffic volumes have resulted in equal increases of CO₂ emissions. Individual freedom has been interpreted as the freedom to travel by private car in the western world post World War 2 in Europe, since the 1960's in Finland and in the 1990's in the transition economies. No easily engineered point sources for emissions exist as the global number of exhaust pipes has exceeded half a billion globally. More sustainable policies for transport have faced public annoyance as the conflicts resulting from the rise in fuel prices around Europe showed in the year 2000. However, there have been many promising empirical experiments and trends as well, for example in Denmark and according to this study, also Finland.

There are several plausible alternatives to the business as usual development although one cannot be sure which transport policies would be the most sustainable. Transport planners all around the world need to consider a wide range of alternative policy scenarios in order to be able to move previous policies in a more sustainable direction. The tools of futures studies seem to offer good operational principles for the innovative production of alternatives and the conscious consideration of their value. These tools could be useful in other fields of climate policy as well.

The purpose of this study was to analyse the practise of futures studies within Finnish transport administration and conduct experiments to find alternative ways of working from the point of view of participatory democracy and environmental protection. Certain empirical lessons can be learned regarding the findings of the content and procedure of administrative futures studies. The discussion is divided into three sub-chapters: Chapter 6.1 focuses on the discussions concerning the empirical findings of the study. Chapter 6.2 contemplates the methodological worth of the disaggregative Delphi study. Chapter 6.3 discusses the logical, causal and empirical connections of the theory of the content environmental policy strategies and the procedural theory, namely the goals of a high quality environment and democracy.

6.1 A Discussion of the Empirical Findings

6.1.1 From a Road Construction Automate to Conscious Planning?

At the beginning of the 1990's the futures studies of FinnRA could be characterised as comtean positivism. Administrative officers or expert consultants studied the future prospects for traffic growth. However, only the business as usual forecast was applied in the policy reports and project level planning was made without the elaboration of alternative policies. On the project level, the business as usual figures were used, as such, in time-saving calculations which formed the core of cost-benefit analysis, the central evaluation tool of FinnRA. No alternative developments were used in the calculations. Sometimes there were different developments in the futures studies reports such as sensitivity analysis but this sensitivity analysis was not applied on a project level. The planning scheme of FinnRA in the early 1990's has been

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characterised as the 'road construction automate' by Wahlström *et al.* (1992, 231). (See also Leskinen 1994; Tapio 1995; Sairinen and Kanninen 2001.)

However, the procedure of the national futures studies of the transport administration changed dramatically in the mid and late 1990's. It first moved towards a mixture of optimistic humanism and pluralistic humanism in the middle of the decade. At the end of the decade, a mixture of polling democracy and critical pragmatism was being experimented with.

The development was fast considering how many philosophical barriers had to be broken down (chapter 3.2). If participatory democracy is seen as a norm then transport administration seemed to significantly improve its performance in the practice of futures studies. One must keep in mind that it is questionable (if not improbable) as to whether this change of approach could have penetrated the more concrete planning procedures as well in such a short time (see Sairinen and Kanninen 2001). The quick paradigm shift has also probably caused some confusion, resistance and annoyance. The concrete impacts of this development require further research.

It is also the task of further research to rigorously study whether the development could be seen in the transport administration of countries other than Finland. If Sweden is a forerunner, small traces of this development could be seen, because Sweden carried out a policy sensitive scenario analysis in 1992 (*Framtida transporter...* 1992). It did not however include interest group participation, but was a rather pure example of pluralistic humanism.

The OECD performed an interesting scenario analysis on Environmentally Sustainable Transport (EST) in the late 1990's, (see *eg.* OECD 1997). It had clearly indicated targets for its starting points and four scenarios for eight countries were made: 1) BAU, 2) High Technology Scenarios, 3) Capacity-Constraint Scenarios and 4) Optimum-Combination Scenarios. Although the exercise is impressive for analytical purposes a critical question can be raised if the set of scenarios were really meant as relevant policy alternatives. The EST project could thus be characterised as optimistic humanism or pluralistic humanism although its backcasting methodology would offer more participatory aspects as well.

6.1.2 From Growth Optimism to Ecological Modernisation?

The theoretical scenarios seem to provide relevant interpretations for the results of the Delphi Study. Figures 5.2-5.5 illustrate the positions of the clusters in relation to the nearest theoretical scenarios. A slightly improved business as usual cluster could be found as well as a version of ecological modernisation. It was interesting to discover two obviously different versions of structural change and two versions of deep ecology. However, a cluster that would have correlated with the hypothetical economic and technological optimism (ETO) scenario is missing from the six clusters. Closest to the ETO scenario is cluster one, which is illustrated in Figure 6.1.

Regarding the growth-oriented policies of Finland and the vague criticism made against them by strong interest groups (see Wilenius and Tirkkonen 1997), the absence of an economic and technological optimism cluster seems somewhat implausible and indicates a

bias in the study sample. TT would maybe present this line of thought but it only produced values only for GDP (21 for year 2025) and CO₂ emissions from road traffic (8,5 for year 2025) and skipped road traffic volume. Another option is that the most growth oriented interest groups simply did not wish CO₂ emissions to be reduced because of the costs involved. But it is also possible that only a few organisations in the transport field believed in the most techno-optimistic views. Thus the question raised is: Have the growth optimists moved towards the optimist version of structural change and ecological modernisation?

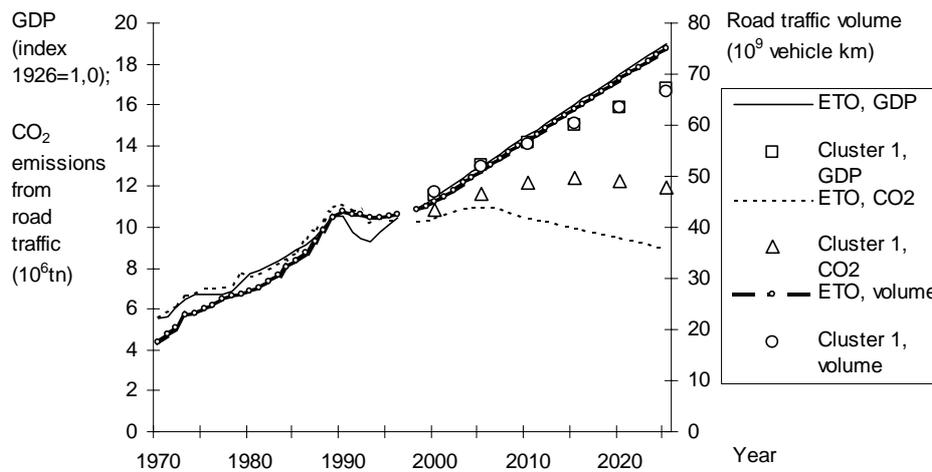


Figure 6.1: The economic and technological optimism scenario (ETO) and cluster one.

All clusters, except cluster one, were based on the idea that GDP will grow faster than road traffic volume (immaterialisation), which will, in turn, grow faster than the CO₂ emissions (dematerialisation). Cluster one also expected dematerialisation. Thus, the interest groups of transport policy in Finland expected a clear change in the relations of the variables in 1999, when the material was gathered.

Some comparisons with the Karmasin and Karmasin (1999) Delphi study can be made, however keeping in mind the differences (see article II). In this study the panellists expected and wished for both dematerialisation and immaterialisation. The expert respondents of Karmasin and Karmasin seemed not to believe in immaterialisation in the probable future but did consider it preferable. The expert respondents of Karmasin and Karmasin seemed to be rather pessimistic about the reduction of CO₂ emissions in the preferable future compared to the interest groups of this study. (Article II.)

The qualitative arguments produced by the respondents included regional and urban structure as major factors that affect the traffic system and these also formed the basis for policy recommendations. Although there has been vast amounts of work made on these mechanisms in transport engineering, transport economics and geography (eg. Lahti and Harmaaajärvi 1992; Jansen 1993, 114-122; Matinheikki 1996; Vickerman 1999; Simmonds and Still 1999), they seem to be poorly discussed in the theoretical literature of environmental policy. Thus I believe that transportation research can make a significant and valuable contribution to the general theoretical discussion of environmental policy.

Three weak signals of mechanisms restraining road traffic volume growth can be detected from the interviews, all anticipate a change in the traffic behaviour patterns of urban people. Firstly, it is possible that the attractiveness of leisure time activities in cities will increase and partly offset the habit of driving cars to summer cottages located in the countryside. Secondly, there are traces of a reduction in the acquirement of driving licences due to alternative patterns of consumption and the shift in status of consumer products to mobile phones and computers, especially by young people. Thirdly, the possible increase in the value given to health and fitness could result in an upward trend of bicycle commuting. These weak signals had little to do with anticipation in the rise of environmental values affecting traffic behaviour.

6.2 The Disaggregative Policy Delphi – Systematic Scenarios or Obscure Potpourri?

Certain lessons can be learned from the methodological approach developed in this study. Compared to ordinary committee work the disaggregative policy Delphi brings out more diverse policy alternatives. The Working Group of CO₂ Emissions for Road Transport in Finland had two alternatives, the “probable” and “0-target”, the difference being a +5% and 0% growth in CO₂ emissions 1990-2010. Passenger car traffic volume growth in the probable alternative was +24% and in the 0-growth alternative +18% (Ministry of Transport... 1999). The working group could be said to have a narrow perspective on what is possible.

There is no need to go into debate as to whether the heuristic scenarios or empirically tested formal models are better because they have a different role (Schwarz *et al.* 1982). Rather Delphi and other heuristic scenario methods could provide new ideas about important factors and mechanisms, which could be adopted into what-if models. However, the qualitative arguments included in a quantitative cluster were more varied than expected. This placed restrictions on the formation of consistent scenarios directly from the data. Overall then it seems appropriate to conclude that the disaggregative Delphi approach of the study does provide a ground for forming the core of a set of scenarios but one must use some heuristic common sense to solve the remaining inconsistencies.

6.3 Environment and Democracy

The general task of this study was to analyse and make innovations within the futures studies of transport administration in relation to the goals of democracy and environmental protection, especially in climate policy. Some discussion is of importance regarding the division of the procedural theory of policy making that addresses democracy (chapter 3.1) and the theory of the content of climate relevant environmental and transport policies (chapter 3.2). One strand of discussion has focused on whether democracy in general or participatory democracy in particular is good or bad for the environment (Linkola 1986; Dryzek 1987, 200-215; Meadowcroft 1997; Hajer and Kesselring 1999).

From a logical and ethical point of view this question relates to the unsolved paradox in social philosophy between the procedural rules for making a good decision and the

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content criteria needed for making a good decision. The discussion has lasted since the days of Plato (1955), whose writing of the last days of Socrates dealt with the paradox.⁶³ Socrates did not agree with the decision makers that he had committed any crime but they decided to execute him. Socrates was offered an opportunity to escape from prison but he refused because for him the obedience of the legal institution was more important than the content of the decision. Thus, Plato seemed to emphasise the rule of a good process over a content based decision.⁶⁴

Aristotle (1991, 72-73) seemed to grasp most of the problem as well in his profound volume of *Politics*. Aristotle's view has been crystallised into a cross matrix, where the rows contained the relative number of decision makers and columns consisted of whether the decision makers made decisions for the common good or for their own good (Baker ref. Dahl 1984, 64; Sihvola 1991, 255). Aristotle's point seemed to be that procedural rules for good decision making and the content criteria are complementary in decision making – they cannot be reduced to one or another nor placed in hierarchical relations of intrinsic values and instrumental values. This view seems to have been sustained through two millennia of social philosophy and political science.

The competition between the emphasis of the content or procedural aspects can thus be considered a draw in logical terms. So what can be said about the theoretical connection of their causal relationships? Dryzek (1997, 200-201) has suggested impressively that if Habermasian communicative rationality would be adopted as an ideal model for democratic planning and policy making it would lead to environmentally better decisions. Rhetorical, emotional, subjective, power-related and selfish claims would be overcome by the rational fact that without the integration of a community to its ecological base the community would disappear.

However Dryzek cannot prove the connection of any content based policy in the success of this integration although he makes a good case against business as usual (Dryzek 1997, 57-60). How could people *really* know for sure which concrete policies would be ecologically sustainable and which unsustainable (see chapter 3.1)? The variation of potentially sustainable policies is so great that the uncertainty opens up an obvious gap between the procedural and content based aspects of Dryzek's theory.⁶⁵

Although environment and democracy cannot be reduced to one or another logically or causally, something can be said about their empirical connections. Hajer and Kesselring (1999) offer an analysis of three participatory processes and one corporatist process of transport planning in Munich. Their conclusion was that increasing direct

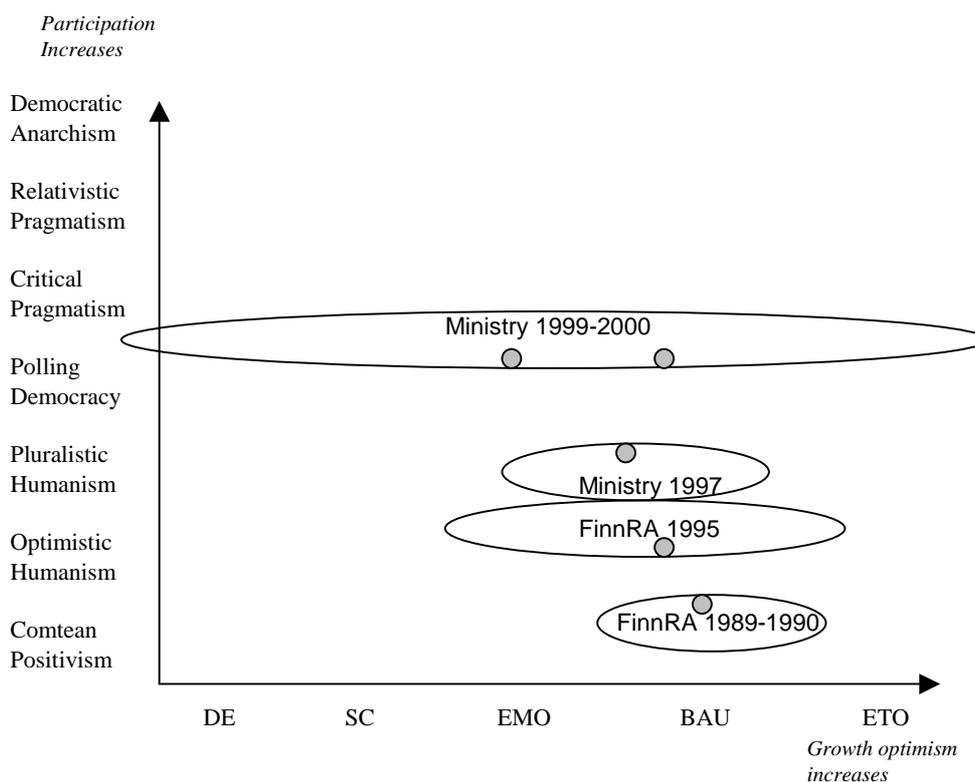
⁶³ Probably the discussion occurred before Plato as well. For example Schemel (2000) made a review of decision making processes in ancient Egypt and Mesopotamia referring to this dilemma on a number of occasions.

⁶⁴ However, democracy was not the good rule for Socrates, who promoted professionalism, 'serious thinkers' (Plato 1955, 55-61).

⁶⁵ The precautionary principle can be suggested to fill in the gap: It says that we should not commit economically feasible actions when there are doubts that in the long run it could prove unsustainable. Thus it would be best to reduce consumption and production as long as it can be proved that increasing consumption can be confidently seen as sustainable. The solution proposal is interesting but from the ETO scenario point of view it can also be considered contradictory because reducing consumption and production might reduce economic output and therefore enterprises and societies as a whole would not gain enough wealth to make the necessary investments in cleaner technology.

public participation in fact produced solutions which were worse for the environment than the expert-oriented corporatist process.

To make a comparison with the findings of Hajer and Kesselring the two continuums of theoretical typologies presented in chapter 3 are cross-matrixed in figure 6.2. The variation ranges of the policy alternatives produced are indicated as transparent ovals. It can be concluded that the more participatory the process was the wider policy range was considered. The wide policy range in turn reflects possibilities and serious considerations for change in current policies.



The **Y-axis** describes a continuum from technocracy to citizen participation. The **X-axis** describes a continuum from growth criticism to growth promotion: DE=deep ecology; SC=structural change; EMO=ecological modernisation; BAU=business as usual; ETO=economic and technological optimism. **Transparent ovals** describe the range of produced substantial alternatives and the type of process, which was followed in a futures study of transport administration. **Grey ovals** describe which one of the produced alternatives was chosen for policy making.

Figure 6.2: The position of the empirical cases of futures studies in the Finnish Road Administration (FinnRA) and the Ministry of Transport and Communication in relation to the schools of thought of content and procedure.

The position of the chosen policy alternative is indicated with a coloured grey oval in figure 6.2. Contrary to Hajer and Kesselring, it could be declared that increasing participation would also lead to better environment. But there is one problem with this conclusion, both in Hajer and Kesselring's work and this study: There is no direct

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empirical evidence that techno-pessimistic growth criticism would be more environmentally sound than techno-optimistic growth promotion. There is only empirical evidence that the business as usual scenario cannot be regarded as environmentally sound. This evidence suggests clear changes in the transport policies of Finland, the European Union and most of the world.

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Acronyms

BAU	Business as Usual scenario
CO ₂	Carbon dioxide
DE	Deep ecology scenario
EMO	Ecological modernisation scenario
ETO	Economic and technological optimism scenario
FinnRA	Finnish Road Administration
GDP	Gross domestic product in market exchange rates and in real terms
GHG	Green-House Gas
GWP	Gross world product in market exchange rates and in real terms (In climatological vocabulary GWP usually stands for Global Warming Potential, which is not the case here)
IPCC	Intergovernmental Panel on Climate Change
ppm	Parts per million
ppmv	Parts per million in gaseous concentration
SC	Structural Change scenario
TAR	Third Assessment Report of IPCC
UNCED	United Nations Conference on Environment and Development (The 'Rio Conference')
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Framework Convention on Climate Change
WCED	World Commission on Environment and Development ('Brundtland Commission')
WMO	World Meteorological Organisation

Appendix 1

Analysed Primary Documents

Case 1: Road project Muurla-Lohjanharju

Suunnittelukeskus & FinnRA, 1989a, *Lohjan seudun tieverkko- ja liikenneturvallisuussuunnitelma: Osaraportti 1, Perusselvitykset ja liikenne-ennusteet*, Suunnittelukeskus Ltd & FinnRA Uusimaa Road District, an unpublished draft. [Road Network and Traffic Safety Plan of the Lohja District: Sub-report 1, Basic Information and Traffic Forecasts, in Finnish.]

Suunnittelukeskus & FinnRA, 1989b, *Turku – Helsinki tieyhteydet välillä Muurla – Lohjanharju: Vaihtoehtoselvitys*, Suunnittelukeskus Ltd & FinnRA Uusimaa Road District, 59 p. + 7 app. [Turku – Helsinki Road Connections between Muurla – Lohjanharju: Analysis of Alternatives, in Finnish.]

Case 2: Road project Pasilanväylä

City of Helsinki & FinnRA & Viatek Tapiola, 1992, *Pasilanväylä: Yleissuunnitelman liikenne-ennusteet*, City of Helsinki, FinnRA & Viatek Tapiola Ltd, 20 p. + 4 app. [Pasilanväylä: Traffic Forecasts of Preliminary Engineering Plan, in Finnish.]

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YTV & Ministry of Transport and Communications, 1990, *Liikennemallit: Paakaupunkiseudun liikennetutkimus 1988*, Helsinki Metropolitan Area Council (YTV) & Ministry of Transport and Communications Finland, Pääkaupunkiseudun julkaisusarja B 1990:15, Helsinki, Four parts: A 50 p. + 13 app., B 17 p. + 5 app., C no page numbers, D 27 p. [Transport Models: Traffic Survey of Helsinki Metropolitan Area in 1988.]

YTV & Ministry of Transport and Communications, 1991, *Pääkaupunkiseudun liikennetutkimus 1988: Yhteenveto*, Helsinki Metropolitan Area Council (YTV) & Ministry of Transport and Communications Finland, Pääkaupunkiseudun julkaisusarja B 1991:7, Helsinki, 77 p. + 11 app. [Traffic Survey of Helsinki Metropolitan Area in 1988: Summary.]

Case 3: TIE 2010 policy

FinnRA, 1990, *Liikenne- ja autokantaennuste 1989-2010*, Roads and Waterways Administration, Research Centre, Research notes/Serie A, TVH 713 432, 2nd edition, Valtion painatuskeskus, Helsinki, 97 p. + app. 31 p. [Traffic and Automobile Stock Forecast 1989-2010 for Finland, in Finnish, Abstract in English.]

FinnRA, 1991, TIE 2010, Finnish Road Administration [no print location mentioned], 23 p. [TIE 2010 policy.]

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National futures studies and related policies in mid- and late 1990's

FinnRA, 1995, *Liikenne- ja autokantaennuste 1995-2020*, Tienpidon strateginen projekti S2, Tielaitoksen selvityksiä 50/1995, Helsinki, 189 p. [Road Traffic Forecast for 1995-2020, Finnish Road Administration, in Finnish, Abstract in English.]

Ministry of Transport and Communications, 1997a, *Menetelmä liikennejärjestelmän vaihtoehtojen muodostamiseksi: Taustaselvitys*, Reports and Memorande of Ministry of Transport and Communications B 42/97, Edita, Helsinki, 183 p. [Method for Creating Transport System Alternatives – Background Study, in Finnish, Abstract in English.]

Ministry of Transport and Communications, 1997b, *Liikenteen toimintalinjat vuoteen 2020*, [no print location mentioned], 23 p. [Guidelines of Transport towards the Year 2020, in Finnish.]

Ministry of Transport and Communications, 2000a, *Liikenneskenaariot 2025*, Publications of the Ministry of Transport and Communications 25/2000, Edita, Helsinki, 101p. [Traffic Scenarios 2025, in Finnish, Summary and Conclusions in English.]

Ministry of Transport and Communications, 2000c, *Kohti älykästä ja kestäväää liikennettä 2025*, Policies and Strategies 1/2000, Ministry of Transport and Communications, Helsinki, 47 p. [Towards Intelligent and Sustainable Transport, in Finnish.]

Appendix 2

The Questionnaire of the First Delphi Round

This appendix presents the whole questionnaire of the first Delphi round. The original questionnaire was written in Finnish and has been translated into English. The font has been changed, the researcher's address and phone number are excluded from the foot notes, the logo of the Finland Futures Research Centre has been removed and Single sided pages have been changed to double sided for editorial reasons, but no other changes are made, although some of the data has not been used in this thesis. The responses to questions considering technically and socially possible futures were scarce and implied that an interview could have been more adequate method.

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Date

Dear N.N., organisation X

The name and phone number of the respondent if different from N.N.

Economy, transport and the environment in the future?

Three variables have been correlated from 1970-1996 in Finland:

- road traffic volume
- the carbon dioxide emissions from road traffic
- gross domestic product

The purpose of this expert survey performed by Futures Research Centre is to trace different views of the future of road traffic volume, the carbon dioxide emissions of road traffic and gross domestic product up to the year 2025. The background of the study is the visionary process of the Ministry of Transport and Communications carried out in 1997, especially the starting point of the final report "*Transport Guidelines to 2020*", namely the challenges of the social environment to the transport sector which are scrutinised closer here. The study will be presented as a doctorate thesis at the University of Helsinki by the researcher.

I ask you to draw the view of your organisation for the development of road traffic volume, the carbon dioxide emissions of road traffic and gross domestic product for the years 1997-2025. Are the variables connected and if so – how? Does GDP growth always result in the respective growth of road traffic volume and does it in turn result in the respective growth of the carbon dioxide emissions of road traffic? Will the variables correlate in the future as well or will they decouple? Should they be decoupled and if so – how? Will the variables return to the growth path of the past, will they stay at the level of the 1990's or will they or some of them start to decrease? What kind of development would be preferable? There are five figures:

- A) probable future
- B) technically possible futures
- C) socially possible futures
- D) preferable futures
- E) non-preferable future

You will find enclosed the return envelope with a stamp and address ready. Please mail the form before Friday 24 April 1998 at the latest. If the questionnaire is somehow unclear please contact us or make comments on the form. This poll will be followed by an interview round for which you will receive a summary of the poll round. You will then see how the other respondents have answered and you may comment on their arguments. The approach is thus a two-rounded application of the Delphi method. I will contact you again next autumn in order to make the interview. Thank you for your participation!

Petri Tapio, researcher
Futures Research Centre
Phone 02-338 3590 (Mon)
09-309 997 (Tue-Thu)
09-708 5053 (Fri)
Fax: 02-233 0755 (Mon)
09-708 5462 (Fri)
E-mail: petri.tapio@tukkk.fi

A) Probable future

Please draw your organisation's view of the most probable development of GDP, road traffic volume and carbon dioxide emissions for the years 1997-2025 on this figure.

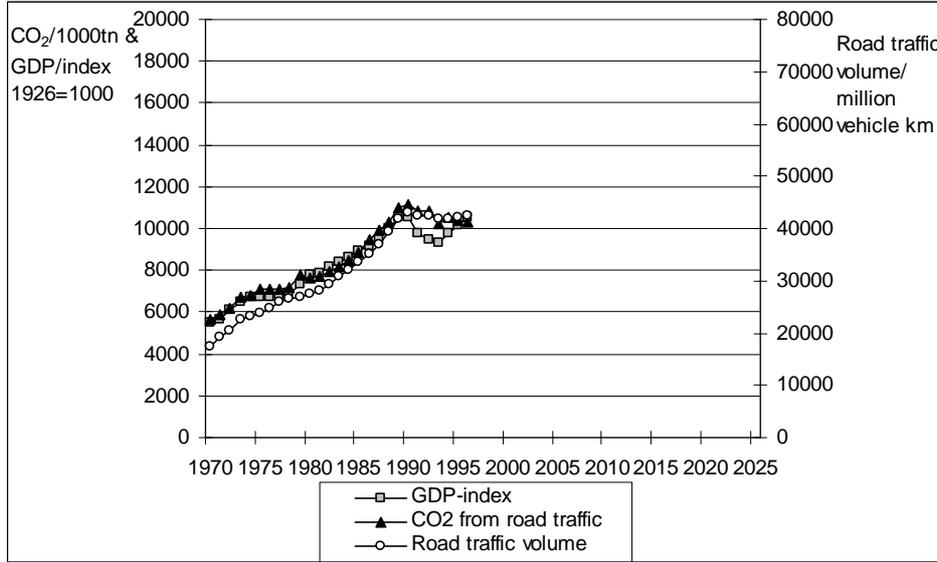


Figure A: The gross domestic product, road traffic volume and carbon dioxide emissions from road traffic in Finland 1970-1996 and your organisation's estimate of the most probable development for years 1997-2025.

Please give a short description of the assumptions on which the view is based:



B) Technically possible futures

Please draw your organisation's view of the extreme highest and lowest technically possible values of GDP, road traffic volume and the carbon dioxide emissions for the years 1997-2025 on this figure. Technically possible futures here refers to future transport systems that also include such physical measures of vehicle technology, infrastructure and urban structure that would not necessarily be accroved society. Thus you need not consider whether the measures would be accepted in political or entrepreneurial decision-making or affect the traffic behaviour of individuals in the market.

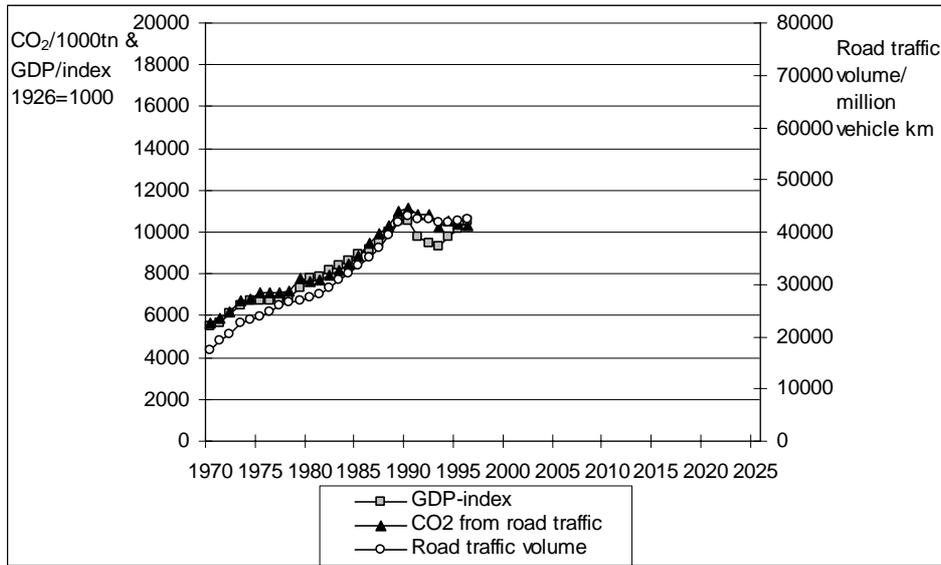
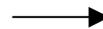


Figure B: The gross domestic product, road traffic volume and carbon dioxide emissions from road traffic in Finland 1970-1996 and your organisation's view of the technically possible extreme values for 1997-2025.

Please give a short description of the assumptions on which the view is based:



C) Socially possible futures

Please draw your organisation's view of the most extreme socially possible high and low values with regard to gross domestic product, road traffic volume and carbon dioxide emissions from road traffic in Finland 1997-2025 to this figure. Here we mean futures which will not be affected by technical obstacles, nor a lack of demand, nor societal decision-making.

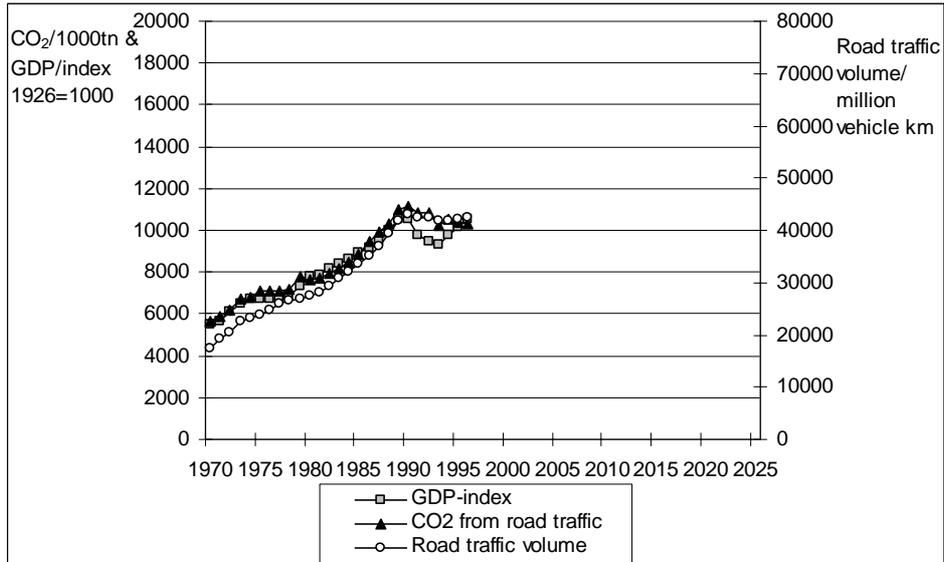


Figure C: The gross domestic product, road traffic volume and carbon dioxide emissions from road traffic in Finland 1970-1996 and your organisation's view of the socially possible extreme values for 1997-2025.

Please give a short description of the assumptions on which the view is based:



D) Preferable future

Please draw your organisation's view of the most preferable development for gross domestic product, road traffic volume and carbon dioxide emissions from road traffic for 1997-2025 to this figure. Here we mean a preferable image of the future which is technically possible and most preferable when all relevant aspects are taken into account. The social possibility (estimates of market demand and decision-making) of the preferable scenario need not be considered here.

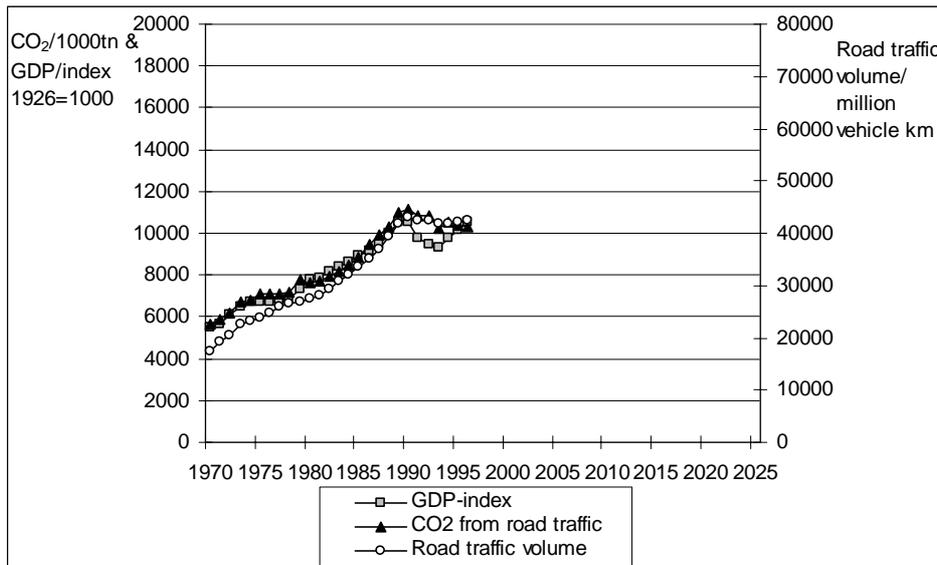


Figure D: The gross domestic product, road traffic volume and carbon dioxide emissions from road traffic in Finland 1970-1996 and your organisation's view of the preferable developments for 1997-2025.

Please explain briefly the most relevant aspects determining preferability. Give a description of what assumptions the estimate is based on and what measures would be needed in order to achieve the preferable future:



E) Non-preferable future

Please draw the least preferable development of GDP, road traffic volume and carbon dioxide emissions from road traffic for the years 1997-2025 on this figure. Here we mean the least preferable image of the future which is technically and socially possible.

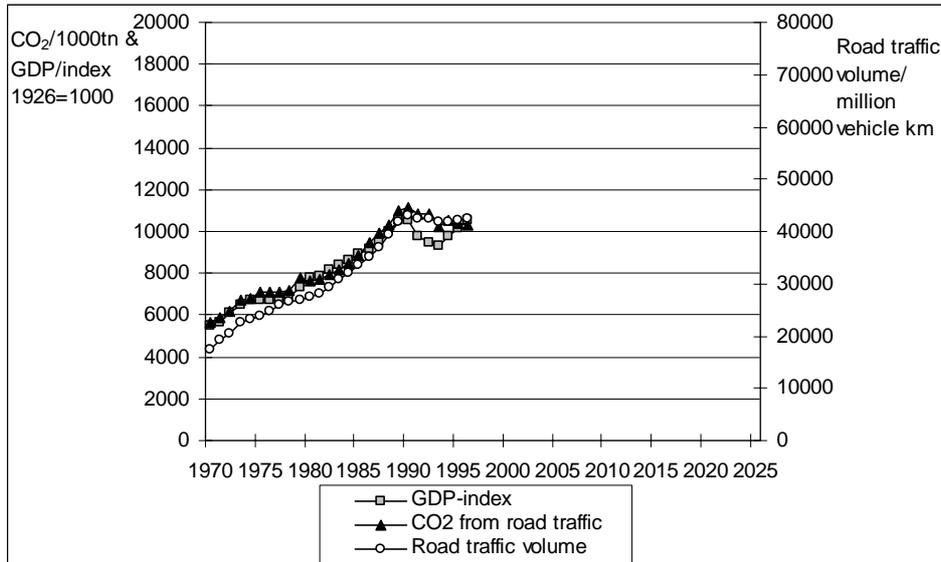


Figure E: The gross domestic product, road traffic volume and the carbon dioxide emissions from road traffic in Finland 1970-1996 and your organisation's view of the least preferable developments for the years 1997-2025

Please give a short description of the assumptions the estimate is based on and explain why it is least preferable:



The Limits to Traffic Volume Growth

Respondents to the poll*

- Transport Workers' Federation, Juhani Koivunen
- Automobile and Touring Club of Finland, Heimo Jaakkola
- Car Importers**, Pekka Puputti
- Dodo – The Living Nature of the Future, Jarre Parkatti
- Traffic Policy Association Majority, Risto Larjavaara
- Traffic League, Sisko Kangas
- Ministry of Transport and Communication, Reino Lampinen
- Bus Transport Federation, Ari Heinilä
- Helsinki Metropolitan Area Council / Transportation Department, Reijo Teerioja
- Rail Administration, Tuomo Suvanto
- Finnish Association for Nature Conservation, Esko Joutsamo
- Finnish Road Association, Jaakko Rahja
- The Confederation of Finnish Industry and Employers, Maire Kaartamo
- Road Administration, Veijo Kokkarinen
- Ministry of Treasury, Heikki Kuitunen
- The Finnish Union of Environmental Professionals, Tuula Kilpeläinen
- Ministry of the Environment, Mauri Heikkonen
- Finnish Oil Federation, Jaakko Tusa

* The organisations were listed in Finnish alphabetical order in the questionnaire. All these respondents did not in fact reply but this was the information given to the respondents.

** The Finnish branch organisation of the International Organization of Motor Vehicle Manufacturers (OICA)

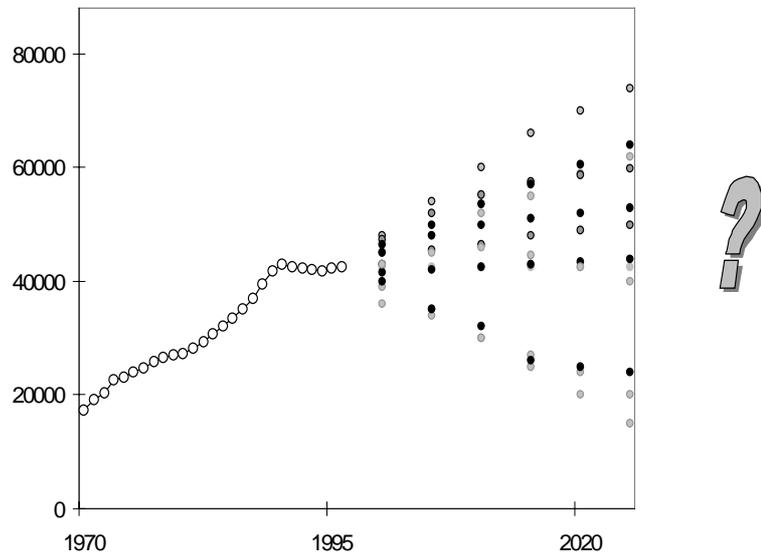
Appendix 3

The Interview Form of the Second Delphi Round

The appendix includes the whole interview form of the second Delphi round. Many aspects of the data have not been used in this thesis. The original Finnish form has been translated into English here and the font has been changed to be consistent with the rest of this report. The obvious errors of the original form, such as the confusions between car stock and car density, or out-of-date modal split statistics, have retained in the translation.

Economy, Transport and the Environment in the Future?

Second Round



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Date

N.N., Organisation X

Economy, Transport and the Environment in the Future?

Second Round

Dear respondent,

This is the summary of the first round of the poll "*Economy, transport and the environment in the future*" which you responded to last spring. You can see from the report, how others responded to the questionnaire. The first round produced a diverse selection of views in the consideration of the future of gross domestic product, road traffic volume and carbon dioxide emissions from road traffic. The responses were surprisingly varied and provide us with interesting material for further discussion.

I hope that you will prepare yourself to specify the assumptions of your organisation's view. I also hope that you will read the arguments provided by the other respondents and be prepared to comment on them. In the interview you may state counter arguments or rephrase the view reported in your first round response, if it seems adequate or it has changed after the first round.

You will find enclosed the interview form, which we have used to specify the general themes of the first round. Some of the questions are quick prompts that are useful to fill out before the interview. Some questions are less structured and may be discussed in an unstructured way in the interview.

The study will be presented as a doctorate thesis at the University of Helsinki. The results will be used in the scenario work of the Ministry of Transport and Communications.

I hope you have an interesting time reading the transport discussion,

Petri Tapio

Researcher
Futures Research Centre, TUKKK
PO-Box 110, 20521 Turku
Ph. 02-3383 530
petri.tapio@tukkk.fi

Economy, Transport and the Environment in the Future?

The summary of round one and the interview form of round two

Contents

- 1 GDP, transport and CO₂ emissions in the probable and preferable future
 - 1.1 First round responses: probable and preferable futures
 - 1.2 Modal split
 - 1.3 GDP, transport and CO₂ emissions in different areas

- 2 Measures to achieve the preferable future
 - 2.1 Information measures
 - 2.2 Measures of vehicle technology
 - 2.3 Physical transport services
 - 2.4 Norm changes
 - 2.5 Transport prices and monetary measures

- 3 In what ways will people and goods move in the future and why?

1 GDP, Transport and CO₂ Emissions in the Probable and Preferable Future

1.1 First round responses: probable and preferable futures

This chapter presents each respondent organisation's response in relation to other organisations' responses. The responses of the other organisations are presented in grey shades and your own organisation's in bold. The assumptions and arguments presented in the first round are gathered beside the figures. It is the target of this summary to describe the first round responses as such and to avoid interpreting the responses. However, substantially similar arguments have been unified although they would have been presented differently.

I ask you to think about the comments and counter arguments especially regarding the responses differing from your own organisation's response and more in-depth arguments for your own organisation's response. You also have the possibility to change the first round response in the light of the others' arguments. Draw a line in each figure to confirm the answer of the first round or to rephrase it.

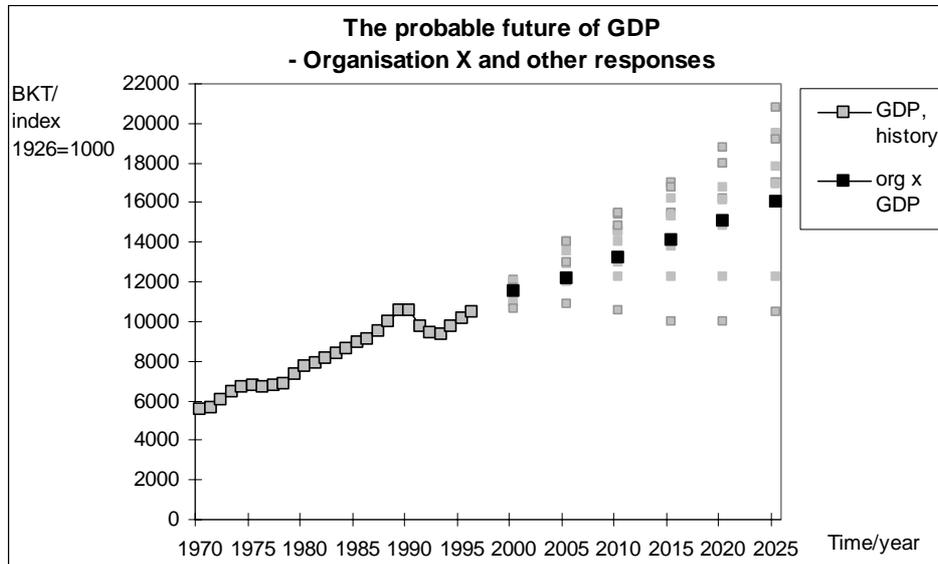
GDP

Regarding the probable development of GDP the responses can be divided into three groups: The first group viewed it probable that GDP will grow faster than in the past. The second expected a somewhat similar growth rate to the past and two responses expected growth to slow down or even stop. The respondents either thought that the economy will return (or has already returned) to the previous growth path or then the recession of the early 1990's was interpreted as a sign of slowing or a stopping of the growth rate.

Most respondent organisations considered a faster GDP growth preferable in relation to the past. The views of the preferable development of the GDP were strictly dichotomic, however, since a group can be discerned that regards stopping economic growth as a preferable goal. There are no responses between these two groups, which would be in favour of slow GDP growth.

The views on gross domestic product included few arguments supporting the answers given. I would like you to deal with your answer in more depth regarding the content of the future economy in the interview.

The Limits to Traffic Volume Growth



Arguments for the upper curves:

- economic growth is a central value in society
- the average relative growth rate of the economy will remain the same (2-3% per annum), which makes the growth accelerate a little
- the Finnish economy possesses good international competitiveness

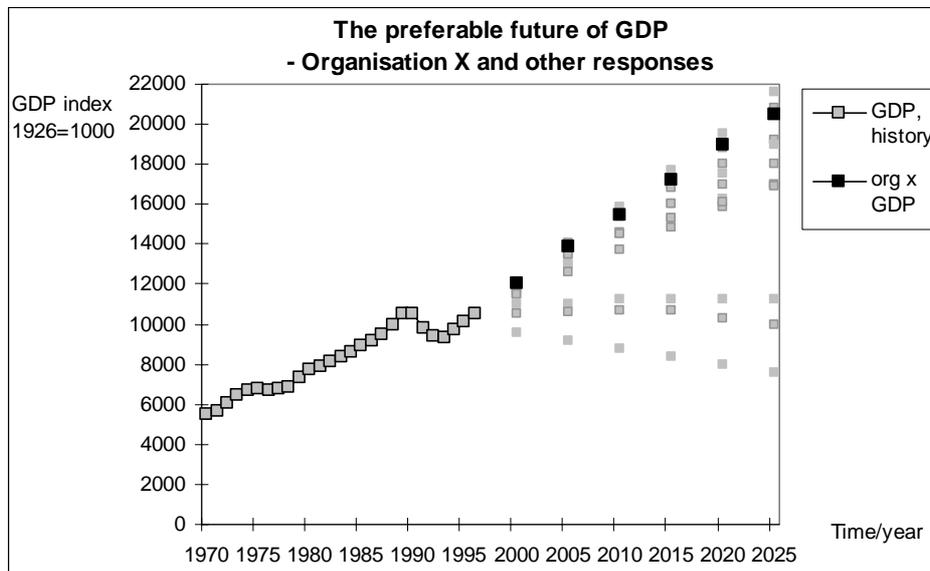
Arguments for the middle curves:

- the overheating of the economy in the late 1980's and the recession of the early 1990's were normal variations of the average trend which will remain possible in the future
- the recession of the early 1990's was the sign of a slight slowing down in the growth rate

Arguments for the lower curves:

- Sustaining the environment and the scarcity of natural resources will limit the growth rate of the economy
- a new recession will emerge in a few years

The Limits to Traffic Volume Growth



Arguments for the upper curves:

- none of the forms included arguments

Arguments for the middle curves

- we need economic growth in order to be able to afford to protect the environment

Arguments for the lower curves

- it is important to maintain the environment for future generations
- the material standard of living is high enough already in Finland

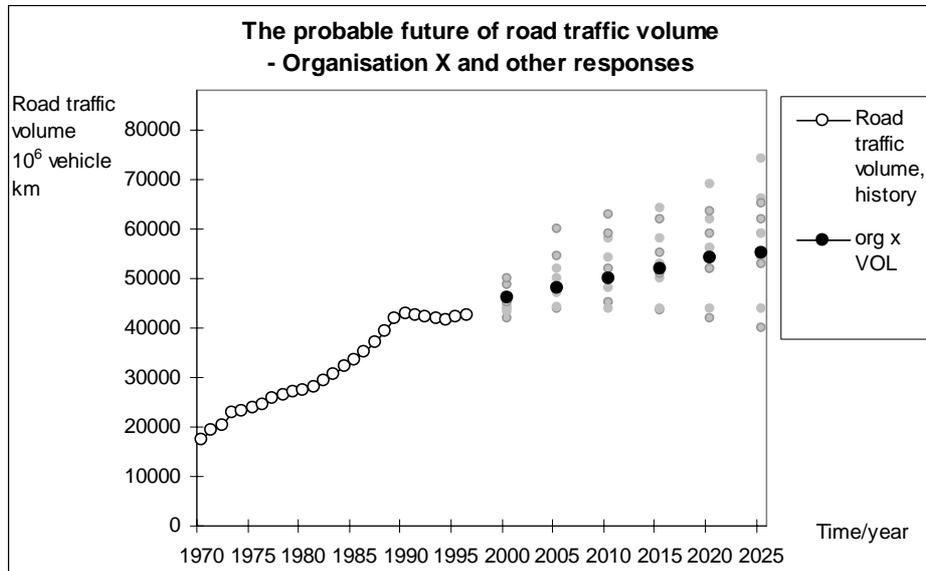
The Limits to Traffic Volume Growth

Road traffic volume

Almost all responses considered it both probable and preferable that the curve of road traffic volume will end up lower than the GDP curve. The highest responses of both the probable and preferable developments of road traffic volume view a somewhat similar development as before. The lowest responses in the range present zero-growth in the probable future and a steep decline in the preferable future.

Road traffic volume was the variable that contained the greatest variation between the respondent organisations. Apparently this is the central controversy of transport politics and the responses varied surprisingly. Also more arguments were generated for the curves than in the GDP estimates.

The Limits to Traffic Volume Growth



Arguments for the upper curves

- economic growth will result in consumer income growth, which will result in private car traffic growth
- the automobile stock of Finland is low in an international respect suggesting potential for growth
- leisure time will increase which will result in increased leisure time and holiday travel
- urban sprawl will make people more dependent on private cars

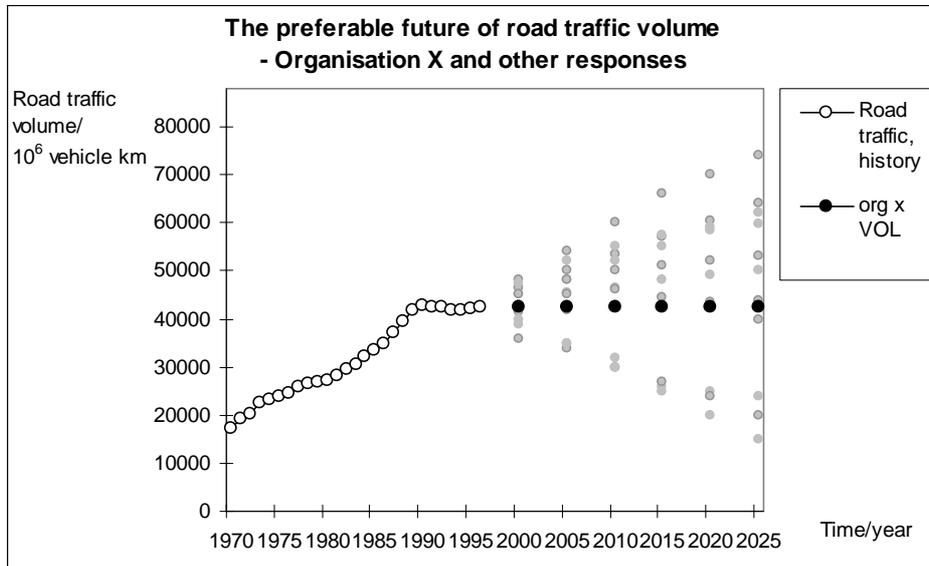
Arguments for the middle curves

- the emphasis on car taxation will be shifted from acquiring one to car use, which will slow down the growth rate
- transport volume growth will shift from passenger cars to air transport
- transport will not grow with GDP any more because economic growth will consist more of non-material 'qualitative' growth
- it is probable that future development will follow the same long run average development as the past
- the population is ageing and older people will travel less than the young and middle-aged
- urbanisation, urban infill and movement to villages from sprawl areas will result in slow growth
- passenger car density will increase towards that of countries with a high car per person ratio and simultaneously the annual car km will decrease towards the current situation in the type of countries noted
- the saturation level of passenger car density (550-600 cars /1000 inhabitants) will be reached in Finland in the 2020's
- the less material intensive electronics industry will grow faster than other sectors resulting in the slower growth of freight transport

Arguments for the lower curves

- information communication will substitute physical transport
- people's values will change towards a less material oriented consumption lifestyle
- the carrying capacity of the environment will limit car traffic volume growth

The Limits to Traffic Volume Growth



Arguments for the upper curves

- the market share of public transport must be increased but without strict obligatory decisions
- the freedom of private car traffic must not be restricted
- the growth of CO₂ emissions can be stopped by technical measures

Arguments for the middle curves

- passenger traffic growth pressure must be guided to soft modes, public transport and communication technology
- urban infill is preferable
- transport is a means not an end, the economy and its communication infrastructure should be organised with only a small need for transport
- production growth should be gained from the electronics industry and services which would result in the slower growth of freight transport

Arguments for the lower curves

- information technology should be used to substitute road transport
- an emphasis on local non-material production is preferable
- rail transport market share will be clearly increased both in passenger and freight transport
- carbon dioxide emissions should be reduced by 60-80% from present in order to combat climate change, this cannot be done without reducing road transport volume

The Limits to Traffic Volume Growth

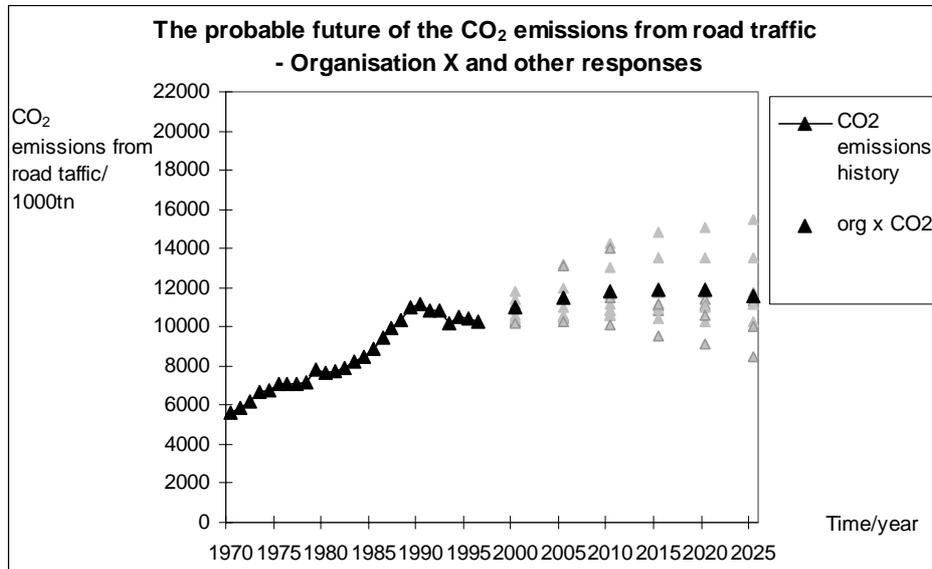
Carbon dioxide emissions from road transport

It was a common belief that the future development of carbon dioxide emissions would differ most from past development. The highest estimates of both probable and preferable were below the business as usual trend. The lowest estimates of the range varied, in turn, substantially: the lowest estimate of the probable development predicted a modest decrease whereas the lowest estimate for the preferable future of carbon dioxide emissions from road traffic included decrease as much as by 80% until the year 2025.

The carbon dioxide emissions from road traffic were the only variable where all the responses to the preferable moved in the same direction in relation to the probable. Most respondents regarded the reduction of the carbon dioxide emissions from the level of the 1990's as preferable. Two responses included a modest growth of carbon dioxide emissions in the preferable future.

Let us specify once more that preferable future here means a future that the respondent sees as technically possible to fulfil. Social possibility need not to be considered other than theoretically whereas social preferability does. This means that you do not have to judge whether your proposal would be accepted for example in political or entrepreneurial decision-making or consumer behaviour and decisions. When considering preferability one needs to take into account all the relevant aspects of preferability from one's own point of view. Thus a preferable future considering only carbon dioxide emissions separated from its social context is not asked for.

The Limits to Traffic Volume Growth



Arguments for the upper curves

- carbon dioxide emissions will grow a little slower than transport volume due to technical development
- the growth of vehicle size will offset any technical development which is why carbon dioxide emissions will increase at a similar rate to transport volume, just as before

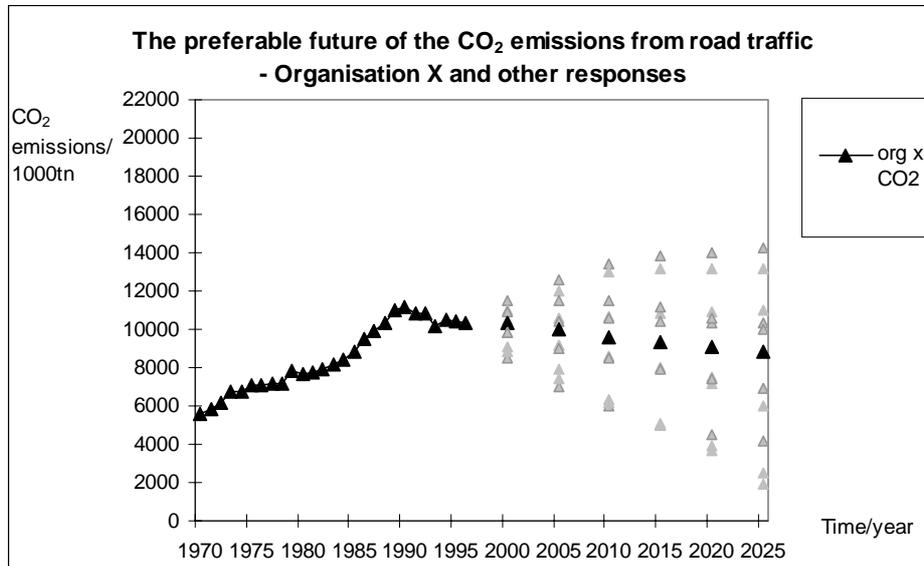
Arguments for the middle curves

- new techniques such as electric vehicles and low fuel consumption combustion engines will effect a change by the end of the period
- fuels will develop to produce less carbon dioxide emissions
- car stock will become newer after the recession and new cars will consume less fuel
- the carbon dioxide and traffic volume curves have already started decoupling in the 1990's

Arguments for the lower curves

- traffic volume growth will stop and the fuel economy of cars will improve resulting in the slow decline of carbon dioxide emissions

The Limits to Traffic Volume Growth



Arguments for the upper curves

- technical development will slow down the growth rate of carbon dioxide emissions
- traffic volume growth should not be restricted by severe measures

Arguments for the middle curves

- let us do what is technically possible and at the same time try to control road traffic volume growth
- international carbon dioxide emission agreements are currently under negotiation and Finland must commit itself to them
- it is technically possible to continue road traffic volume growth and simultaneously stop increases in carbon dioxide emissions

Arguments for the lower curves

- Finland should comply with ecologically sustainable development in a global sense, business as usual is unsustainable
- it is preferable and possible to drop the average fuel consumption of passenger cars to 3 litres per 100km
- the combustion engine will be phased out by newer energy sources, mainly electric cars
- telematics (computer-aided transport planning) and electronic congestion tolls should be used in order to reduce congestion and therefore pointless fuel consumption

1.2 Modal Split

While previous chapters dealt with the vehicle kilometres of road transport this chapter focuses closer on all transport modes. First, your organisation's view is asked for regarding passenger transport and then freight transport. Both are dealt with in regard to probable and preferable futures. Preferable future here means your view of a technically possible future that is most preferable when all relevant aspects are taken into account. The social possibility needs not be considered here (for example you do not need to consider if your preferable future would gain enough support from political decision-makers or consumers to be approved in society).

Passenger transport

You will find the modal split of 1996 in the table below as a percentage of passenger transport volume (passenger car traffic, bus traffic, rail traffic, waterborne traffic and domestic flights). The percentages are calculated from **passenger** kilometres, not from vehicle km as above. What kind of modal split would be the most probable and most preferable in 2025? Please give your estimates in percentage units, so that no decimals are needed.

	Passenger car	Bus	Motor-cycle	Rail traffic	Domestic flights	Domestic ship traffic	Total
1996	79,4%	12,6%	1,4%	5,2%	1,3%	0,2%	100%
Probable 2025? % - estimate							
Preferable 2025? % - estimate							

Soft modes, international flights and international ship traffic are asked for in terms of an index value where passenger km in 1996=100:

	Soft modes	International flights		International ship traffic	
		Finns	Foreigners	Finns	Foreigners
Probable 2025?					
Preferable 2025?					

Freight transport

This table includes statistics on the freight transport modal split (vans, lorries, rail, waterborne transport) in 1996. Percentages have been calculated from **ton** kilometres, not vehicle kilometres. What would be the probable and preferable modal split in 2025 be? (Percentage units, no decimals.)

	Lorry	Van	Rail	Shipping	Floating	Total
1996	63,6 %	2,5 %	24,1 %	9,0 %	0,8 %	100 %
Probable 2025?						
Preferable 2025?						

Air and ship freight ton km to and from Finland are asked for as an index number 1996 =100.

	International air freight		International shipping	
	*From Finland	*To Finland	*Finns	*Foreigners
Probable 2025?				
Preferable 2025?				

(*these were corrected in the interview to be 'import' and 'export')

The Limits to Traffic Volume Growth

1.3 GDP, transport and CO₂-emissions in different districts

This section asks for your organisation's view of the development of certain macro variables on different spatial levels: Finland, current EU countries and the world. Please distinguish between preferable and probable futures. A preferable future means a technically possible future that is most preferable with regard to all relevant aspects. Here you need not think about whether you consider the preferable future image socially possible.

What will be the total number of passenger km of all modes in 2025 (Answer with an index 1996=100)

	Finland	Current EU	World
Probable future 2025?			
Preferable future 2025?			

What will freight transport ton km be in 2025? (Answer with an index 1996=100)

	Finland	Current EU	World
Probable future 2025?			
Preferable future 2025?			

What will be the GDP value be in 2025? (Index 1996=100)

	Finland	Current EU	World
Probable future 2025?			
Preferable future 2025?			

What will the number of total CO₂ emissions be in 2025? Include emissions from other sources than the transport sector (1996=100)

	Finland	Current EU	World
Probable future 2025?			
Preferable future 2025?			

2 Measures to achieve the preferable future

Chapter two will ask for your organisation's view of the adequate measures needed to achieve the preferable future, which you have described above. The preferability and probability are asked for of each measure. I also ask for an estimate, of the effect on gross domestic product, road traffic volume and CO₂ emissions from road traffic. Some questions include a rather precise estimate, some we can deal with more loosely in the interview. It is important that you bring out the relevant measures, which are missing from the examples here.

2.1 Information measures

What do you think of using information technology to **speed up traffic flow**?

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

What is your view of the effect of the weak and strong points of so-called intelligent cars, intelligent roads and the GIS?

What do you think of using information technology to **decrease traffic volume**?

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

How could this be realised and what would the relevant applications be?

In the interview: What role does your organisation attribute to the following information based measures/trends in future transport?

Communication technology

-Logistics

-Video negotiations

-Telework and teleschool

-Other distant actions (shops, offices, banks)

-Internet

The Limits to Traffic Volume Growth

Marketing

- marketing to sell vehicles
- traffic educational work
- eco-labels for vehicles

Other informational measures

- education in driving schools
- indicators for energy efficient rotation and speed to the dashboards of vehicles
- distribution of public transport schedules
- making and distributing integrated bus transport schedules
- multi-modal passenger transport of buses and rail
- park and ride signs
- multi-modal freight transport
- organised car-sharing
- environmental management systems in private enterprises
- strategic impact assessment in transport policy making
- transport research, what kind of needs for information are there?

What other information measures would you consider relevant in achieving the preferable future?

2.2 Measures of vehicle technology

Energy sources for road transport in the future

What do you think of the development and wider use of traditional fuels, gasoline and diesel?
(One tick in each empty line)

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

What do you think of development and wider use of hybrid vehicles? (One tick in each empty line)

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

The Limits to Traffic Volume Growth

What do you think of the development and wider use of electric cars? (note also the carbon dioxide emissions from electricity production)

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

What do you think of the development and wider use of bio-fuels, like wood cutter chips, turnip rape seed oil and timber and barley based alcohol as energy sources of transport?

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

What do you think of development and wider use of hydrogen fuel cell technology as an energy source for transport?

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

What do you think of the development and wider use of direct solar power as an energy source for transport?

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

The Limits to Traffic Volume Growth

What do you think of the development and wider use of natural gas and liquid gas vehicles?

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

What do you think of combining muscle power and external energy sources in soft mode traffic?

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

What do you think of development and wider use of covered motor cycles, mopeds and bicycles?

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

What other ideas do you consider to be relevant energy sources for future transport?

The energy efficiency of vehicles

- A external electric engine heater for all cars sold in Finland?
- Design of bodywork (passenger cars, vans, lorries, train engines)
- Development of tyres
- Engine efficiency
- Other ideas?

The Limits to Traffic Volume Growth

Vehicle size and power

- Bigger or smaller lorries?
- Smaller cars or better fuel efficiency?
- The adequate size of buses?
- Making lighter vehicles with new materials
- The rise or fall of engine power?
- Technical speed limiting devices? At what speeds?

2.3 Physical transport services

What is your organisation's view of the total length for the following transport connections in Finland in the future? Answer with an index 1996=100.

	Probable future 2025?	Preferable future 2025?
Length of bicycle lanes		
Length of public roads		
Length of motorways		
Length of all roads		
Length of rail network		

(Length of street network was added to the list in interviews)

Urbanisation has proceeded and urban sprawl has increased in the last couple of decades. What is your organisation's view of efforts for urban infill?

Preferability of the measure	We strongly support	We support	Makes no difference	We oppose	We strongly oppose
Probability of the measure	Very probable	Rather probable	'Fifty-fifty'	Rather improbable	Very improbable
The effect on different variables	Strongly increases	Increases	No effect	Decreases	Strongly decreases
<i>GDP</i>					
<i>Road traffic volume</i>					
<i>CO₂-emissions</i>					

What do you think of the following measures?

- More turning lanes and acceleration lanes at crossroads
- Car free centres in cities
- Constructing more aircraft runways
- Should parking places be constructed more, less or kept at the current level? What will future parking places be like?
- Developing and providing with more bicycle shelters, what kind of?
- Developing public transport stations and stops, what kind of?
- The widening of under street warming
- Developing moving pavements
- Transporting freight via an underground tube system

The Limits to Traffic Volume Growth

-Other ideas of physical transport services, which would contribute to a preferable future?

What do you think of the following statement:

Investing in fluent traffic flows will not produce any time saving but increase driving distances, because on average people budget for travel time and when speed of access increases they will drive the same amount of time but on longer trips.

2.4 Norm changes

Should speed limits be reduced, kept at the current level or increased? (One tick on each row.)

	Reduced by at least 20km/h	Reduced by some 10km/h	Kept at the current level	Increased by some 10km/h	Increased by at least 20km/h
Built up areas					
Main roads					
Motorways					

Should a directive of maximum fuel consumption be established for different vehicles?

Should high occupancy vehicles (three persons) be allowed to drive in bus lanes?

Should giving way rules be renewed?

Should speeding fines be increased, decreased or kept at the current level?

Other ideas for changing traffic rules?

2.5 Transport prices and monetary measures

In the following your organisation's view of the price level of transport is asked for. I ask you to state an index number of the price for the following commodities in 2025. (Price index 100=1996, real terms, purified from inflation)

	Probable price 2025	Preferable price 2025
Gasoline		
Diesel		
Kerosene		
Bus ticket monthly (local traffic)		
Bus ticket (long distance travel)		
Flight ticket		
Train ticket		
Average price of a car		

The Limits to Traffic Volume Growth

The diesel tax on vehicles should be...

	Clearly higher	Higher	At the current level	Lower	Clearly lower
Diesel vehicles					
Liquid gas vehicles					
Electric vehicles					

Some presented ideas of monetary measures of governing transport

What do you think of “cashing out” (receiving money to not use the company car park) employer-paid parking?

Should bicycle commuters be entitled to shorter working-hours?

Should the size of company cars be increased, kept at the current level or reduced in your view?

What is your position on the taxation of company cars?

What is your position towards a tax allowance of commuting?

What should be done to subsidies on freight transport in your view?

Should public transport subsidies be changed?

What do you think of road tolls? If road tolls were to be established, how should the money gained be invested?

Other ideas on the pricing of transport?

What do you think of the following:

Taxation on new cars should be reduced because new cars pollute less than old ones.

3 In what ways will people and goods move in the future and why?

In the interview we will discuss in an unstructured way the following themes affecting transport. The themes consist of people's lifestyles, values and the substance of the economy. In this last chapter you may express more of your personal interpretations if your organisation does not have a public view on the themes. However, I ask you to relate your estimates to the probable and preferable futures, which you have presented above.

Lifestyles

How many people will live in the following community types in Finland in 2025? (Answer with the index 1996=100)

	Year 1996	Preferable 2025	Probable 2025
-Capital area	100	_____	_____
-Major cities	100	_____	_____
-Smaller towns	100	_____	_____
-Villages	100	_____	_____
-Sprawl areas	100	_____	_____

How will people's lifestyles change in the probable and preferable future (or would they)? How will the change affect traffic?

- Home
- Work (commuting and work related trips)
- Hobbies
- Holidays and summer cottages

Will the rhythm of life be more or less busy?

Will daily routines change in the future?

Will boating, sailing or other 'wild' modes (water scooters, snow mobiles, etc...) substitute leisure time driving?

Will the growth of air transport continue in work related travel?

What will the role of telecommunication be in the future and how will it affect transport?

A change in the age structure until 2025 is probable. How will elderly people in the future take care of their business?

Do you think that people's values will become more environment friendly in the probable and preferable future?

Yes ____ No change ____ Less environment friendly ____ No comment ____

If they will, how will people's travel behaviour be affected? (You may tick several alternatives)

People will...	Probable future	Preferable future
avoid flying		
drive calmer/slower		
buy newer cars		
stop buying bigger cars		
shift from car to public transport		
shift from bus to rail		
shift from motorised modes to bicycles		
avoid physical traffic and take care of business via information technology		
not be affected by change		
Enterprises will use more the train due to environmental reasons		

Other, how? _____

The Limits to Traffic Volume Growth

On the economy

What will the substance of the economy be in the future? What will the role of the heavy metal and forest industries be when compared to the electronics industry? How will the service industries affect us?

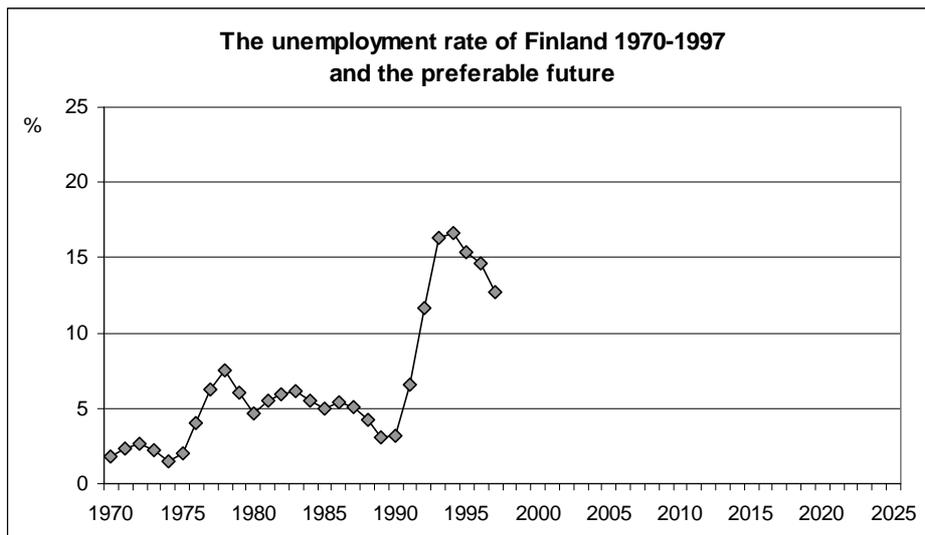
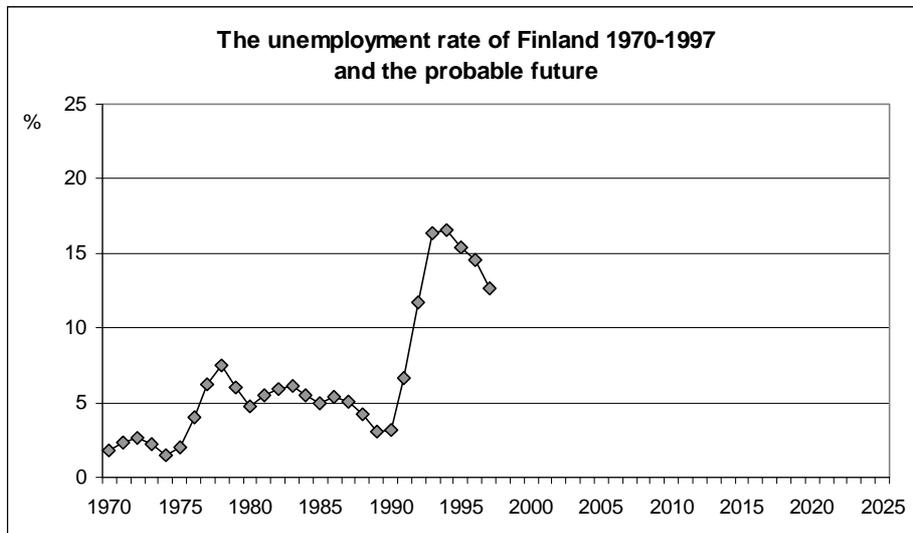
Will the demand for faster freight transport increase? Will markets become more international?

Which will be transported in the future, services or clients?

What will the role of multimodal freight transport be in reducing the need for traffic?

Will the widening of income distribution continue or not?

How does your organisation view the future of unemployment? Please draw your organisation's view of the Finland's unemployment rate in the probable and preferable future described above.



Respondents to the questionnaire⁶⁶

- Transport Workers' Federation, Juhani Koivunen
- Automobile and Touring Club of Finland, Heimo Jaakkola
- Dodo – The Living Nature of the Future, Jarre Parkatti
- Traffic Policy Association Majority, Risto Larjavaara
- Traffic League, Sisko Kangas
- Ministry of Transport and Communications, Reino Lampinen
- Bus Transport Federation, Ari Heinilä
- Helsinki Metropolitan Area Council, Transportation Department, Reijo Teerioja*
- Rail Administration, Harri Lahelma
- Finnish Road Association, Jaakko Rahja
- The Confederation of Finnish Industry and Employers, Maire Kaartama
- Road Administration, Aulis Nironen ja Veijo Kokkarinen
- Ministry of the Environment, Mauri Heikkonen
- Finnish Oil and Gas Federation, Jaakko Tusa*

⁶⁶ The list is here as it was attached to the interview form and refers to the first round questionnaire. The total list of panellists is attached as appendix four. The special status of representatives of YTV and ÖKKL were not specified in this list, because the first round responses were presented anonymously in the form.

Appendix 4

The Representatives of the Target Organisations of the Delphi Study

- Transport Workers' Federation
 - Juhani Koivunen (both rounds)
- Automobile and Touring Club of Finland
 - Heimo Jaakkola (first round)
 - Matti Sinervä (second round)
- Dodo – The Living Nature of the Future
 - Jarre Parkatti (first round)
 - Timo Lahti (second round)
- Traffic Policy Association Majority
 - Risto Larjavaara (both rounds)
- Traffic League
 - Sisko Kangas (both rounds)
- Ministry of Transport and Communications
 - Reino Lampinen (first round)
 - Juhani Korpela (second round)
- Bus Transport Federation
 - Ari Heinilä and Mikko Saavola (both rounds)
- Helsinki Metropolitan Area Council, Transportation Department^{*}
 - Reijo Teerioja (both rounds)
- Rail Administration
 - Harri Lahelma and Tuomo Suvanto (both rounds)
- Finnish Road Association
 - Jaakko Rahja (both rounds)
- The Confederation of Finnish Industry and Employers
 - Maire Kaartama (both rounds)
- Road Administration
 - Aulis Nironen and Veijo Kokkarinen (both rounds)
- Ministry of the Environment
 - Mauri Heikkonen (both rounds)
- Finnish Oil and Gas Federation^{**}
 - Jaakko Tusa (both rounds)

^{*} The operative manager's own views, not that of the organisation's.

^{**} The responses are qualitative discussions about different possible trends, not statements of probability or preferability. Second round responses were not included in quantitative calculations.