

Analytic hierarchy process and positional analysis in participative forest planning

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Abstract

Two decision-supporting methods, Analytic Hierarchy Process (AHP) and Positional Analysis (PA), are briefly viewed and their suitability for participative forest planning is evaluated. Criteria for a decision-supporting method to transmit citizens' values to decision-making are: a) Does the method used enable to formulate and delimit the decision problem comprehensively and clearly? b) Is the method applied able to manage both qualitative and quantitative information when collecting the information? c) Are all the different values associated with the information presented clearly when managing the information? d) Does the method present the standpoints of the different parties and the impacts resulting from following them? It becomes apparent from the evaluation that both AHP and PA have their advantages and disadvantages as decision-support method in participative forest planning. Conclusion is that better results in participative forest planning may be reached by combining these methods.

Keywords: public participation, evaluation, decision-support methods, planning theories

1 Introduction

Participative planning in forestry means usually multi-objective forest planning, where citizens' opinions and objectives concerning forest planning are included in the decision-making process. Typical for this kind

of planning is to have high number of decision alternatives. In environmental and social decision-making situations the cost-benefit analysis (CBA) has usually been used to compare decision alternatives. CBA is the most used and probably the most

criticized decision-support method (e.g. Price 1997).

Given this situation, new decision-supporting methods have been introduced in participative planning and multi-objective forest planning (Lidestav 1990, 1994, Mattsson 1991, Kangas 1994, Kangas et al. 1995). Positional Analysis (PA) has been introduced as a method of participative forest planning in Sweden, while Analytic Hierarchy Process (AHP) has been used in Finland for the same purpose (Lidestav 1990, Kangas et al. 1995). These two decision-supporting methods, AHP and PA, are briefly reviewed and evaluated in this paper as participative forest planning methods.

2 The methods

2.1 Analytic Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP), originally developed by Saaty (1980), is a mathematical method for analysing decision problems with multiple criteria. In the method, a hierarchical decision schema is constructed by decomposing the decision problem in question into decision elements – goals, objectives, attributes and decision alternatives. The most general goal is at the top of a decision hierarchy, and decision alternatives constitute the lowest level of the hierarchy. The importance or preferences of the decision elements are compared in a pairwise manner with regard to the element immediately above in the hierarchy. Based on these compari-

sons, an additive model on a ratio scale describing the preferences of the decision-maker is estimated. The model is called a priority function. The decision alternative producing the highest global priority is considered the “best” and most satisfactory one and it is the one that is recommended.

In an approach based on representative democracy as presented by Kangas et al. (1995), a level of “players” (i.e. participants) consisting of interest group representatives is placed in the decision hierarchy immediately above the level of decision objectives. The basic steps in applying AHP to participatory planning consist of 1) determining the interest groups participating in the decision-making process, 2) constructing the decision hierarchy for different interest groups, 3) assessing the weights for different interest groups 4) estimating the priority functions for each interest group, and 5) evaluating the alternative management strategies. (Kangas et al. 1995.) In the step 5, by using AHP+HERO -solution, it is possible to evaluate a great number of alternative forest plans. For more details on HERO techniques, readers are referred to Pukkala and Kangas (1993) and Kangas et al. (1995).

2.2 Positional Analysis (PA)

The main purpose of Positional Analysis is to shed light on decision situation (Söderbaum 1986, 1994). It was developed to be open-minded in its relation to all actors and interested parties and it is versatile in its ana-

lytical properties. No consensus regarding valuation rules is assumed, and so one has to refer to valuation rules or standpoints that are possibly relevant to decision makers and those affected, and point to conditional conclusions. (Söderbaum 1986, 1994.)

Depending on the kind of decision situation and the social and institutional context, simplified versions of Positional Analysis may be considered. A more ambitious study would include the following (Söderbaum 1994):

- Description of the decision situation. Historical background. Relationships to other decisions (previous and simultaneous). Identification of relevant institutions (organisations and rules of the game) and interest parties.
- Identification of the problem(s). Reproduction of problem images as stated by different actors and interested parties.
- Design of alternatives and formulation of the problem (choosing a set of alternatives for further consideration).
- Identification of impacts (monetary and non-monetary, in flow and positional terms) and comparison between alternatives in relation to these effect dimensions.
- A study of possible inertia and irreversibilities in non-monetary positional terms. In what way will first-step alternatives influence future options for different affected parties?
- Analysis of activities and interests in relation to the decision situation: identification of activi-

ties that will be affected differently depending on the alternative chosen. Assumption of goal direction (target orientation) for each activity. Activity, together with goal direction, defines an interest. Construction of preference ranking from the standpoint of each activity in relation to each alternative.

- Analysis of prevailing risks and uncertainties.
- Summary of information basis for decisions at the two levels of impacts and activities (with associated assumed interests).
- Articulation of possible valuation standpoints in terms relevant to the study area.
- Conditional conclusions, relating to the expected impacts of each alternative on possible future and valuation standpoints.

3 Framework for evaluation

3.1 Background

Planning theories are usually divided to substantive and procedural planning theories. Procedural theories concentrate on how the given ends are reached. Substantive theories emphasize defining the decision-making problem in its context. Relevant question is how the decision process has been carried out. Means themselves have their value, not only the ends reached by means.

According to the critical planning theory (substantive), in decision-making there is two kind of rationality: instrumental and non-instrumen-

tal. Instrumental rationality is appropriate for goal oriented behaviour within a means-ends structured problem area (Habermas 1971). It tells us how to combine the means to achieve given ends. Applications of analytic techniques in planning are examples of the use of instrumental reason (Sager 1992).

Non-instrumental types of rationality have been identified and analysed as social rationality and communicative rationality. Communicative rationality is found in speech meeting the validity claims of comprehensibility, truth, rightness, and sincerity, and the same time aiming at mutual understanding and agreement (Sager 1992). A community can rationally derive the goals to be collectively pursued. Values and norms, which could not be seen to have any rational founding under instrumental reason, may be established in a communicative rational manner (Sager 1992).

The concept of social rationality works through integrative decision-making to turn personal change into a rational process. In integrative decision-making preferences are attached to the means themselves. Personal change refers to e.g. that desires are changed rather than satisfied, and to personal growth by self-discovery and learning (Sager 1992).

Although non-instrumental rationality concepts refers to changing desires and reaching mutual understanding, they are not meant to be manipulative. On the contrary, at least in theory, they should work to prevent manipulation by emancipatory process, which free people from domination and promotes equality.

From the rationalities presented above, it can be indicated four stages in the decision-making situation with public participation. These can be seen divided even they are contemporary.

- 1) Personal growth i.e. to discovering one's own desires and preferences.
- 2) Communication i.e. transforming preferences and values to decision-making process.
- 3) Mutual understanding i.e. common decision-making.
- 4) Instrumental rationality i.e. combining the means to achieve given ends.

Concerning decision-supporting methods these considerations are formulated as following questions. Does the decision-supporting method help the participants become conscious of their values and to put them in order? Does the decision-supporting method transform the citizens' values to decision-making? Do the decision-supporting method support mutual understanding and undistorted communication? Does the decision-supporting method search means to reach certain goals? In this paper two decision-supporting methods are analysed from the viewpoint of the stage 2.

3.2 Criteria for evaluation

The earlier experiences of public involvement in natural resource management planning has been reported widely (Paldanius 1997). According to e.g. Leskinen and Turtiainen (1988), Leskinen et al. (1991), and

Paldanius (1992) there are several preconditions to successful participative planning process. These preconditions concerns e.g. about timing of the participation, managing information and choosing of the participants. From the viewpoint of these preconditions criteria for decision-supporting methods are formulated. To meet the objective of to transmit citizens' values to decision-making, the decision-supporting methods should fill at least the following four criteria.

- a) *Does the method used enable to formulate and delimit the decision problem comprehensively and clearly?*

For successful public participation it is important that citizens are involved to the planning process from the very beginning (Leskinen and Turtiainen 1988, Miller 1988). The purpose is that a well-based decision should be taken as to which interests and interest parties are relevant to the planning situation. For this to be achieved, there should be a procedure for identifying all the interests and interest parties affected by planning. The decision problem should be modified comprehensively, clearly and openly (Leskinen and Turtiainen 1988, Leskinen et al. 1992, Paldanius 1995).

- b) *Is the method applied able to manage both qualitative and quantitative information when collecting the information?*

The method used should be able to treat all kinds of information. In order to be appropriate in

changing situations, procedures should be modifiable (Paldanius 1995). Information and opinions should be able to express the way citizens are familiar with.

- c) *Are all the different values associated with the information presented clearly when managing the information?*

The method should present important affairs and their grounds (values, preferences). It should become readily apparent which alternatives support which objectives. Evaluation should also be comprehensible and consistent. The consistency of the method means that the information utilized is free of conflicts, or if it is not, that conflicting standpoints are clearly presented (Paldanius 1995).

- d) *Does the method present the standpoints of the different parties and the impacts resulting from following them?*

Clear and comprehensible decision-support analysis should be performed so well, that anyone is able to evaluate the alternatives from his/her standpoint by him/herself (Leskinen et al. 1992). An appropriate "open" method would also produce analysis about the profits and disadvantages of the alternatives from the viewpoints of the different interest parties. Methods, which optimise and make things mutually comparable, hide the value conflicts between interests, and do not show who will be affected and/or how (Miller 1988, Leskinen et al. 1991, 1992).

4 Does the decision-supporting method transform the citizens' values to decision-making? – Evaluation of AHP and PA

- a) *Does the method used enable to formulate and delimit the decision problem comprehensively and clearly?*

AHP does not include any procedures for identifying different interest parties and interests. When AHP is used, every interest party is able to formulate the decision problem by setting their own decision-making hierarchy. Positional Analysis includes procedures for mapping all the interests and interest parties, e.g. "Description of the Decision Situation", "Identification of the Problem(s)" and "System Analysis". AHP has procedure to formulate the decision problem very clearly when PA has better procedure to obtain comprehensive understanding of the problem.

- b) *Is the method applied able to manage both qualitative and quantitative information when collecting the information?*

Both AHP and PA are capable of managing qualitative as well as quantitative information. Different techniques for collecting information and opinions are available in PA. E.g. surveys, inter-

views and meetings. When using the AHP -method participants express their opinions (preferences) setting priorities e.g. by doing pairwise comparisons. This means possibility that other ways to collect participants opinions (e.g. theme interviews) have not the same importance with priorities set in the decision-making process. This might result in inequality of participants.

- c) *Are all the different values associated with the information presented clearly when managing the information?*

In principle both methods can deal with values concerning information. The main purpose of AHP is to identify participants subjective preferences concerning the decision criteria. In AHP, included decision criteria are seen from the hierarchy. PA collects and analyse opinions and reports different viewpoints to decision-making situation. In PA at "System Analysis", "Definitions of Activities and Interests", and "Effect Analysis" reveal, which questions have been included in the process.

In AHP and PA there are some properties that might result in inconsistency and unclear presentation of decision-making situation. In AHP process it is possible that the uncertainty of the priorities and utilities accounted are not always demonstrated and understood.

PA also has consistency problems in assessing impacts. At the step "Identification and Comparison of Impacts", the planner may decide

which kind of impact is valued as being good or bad. To avoid hidden valuation, it is better to identify impacts at this step. The identified impacts should be compared and valued at the step “the Analysis of Activities and Interests” at which point the viewpoint of the valuation can be seen openly.

Sometimes PA can also be too comprehensive and thereby conceal important points. When using Positional Analysis planner has to concurrently attend to compactness and comprehensibility of the analysis. The problem is that analysis easily expands and becomes too comprehensive to be controlled any more.

d) Does the method present the standpoints of the different parties and the impacts resulting from following them?

As a whole, both AHP and PA are capable of analysing and expressing the participants’ standpoints in the planning process. In AHP, every interest party can have their own decision hierarchy and decision alternative, which consequences can be simulated and so directly seen. “Analysis of Activities and Interests” and “Conditional Conclusions” of Positional Analysis shows the standpoints of the participants.

5 Conclusion

It becomes apparent from the evaluation that both AHP and Positional Analysis meet the objective of to transmit citizens’ values to decision-making by their own way. Both

methods have their advantages and disadvantages as decision-supporting methods in participative planning. PA has the procedure for identifying all relevant interest parties. AHP has a tool for modifying the decision problem clearly, when PA has tools for more comprehensive analysis of the decision problem. Both methods are able to manage quantitative and qualitative information. The advantage of PA method is the option for collecting information by different techniques. Both methods can manage values concerning information. Both methods have problems with consistency and clear presentation. PA might be too comprehensive and by that way conceal important points. Both methods show standpoints of the participant groups.

In participative forest planning there seems to be need to same time combine the comprehensive analysis of decision situation and keep the analysis clear and compact. This need can be obtained by combining AHP and Positional Analysis as one procedure. For example,

- 1) By using Positional Analysis “Analysis of Activities and Interests” the comprehensive study of the decision situation is substantiated.
- 2) Only the most relevant points are concentrated and analysed thoroughly by using AHP-method. The consequences of the different decision alternatives formulated can be demonstrated by simulations with AHP+HERO - solution. Different standpoints can be demonstrated by “Analysis of Activities and Interests” and “Conditional Conclusions”.

- 3) After “compact analysis” decision alternatives formulated can be analysed again comprehensively with the help of “Analysis of Activities and Interests” substantiated in the step one.

In this paper two decision-supporting methods were analysed from the viewpoint of the question: “Does the decision-supporting method transform the citizens’ values to decision-making?” The aim of the study was to compare how one qualitative and one quantitative decision-supporting method support the aim of transmit citizens’ values to decision-making process. The future studies will concern decision-supporting methods and other questions introduced in the section 3.1. Also the procedure where AHP and PA is combined will be presented and tested in case study.

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