Chapter 7
Group Decision Making and Participatory Planning

7.1 Decision Makers and Stakeholders

Environmental problems are typically messy and complex. There may be high risks involved and/or lack of scientific agreement on the cause of problems. The problems may be ill defined, and the goals may not be clear. In addition, numerous decision makers or other stakeholders are often involved in environmental planning.

The stakeholders are defined to be "any group or individual who can affect, or is affected by, the achievement of a corporation's purpose" (Freeman 1984). They could be persons like forest owners, farmers, forest workers or local inhabitants, or stakeholder groups such as tourism and recreation services, organizations concerned with nature conservation, rural communities, hunters associations, sporting and recreation associations or wood and forest industry (International Labour Office (ILO) 2000). Each of them can have different objectives concerning the use of forests or other natural resources, which further complicates the evaluation.

Group decision making is inevitable, for example, when dealing with forest planning of forest holdings owned by several people. In addition, group decision making is commonly used in business decision making, for instance wood procurement organizations. In group decision making, the total utility to be maximised can be taken as a combination of utilities of the persons belonging to the group. In group decision making typically at least some agreement among participants can be found, due to the organizational culture (Hjortsø 2004).

Public participation means that citizens are involved in the environmental or natural resource decision making that has an effect on them. Public participation is also seen as part of sustainable development. This is further underlined by the UNECE (1998) convention on access to information and access to justice in environmental matters. In the case of public participation, the views of participants are often fundamentally different and even conflicting (Hjortsø 2004). In such situations people often focus on protecting their own interests so that conflicts are an inherent part of public participation (Susskind and Cruishank 1987; Hellström 1997).

The most distinct difference between these two cases is the actual power to make the decisions. The group typically withholds all the power to make the actual decisions, but in participatory planning this is not the case, but usually the managing agency holds all the power. Thus, the level of participation may vary from mere informing the public to total control of public, depending on how much power the managing organization is willing to give up.

In most cases, organizing a participatory planning process is voluntary for the managing organization. In some cases, however, the use of participatory planning is required by law. Such is the case in many Environmental Impact Assessment (EIA) processes. In Finnish forestry, participatory planning has been used for instance in the decision making of Metsähallitus (formerly Forest and Park Service, e.g. Wallenius 2001) and municipalities owning forest, such as Raahe, Helsinki and Tampere (e.g. Tikkanen 1996; Sipilä and Tyrväinen 2005). Participatory approach has also been used for many policy programmes, like the National Forestry Programme and its regional counterparts (e.g. Tikkanen 2003; Primmer and Kyllönen 2006). In addition, participation has been used in defining nature conservation programmes, such as NATURA 2000 (Metsien suojelun … 2006).

There are several reasons for promoting public participation. The specific purposes may depend on the issues involved, the perspectives and interests of participants, and the existing cultural, political and organizational contexts. It can be assumed that the final decisions are made with more competence, when local knowledge is included and expert knowledge is scrutinized by the public (Webler et al. 1995). Furthermore, the legitimacy of the final decision may be better, when the citizens whose interests the project has an effect on are involved in the decision making.

In relation to forestry, ILO (2000; see also Hjortsø 2004) has identified seven purposes:

1. Increase awareness of forestry issues and mutual recognition of interests
2. Gather information and enhance knowledge on forests and their use
3. Improve provision of multiple forest goods and services
4. Stimulate involvement in decision making and/or implementation process
5. Enhance acceptance of forest policies, plans and operations
6. Increase transparency and accountability of decision making
7. Identify and manage conflicts and problems together, in a fair and equitable way

According to Heberlein (1976), the reason why people want to participate in the decision making is that people feel there is a discrepancy between the values held by agency personnel and the public. This may be the case especially in decision making concerning the environment, as the values in the society have been fast evolving. Public participation is not, however, the only way to involve public opinion in decision making regarding natural resources. The public views and values probably have their influence on the missions of the agencies doing the planning. Similarly, the views of public affect through the agency personnel. Moreover, public opinion also affects the democratic decision making system, which supervises the work of agencies making the actual decision.

Group decision making can often be aided with the same kind of methods as the decision making of one decision maker. In addition, group decision making might benefit from problem structuring methodology, if the process is ill-defined. The same methodology can also often be used in a public participation process (e.g. Kangas 1994; Pykäläinen et al. 1999; Kangas and Store 2003). However, there are many other aspects that also need to be accounted for, such as equity and equality.

7.2 Public Participation Process

7.2.1 Types of Participation Process

The public participation process can be divided in many ways. First, it can be seen either as a method, a mean to an end; or as an approach or ideology (Buchy and Hoverman 2000). It can vary from passive participation organized by an agency to self mobilization of local people at the face of some decision of interest to them. Participation processes can also be divided to open (every interested citizen can attend the process) and closed (only people invited by the managing organization can attend); or to combined (all interest groups participate at the same time) and separated (each interest group have their own process) (Tikkanen 2003).

One important division is division with respect to power given to the participating people (e.g. Arnstein 1969; Tikkanen 2003). Germain et al. (2001) divide the process to six levels:

1. Informing
2. Manipulation
3. Consultation
4. Collaborative decision making
5. Delegated power
6. Total control by participants

In the first case the managing agency informs the public about their future plans, but there is no public avenue for feedback or negotiation. The process may aim at educating people and/or changing their attitudes. It may be that the managing agency truly believes that if the public knew what the professionals know, they would think the same way (Daniels and Walker 1996). Such thinking can, however, also apply to the participants (Webler et al. 2001).

In the second case, participation is organized but it is illusory in the sense that public has no true power on the outcome. The purpose of the process may be to engineer support for the project (Germain et al. 2001). This kind of participation process may have a co-optation function, meaning that people can complain about the project, although the agency is not responding; or, the process can have a ritualistic function, meaning that the participation is required by law, but there is no direct need for the participation (Heberlein 1976).

In the third case, people can also express their own opinions about the project, but the managing agency retains the power to make the decisions (Germain et al. 2001). In this case, public cannot be sure if their opinions are accounted for or not (Heberlein 1976). It often places the public to a situation where they only can react to the decision the agency has made (Germain et al. 2001). Thus, although majority of studies have found that the public meeting influence the decisions of the managing agencies (Chess and Purcell 1999), people may feel that they are not adequately heard. And, at the same time, the personnel of the managing agency may feel that the public is never satisfied, whatever they do (Buchy and Hoverman 2000). In this level, public participation is usually carried out using public hearings, conferences and formation of advisory groups (Hjortsø 2004).

In the fourth case, the public is partly responsible for the resulting plan (Hytönen 2000). The aim in this level is to build consensus through collaborative problem solving, negotiation, conciliation and mediation, and joint decision making (Hjortsø 2004).

In the last two levels, the public has a dominant role in the decision making.

It has often been noted that a problem in public participation is the resistance of the managing agencies (e.g. Garcia Pérez and Groome 2000). On the other hand, it has also been noted that people usually avoid participating in the decision making (Riedel 1972). Even if the people want to participate, it may be that they are only interested in one or two issues. The silent majority may be satisfied with the work of the managing organizations, so that those participating have the most extreme views.

7.2.2 Success of the Participation Process

The success of public participation can be viewed from two different viewpoints: outcome and process (Chess and Purcell 1999). They also relate to specific concepts of justice, namely distributive justice and procedural justice (Smith and McDonough 2001).

Some people may evaluate the public participation only with respect to the outcome of the process. The criteria for the outcome include better accepted decisions, consensus, education, and improved quality of decisions (e.g. English et al. 1993). It may, however, be difficult to say whether the outcome is favourable or not: people may use the participation process to delay difficult decisions or to block unwanted proposals. It is also not easy to say how much the outcome is due to the participation process and how much due to some other factors (Chess and Purcell 1999).

The process also has an effect to the success. It has been noted that a fair procedure make people react less negatively to unfair outcome (Brockner and Siegel 1996) and that fair outcome could make people think more positively about the process (Van den Bos 1997). On the other hand, people may raise questions concerning the process if the outcome is not to their liking (Webler and Tuler 2001).

Although researchers and practitioners agree on the importance of the process, there still is no agreement on what the process should be like (Tuler and Webler

1999). There exist several criteria given to the participation process. Some of them may be theoretical, such as 'fairness', 'competence' and 'reasonableness', some may be based on participants' goals and satisfaction (Chess and Purcell 1999). The participants' goals, on the other hand, may vary according to culture, environmental problem, historical context, etc.

Tuler and Webler (1999) studied the opinions of participants concerning a good process. They found seven normative principles that emerged from the interviews.

1. Access to the process
2. Power to influence process and outcomes
3. Structural characteristics to promote constructive interactions
4. Facilitation of constructive personal behaviours
5. Access to information
6. Adequate analysis
7. Enabling of social conditions necessary for future processes

Access to the process means getting people present and involved in the participation process. It also means that in order to succeed, organization have to actively reach out to people (Chess and Purcell 1999).

Structural characteristics to promote constructive interactions emphasise the structure of social interaction: the time, location, availability and structure (e.g. seatings) of the meetings. The time and location needs to be such that not only experts who work on the case can attend (Heberlein 1976). Facilitation of constructive personal behaviour, on the other hand, emphasises the behaviour of the people involved. Respect, openness, understanding and listening are required. For instance, the process may be good in every other respect, but if people feel they have not been treated with dignity, the process does not feel fair (Smith and McDonough 2001).

With respect to access to information, people feel that both the knowledge and experiences of layman and experts should be heard. Adequate analysis means that people want to be able to understand the scientific reasoning behind the plans (Tuler and Webler 1999).

Finally, enabling the social conditions necessary for future processes emphasises that participatory process should not fuel the conflicts. On the contrary, it should build better relationships between the interest groups in the region.

One task of planning is to uncover common needs and understanding (Webler et al. 1995). According to McCool and Guthrie (2001), especially managers stress learning as an important aspect of successful participatory planning process. In the review made by Chess and Purcell (1999), the managing agencies could enhance the success of the participatory process also by (i) holding public meetings in addition to other forms of participation, (ii) providing significant technical assistance to participants, (iii) conducting vigorous outreach, (iv) discussing social issues, and (v) fielding questions adequately. On the other hand, the unsuccessful participation in their review was characterized by (i) poor outreach to potential participants, (ii) limited provisions of technical information, (iii) procedures that disempower citizens, (iv) unwillingness to discuss social issues, and (v) timing of hearings after the decisions have been made or otherwise late in the decision-making process.

Good examples of unsuccessful planning processes are presented by Garcia Pérez and Groome (2000).

While these general criteria for successful participatory process were clear, different people emphasise different issues. For instance, Webler et al. (2001) found five different perspectives emphasising different issues and Webler and Tuler (2001) found four differing perspectives in two different participatory processes. The perspectives in the latter were (a) a good process is credible and legitimate, (b) a good process is competent and information-driven, (c) a good process fosters fair democratic deliberation, and (d) a good process emphasises constructive dialogue and education. In the former case, the perspectives were a bit different: (a) a good process should be legitimate, (b) a good process should promote a search for common values, (c) a good process should realize democratic principles of fairness and equality, (d) a good process should promote equal power among all participants and viewpoints, and (e) a good process should foster responsible leadership.

Thus, some people emphasise discussion among the participants, some high quality information, some emphasise fairness and some leaders taking the responsibility. The differences may be due to both participation situations, and the participating people, and their occupation and previous experiences in participatory processes (Webler and Tuler 2001; Webler et al. 2001). For instance, being a politician or a proponent of property rights had a significant effect on the preferred way of participation. The good process also depends on the planning context (Webler and Tuler 2001).

7.2.3 Defining the Appropriate Process

In participatory planning, the problem setting phase includes: (i) analyzing the planning situation, (ii) identifying the people affected by the decisions, (iii) assessing if there is a conflict and the severity of the possible conflicts, (iv) defining the level of power given to the participants, and (v) gaining internal commitment in the managing agency for the participatory process (Kangas et al. 1996).

There exist several handbooks and guides for planning a participatory process (e.g. Bleiker and Bleiker 1995; ERM 1995; English et al. 1993; ILO 2000; see also Webler 1997). In more detail, the participatory planning process can be planned, for instance, using the list of questions presented by English et al. (1993):

- What is the goal of the participation process?
- Who counts as affected party?
- Who should participate in the process?
- Where should participation occur in the decision making process?
- What should be the roles and responsibilities of the participants?
- How to handle ethical principles?
- How to balance technical and value issues?
- How much influence on the decision should the process have?
- How long should the process last?
- How should the process relate to other decision making activities?

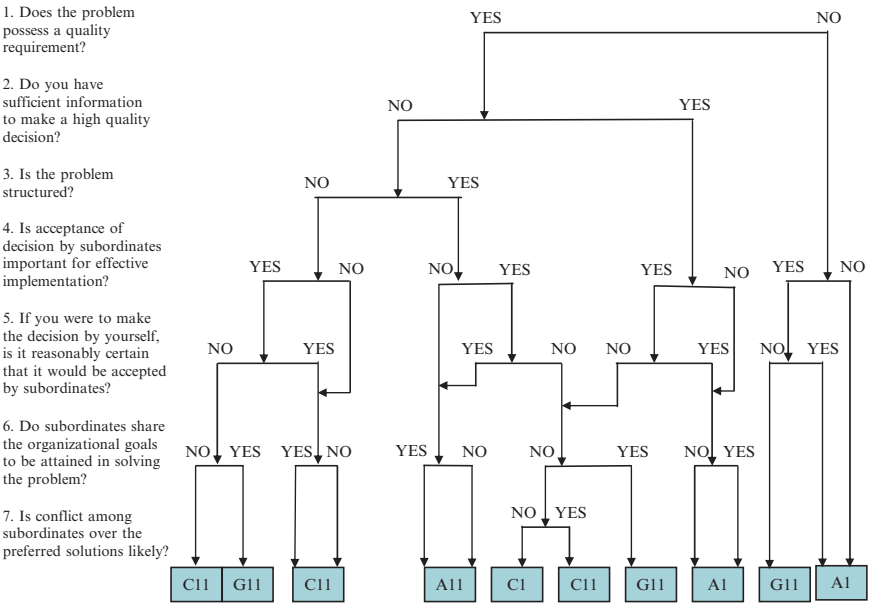

Fig. 7.1 Original Vroom–Yetton model (Vroom and Yetton 1973; Lawrence and Deagen 2001)
A1: The manager solves the problem alone using information presently available to the manager
A11: The manager obtains any necessary information from subordinates and then decides on a solution alone
C1: The manager shares the problem with relevant subordinates individually without bringing them together as a group, gets their ideas and suggestions, and then makes decision alone
C11: The manager shares the problem with subordinates in a group meeting, getting their ideas and suggestions, and then makes a decision that might or might not reflect the subordinates' influence
G11: The manager shares the problem with subordinates as a group, and together manager and the subordinates attempt to reach agreement on a solution

One possibility to analyze the level of participation is to use the so-called Vroom–Yetton approach (see Vroom and Jago 1988). The Vroom–Yetton model is a set of questions that lead to the different levels of participation in a decision making of an organization (Fig. 7.1) It has been later developed to better suit a public participation situation (Lawrence and Deagen 2001; Tikkanen 2003).

This approach may, however, be too simple, as there is evidence that only a few people are willing to commit themselves to very intensive planning (e.g. Riedel 1972). Instead, they would like to have many different channels for participation, varying from low to high intensity: some people will only want to have information concerning the project, some would like to be consulted in the projects and some would also like to participate in the decision making (ERM 1995). People would also like to be able to choose the level of participation suitable for them. The ERM (1995) manual advises planners to provide possibilities for participating at all these levels.

Participation includes many phases, and in each of these phases several different tools can be used. Janse and Konijnendijk (2007) present a set of tools for urban

Table 7.1 Categorization of individual tools (Janse and Konijnendijk 2007)

Tool categories	Tool sub-categories	Tools
Information Provision	Information Distribution	• Newsletter • Website • Contact and information office
	Public events	• Information meetings • Public exhibitions • Information stands • Public sensitization/ awareness raising events • Events dedicated to the presentation of project Vision documents
Information collection	Social surveys/interviews	• Social surveys • Interviews while walking through the forest
	Other surveys/inventories	• Land-use surveys • Botanical surveys • Forest inventory
Involvement of experts and the public at large	Involvement of the public at large/interest groups	• "Sounding board" group • Public workshops • Thinking days with the public
	Expert analysis/connoisseur approach	• Connoisseur approach – "future managers meeting local connoisseurs" • Expert analysis of urban woodland design • Expert interviews • Thinking days with experts
	Involvement of children and youths	• Youth work-play happening • Design of a play-forest with children • Education activities • Communication with children and teenagers though participation in practice • Youth round table
Processing and use of information	Assessment and analysis of information GIS tools	• Working group sessions • Visioning processes • Multi-Criteria analysis • Thematic maps/GIS mapping • Mapping of social values and meanings of urban green areas • Assessing the recreational potential of urban forest areas by means of GIS

forest planning, but this set of tools can be used also for other types of participatory processes (Table 7.1). For instance, the information required for participatory planning can be obtained with several different ways, for instance using public hearings, surveys, or different group decision support methods (see also Heberlein 1976; Hytönen 2000). Each of these methods has its own drawbacks and benefits. Glass (1979) states that none of the methods used for participatory planning is able to satisfy all the objectives of participation. Thus, the best technique depends on the planning situation. Moreover, it also means that using several different methods may be advisable.

There exist also several methodologies that are intended to cover the whole participatory planning process. The readers interested are referred to a thorough review by Tippett et al. (2007).

7.3 Tools for Eliciting the Public Preferences

7.3.1 Surveys

Surveys provide representative information on the population. A random sample of people is selected and their opinions are asked using a questionnaire. The sample can also be quite large, so that it is possible to investigate the opinions of larger number of people than with any other method. In surveys, the questions are usually structured and therefore easy to analyze quantitatively. On the other hand, this also means that the questionnaires are rigid.

The response rates in questionnaires are usually quite low (around 40–58%, Hytönen 2000), and the high rate of non-response may cause bias to the results. This may happen, if some groups respond more than others (e.g. Janse and Konijnendijk 2007). There may also be a trade-off between the length of the questionnaire and the response rate.

One potential problem with surveys is that the public responding may be uninterested and uninformed so that their preferences may be based on false (or nonexistent) information of the consequences of the alternative actions (e.g. Lauber and Knuth 1998). Thus, the preferences might be different if people had more information on the subject.

Another potential problem is that the questions asked in surveys may be too general to provide information that is directly useful for decision making in a particular case (e.g. Satterfield and Gregory 1998). For instance, the general environmental values may seem quite similar among people, but the reactions of people to an actual planning situation may still vary a lot. Therefore, the results of surveys can best be used as background information in a certain decision situation (Hytönen 2000). On the other hand, it is often possible to form the survey specifically for a certain planning situation (e.g. McDaniels and Thomas 1999).

The data presented and the questions used for preference gathering in the decision support methods may, however, be too difficult for the public to understand

(e.g. Heberlein 1976). Moreover, small differences in the wordings may produce different results.

One promising method for public participation surveys is the social values mapping (Tyrväinen et al. 2007). In this method, the participants are provided a map, and they assign (pre-defined) areas with values according to their preferences. The values may include beautiful sceneries, space and freedom, or peace and tranquillity. This approach is easily comprehended by the public and also provides the planners spatially located information on the preferences of public. The participants could also themselves delineate the areas they value, but this approach is by far more laborious to the planners (Kangas et al. 2007).

The information provided along the questions may also influence the public opinion (e.g. McComas and Scherer 1999). It is possible that those who carry out the survey may manipulate the information to serve their needs. On the other hand, it may be that 'overly' positive information may not seem credible to participants. It has been noted that one-sided positive information had the most persuasive influence on those people, who already had positive assertions to the plan, and two-sided balanced information for those persons, who initially opposed the plan (Hovland et al. 1965). Furthermore, one-sided information had greatest effect on uneducated people, and two-sided to educated people. All in all, information has least effect when people already have well-formed opinions about the subject (e.g. McComas and Scherer 1999).

Due to all these problems, Heberlein (1976) argues that opinions of public gathered through survey may be poor indicators of the true preferences of public.

7.3.2 Public Hearings

In public hearings it is possible to consider the opinions of smaller groups. In hearings people typically can express their opinions in a non-structured way, so that the questions asked do not affect to the result. This way, they can also provide information that the organizers have not thought of asking. However, the problem is that the unstructured responses are much harder to analyze than structured surveys (for an example see Hytönen et al. 2002). They need to be analyzed using qualitative procedures, usually by classifying the answers in some way. It may also be that much of the information received is not useful in the planning process. For instance, people may state facts concerning the area rather than their preferences.

As the hearings are not based on sampling, there is no guarantee on how well the attending group represents the society at large. It may be that the hearing only reflects the well-known views of well-identified interest groups, or that only opponents of the propositions attend to the meetings (Heberlein 1976). In the worst case, the public hearings may represent the opinions of those dominating the discussion, not even the persons in the meeting (Hytönen 2000). However, there is also evidence that the opinions gathered with public hearings have been "in most respects" similar to the results of survey (O'Riordan 1976).

On the other hand, people attending the hearings are likely to have more information on the issues than people at large (e.g. Lauber and Knuth 1998). They may also be more interested on the issues at stake. The difficult question is how much the opinion of persons, who do not have adequate information and who are even not interested on it, should be accounted for in the planning.

It may also be that although ordinary people attend to the meeting, they do not actually participate. It may be very intimidating to present ones opinion at public, so that the opinions shared in the meetings are those of experts, people most severely affected by the decisions or people who are not intimidated by behavioural norms of the meetings (Heberlein 1976).

7.4 Problem Structuring Methods

7.4.1 Background

Problem structuring is an unavoidable phase of any decision support process. The MCDM methods presented so far do not provide enough tools for efficient problem structuring. Therefore, specific problem structuring techniques or so-called "Soft OR" have been developed. They may be useful for exploring the situation in such a way that formal MCDM methods can be successfully applied in later phases. Problem structuring methods are useful especially when the problem is complex and/or ill-defined (see Rosenhead 1989; Belton and Stewart 2002). Ill-defined problem means that people are attempting to take some purposeful action that will improve the current situation, but the possible actions to improve it are unknown, and the goals undetermined. Problem structuring methods are intended to (Mingers and Rosenhead 2004)

- Pay attention to multiple objectives and perspectives
- Be cognitively accessible to a broad range of participants
- Operate iteratively so that the problem representation adjusts to reflect the discussions among the participants
- Permit partial or local improvement to be identified

The problem structuring approaches vary in their scope and complexity, but they all aim at supporting problem structuring and problem solving. They all require a lot of time and commitment from participants, when compared to public participation using, for instance, public hearings. These methods are suitable when workshops are used as a form of participation. Usually also a facilitator (i.e. person guiding the decision makers in the use of analysis method) is needed to aid the work in groups.

One simple and popular way in problem structuring is to ask the participants to write their ideas and views on Post-It notes, and then distribute them to the walls. This way, a lot of detailed ideas can be generated by individuals; they are directly recorded; and also easily seen by other participants (e.g. Belton and Stewart 2002, p. 41). In the beginning, the ideas appear in an unstructured format, but as it is easy

to move the Post-Its around, structure can eventually emerge, when similar ideas are clustered together. Clustering of the ideas together will further stimulate discussion and improve mutual understanding.

According to Belton and Stewart (2002) the main benefits of this approach is that all people have an equal chance to contribute with their ideas, there is a degree of anonymity involved and the process cannot be dominated by more powerful or eloquent persons.

Many researchers have developed specific, more formal methods for problem structuring (for a review see Mingers and Rosenhead 2004). In this book, two of these are presented, namely Strategic Options Development and Analysis (SODA, e.g. Eden and Simpson 1989) and Soft Systems Methodology (SSM, e.g. Checkland 1981, 1989). In its further developed form SODA is also called JOURNEY making (JOintly Understanding, Reflecting, and NEgotiation strategy, Eden and Ackermann 2001).

7.4.2 Strategic Options Development and Analysis

SODA is based on cognitive mapping (Eden 1988). It was developed as a way to represent individuals' 'construct systems' based on Kelly's personal construct theory (Kelly 1955). SODA aims at presenting the problem as the decision maker sees it, as a network of means and ends, or options and outcomes. The concepts linked to the network are action-oriented, which makes it a suitable approach for strategy development (e.g. Belton and Stewart 2002, p. 49). The cognitive maps can be done in paper, but there exists also software for doing them, for instance Decision Explorer (Eden and Ackermann 1998). Using computer enables a thorough analysis of the maps.

In the map, alternatives or contrasting ideas can be expressed as pairs or words connected with dots like 'saw mill … paper mill'. Concepts are linked with arrows to other concepts that they imply like 'employment' or 'deterioration of water quality'. The arrows can also be marked with minus signs to imply counter-effects, like 'loss of agriculture' may imply negative effects on 'quality of life' (Fig. 7.2). The (desired) outcomes or ends are concepts where the arrows lead ('e.g. quality of life') and strategic options or means are the concepts from which the arrows lead to outcomes (e.g. 'pulp mill … saw mill').

One cognitive map typically presents the cognition of one individual. In order to utilise cognitive mapping in group work, these individual maps need to be merged. This is what the SODA method is about. The idea is to structure multiple conflicting aspects and put the individual views into context. Giving the individual views anonymously, through software, may help in reducing conflicts, as people can concentrate on ideas rather than on persons (Ackermann and Eden 1994). It is, however, also possible to make a group map from the start (Ackermann and Eden 2001).

According to Eden (1989, 1990), SODA includes the following phases (all of which do not have to be included in the process):

1. Initial individual interviews and cognitive mapping
2. Feedback interview where the initial maps are verified

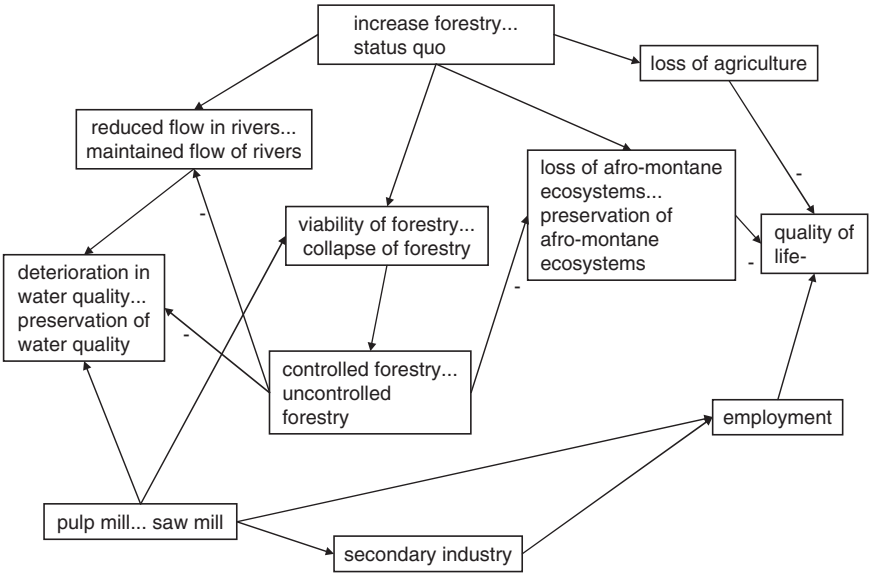

Fig. 7.2 An example of cognitive map for a problem of allocating land to exotic forest plantations (Modified from Belton and Stewart 2002)

3. Analysis for key issues
4. Refinement of issues
5. A workshop focusing on awareness
6. A workshop focusing on orientation
7. A workshop focusing on action portfolios

In the initial interview, participants express their view of the problem situation, and the facilitator or consultant aims at capturing the ideas on the map. In the second phase, the facilitator goes through the map with the participant, either exploring the goals and then working gradually down to the options, or exploring the options and then gradually working up to the goals. The idea is to make sure the map really expresses the view of that participant.

In phase three, the individual maps are first merged. This group map contains all the concepts of each member of the group, but in the group map they can be seen in the context of all other ideas (Eden 1990). Then, the key issues are identified with formal research. First, clusters of material that are closely linked to each others are searched for. Each cluster represents a problem within which there are problem-related goals and strategic options (Eden and Ackermann 2001). The clusters are re-arranged so that the goals are at the head of the cluster, and options in the tail of the cluster (Fig. 7.3). The clusters are linked to other clusters so that goals of one cluster lead to options of another, and options of one problem are consequences of a sub-ordinate problem. The issues best describing each cluster are the key issues. In phase four the resulting model is further refined, using interviews with experts. It means that issues missing are searched for, or orphan issues are included to the

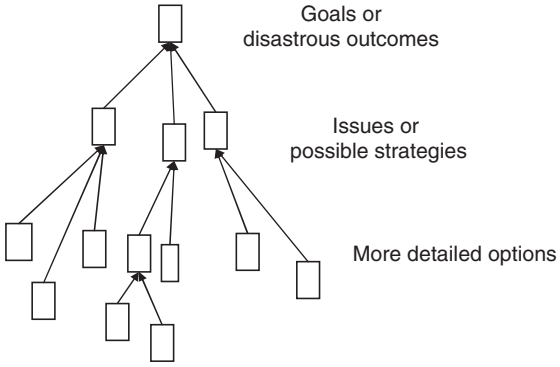

Fig. 7.3 A cluster rearranged as a 'tear-drop' (Modified from Ackermann and Eden 2001)

groups and so on. In phases from five to seven, it is used as a device facilitating negotiations within the group.

The cognitive map resulting from merging can be analysed using concepts such as domain, centrality and criticality (Eden and Ackermann 1998; see also Mendoza and Prabhu 2003). The idea is that these concepts help in finding important items from the maps.

Domain reflects the number of items linked to a particular item, irrespective of the causal directions (direction of the arrows). High domain values indicate a large number of items directly affecting or affected by this particular item. In Fig. 7.2, item pulp mill … saw mill has fairly high domain with four connections, and loss of agriculture fairly low with two connections.

Centrality reflects not only the direct impacts of an item to other items, but also the indirect impacts, through indirect connections to other items downstream the impact chains. The central score can be calculated as

$$C_i = \frac{S_1}{1} + \frac{S_2}{2} + \ldots + \frac{S_n}{n} \tag{7.1}$$

where S_j describes the j-level connections and n is the number of connections considered. The contribution of direct connections (S_1) is higher than that of the connections further away. In Fig. 7.2, loss of agriculture has two direct connections, four second-level connections thus its central score with $n = 2$ would be four.

Criticality reflects the number of critical items linked to a particular item, where the critical items are defined by the decision makers. It can be calculated how many critical items affect a particular item, and how many items are affected by it. The former is related to the number of different paths to a particular item and the latter is related to the number of paths from it. For calculating the criticality of an item, all paths to it or from it are counted, and the critical items in these paths are summed.

For instance, in Fig. 7.2 there is a path from increase forestry … status quo to quality of life either through loss of agriculture or through loss of afro-montane ecosystems … preservation of ecosystems. If employment is a critical factor, it is in two backward paths from quality of life, and respectively in two forward paths

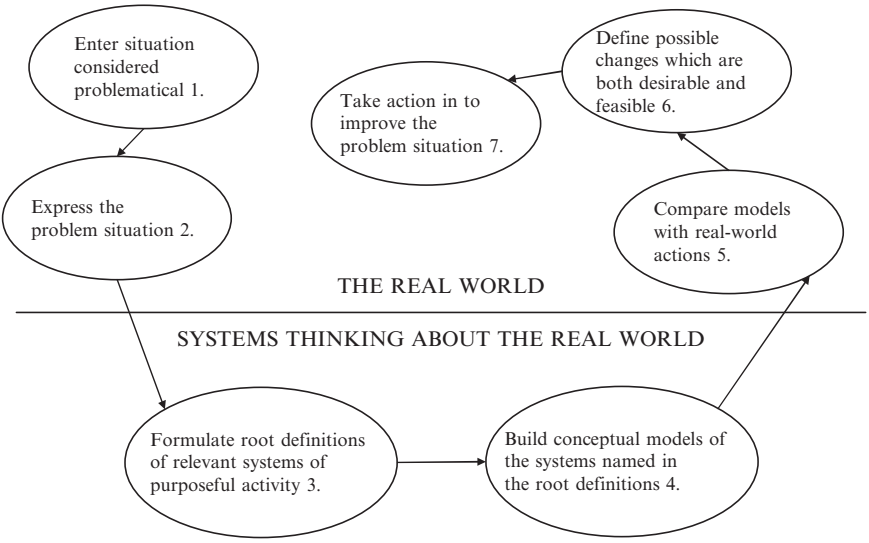

Fig. 7.4 The 7-stage representation of soft systems methodology (Modified from Checkland 2001)

from pulp mill . . . saw mill. For a more detailed example, see Mendoza and Prabhu (2003).

7.4.3 Soft Systems Methodology

Soft Systems Methodology (SSM) is a learning system that is developed to aid a system redesign. It is assumed that in any 'human activity system', i.e. in a system of people making decisions and taking actions, each person have their own way of thinking about the problematic situation (Checkland 2001). This is called 'Weltanschaung' or world view. For instance, the people who from one perspective are declared as terrorists, from another perspective are seen as freedom fighters. The SSM in its original form consists of seven stages (Fig. 7.4). These stages, however, need not to be rigidly followed and can be used more or less as an aid in the learning process.

In stages 1 and 2, the participants are supposed to find out what the problem is and express it. In the first versions of SSM the finding out was carried out with so-called 'rich pictures' (e.g. Khisty 1995). In the rich pictures, the participants are supposed to represent important relationships (e.g. between the citizens and city administration) and problem issues related to them (e.g. how can citizen impact the city to improve the recreation possibilities) as pictures.

In the later versions this finding out process was carried out with so-called analyses 1, 2 and 3 (Checkland 2001). In the first analysis the actors who have interest in the situation or could be affected by it are identified. In the second analysis it is

analyzed what social roles are significant in the situation, what norms of behaviour are expected from role holders and what values are used to judge the role holders' behaviour, i.e. the culture of the social system. In the third analysis the situation is examined politically, by asking questions about the disposition of power. Thus, the method has also evolved in time (Checkland 1999).

The third stage is carried out by naming relevant systems for carrying out purposeful activity. Term 'relevant' here means that the system described is thought to help in exploring the problem situation. The system is analysed using the so-called CATWOE elements (Checkland 1985):

C 'customers'	Who would be victims or beneficiaries of this system were it to exist?
A 'actors'	Who would carry out the activities of this system?
T 'transformations'	What input is transformed into what output by this system?
W 'world view'	What image of the world makes this system meaningful?
O 'owner'	Who could abolish this system?
E 'environmental constraints'	What external constraints does this system take as given?

These questions are used to define the so-called 'root definitions' of the system. A different root definition is needed for each perspective. Examples of root definitions can be found, e.g. in Khisty (1995).

Example 7.1. A hypothetical example of root definition for a situation where citizen of a city would like to create a recreation area from a forested area could be as follows:

C Citizen of the city
A Committee chosen from among the citizen
T Transforming the forest area to a recreation area
W Improved recreation possibilities improve the well-being of all residents
O Committee chosen from among the citizen
E Budget constraints

From the city point of view the situation could be seen as a possibility to engage the citizen in the administration:

C City council members
A City staff
T Engaging the citizen more tightly to the city administration
W Improving the citizen activity would improve the mutual understanding and prevent conflicts
O The city council
E Time, staff and expertise

In the fourth stage, conceptual models (CM) of systems are built by participants using these root definitions as a basis. A different system is built for each relevant world view. Conceptual modelling of the system means assembling the verbs describing the activities that should be in the system named in the root definitions,

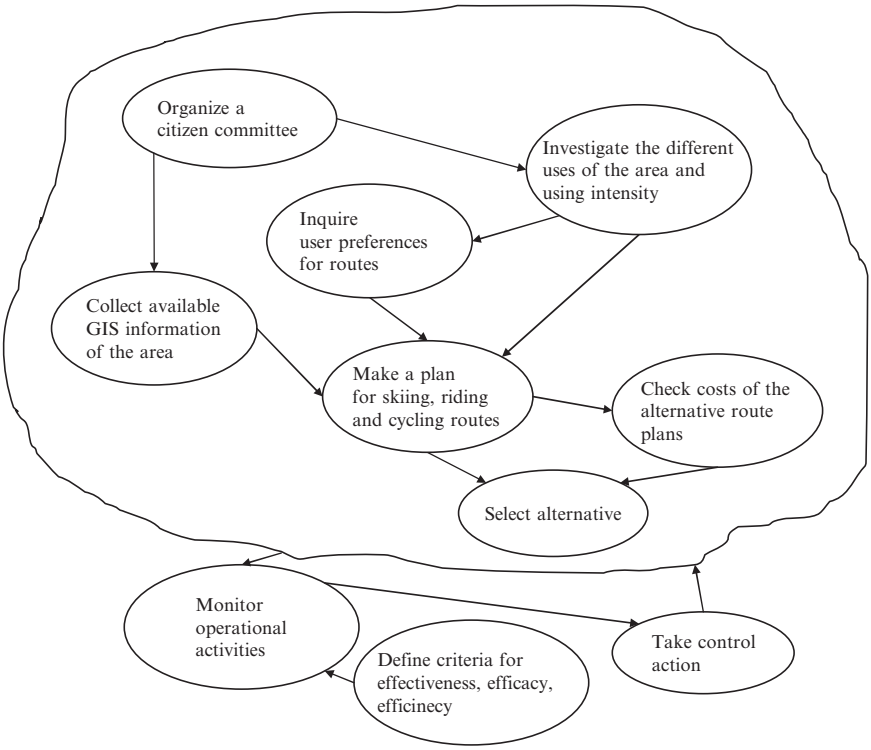

Fig. 7.5 A hypothetical example of a CM for creating a recreation area with facilities for different users

and structuring the verbs according to logical dependencies (Checkland 2001). For each system, also a sub-system for monitoring and controlling the system is added. It means defining criteria for effectiveness (is the proposed action the right thing to do), efficacy (do the selected means produce intended results) and efficiency (the ability to do the task without wasting resources) of the system.

The process is carried out in four steps (Checkland 1999):

1. Using verbs in imperative, write down the activities necessary to carry out T in CATWOE. Aim for 7 ± 2 activities.
2. Select activities which could be done at once.
3. Write those out on a line, then those dependent on these on line below, continue in this fashion until all activities are accounted for. Indicate the dependencies by arrows.
4. Redraw to avoid overlapping arrows where possible. Add monitoring and control.

In Fig. 7.5, a hypothetical example of a CM from citizen perspective for Example 7.1 is presented.

Then, the participants compare the real-world system with these ideal systems, and debate about the changes that are feasible and/or desirable, and the actions that

need to be done (Fig. 7.4). The comparison is supposed to reveal the norms, standards and values among the participants. The idea is that when people compare the ideal models defined from different perspectives, their own way of perceiving the world also changes (Checkland 1989). Thus, they are supposed to learn from each others.

In example 7.2 a hypothetical example of the SSM methodology for improving a regional participation process is presented.

Example 7.2. by Teppo Hujala

Background: In Finland, forestry centres are statutory county-wide organisations, the duties of which include promoting sustainable forestry by means of law-enforcement, counselling of private forest owners and participating the development of regional forest-based economies.

Step 1: Problem definition

Problem: The Forestry Centre of "Deep Finland" (pseudonym) is claimed to have an inefficient impact on forestry sector's success and people's well-being in its region.

History: The Regional Forest Programme of Deep Finland, coordinated by the forestry centre, has been created in cooperation with regional forest council for period 2006–2010. The process gathered representatives of relevant interest parties to form a comprehensive strategic plan for forest-related issues. The plan is currently being implemented and monitored, and the new programme process will begin in 2009.

The owners: The development director of the forest centre (programme responsible), Secretary General of the National Forest Programme.

The actors: Members of the regional forest council (nominated by the Ministry of Agriculture and Forestry), decision-makers and employees of regional institutions related to forests, forest-related companies and entrepreneurs as well as forest owners in the region, researchers who act as consultants in the transformation process.

Internal need and pressure for change: Strategic objective of the forestry centre to achieve and strengthen the role as an acknowledged expert organisation which facilitates the sustainable success of the forest sector in Deep Finland Region.

External need and pressure for change: Societal needs for legitimacy and political pressures for more influential regional development and cost-effective activity. Diversified values of citizens. Agenda for following all-inclusively the National Forest Programme: "Sustainable welfare from diversified forests".

Step 2: Envisioning

What and where are we now? CATWOE

C = **client/customer**: Citizenry of the region in general, forest owners and people working within the forest-based sector in particular

A = **actors**: Members of the regional forest council

T = transformation process: A series of meetings where alternative futures are discussed and finally a suitable action strategy is agreed after.

W = world view: A constructive and collaborative planning process results in an outcome which is both desirable and feasible.

O = owners: The development director of the forest centre (programme responsible), Board of the forestry centre, Ministry of Agriculture and Forestry (Unit for Forestry Promotion), NGOs that were not invited for participation.

E = environmental constraints: Conflicting values, attitudes and interests among the participants, limited time resource for in-depth discussions, lack of information on which to base the decisions.

Core concept is formulated in the following form: The regional forest programme has been formulated through a participative process. However, the process has failed in reaching true collaboration, and thus, commitment to the plan is only partial. The decisions have been based on inadequate information on people's (citizens and stakeholders) perspectives. Additionally, the forestry centre lacks tools and money needed for monitoring and affecting the fulfilment of the plan.

Core vision: What do we want to be year 2012?: The Forestry Centre of Deep Finland administrates a comprehensive repertoire of tools for collaborative planning, which contributes to a constructive formulation of the forest programme, which is desirable and feasible. The programme process includes a monitoring system, with which the development actions can be adaptively modified. Thus, both the controllability and transparency of the programme have been improved, and the forestry centre is publicly regarded as an effective expert organisation for regional development.

Step 3: Analysis of the present and comparison with the vision

There seems to be a need for experimenting with different alternative collaboration methods, studying possible conflicting values regarding desirable participation methods, and most importantly, establishing a more thorough programme monitoring system.

The analysis of a subsystem: Programme monitoring system:

C = client/customer: The employees of the forest centre, members of the regional forest council.

A = actors: The same as above, as well as companies and entrepreneurs in the forest sector in the region, relevant public institutions providing statistics (e.g. municipalities, environment centre).

T = transformation process: Gathering relevant accumulative information flow into a special knowledge management system and deciding how to utilise the system in the meetings of the regional forest council.

W = world view: Statistics on activities in forest sector can be monitored in (almost) real time, and that will help the council to manoeuvre the developmental activities of the region.

O = owners: Companies or entrepreneurs not willing to join the information exchange scheme, employees of the forest centre who might not be ready for the change in working culture.

E = environmental constraints: Inflexibility of public agencies, incompatibility of information systems in different organisations, time schedule and functionality of national forest resource data system.

Core concept of the sub-system year 2006: The information needed in monitoring has been discussed in the meetings of the regional forest council.

Core vision of the sub-system year 2009: The requested information flow has been piloted and proven successful for contributing the council meetings.

Year 2012: The adaptive monitoring and management scheme is fully functioning as an essential part of the work of the regional forest council.

Analysis of the social system: Members of the current regional forest council are very interested in the new forms of participating the processes in forest sector, and they are a bit frustrated because of the slow progress of the project; the employees of forest centre possess some resistance for change, which brings some tension to the meetings: some consultancy to talk the issues through is needed

Analysis of the political system: The ministry pushes strongly to get the new up-to-date national forest resource data system work: along with new monitoring-based methods for acquiring and distributing money the forestry centre has to overcome its resistance as well as the doubts of losing power with allowing more open collaborating methods. Simultaneously, the forest programme is becoming a more legitimate tool for promoting regional economy among the public.

Step 4: Mission, i.e. changing the situation towards the direction stated in the core vision

Next Step 1: The regional forest council establishes a project for enhancing the process of composing and monitoring the regional forest programme.

Next Step 2: Decision-support researchers study the possible conflicting values regarding the desirable participation schemes.

Next Step 3: In the light of the study results, the researchers and the council jointly experiment with different alternative methods for collaborative planning (e.g. interactive utility analysis).

Next Step 4: Based on the experiences and the feedback of the experiments, guidelines for applying alternative collaboration approaches and methods in regional forest programme process are formulated.

Next Step 5: The enhanced programme process with guidelines, knowledge of values, and monitoring system is mobilised. The legitimacy and efficiency of the process increases, and the forest centre reaches the targeted reputation.

7.5 Decision Support for Group Decision Making

Decision analysis methods are often useful in a group decision making or participatory planning context. They force all the decision makers to systematically discuss all the important issues. Without a systematic analysis, it could be that some issues are addressed several times while other issues are not covered at all. It may be that

people have already made their minds, and rather than learning from each other, the pros or favoured alternatives and cons of competing alternatives are repeated over and over again (Dyer and Forman 1992). Decision analysis methods are usually considered as most useful in fairly small groups.

There are two basic possibilities in using MCDS methodology in group decision making: (1) to do a combined analysis for all decision makers at the same time or (2) to do separate decision analyses for all decision makers and then either combine them to obtain priorities of the group, or use them as a basis for negotiation.

Combined decision analysis means that only one analysis is carried out, and it is supposed to capture the preferences of the group as a whole. In principle, for a combined analysis the group should have a consensus on every parameter needed in the analysis, in order to produce meaningful results. Decision makers should have, for instance, basically similar objectives.

In AHP, combined analysis means that each pairwise comparison should be made as a group. If a consensus cannot be reached, a good compromise is required. In such a case the individual pairwise judgments can be combined using a geometric mean of the pairwise comparisons to form one compromise value (Dyer and Forman 1992). A geometric mean is used instead of arithmetic mean to preserve the reciprocal property of the pairwise comparisons matrix (Aczel and Saaty 1983).

In other MCDS methods the group can, for example, vote to find the appropriate judgment. This kind of analysis is possible with any other MCDS method besides AHP, for instance with any of the outranking methods or multicriteria approval method.

The problem with the combined approach is that it is not possible to show the effect of each individual in the group on the analysis. It makes it easy for dominating participants to manipulate the results to their liking. Furthermore, the compromise value obtained by geometric mean or voting may not describe the preferences of any of the participants. On the other hand, it is possible that decision makers commit themselves more readily to a plan made together.

When the analyses are made separately for each decision maker in a group, it is possible to explicitly take each decision makers' preferences into account. If the separate analyses are combined, it is possible to show explicitly the effect each member has on the final result. For instance, the correlations between the result with and without one decision maker can be analysed (e.g. Vainikainen et al. 2008). Moreover, even if the analyses were not combined at all, learning more about the other participants' preferences might in itself help in building consensus.

One possibility for doing separate analyses for different decision makers is to calculate the mean of priorities (e.g. Forman and Peniwati 1998). This approach is possible for all decision analysis methods that provide global priorities for the alternatives. Such methods are, for instance SMART and AHP. Instead, methods such as outranking cannot be used this way. In a separate analysis, the decision models need not to be the same for all decision makers. For instance, each decision maker can include criteria that the other DMs do not consider as important.

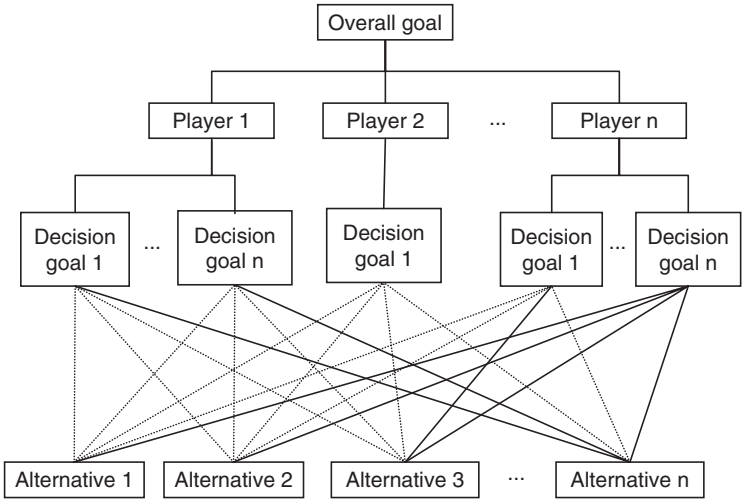

Fig. 7.6 AHP hierarchy including player level

Another way to make separate analyses is to include a separate player level to the analysis (Fig. 7.6). Then, the decision makers are included as one level in the decision hierarchy. Each decision maker can also in this case have his/her own decision model. Then, the players can also have different weights in the analysis, with respect to the size of the group they represent or years of experience on the matters handled or so on. If all the players have equal weights, the results of the player-level aggregation and mean of DMs' priorities are also equal. If the players have varying weights, a weighted mean of the priorities would produce the same results. Thus, the choice between these approaches is basically a matter of convenience. The selection of weights for the groups is, by no means, self-evident. Therefore, doing separate analyses for each group and using them as basis of negotiation may be a good option.

The use of MCDS methods can also be combined to a more general participatory planning context. The outline for such a situation using AHP is given by Kangas et al. (2001). The outline (slightly modified) is as follows:

(i) Description of the planning situation.
Preliminary identification of the relevant actors, interests, interested parties and institutions.

(ii) Detailed identification of the planning problem.
Starting an open participation process with traditional participation means and information gathering channels. Organising the first open meeting. Agreement on the need for the planning process with the public. Reproduction of problem images as stated by different actors and interested parties. Agreeing upon the rules to be followed if no compromise could be gained in the process.

(iii) General formulation of the problem
Explaining how the decision making process is intended to be carried out in the preliminary stage, and gaining commitment for the approach; modifying

the approach if necessary. Forming a planning group. The planning group might include a professional planner, representatives of interested parties, and other individuals. The tasks of the group include working as a link between all the interests and the organisation responsible of planning, taking part in the planning work on a voluntary basis, and controlling the process.

(iv) Creating decision models.
Each interest within the planning group creates its own decision model with AHP together with planners. The planner would help to analyse how the different objectives can be integrated or are in conflict with another. The planner together with the members or representatives of the interest parties can form an optimal solution from their point of view. Planning calculations are performed for each interest. As background information on the planning problem, calculations on the area's production possibilities as well as conventional cost-benefit analyses are presented to the participants. All the other information gained through the participatory process so far is analysed, too, especially that of qualitative nature. If found appropriate, the decision models are also derived representing that information mass.

(v) The planning group tries to negotiate a solution.
The planner's duty is to present possible compromise solutions and conduct the negotiations. Planning calculations and their results are interpreted, justified, and applied as background information in the negotiation process. New calculations, if necessary, are carried out interactively. AHP calculations are made using their multi-party options with differing weights of the participants so that participants can see the effects of different weighting schemes. Assessments are made on how well each interest's concerns are addressed in alternative solutions, and holistic evaluations and conditional conclusions are carried out. Especially those activities and goals, and their combinations, are carefully considered, which could not be included in the AHP calculations.

(vi) Presenting the results of the working group.
The results are presented in an open meeting and in different participation channels (such as newspapers, internet, open houses). Gaining feedback from the public. Also, alternative solutions with probable consequences might be presented to the public, especially if no initial consensus has been gained in (v). If a general agreement is achieved, proceed to the next phase. Otherwise, return to phase (v).

(vii) The planning group agrees on the follow-up procedure.
The planner writes a report including conclusions about the standpoints of every interest party. The plan is presented widely for the public.

(viii) Control of the actual implementation of the chosen plan, as agreed upon in (vii).
Assessing the need for continuous planning procedures according to principles of adaptive planning. Assessing the need for new planning processes.

Example 7.3. Assume three decision makers who have given their preferences with respect to net incomes (Example 3.5) using pairwise comparisons. The comparisons

Table 7.2 Preferences of the three DM with respect to net incomes

	NAT	SCEN	NORM	GAME	MREG	INC
(a)						
NAT	1	0.25	0.5	0.5	0.143	0.111
SCEN	4	1	2	2	0.333	0.2
NORM	2	0.5	1	1	0.25	0.143
GAME	2	0.5	1	1	0.2	0.143
MREG	7	3	4	5	1	0.5
INC	9	5	7	7	2	1
(b)						
NAT	1	0.5	1	1	0.333	0.25
SCEN	2	1	2	2	0.333	0.25
NORM	1	0.5	1	1	0.25	0.333
GAME	1	0.5	1	1	0.25	0.333
MREG	3	3	4	4	1	0.5
INC	4	4	3	3	2	1
(c)						
NAT	1	2	3	3	0.333	0.25
SCEN	0.5	1	2	2	0.333	0.2
NORM	0.333	0.5	1	1	0.25	0.2
GAME	0.333	0.5	1	1	0.2	0.2
MREG	3	3	4	5	1	0.5
INC	4	5	5	5	2	1

Table 7.3 Aggregate preferences

	NAT	SCEN	NORM	GAME	MREG	INC
NAT	1	0.630	1.145	1.145	0.251	0.191
SCEN	1.587	1	2	2	0.333	0.215
NORM	0.874	0.5	1	1	0.25	0.212
GAME	0.874	0.5	1	1	0.215	0.212
MREG	3.979	3	4	4.642	1	0.5
INC	5.241	4.642	4.718	4.718	2	1

Table 7.4 Priorities of the three decision makers, the arithmetic mean of them and the priorities based on the aggregate preferences

	DM 1	DM 2	DM 3	Mean priority	Aggregate priority
NAT	0.036	0.076	0.135	0.082	0.071
SCEN	0.113	0.126	0.088	0.109	0.11
NORM	0.064	0.077	0.056	0.066	0.067
GAME	0.061	0.079	0.054	0.065	0.066
MREG	0.272	0.279	0.265	0.272	0.276
INC	0.455	0.363	0.402	0.407	0.41

are presented in Tables 7.2a–c. The single preferences were combined at the level of single comparisons using the geometric mean (Table 7.3). Then, the aggregate preferences were used to calculate the aggregate priorities (Table 7.4). For comparison, the priorities of the single decision makers were also calculated from the preferences in Table 7.2 and their arithmetic mean was calculated. The obtained combined priorities from these two cases are almost identical, the difference being due to rounding.

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