An approach to holistic evaluation of welfare impacts in strategic transport system planning

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Abstract

The present paper outlines the aims of an ongoing Finnish study that is focused on promoting sustainable actions within the strategic planning of regional transport system. The study is concerned with the changes in welfare of individuals and communities, that occur due to changes in the regional transport system and land use. The main objectives of the study are to create evaluation criteria that can be used in identifying the significant impacts, and to provide a tool that guides the production of applicable decision-making material, based on the above-mentioned evaluation.

The study was started in 1998, and the intermediate results of this pre-study phase were formulated in 2000. These intermediate results are used to focus the continuation of the study in the years 2003 – 2006. The pre-study phase included a literature study, a telephone survey, a case study in Northern Finland, and a questionnaire survey with its statistical analysis.

The ongoing phase will include repetition of the questionnaire survey concerning the significance of welfare impacts. Formulation of evaluation criteria will take place in order to support assessment of welfare impacts within transport system planning. These criteria will be tested through a case study. The final step of the study will be to create and test an application of multi-criteria decision-making (MCDM) methods. This application will serve as a tool to support regional decision-making concerning the transport system. The tool will enable production of approachable and transparent evaluation results, taking account of the various underlying values and views of the desired future.

Keywords transport system, evaluation, welfare impact

1. Introduction

The transport system has great effects on the welfare of communities and individuals. However, the traditional way of evaluating the impacts of changes in the transport system has mainly concentrated on quite narrow technical and economical aspects. In the recent years, there has been growing interest towards certain impacts that earlier were ignored, or presented in attachments as qualitative lists, with no direct effect on the outcomes of the planning.

The present paper outlines the aims of an ongoing Finnish study that is focused on promoting sustainable actions within the strategic planning of regional transport system. The objectives of the study are

(i) to create evaluation criteria that can be used to evaluate the welfare impacts of developments in regional transport systems, and

(ii) to provide a tool that guides the production of applicable decision-making material based on the above-mentioned evaluation.

The underlying major target of this work is to promote sustainable development. In this study, two definitions of sustainability have been merged. In general, this concept is understood as defined by the Finnish National Commission on Sustainable Development (FNCSD, 2003). According to the FNCSD, sustainable development is a continuous, guided process of societal change at the global, regional and local levels. The process is aimed at providing every opportunity to present and future generations to lead a good life. The basic preconditions for ecologically sustainable development are preservation of biodiversity and adjustment of mankind's economic and other material activities to our global resources and the carrying capacity of the nature.

The FNCSD (2003) defines the three operational dimensions of sustainability to be as follows: an ecological dimension (including and closely integrated with economic sustainability), a social dimension and a cultural dimension. However, it was stated in the first phase of this study, that the issue of welfare has to be examined from the economics point of view, too. Therefore, the first definition is not adequate for the purposes of this study. The definition can be amended with another justifiable view. The OECD (2001) defines sustainability to consist of three dimensions; economic, social and environmental objectives. The intention to sustainability entails integration of these objectives, where possible, and making trade-offs between the objectives where integration is not possible.

These two definitions lead to the classification applied in this study. The dimensions of sustainable development, as applied here, are a) ecological dimension, b) economic dimension and c) social dimension, including cultural issues. The crucial issues of institutional or administrative arrangements, with peace and security, are emphasised in all these dimensions (OECD, 2001).

Welfare is defined here to comprise of the above-mentioned dimensions of sustainability. This study is concentrated on the welfare of people and communities. Tapaninen et al. (2002) point out that welfare takes its shape in the interactive process of the people's needs and the resources available. Although the needs of different individuals are varied, they

always depend on the surrounding society and its culture. A crucial question is, whether the decision-makers, authorities, different actors and residents agree on the desired living environment and on the ways to achieve this (Tapaninen et al., 2002).

In this study, evaluation of welfare impacts is examination of changes in certain response variables, with respect to changes in transport system. The identification of these response variables that represent the significant welfare impacts, is one of the main challenges of this study.

Transport system is understood as an aggregate that comprises of two major components. These components are 1) transport infrastructure, including transport facilities and terminals, as well as the systems for transport management and guidance, and 2) vehicles, organisations for transport administration and maintenance, as well as public transport operations. (Sirkiä et al., 2000.) Transport system is in close interaction with the surrounding land use and urban development.

The theoretical foundation of the present study is based on recent academic research in the areas of strategic planning, impact assessment and decision-making related to transport systems in Finland (see Leskinen, 1994 and Valli, 1998). The theory of Multi-Criteria Analysis and some of its practical applications is included in the theoretical basis of this study, and will be utilised in the future empirical application (see e.g. Dodgson et al. 2000, Nijkamp et al. 1990, Munda et al. 1994).

The evaluation methods or procedures that have an effect on the contents of this work, are a British framework called 'Best Practicable Environmental Option' (BPEO) by Bond and Brooks (1997) and a Swedish method called 'positional analysis' that is based on disaggregative evaluation of impacts (Moberg et al., 1999). The current practices of environmental impact assessment (EIA), strategic environmental impact assessment (SEIA) and social impact assessment (SIA) are essential building blocks of the theoretical framework in this study, as well as the current legislation in Finland and in the EU (EIA 468/1994, 268/1999 and EIA Directive, 85/337/EEC).

This paper first outlines the theoretical views applied, and then introduces the research methods. In Chapter 2, Methodology, both the methods used in the pre-study in 1998 – 2000, and the planned methods to be applied in the ongoing research phase, are discussed. Chapter 3, Intermediate results is concentrated on the results of the pre-study, and Chapter 4 contains conclusions of how these results were used to focus the work to be carried out in 2003 - 2006.

2. Methodology

An approach defined by Valli (1998) is used as the fundamental method of this study. This approach emphasizes system-oriented assessment, instead of the traditional, sector-related impact assessment. The key issue in this approach is to recognize the underlying values and objectives, with considering the complicated interactions. The role of assessment as a crucial part of every stage of the planning process is pointed out. It is essential that the approach of this research is interdisciplinary.

The focus of this study requires a view that enables the values in question to be identified and used for the formation of the objectives, already in the early stages of the planning process. This can be done by means of value-focused approach (see Keeney, 1992).

The pre-study phase included four sub-tasks. These tasks were a) a literature review of Finnish and international evaluation research, b) a telephone interview survey concerning the Finnish experience in regional transport system planning, c) a case study focused on the planning process of the integrated transport plan in the city of Oulu in Northern Finland, and its surrounding municipalities and, in addition to this d) a postal questionnaire survey in the case study area, concerning attitudes towards the significance of different types of environmental impacts and their consequences.

The findings of the literature study were used to create a long list of potential welfare impacts, and a classification for these. In addition, the literature study was used to identify methods that could be useful for comparing the welfare impacts and ought to be tested in the following phase of the study. The answers to the telephone interview survey, concerning 12 regional plans, were classified according to the main questions about which impacts are usually evaluated, with which methods and data, and what are the major needs for development. In the case study, the research group took part in several meetings of a regional planning group, as well as studied the material produced in the planning process and analysed the targets and premises of the transportation system plan. The results of the questionnaire survey were analysed using cross-tabulations, Principal Component Analysis and Likelihood Ratio χ^2 test. These analyses provided information about the significance of the welfare effects, as well as differences in opinions of different actor groups.

The second phase of the study started in 2003. This four-year study will include a repetition of the questionnaire survey, with a slightly modified questionnaire and a larger group of interviewees. A list of critical evaluation criteria for assessment of welfare impacts will be established, using for example Analytic Hierarchy Process (AHP), and, where appropriate, the theory of defining the Best Practicable Environmental Option (BPEO). A new case study will be included, concerning evaluation of welfare impacts of improvements to the Finnish railroad corridor from Seinäjoki to Oulu. This case study will be used for the pre-testing of the evaluation criteria. A tool for decision-making, an application of Multi-Criteria Decision Making (MCDM) techniques will be created and tested as the final task of the study (see e.g. Olson 1996, Triantaphyllou 2000).

3. Intermediate results

The first phase of the study was a pre-study with the objective to focus the research questions and give some preliminary ideas about potential methods. As an intermediate result, a classification of certain impacts that can be understood as welfare impacts of changes in transport system, was created (*see Figure 1*).

The examination of these complicated causal chains of impacts was simplified by defining whose welfare the changes in the regional transport system could have impacts on (*see Table 1*). This definition led to introducing three groups that are quite similar to the dimensions of sustainable development. However, an additional fourth group is included to comprise the changes in the business environment, for example business fluency or use of terminals.

The roles of and interactions between all parties concerned, with the value statements of the authorities are needed case-spacifically in order to provide weighting for the four aspects. The justification for this grouping and the details in it have to be studied further, in order to combine a holistic view of the potential welfare impacts of changes in the transport system.

The case study indicated that all the dimensions of sustainaibility are usually present in the strategic objectives of a regional transport system plans, but the realisation of these welfare issues is difficult.

The significance of the welfare impacts was tested through a questionnaire survey in Finland (*see Table 1, the significant impacts underlined*). However, the sample (N=72) was reasonably small and biased, most interviewees being actors in the process to revise the Oulu transport system plan. Still, the results of the survey provide useful information about how the actors and interest groups within transport sector revealed to perceive the significance of different welfare impacts. The repetition of the survey is expected to show how the attitudes of the actor groups have changed as a result of attending the process of revising the regional transport system plan.

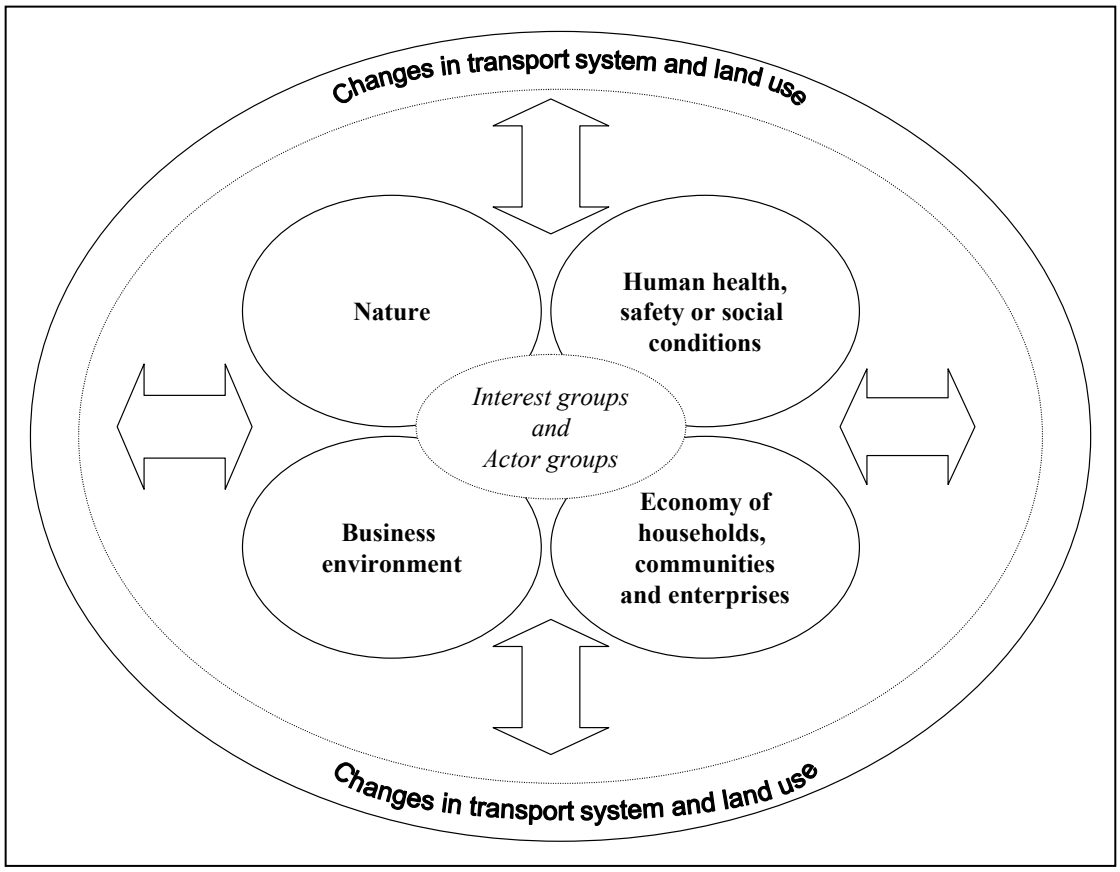

Figure 1. The welfare impacts of changes in the transport system can be classified according to their objects of influence. (Modified according to Rusila et al., 2003.)

In general, the respondents expressed the most significant impacts to be those met in everyday living. However, there may have been difficulties to see the connection between the regional transport system and the global environmental changes. Also, there is plenty of nature in Northern Finland, and therefore the impacts on environmental conditions may not

seem as relevant as the impacts on for example mobility or accessibility. The impacts targeted to human beings were clearly expressed as significant ones. Moreover, the impacts on the economic conditions of households, communities and enterprises were stated to be of great importance in regional planning.

The study showed that there exists inconsistence between the definition of high-level welfare objectives, evaluation of impacts, decisions and realisation of the plans. Although welfare objectives are sometimes identified, the actualisation of those is hardly ever examined.

Table 1. The pre-study provided a first general list of potential welfare impacts of changes in the transport system. These can be identified according to their objects of influence. Those stated as significant welfare impacts are underlined. (Modified according to Rusila et al., 2003.)

Direct and indirect impacts that influence the nature	**Chains of impacts that contribute to business environment**
- Well-being, living conditions and interdependency of flora and fauna - Conditions of endangered species - Amount and quality of areas in natural state	- Business fluency - Safety, comfort, and easiness of travel (employees & customers) - Use of terminals - Use of premises
Direct and indirect impacts that have an effect on human health, safety or social conditions	**Chains of impacts that influence the economy of households, communities or enterprises**
- Quality of life and life-style - Living conditions - Satisfaction with the milieu - Attitudes towards the nature - Population; number and structure - Effects on special groups of people, e.g., children, the elderly or handicapped - Status and interrelations of population groups - Social relationships - Behaviour, manners - Attitudes, conflicts - Values, norms - Structure of private and public services - Accessibility of services - Employment, unemployment - Income level and structure - Wealth and properties - Costs of living - Participation in decision-making concerning the milieu - Opportunities to affect local decision-making - Communication links, information - Accident risk - Exposure to air pollutants - Exposure to noise - Quality of water supplies - Quality of food supplies - Exposure to radiation	*Economy of households*: - Travel costs - Health care costs - Living costs - Leisure costs - Social costs, e.g., services for the elderly or prevention of crime *Economy of communities:* - Construction costs - Maintenance costs - Transport costs - Land rent - Property values - Changes in land use (from leisure use to industrial) and its effectiveness - Changes in accessibility - Changes in social status (for example chances in property values due to chance in social status) - Costs to maintain biodiversity and vitality of the environment *Economy of enterprises:* - Changes in cost-effectiveness - Changes in market area - Changes in business situation

At this stage, it appears that support concerning evaluation of welfare impacts is needed in the following three levels of transport-related decision-making:

1) to help the experts form a general view of the system,
2) to better understand and use public involvement,
3) to provide a tool for the decision-makers and those preparing the decisions that concern regional transport systems.

The above-mentioned specification has major influence on the selection of the MCDM techniques in the study. For example the relevant levels of detail and aggregation, or number and experience of the actors concerned, vary between the different levels of decision-making.

The geographical scope of the study is regional. This extent was chosen to ensure the availability of practical data and the possibilities to examine actual impacts. The regional dimension allows examination of impacts in more than one local area, but is notably more concrete to study than for example the national transport system.

4. Conclusions

During the pre-study phase, the vague research subject of 'indirect impacts and impact chains that happen due to changes in the transport system, and that affect the welfare of individuals and communities', was sharpened and focused. As a result, the subject is understood as certain welfare impacts that are identified according to their objects of influence. It was proved that the classification of these impacts could be derived from the dimensions of sustainability.

Consequently, the research subject was re-defined as follows:
This study is aimed at identifying and providing tools for the evaluation of welfare impacts that happen with respect to changes in the transport system. These impacts are the indirect outcomes that take place in the nature or in human health, safety or social conditions. Also, changes in the economy of households, communities and enterprises or changes in the business environment of enterprises are covered by the current definition of welfare impacts.

The above-mentioned impacts cannot be unambiguously defined, as they need to be specified according to the situation in question. The importance of different aspects is determined in relation to the set of values of the authorities, and in relation to the needs, resources and vulnerability of relevant actors and interest groups.

The identification of case-specific welfare impacts is concerned with the concepts of social equity and possibilities to public participation. A general overall reminder is the purpose to strengthen the possibilities of present and future generations to lead a good life.

Although the evaluation of the welfare impacts of a plan is a case-specific process, it was assumed that a general list of potential welfare impacts could be defined. The first version of this list was created in the pre-study. However, the classification that was created and the individual impacts within it need to be further examined. Also, the significance of the impacts must be redetermined, in order to have the results generalized. A pre-test is needed for the intermediate results. It is necessary, that this test will be carried out as part of an ongoing planning process, to ensure that all the different stages of the planning process are included.

Through the interviews of experts, it was confirmed that a consistent approach and practical tools are needed for evaluation of welfare impacts. It appeared to be true that financial and time constraints often overtake the planning process, and welfare impacts end up in reference lists.

The final outcome of this study will be evaluation criteria that can be used to evaluate the welfare impacts of the development of urban transport system, and a MCA-tool for decision-making. The validity of these results will be thoroughly tested, using data from a completed plan, for example the Helsinki Metropolitan Area Transport Plan. In addition to this national verification process, the validity and applicability of the results in other parts of the Europe will be discussed.

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