EVASERVE

Module:
Evaluation of social impacts
(of transport system programmes, plans and projects)

Revision history

Version	Date	Writer	Comments
0.1	21.8.2006	Katja Estlander	First draft

Contents

1. Evaluation objective

This module studies the evaluation of social impacts of transport policy decisions and transport system (Figure 1) measures and services.

The results of the evaluation can be utilized in e.g. choosing between alternative strategies and measures, monitoring project progress and evaluating the social impacts of the implementation of measures.

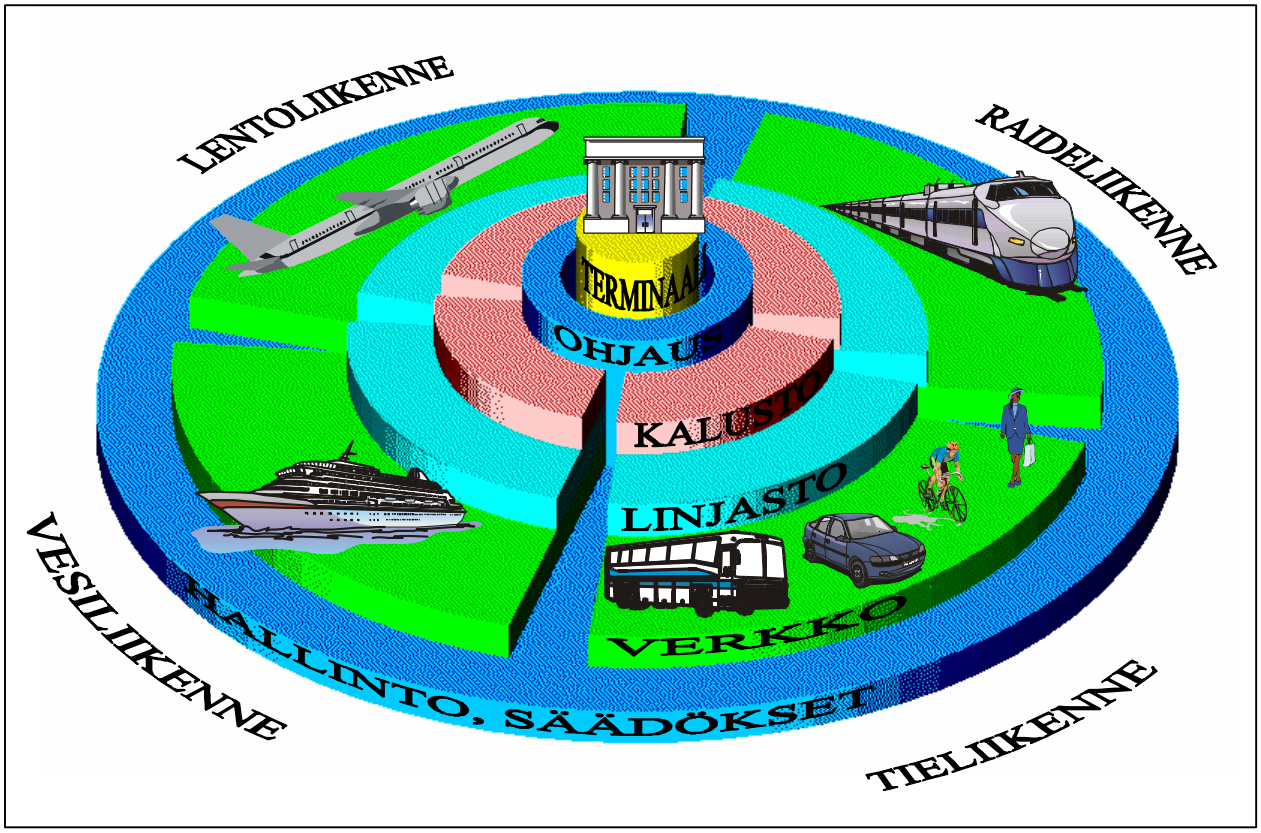

Figure 1. Transport system components (Metsäranta, Sirkiä and Markkanen 2000).

2. Description, definition and perspective of the evaluation process

The social impacts can be evaluated either by evaluating the impacts of the study or by evaluating the impacts of the studied phenomenon.

Oksanen et al (2003) present the following points about the social impacts, evaluation and impact criteria of research:

- the social impacts of research are interactive processes
- the social impacts of research vary according to the field of research and cannot be outlined in an uniform way
- the social impacts of research spread trough different utilization and influence mechanisms.
- the social impacts of research occur during a long period of time and they are usually indirect and difficult to determine.

Kutinlahti and Hyytinen (2002) name the following social impacts:

- Health, well-being and quality of life

- Sustainable use of natural resources and conservation of energy
- Accident prevention and increased safety of people and society
- Clean environment (pollution and toxic emissions, noise and smell nuisances).

Altering the transport system affects all the above factors. Transport system actions can also have considerable economic impacts. In this module the social impacts signify the impacts on the realization of the strategic goals decision makers and authorities, the economics of service providers and society, functionality of the transport system, state of the environment, traffic safety, the economics of service users and interest groups and public well-being. Social impacts can be evaluated at different stages of planning and implementation of projects according to the result demands (Table 1).

Table 1. Development of the transport system, decision making process and impact evaluation (EC 1999a, EC 2003a)

Phase	**Evaluation content**
Appraisal, ex-ante evaluation	Estimated realization of the social goals of a plan. Used often in the comparison and selection of alternative working methods.
Monitoring, interim evaluation	Technical and economic monitoring of a project. Social impacts are usually not evaluated.
Evaluation, ex-post evaluation	Realized impacts of a plan and evaluation of the realization of social impacts. These are compared to the results of the ex-ante evaluation.

The development of the Finnish transport system is guided by the strategic goal set by the Ministry of Transport and Communications: Prosperous Finland. The realization of the goal is promoted by the functionality of necessary trips and transports so that they support the good everyday life, competitiveness of the industry and commerce and the vitality of areas (Ministry of Transport and Communications 2006). The transport policy goals and measures are affected by the verified state of the transport system and user needs and also by EU regulations and international competitiveness and striving for sustainable development (Figure 2).

The objective of the law of land use and building is to arrange the use of areas and building in such a way that the premises of a good living environment are established. This promotes sustainable development ecologically, economically, socially and culturally. The goal is also to ensure that everyone can take part in the preparation of matters. Quality and interactivity of design, versatility of know-how and open communications in the matters under preparation are also objectives of the law (Council of State 1999a).

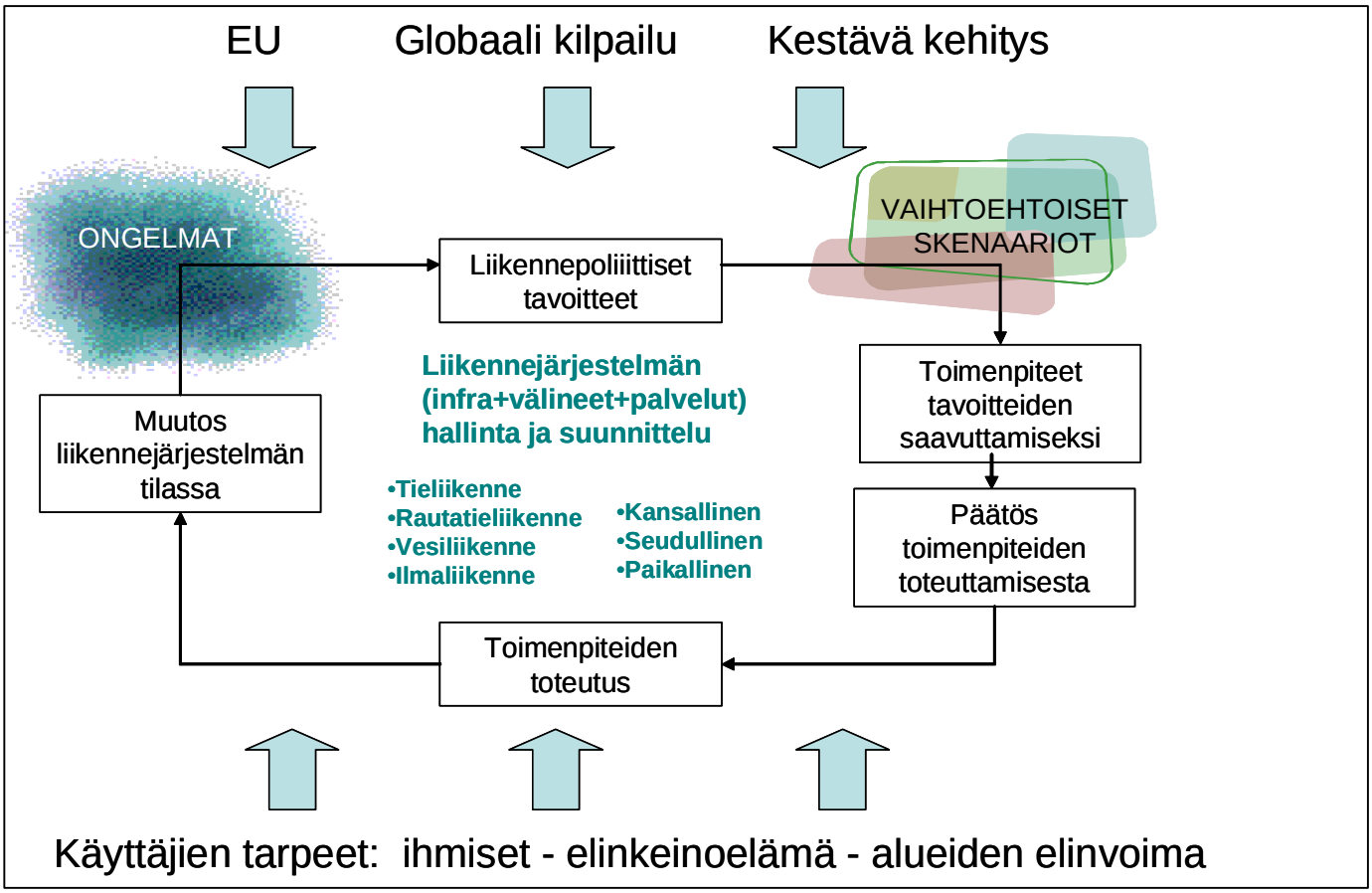

Figure 2. Development of the transport system, decision making process and impact evaluation (Tuominen et al. 2006).

Transport policy measures usually impact transport demand, the supply of transport services or the costs of the production and maintenance of the transport system (EC 2003). The source data for social impact evaluation can thus be e.g. estimates of traffic-related changes, changes of the changes in the daily movement of people and environmental impacts.

The Ministry of Transport and Communications requires that the action and economic plans and investment programmes of the ministry and transport projects in line for the budget are evaluated according to the guidelines for the assessment of transport infrastructure projects (Ministry of Transport and Communications 2003).

Other transport administrations have compiled their own evaluation guidelines based on the above-mentioned general guideline (e.g. Finnish Rail Administration 2004, Finnish Road Administration 2004). Guidelines have also been compiled for the evaluation of ITS projects (Kulmala et al. 2002).

The evaluation of environmental impacts of projects, plans and programmes is guided by the act on environmental impact assessment (EIA) and the act on the assessment of the impacts of the authorities´ plans, programmes and policies on the environment (SEA) (Council of State 1994, 1999b, 2005) which are based on the EU directives on the matter (EC 1985, 1997, 2001 and 2003c).

The act on environmental impact assessment (Council of State 1994, 1999b) defines that environmental impacts include the direct and indirect impacts of a project or activity in Finland and abroad. These impacts are directed at

a) the health, living conditions and comfort of people;

b) group, water, air, climate, vegetation, organisms and diversity of nature;

c) community structure, buildings, landscape, townscape and cultural heritage;

d) exploitation of natural resources; and

e) mutual interdependencies of the factors a-d.

There is a separate handbook on the evaluation of impacts on people (Kauppinen and Tähtinen 2003). Traffic safety is evaluated using the TARVA software, a tool for estimation of traffic safety effects of road improvements (TARVA 2006). The Finnish Road Administration has defined unit prices for accident costs (Finnish Road Administration 2006).

The guidelines mentioned above mainly deal with ex-ante evaluation.

3. Methods and indicators of evaluation of social impacts

3.1 Evaluation and collection methods of impact data

The social impacts of transport system measures are caused indirectly as a result of traffic-related changes. There are several impact data collection methods due to numerous different impacts. Table 2 shows the commonly studied impacts of transport system projects and the methods and indicators used in their evaluation.

Impact evaluation is an interactive process between evaluer and decision-makers. Interaction is necessary in all phases of planning; setting of goals, problem evaluation, option definition and evaluation of the impacts of plans. Usually transport system related projects include public hearings and information gatherings (EC 2003).

Table 2. Methods for the evaluation of social impacts of transport system measures (European Commission 2003a, 2003b, Brent 1996, Tapaninen and Tähtinen 2003, EC 1999a,b, Turtiainen 2000).

Use	Type of impact	Methods	Indicators
Transport policy evaluation	functionality of transport politic decision making process, impacts of strategic decisions	goal evaluations, scenario evaluations, interview studies, actor net analysis, methods developed and used in EU studies: e.g. SAMI-method (EC 2000) and Fitness for purpose (TRANSFORUM 2006).	vary by case according to the decision making situation
Prediction of impacts, measuring realized impacts.	impacts on transport system and land use	modelling; e.g. transport-land use models, simulation models, traffic assignment software, geographical information systems, traffic methods and measurements	transport and mobility changes, land use changes, transport and land use interaction, vehicle distribution changes, e.g. travel times, wait times, reachability, congestion, speeds, technical functionality of the system, operational preconditions of goods traffic
Collection of base data for study and selection of options and evaluation on goal realisation	environmental impacts, consumption of natural resources, living conditions of future generations	calculation models, identifying methods (check lists, interaction matrixes), data collection methods, impact prediction methods, communication methods (elucidation methods, work shop methods), emission calculation methods, measurements	fuel consumption, pollution of land and water, community disturbances, changes in townscape, CO_2 emissions, air pollution, noise, areas left for spare time use, agriculture and cultural use, land use; virgin areas, built-up areas and areas used by transport
	traffic safety impacts	behavioural science methods, interviews and questionnaires, before-after studies, accidents, accident statistics, conflict analysis, calculation software (e.g. TARVA 2006), safety inspections	exposure (e.g. traffic kilometreage), accident rate, accident density, accident costs, number of fatalities and injured, number of personal injury accidents
	impacts on mobility equality of groups	behavioural science methods, qualitative methods, traffic engineering measurements and models, geographical information systems, economic models and calculations	mobility of persons without cars, public transport service level, reachability of the handicapped using public transport, unequality of income, equality impacts, unequality of user benefits, distribution of regional benefits, changes in the monetary benefits of taxpayers

Use	Type of impact	Methods	Indicators
	social impacts, personal impacts	interviews, questionnaires and contribution data, scenario studies, impact tabulation by participant, study of set goal achievement (measure-goal –analysis), workshops, expert and group evaluations	impacts to service needs socially, impacts to well-being from the person or community viewpoint, direct and indirect impacts, impact allocation
	economical impacts, economical efficiency	econometric and statistical methods, before-after studies, questionnaire and interview studies, input-output models	growth potential, costs (e.g. investment costs, system maintenance costs, communal subsidition), benefits (e.g. profitability)
Comparison of ex-ante evaluation alternatives or realized impacts	impact data in money	benefit-cost analysis	benefit/cost ratio, net present value (NPV) and internal rate of return (IRR)
	often tabular presentation of impacts and goals	impact analysis	impacts significant for project goals
	qualitative or quantative meters	multi-criteria analysis	relative order of the studied alternatives, alternative selection and illustration of attributes of the alternatives
	qualitative data	analysis of basic data, e.g. participant material analysis, complementary scenarios, expert opinions, Delphi techniques, interviews and talks, questionnaires, workshops, comparison tables and illustration using map and picture techniques	significant impacts and differences between alternatives described verbally as e.g. report text, tables and map depictions

3.2 Impact summary and comparison methods

Cost-benefit analysis

The main purpose of impact evaluation is to support planning and decision making by producing coherent data of the alternatives for the realization of one or several goals. Cost-benefit analyze method is used to evaluate if the net benefits of the alternatives are greater than the realization costs. The benefit change is based on the change in the readiness to pay of the individual and through money the different impacts are made comparable. If the set goal can be realized in several ways the cost-benefit analysis reveals the alternatives that return the greatest profits for the offered resources. (Glaister 1999, Estlander and Pekkarinen 2005).

In practice the cost-benefit analysis involves the following stages (Hanley & Spash 1993, Brent 1996, OEEI 2000, Finnish Road Administration 2004):

- Definition of project and the investment cost.
- Identification of all impacts of the project.
- Identification of the impacts that are economically significant
- Defining the magnitude of the impacts.
- Evaluating the quantative impacts.
- Discounting the values. Converting the benefits, costs and investment cost to the present value of the base year using verified design values.
- Calculating the net present value of the project.
- making the sensitivity analysis.

In practical evaluation the method used is usually the *standard cost-benefit analysis* where only the internal impacts of a project or transport system on the road and transport service providers and users are evaluated. *Extensive cost-benefit analysis* includes the indirect impacts, externalities and distribution impacts in addition to the internal impacts (OEEI 2000). Only the extensive cost-benefit analysis can answer whether it is sensible from the social resource use point of view to realize the evaluated project. The cost-benefit analysis has a strong base in theory and it is well documented but also a controversial evaluation method (see Hanley & Spash 1993, Brent 1996, Sudgen 2003).

In Finland all transport route projects require an impact evaluation compiling all the essential impacts of the project in addition to the monetary impacts (Ministry of Transport and Communications 2003). The manual of the road traffic transport cost unit values (Finnish Road Administration 2006) defines the unit values of vehicle costs, travel time savings, accident costs and environmental costs used in the calculations.

Cost-impressiveness analysis

The cost-impressiveness analysis can be made when either the project costs or impacts have been fixed at the beginning of the evaluation. An example could be a city wanting to decrease the number of pedestrian-car collision accidents by x. In this case the selected measure would be the one with the least realization costs per avoided accident. Haveman (1967) said in his answer to an early critique to cost-benefit analysis that in many public sector expenditure decision-making situations it is totally sufficient to compare costs to direct impacts without evaluating the impacts in money. This can be done if the aim is to change the people's basic rights e.g. their premises for education, health care and transport (Estlander and Pekkarinen 2005).

If the goal is to achieve a certain environmental standard in a most cost-effective way, e.g. by reducing the emissions of mobile emission sources, Wang (2004) suggests the use of cost-impressiveness analysis in the search and realization of efficient means. Also Nijland et al. (2003) evaluated the cost-impressiveness of traffic noise reducing means by compiling an optimal array of measures for solving the noise problems of a certain area.

Although cost-impressiveness analysis is an easier method than cost-benefit analysis, it also requires decisions about e.g. the following matters: should one observe only user costs or social costs, are the costs calculated based on producer or consumer prices (taxes and subsidies) and the regional and temporal definition of impacts. The cost-impressiveness analysis is used e.g. when the goals have been set according to a certain standard or law; e.g. air quality, water quality and the quality and safety standards of products and services. Cost-impressiveness analysis reflects the normative concept of well-being in a situation in which the goal impact is hard or impossible to evaluate (Estlander and Pekkarinen 2005).

Multi-criteria analysis

Measures that alter the transport system are often extensive and have related impacts which are hard to evaluate. *Multi-criteria analysis* produces data about the extent that the plan or alternative plans fulfil the goals agreed upon by the decision makers. The method can be used as a tool for multiple-valued planning and when the evaluation contains several actors and differing interests. The subjective opinions and evaluations of the participants of decision making are used in setting and evaluating goals and evaluation criteria. A concise form of multi-criteria analysis is a table showing the alternatives from criteria point of view (Dodgson et al. 2000).

Multi-criteria analysis can be used when the studied alternatives are compared or classified but all of the impacts cannot or will not be evaluated. Transport system projects often have complex impacts that are hard or contradictory to evaluate (Dodgson et al. 2000).

Multi-criteria analysis is suitable for impact evaluation either by itself or supplementary to cost-benefit analysis. The method can be used in studying qualitative and quantative, monetary and non-monetary impacts simultaneously. Choosing multi-criteria analysis is based on whether the number of evaluated alternatives is limited or if the set to be optimized is indefinite. In traffic and community planning the number of alternatives is usually definite and known (Dodgson et al. 2000). The application is chosen based on whether one best alternative is chosen or some alternatives separated from several. Other impacting factors are e.g. the number of criteria and the extent of decision maker participation (Olson 1996, Estlander and Pekkarinen 2005).

Multi-criteria analysis can be used in picturing how the evaluated plan or alternative plans would fulfil the goals agreed upon by the decision makers. The goals and evaluation criteria are formed and evaluated using the opinions and valuations of the participants. More objective data complementing the subjective valuations could be used in addition to these e.g. data about realized prices (Dodgson et al. 2000).

Multi-criteria analysis usually involves the following eight phases (Dodgson et al. 2000):

- Defining the decision making situation
- Defining the goal of the analysis, decision makers and key actors
- Establishing alternatives
- Defining goals and criteria
- Defining which criteria represents the changes to the goals made by the alternatives
- Representing the effects of the alternatives using the criteria
- The analysis can be stopped at this point if there is no need for weighting
- Weighting
- The criteria is weighted according to their importance in the decision making
- Sorting the alternatives according to their weight and criteria values
- Studying the results
- Sensitivity analysis

Qualitative comparison methods

Easily measurable, quantative factors usually get a great weight in planning and decision making. Behind the decisions, however, lie attitudes, impressions and fears. Measurable factors represent reality up to a certain point. Analysing qualitative factors in the evaluation process brings these decision making affecting factors to light. When representing images, conflicts, fears, wishes and probabilities qualitative comparison complements impact evaluation (Stakes 2005).

Studying qualitative factors emphasizes the process and learning while working unlike the finding and presenting measurable values which is usually only aimed at the unambiguous choosing of one, best alternative. The result of the learning is that there is no single best intended future. Qualitative evaluation brings forth different possibilities with probable consequences and realizes the goals up to a certain level. According to the Stakes (2005) manual qualitative comparison can be realized in e.g. the following two ways:

1. The different solutions are evaluated by describing their probable consequences, uncertainties and discrepancies verbally.
2. The realization of separately defined goals is evaluated in different alternatives. The goals can also be measurable and enumerable.

Qualitative and functional matters are represented verbally e.g. impacts on different population groups, uncertainties, reasonings and conditions. The summary can be given as a table.

Qualitative evaluation can be described as interactive participation where at each stage the evaluer first identifies and selects the preliminary factors from the accumulated data and then the impact object or their representative check and complement the expert work. The evaluations are adjusted according to feedback (Stakes 2005).

Impact recognition methods include e.g. analysing basic data, complementary scenarios, mathematical models, expert opinions, simplified Delphi techniques, interviews, questionnaires, workshops, comparison tables and visualization using e.g. maps and pictures. Impacts can be described by studying the potentialities and risks of goal realization, textboxes on maps, impact concentration described through types, barometric representations and future scenarios.

The impact chains recognised and described by the participants are represented with their explanations. Alternative impact chains and uncertainties generated from the different basic data and values of the participants should be recorded in the evaluation. It is important to represent the different point of view and consider the reasons for the differences in opinion and disagreements.

The use of qualitative material is often suspected to be an unreliable and subjective method. Public control and evaluation in phases increase the reliability of the comparison. The accumulated basic data should e.g. represent all the compared factors and the comparison should be systematical based on the decided comparison factors. Qualitative evaluation is credible when there are enough verification possibilities and reasoned choices between the work stages (Stakes 2005).

4. Results

The results of the evaluation are presented to experts, decision makers and the public. The representation manner needs of the target groups are different. When the results of the evaluations are presented to decision makers or the public all of the decisions and presumptions of all stages of the evaluation process should be compiled and presented. Experts can be presented with more detailed and theoretical information. Results of different types of impacts can be presented e.g. as follows. (EC 2003a, Dodgson et al. 2000, Estlander and Pekkarinen 2005):

Economic efficiency – cost-benefit ratio, tables and figures of all target groups, user benefits e.g. on maps, a presentation of how the data is connected to the goal of sustainable development.

Protection of the environment – changes in the number of people exposed to emissions, possible monetary impacts, maps, indicators on maps, tables.

Traffic safety – present state of accidents and the impact on it by the proposed measure e.g. how many personal injury accidents can be prevented by the measure usually in table format, the safety impacts of large projects are studied measure-wise.

Vitality of living environment – the geographical distribution of unprotected road user accidents, maps or indicators that visualize differences between different areas e.g. socially, culturally or leisure activity-wise, indicators concerning the reachability differences between areas.

Equality and social conformity – indicators showing the reachability differences between groups of people, maps and figures showing relative changes, maps showing the unequality of areas or groups of people.

Economic growth – indicator of economic growth defined using user benefits, producer surplus and state surplus, indicator showing the geographical distribution of user benefits.

All of the primary indicators of the impacts of the evaluated plans are presented in table format. Impacts are shown in map and geographical information form whenever possible. The analysis and comparison method results are often presented in the following ways:

Cost-benefit analysis results are presented as the cost-benefit ratio, net present value and internal rate of return.

Cost-impressiveness analysis results are usually presented in tables showing the impacts verbally, numerically or with symbols.

Multi-criteria analysis results can be presented according to the used technique as a presentation of the order of superiority of the evaluated plans according to the chosen criteria, selection of one alternative as the most feasible or presenting the attributes of the alternatives in an interactive process with the decision makers.

Qualitative comparison method results are presented as tables showing the impacts verbally, as text describing the impacts or e.g. on a map in text boxes.

5. Conclusions, recommendations and reporting

The reporting of evaluation results depends on the level and purpose of the evaluation. E.g. the results of a transport policy study can be reported as transport policy instrument impact evaluations or report on the functionality of transport policy decision making and give recommendations on how to make it more efficient.

The results of project evaluation are used in evaluating the realization of a single project or as base data in the comparison of alternative plans. The results are often presented according to a defined report format e.g. as project information cards. The guidelines for the assessment of transport infrastructure projects Ministry of Transport and Communications 2003) present three different project information card models.

The most brief project information card presents a short presentation and map of the project, present state and problems, the most important positive and negative impacts and construction costs, financiers, portions to be financed, price level of the budget and cost-benefit ratio. The most extensive model presents in addition to the brief one separate more detailed descriptions of these factors and a possible alternative. In addition the profitability calculation, feasibility and impact evaluation is presented. The impact evaluation is a summary of the impacts on the following: daily transport, business, regional development, environment, traffic safety and economy.

The reporting on environmental impact assessment (EIA) has two phases. The company or community responsible for the project first delivers an evaluation programme to the regional environmental centre. The evaluation programme presents the realization alternatives of the project and the impacts which will be studied during planning. When the alternatives and their impacts have been evaluated the results are collated in an evaluation report.

The public and authorities have a possibility to influence the decision making material. Environmental impact assessment ends when the regional environmental centre has made its statement on the impact assessment. Also the human impact assessment (HuIA) has to be made during the EIA procedure. The assessment report usually contains both quantative and qualitative information. The results are used in addition to the project evaluation in the consideration of the realization of a single project or as basic data for selecting alternatives (Ministry of the Environment 2005).

The phases of assessment of the impacts of the authorities´ plans, programmes and policies on the environment (SEA) are as follows:

- information and hearing of the data presented in the environmental assessment
- plan or programme draft and environmental description
- hearings on the plan or programme draft and environmental description
- information and negotiations on transboundary environmental impacts
- acceptance of plan or project
- monitoring of environmental impacts.

The environmental description required by the SEA act presents the content of the plan or programme, main objectives and relations to other possibly connected plans and programmes. In addition to these the description presents the present state of the environment and its development if the plan or programme is not realized and the environmental characteristics from the areas probably significantly affected. The description also presents the environmental problems significant for the plan or programme, especially the regional problems that have special environmental implications. The results are used in the evaluation of the realization of the plan or programme (Ministry of the Environment 2006).

Finnish Road Administration has defined the evaluation procedure for the traffic safety impacts in which an outside impartial examiner reviews the roads or street plan. This procedure is not yet commonly used but it is being developed and brought to general use. The work methods of traffic

safety evaluations can be divided into examining general matters and analytic examination. In the examination of general matters the project is evaluated as a part of the transport system. On the other hand, in analytic examination the technical solutions and details are evaluated as a whole and after this the evaluation can be expanded according to points of view e.g. road users or accident types characteristic of the road. The observations are recorded in an examination memo and located on a map. The examination memo is complemented during planning. A short project description and information about examination data, examination work methods and participants is also included in the memo (Finnish Road Administration 2003).

The impact evaluation of transport system programmes, plans or projects is usually aimed at the preparation of decision making. Often the case is of comparing alternatives or studying the characteristics of a single plan. Usually several of the above mentioned impact evaluation means are required parallelly. The decisions on extensive projects or programmes are made in political decision making bodies. The challenge for the evaluation of social impacts is thus presenting the results as clearly and unambiguously as possible so that the impact information can be used effectively to back up decision making.

6. Connection to other modules

The module evaluation of social impacts is connected to the following modules:

- Policy impacts evaluation
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