Technology Assessment through Interaction

A guide

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Foreword

The Rathenau Institute devotes part of its funds to activities aimed at the further development and evaluation of technology assessment methodologies. This guide is a product of such an activity. It is an attempt to provide Technology Assessment analysts with a taxonomy for the process side of interactive projects. The guide was a side product of a project on sustainable crop protection and was originally published in Dutch. It was decided to translate it to make it available for an international public, since Technology Assessment and the discussion on Technology Assessment methods is an international one. Being Dutch-in-origin, most examples in the guide are Dutch.

I expect however, that this is no obstacle for foreign analysts to use the guide. I hope much of insight and experience will be gained reading and using the guide, which could contribute to the further development of Technology Assessment.

Professor Ms Josee C.M. van Eijndhoven
Director Rathenau Institute
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1 Introduction

This is a guide for the actual practice of interactive forms of technology assessment (TA). In the first chapter, we delineate the position of the concept of interactive TA in the TA tradition. Also, a working definition of the term 'interactive TA' is given. In section 1.2, we discuss the aims, the key problems, and the organization of this guide. The unavoidable limitations of a guide intended for a field in which relatively little practical experience has been acquired and to which little systematic thought has been given are also discussed. A guide of this nature has more in common with what one major publisher of travel guides called a travel survival kit than with a classical, exhaustive, travel guide. We hope that this guide gives some reassurance to TA researchers who want to take up the challenge of a journey.

1.1 The main idea and the definition of interactive TA

The main idea of interactive TA can be effectively explained against the background of the two dominant themes of TA: from whose perspective is TA performed and how can TA help influence technological and social decision making.

TA from whose perspective?

The first question has everything to do with what has always been the very substance of TA: analysis of the relationship between technological developments and political and social problems. This means that TA has had a highly normative bias from the very start. Whose values and preferences should have primary importance? How should those values and preferences be put into effect for a specific problem related to 'technology and society'? Who determines this after all, and on what grounds?

Initially, the answer to the above questions was that the TA researcher was the one who decided what values and preferences were to serve as a guideline. These preferences were often critical towards society. After all, TA emerged from the need for critical reflection upon and early warning of the negative effects of particular technological developments. This need arose from dissatisfaction with the fact that, up to that time, technological developments had automatically been seen as a blessing and had not been subjected to critical assessment.
Gradually, other answers also surfaced. A frequently given answer was that the values and preferences of the client (commissioner) should take precedence. According to this view, the TA researcher plays the role of an analyst who serves his or her client as far as possible. This approach can be referred to as usable TA (Hoppe & Grin, 1995).

Another common answer was: precedence should be given to the values and preferences of the parties who are involved in one way or another in technology development paths. (By development path is meant the directed, coherent development process of a particular technology and its social context). The parties concerned are, first, those who play an active role in designing development paths and who thus have a definite, direct influence on the nature of those paths. Such actors are primarily technology developers (suppliers), providers of finance (sponsors) and policy makers concerned with the social context of a particular technology, by means of legislation for example (embedders). Also users often have an effect on the final shape development paths take, due to the way to which they use a given technology. Box 1.1 gives two examples.

A second category of actors consists of those who experience the positive or negative effects of a given technology. These people, or the organizations representing them, play a more passive role in technology development paths. We refer to them as the parties affected. Examples of such parties are consumers and consumer organizations, environmental organizations, and patients or patient associations. It should be noted that the distinction drawn here concerns roles played with respect to development paths, i.e. active and direct versus passive and indirect. In actual processes, some of the people or organizations involved may play several roles. This applies particularly to users. In the example of the paperless office, users not only play a part in determining the size of paper flows but also experience the effects of information systems, such as greater convenience, more stress, less work. In the other example, patients not only use medicines but also experience their effects, such as a cure, side-effects, reduced or increased dependency. Nevertheless, the role distinction is important since, in principle, the different roles are associated with different perspectives from which a development path is viewed.

In TA, the perspective of the parties affected has been given precedence more often, since suppliers, sponsors or embedders were thought to already wield enough influence. In cases where the perspective of users has been given precedence, it has usually been in their capacity as the parties affected. This parties-affected approach was authoritatively expressed in the Netherlands in a policy document titled Nota Integratie van Wetenschap en Technologie in de Samenleving (IWTS - The Integration of Science and Technology in Society).1 In this document, there was reference to the 'broadening the basis of decision making.' The broadening refers to both the number of aspects of an issue and the actors who have an influence on decision making.

**How can TA help influence technological and social choices?**

The second key problem TA dealt with in the course of its development as a professional field, was: Can TA influence development paths and, if so, how? This implies questions such as: How can designers of technology be influenced in such a way that they consider the social impact of a given technology when choosing for a particular design? In what ways can TA contribute to influencing the choices companies make when bringing technological innovations to the market? In what ways can TA contribute to the choices a government makes when formulating technology policy?

Initially, these questions were hardly posed explicitly. In a way, the answers were considered self-evident and thus remained quite implicit. It was believed that TA almost automatically would contribute to critical judgment on technological developments. After all, TA was showing convincingly and exhaustively the downside of technological developments to all suppliers, sponsors and politicians. At the same time, the parties affected got arguments and facts to use for a debate with more active parties or actors. Thorough analyses of the social aspects of technology, often conducted behind university walls, were supposed to have sufficient authority to influence the choices of decision makers. Ironically, a critical approach towards

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**Box 1.1**

**Influence of users on technology development paths: two examples**

The paperless office was predicted with the rise of digital information systems, yet it never came to reality. Paper flows increased, because users still preferred to read and retain the growing amounts of information on paper, and to have their own copies of documents for taking notes during meetings etc.

Medicines sometimes do not have the intended effect because they are not used as prescribed. Patients may adjust the prescribed times for taking medicines in their daily schedule, or alter the prescribed dosage in the belief that this is better for their health.
technology and a classical, synoptic\(^1\) approach to analyses and their role in decision making went hand in hand. We have referred to this elsewhere (Hoppe & Grin, 1995: pp. 7-9) as the critical-synoptic approach to TA.

Around 1980, it began to become clear that TA carried out from this perspective, quite often did not have the intended influence. This insight originated initially from practical experiences with TA: TA frequently appeared to exert disappointingly little influence. Doubts regarding the cryptical-synoptic approach were further fueled and highlighted by new scientific insights. Research on single cases of technology development made clear how development paths occur from an interaction between actors, who all have their own perspective to look at and deal with their fellow actors, the technology and its context.\(^2\) Studies on the impact of analyses\(^3\) like TA on the ideas and behavior of those addressed showed that they had a significant impact only in cases when the perspective of those addressed was taken seriously. Box 1.2 shows the three most important outcomes obtained from studies of the use of analyses.

These studies show just how complicated the second problem actually is and what challenges it poses for TA. Influencing development paths amounts to influencing the interactions of the various actors. This infringes influencing the choices these actors make, each from their own perspective. If TA is to make a significant contribution in this respect, the perspectives of these actors must be taken seriously: this is the first challenge. However, this alone is not sufficient, because the interaction among actors is more than just the sum of the individual actors' actions. A second challenge for TA is to reveal the factors that promote or hinder such interaction.

**Interactive forms of TA as a new answer**

Below, we define the specific place of the interactive forms of TA in the context of the two dominant themes in the field of TA. We formulate a number of characteristics which together define what is understood here as interactive TA.

The primary function of an interactive TA analysis is to contribute to the influencing of development paths in a direction desired or at least accepted by the affected parties. In order to realize this, TA is carried out from the perspectives of the parties affected, as well as the suppliers, the sponsors, the embedders and others actively involved in the process. For this purpose, a method is selected in which the questions posed and the way they are answered, the data and the assumptions, the conclusions and recommendations of the analysis all result from an interaction between the TA analyst and the involved actors. The idea upon which this approach rests, is illustrated in box

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**Box 1.2**

**Literature results on the use of analyses**

From the literature on the use of analyses that is referred to in the main body of the text and in note 4, we present three findings important for our purposes:

(1) Actors mainly use information from the analyses which makes sense from their own perspective.

(2) Actors seldom use analyses instrumentally, i.e. in order to make decisions about alternative options in a specific case. They are much more likely to use the results conceptually, i.e., the analyses contribute to the development of the perspective from which actors view reality. Every analysis they take up changes their perspective. In this way, analyses alongside with other types of information, exert an influence on the way in which actors define future problems and seek and judge future solutions.

(3) In order to understand how analyses are used, it is also important to assume explicitly that policy (and other plans, such as business strategies) come into being in a fragmented fashion. Plans are not drawn up by one person in one location. Rather, they are the outcome of complex processes in which many different people participate and in which thousands of decisions are taken. This is another reason why analyses are more likely to have a conceptual rather than an instrumental effect on plans.

Based on this short and, moreover, selective summary of the literature, it can be deduced that analyses must either be carried out explicitly from the perspective of a single actor or consciously reflect all the perspectives of the parties involved. In the first case, the analysis is intended to support one party in a planning process. If other parties also enjoy sufficient support, this may improve the process. In the second case, the analysis functions as a source of conceptual learning for all the parties involved. Its purpose is to work throughout the planning process, in all its diffuse locations, in order to support actors (such as parliament) that want to influence such diffuse planning.
Box 1.3
The Interactive Bottom-up Approach

The Interactive Bottom-Up Approach (IBU-method) was developed by Bunders and others (Bunders & Broere, 1992; Bunders, 1994). They saw that agricultural technology transfer from developed countries to developing countries hardly took into account the small-scale farmers' needs and local conditions. The local farmers, as users, did not act according to the expectations of their counterparts in the West. As a result, in quite a few cases the technology transferred was not used at all (maintenance problems, poor fit with existing methods), or was not used as intended. In other cases, the technology was used properly, but did not remedy the problems experienced by the farmers in their role as the parties affected (among others). As a result, the farmers continue to experience difficulties, such as recurrent crop failure. The result may be social and ecological disruption.

The answer initially put forward by the practice of TA as a remedy for this situation was to look at matters primarily from the viewpoint of users in the Third World. TA's based on this farmers first approach provided an analysis which could be used as a basis for the development of modified technology. In practice, however, it became apparent that such technology was not considered interesting or feasible by technologists and companies, most of whom were from the Northern Hemisphere. As a result, important technological options remained out of reach for users in developing countries.

The IBU approach is a form of TA that includes the perspectives of users as well as developers and sponsors. IBU thus provides an answer to the one-sidedness of both classical technology transfer and the farmers first approach as an initial response to it. In this way, development paths can be constructed and assessed through a process of interaction between all parties involved (form the North and the South). The Interactive approach covers the whole area from the formulation of the criteria for a technology, via the choice of the technologies to be considered, through their assessment, up to the formulation of necessary research and development programs.

1.3 By a concrete example of an interactively performed TA: the Interactive Bottom-Up Approach (IBU).

Thus, in order to influence development paths, an interactive TA must ensure the participation of suppliers, sponsors, embedders and other actively involved parties. In order to influence these development paths in a direction considered desirable also by the parties affected, their participation in an interactive TA is required. The main goal of TA is thus that its results take as much as possible into consideration, and offer insight into the degree to which certain development paths are considered meaningful by all parties concerned.

We chose intentionally a very cautious formulation of the previous sentence. To begin with, an interactive TA will not always lead to complete consensus, thus the qualification 'as much as possible.' Second, even if consensus were to be achieved, the participants in an interactive TA remain no more than a selection of all those parties in the real world who are involved in development paths. Also, participants go through a learning process in which they jointly construct paths they all see as meaningful. However, this does not automatically say anything about processes in the real world. An interactive TA is a sort of social experiment, an attempt to conduct a creative and innovative analysis in a space as free of power influences as possible. In the real world, power influences do play a role, thus the qualification 'to offer insight.' The insight which interactive TA offers is primarily useful to an actor who has the means to transform it into action to influence existing relationships and processes. In this guide, the target audience is an actor in the public sector, i.e., parliament. Parliament, and, by means of its powers, the government too, can use the insight provided to introduce measures (such as subsidies, convenants, and legislation) to stimulate the desired changes.

Interactive TAs do not coincide with technology development processes. Also, an interactive TA differs from approaches where a mediator attempts to reconcile the views of a number of influential people in a problematic area. At most, an interactive TA simulates technology development processes, with an explicitly evaluative goal, for the purpose of exerting influence upon actual processes.

Lastly, it is helpful to position interactive TA with respect to constructive TA (CTA). The stakes by constructive TA (Daey Ouwens et al., 1987; Rip et al., 1995; Schot & Rip, 1997), are more or less the same, i.e., to influence development paths. However, by no means all the examples from the CTA literature and CTA practice demonstrate an interactive approach. The parties affected by the technology are usually involved in the analysis; users in their active role are also often involved; but suppliers, sponsors and embedders are not always
involved. In addition, some CTAs are directed towards a specific category of parties affected, i.e. consumers (cCTA; Fonk, 1994), producers (pCTA; Rip, 1995) or the government (gCTA; Schot, 1995).

In an interactive TA, all these perspectives are by definition involved.

### 1.2 Aims, limitations, key questions and structure of this guide

This guide's first aim is to provide guidelines for carrying out an interactive TA in a way that it contributes optimally to policy formation and technology development. There is as yet relatively little experience with interactive forms of TA. That is why, in this guide, the set of tools offered is still incomplete and has not yet been extensively tested in practice. However, we believe that people who dare to set foot on the relatively virgin soil of interactive TA will be able to tread safely when accompanied by this travel survival guide. They will gain a lot of experience along the way, which, we hope, could contribute to the further development of this tradition within the field of TA research.

Before we begin to discuss the contents of the toolbox – the methods and techniques – a number of methodological insights will be given. They can be used, in the first place, to determine if a job should be tackled interactively, and in the second place, to determine how the tools must be employed. The methods and techniques discussed are not always interactive in themselves. However, they can be used in an interactive process, under appropriate methodological conditions.

A second aim of this guide is to describe the circumstances under which an interactive TA can influence policy making and technology development.

With this as a backdrop, the guide deals with the following key questions: In what cases is an interactive form of TA worthwhile? What methodological guidelines apply to interactive TA? How can such guidelines be put to use? What methods and techniques might be useful for that purpose?

These questions are split into a number of sub-questions, which are dealt with in successive chapters: In what cases is an interactive TA worthwhile and what functions could it fulfill? Chapter 2 first provides a general answer. Then, two different situations are discussed more specifically: one in which the interactive TA is primarily intended to contribute to policy formulation, and one in which it is intended to influence technology development.

What is essential in an interactive TA and what methodological guidelines and other considerations are thereby implied? Partly based on methodological literature, in Chapter 3 we provide guidelines for an interactive approach to a TA, derived from the functions discussed in Chapter 2. Further, chapter 3 discusses the closure of an interactive TA and the qualitative criteria for its evaluation.

How can the guidelines be put into practice in diverse situations, and what limitations apply? We address this question in Chapter 4 by discussing a number of examples. Since the interactive approach is still relatively new, there are comparatively few examples of actual practice. Thus we use also a number of examples which do not fully conform the definition of an interactive TA, but which do indicate a number of interesting ways to carry out in practice an interactive TA.

What steps can be differentiated with respect to an interactive TA? Chapter 5 provides a step-by-step plan for interactive TAs, which is a rather simplified depiction of an essentially iterative process. Some steps have to be repeated, and the order in which they are performed may vary too. A brief summary of the step-by-step plan is given, followed by practical advice for implementation. Methods and techniques to be used are also suggested. In an interactive TA, much use is made of methods and techniques that are not specifically intended for interactive forms of analysis. In such cases, reference is made to relevant literature, and an indication is given of the way in which these methods and techniques can be employed in an interactive TA. Those methods and techniques that are specific to an interactive TA are discussed in greater detail.
2 The functions of an interactive TA

This chapter addresses the questions of a so-called start TA, a tool which helps us to select the most suitable approach for a TA. Then we show how such a selection can be actually made. Finally, we give examples of interactive TA directed towards policy formulation or technology development.

2.1 Setting up a start TA

A start TA – a concept introduced by Smits & Leyten in 1990 – is a short preliminary study which serves as a basis for selecting the best approach to a TA. Smits & Leyten (1991) drew up a list of four questions to be answered for any start TA. We formulate the questions as follows:

1. What actors (individuals, groups or organizations) are or should be affected by the technology concerned, or: what does the social map look like?
2. What is currently known about the technological development and its effects, and what knowledge is employed by each of the specific actors?
3. Are there any gaps in the available information? Is it possible, in principle, to fill the information gaps? Is there any value dissent?
4. How much discretionary space is available? What changes are necessary?

Depending on how much information is already available, a start TA can be tackled with a greater or lesser degree of comprehensiveness and formality. Often, one has to switch back and forth between the four questions. In practice, the questions function primarily as a guideline, rather than as a step-by-step instruction.

By answering the second and third questions, one can select a particular TA approach, based on the taxonomy presented in the next section. The social map can be filled in by systematically considering the various categories described in Chapter 1. This includes both the parties who play an active role in designing development paths (suppliers, sponsors, embedders and some users) and the parties affected, who experience the effects of a given technology but do not play an active role in its development. Further selection depends
partly on the specific function of the TA analysis. The *social map* (question 1) and the conclusions reached regarding the amount of discretionary space (question 4) may supply useful information when putting the chosen approach into practice.

### 2.2 An interactive TA or something else?

Two important issues should be considered when choosing for an interactive approach: the type of problem (section 2.2.1) and the effectuation of recommendations (section 2.2.2).

#### 2.2.1 What type of problem is suitable for an interactive form of TA?

The nature of the uncertainty of the research issue is important for the choice of an interactive TA. We differentiate between two types of uncertainty. First, there is uncertainty regarding facts. The cause of such uncertainty is lack of information about issues which are relatively new or still to emerge in the future (compare Collingridge's *control dilemma*). High costs (financial or social) of acquiring adequate information are also a source of uncertainty.

Second, value dissent may exist. The various actors all perceive reality through their own value systems and corresponding world views. Such value systems focus the actors' attention to certain facts and interrelationships, and help them to make the facts meaningful. Thus, value systems and world views define the boundaries of one's rationality. If adherents to various value systems and world views disagree about a certain issue or technology, an interactive TA approach may be preferable. However, this is not always the case. Below, a taxonomy is developed which can be of use to decide in such cases.

Depending on the factual uncertainties and value dissent with respect to the technology-in-its-context, a differentiation can be made between four types of problems (Box 2.1, also Hisschemöller, 1995):

- **Structured problem:** little uncertainty regarding facts and little value dissent.
- **Moderately structured scientific problem:** little uncertainty regarding facts, but much value dissent.
- **Moderately structured political problem:** much uncertainty regarding facts, but little value dissent.
- **Unstructured problem:** much uncertainty regarding facts and much value dissent.

**Box 2.1 Different combinations of the degree of uncertainty regarding facts and value dissent**

<table>
<thead>
<tr>
<th>Uncertainty regarding facts:</th>
<th>Value dissent:</th>
</tr>
</thead>
<tbody>
<tr>
<td>little</td>
<td>little</td>
</tr>
<tr>
<td></td>
<td>Structured problem: little need for a TA</td>
</tr>
<tr>
<td></td>
<td>TA to clarify facts and their relationships</td>
</tr>
<tr>
<td>much</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Moderately structured scientific problem:</td>
</tr>
<tr>
<td></td>
<td>interactive form might be beneficial, in which value systems and world views are included for consideration, possible</td>
</tr>
<tr>
<td></td>
<td>interactive TA</td>
</tr>
</tbody>
</table>

Adapted from Van de Graaf & Hoppe (1989, p. 48).

Researcher or his client may decide that the TA must help to put a dominant problem definition or a favorite solution into discussion.

In the simplest case (a structured problem, Cell A), there is little uncertainty regarding facts and little value dissent. In general, there will be no need for a TA in such cases.

In cases where there is uncertainty regarding facts and little value dissent (a moderately structured scientific problem, Cell B), gathering factual information and identifying causal links can contribute significantly to (judgment of) possible development paths. There is little disagreement about the normative perspective of a TA. The TA analyst's primary concern is to give the TA a form that suits the preferences of the intended user. In these cases, a *usable* TA (Hoppe & Grin, 1995; based on Lindblom & Cohen, 1979), an approach optimized with respect to usefulness, is the most adequate approach.
If there is little uncertainty regarding facts, but a great deal of value dissent (a moderately structured political problem, Cell C), such analyses cannot contribute much to the structuring of a problem. After all, gathering facts and analyzing them from a single value system is not likely to reduce uncertainty. Rather, it will result in an 'endless technical debate' (Collingridge & Reeve, 1986). In such a case, various alternatives exist. First, one could decide to conduct a TA based on a particular perspective (value system and world view). A usable TA would also be a correct choice, although it would now be conducted from a perspective that is not shared by all those involved. This could be done, for example, in order to reinforce deliberately the contribution of adherents to a particular point of view. The term advocacy TA would be appropriate in such a case. A second approach is to compare the implications of the development paths preferred form the various perspectives. This was the case in a TA of technologies used for the command and control of NATO forces in Central Europe during the Cold War. (see box 2.2, Grin, 1990)

It should be mentioned that the analyst from the example in box 2.2 belonged to one of the camps. Although the perspective of the other camp was taken seriously, his affiliation undoubtedly influenced the result. It is difficult for a researcher to place himself completely in someone else's shoes and to see the world through their value perspective. This makes a certain degree of interactivity in the

| Box 2.2 |

**Technological options within defense technology assessment**

Research was carried out in order to determine the respective technological choices of two different military postures: the usual NATO deployment and one that was optimized for non-offense. These postures represented two different political perspectives: one in which aggression from the East was seen as the primary threat, and one in which escalation of a political crisis into war was seen as the most important danger. Subsequently, the technological choices were assessed in the context of a particular posture. The assessment criteria were selected and operationalized in such a way that adherents to both perspectives could subscribe to at least some of the criteria. Two examples are the military effectiveness of defense against a surprise attack (mainly associated with the 'usual' perspective) and stability in times of crisis (mainly associated with the 'non-offense' perspective). The result was an analysis of the development paths which fit the two different perspectives, based on criteria that adherents to both perspectives felt reflected their views.

method necessary. In the example described in box 2.2, the analyst had a lot of contact with the adherents to both perspectives. They inspired the structure of the analysis, commented on drafts, criticized the conclusions and disputed the recommendations. However, the TA analyst took most of the initiative at all stages of the research process, and it was the analyst who made the final decisions. The participants merely supplied analytical input. We could call this a moderately interactive TA. In a truly interactive TA, the analyst only starts up the process and takes care to maintain it. At all stages of the analysis, the analyst makes decisions together with the other participants. The result is a combination of the contributions from the various perspectives. In the best case scenario, even a synthesis of the various perspectives might be achieved. In some situations, a truly interactive approach of this kind can be selected for cases in Cell C.

In the last case that we distinguish (Cell D), there is both uncertainty regarding facts and value dissent. This is a very difficult situation to manage, because it is not even clear what kind of meaningful questions should be asked with regards to a possible analysis and judgment. This is what we call an unstructured problem. A good example of an unstructured problem is the issue of the development of car mobility and its environmental aspects. There is a great deal of uncertainty about the facts because it is difficult to predict car mobility developments and the effects of policy measures on them. It is also extremely difficult to predict the response of potential users to innovations such as electric cars. The value dissent is also substantial. For some people, car mobility is associated with deep feelings regarding freedom and independence. Others see car mobility as the preeminent cause of very serious social and ecological problems. In such cases, debate between the adherents to the various value systems is necessary in order to structure the problem. TA can be used in an advocacy fashion, where different TAs support the contributions of the respective parties to the discussion. The precise structuring of the problem then depends on the distribution of power. There is, however, the disadvantage that a debate of this nature tends to soon degenerate into a dialogue of the deaf if the differences in underlying value systems are not made explicit. An interactive TA can offer a necessary forum for structuring the problem in a manner considered meaningful from all the perspectives present.

2.2.2 What is needed in order to implement recommendations?

The second key problem of the TA tradition concerns the extent to which and the manner in which TA can contribute to influencing the actions of actors who actually give shape to development paths. Examples of such actors are technologists who develop new artefacts
or managers of the companies who produce or use them. In general, the rationality of these actors is not primarily determined by their political perspective. Rather, it is determined by their professional convictions, and by the beliefs and preferences they have developed as a result of their education or extensive practical experience in a given field (see Section 3.2 for a more comprehensive discussion). That is why they will behave differently from someone who act primarily from a political perspective.

The fact that those who have to give shape to development paths often act through a type of beliefs and preferences very different from the political ones, can have far-reaching consequences for a politically oriented TA. If one considers the analysis and recommendations of a TA solely from a political viewpoint, the results might very well lose their importance to the actors who actually have to give shape to development paths. Solutions proposed from the perspective of a policy maker might be commercially unattractive or technologically infeasible. Or, they might not fit in with the work routines preferred by users (remember the example of the paperless office). This leads to a lack of support and ineffective implementation. To prevent this, people representing such roles should be involved in the process of TA. A fully interactive approach is not always necessary. The actors could also be regularly asked to evaluate the feasibility of certain ideas and to indicate the extent to which they would be willing and able to help bring them to reality.

Still, an interactive approach has several advantages in the following situations:

i. The intention is to come up with creative innovations during the process of TA. This means that various actors should be given the chance to think beyond existing boundaries and to jointly find out ways leading to significantly new development paths;

ii. The intention is to obtain, during the TA, a detailed overview of the possibilities and problems that arise during the actual creation and implementation of development paths;

iii. In the current situation, there is a large gap between what is desirable from a political perspective and how it is viewed by the parties who have to materialize those desires;

iv. It is the case that the actors who actually give shape to development paths from their own professional perspective, also have a far-reaching influence on the choice for a desired direction (the first dominant theme) of development paths. Whether or not one of these situations applies can be judged from the start TA.

In the last part of this chapter (Sections 2.3 and 2.4), we present a number of examples in which an interactive TA approach has been chosen.

2.3 Policy oriented TAs

The subject of this section is TAs that are primarily oriented towards influencing policy. Certainly, this policy can be directed not only to changes in the social context of a technology, but to the further development of the technology as well. Examples of the latter are research financing or regulations for existing technology, intended to promote innovation (for example, emission standards for cars, which might lead to the development of cleaner engines).

In each of the examples below, it is indicated who has to participate in order to achieve the intended goal. There are additional conditions that must be met in order to achieve this goal. First, the interactive TA must be carried out in a methodologically sound manner (Chapters 3, 4 and 5). Second, the analysis must be in line with the particular policy process. The limited space does not allow us to elaborate further on the topic. Still, the three examples below emphasize the importance of good and timely communication of the TA results (Question 4 from the start TA on decision points).

2.3.1 The GIDEON project: Evaluation and improvement of existing crop protection policy

The first example is the GIDEON Project, which concerns sustainable crop protection (GIDEON is a Dutch acronym for 'crop protection in harmony with a sustainable and healthy economic development in the Netherlands'). The discussions being held on the Government’s Crop Protection Multi-Year Plan gave rise to this TA-project. The Plan seeks to reduce the environmental and agricultural problems caused by pesticide use. This is to be achieved through a reduction of the quantities of pesticides, by a decrease of emissions and diminishing of the dependence on such substances by means of switching to other cultivation methods.

In view of the Plan's goals, it is primarily agriculturists who will have to modify their behaviour if the policy is to be implemented. However, they can only do so in interaction with others, such as vendors, consumers, seed and pesticide suppliers, and researchers who invent new methods and techniques for preventing and combating plant sicknesses and plagues. These actors too will have to adapt their behavior in order to make the policy succeed. A start TA made clear why the main goal of the Crop Protection Multi-Year Plan — to switch to other cultivation methods primarily oriented towards prevention of sicknesses and plagues — was difficult to achieve: situations i (creative innovation as part of an interaction between several parties), ii (the seed for an overview of what happens when development paths are implemented) and iii (a gap between politics and target groups) appear to apply. The actors who needed to be...
involved in the TA were of course agriculturists and also other parties such as suppliers, customers, researchers, the environmental movement and actors involved in policy making (such as the Ministry of Housing, Physical Planning and the Environment and the Ministry of Agriculture, Nature Management and Fisheries).

In an interactive process which involved representatives of these parties, several scenarios were drawn up for sustainable crop protection in the Netherlands by the year 2030. At the same time, the short-term and long-term conditions were identified, which had to be met in order to bring about these scenarios.

The issue of sustainable crop protection in the future is a relatively unstructured problem. It inherently manifests the tension between agriculture/economics and the environment and thus the apparent value dissent. Furthermore, since the future was at issue, there were important factual uncertainties. The areas of uncertainty varied from consumer trends to the possibilities and the limitations of new technological developments. Because the problem was unstructured (Case D from Section 2.2.1) adherents to a variety of divergent political perspectives were invited to participate.

2.3.2 Broadening the basis of policy making on the costs of car mobility

One example of a partially interactive TA, aimed at broadening the basis of policy making for an unstructured problem, was the Rathenau Institute's project The price of a trip (De prijs van een reis, Werkgroep 2duizend, 1996). This project's primarily goal was to resolve disagreements about the scope and the methods for calculation of the so-called external costs of car mobility, including the economic value of environmental pollution.

The Rathenau Institute's analysis led to the conclusion that the implicit problems of pricing policy and the underlying values did not receive enough attention, and that many pricing policy initiatives failed because the existing intermediary organizations were too attached to their viewpoints. The Rathenau Institute wanted to find out whether they could involve individual citizens, the organizations' presumable supporters, in order to structure the problem in a more fruitful manner. In the project, a survey and interviews were used to detect the viewpoints of ordinary citizens. The findings were then tested and modified in a public debate with experts. As a result, a broadening of the base of policy making and, possibly, a break through the existing impasse was expected.

In order to broaden the base of policy making, it is necessary that those parties whose perspective must be included (ordinary citizens in this case) be allowed to participate. However, other parties, whose cooperation is necessary for the success of the proposed measures, must also participate. If the contributions of the latter are not considered seriously, there is a high chance that the results will simply be brushed aside, or that the proposed measures will turn out to be impossible to implement, and with effects other than that intended or no effect at all. It is necessary to find a middle ground between those risks, on the one hand, and, on the other, the risk that the intended broadening of the basis of policy making will not come about because other parties would prevail over ordinary citizens.

2.3.3 Researching the validity of the assumptions underlying the policy on phosphates

At the end of the 1970s, the Dutch government launched a policy to reduce the excessive amounts of fertilizers released into Dutch surface water. Phosphates were seen as the major culprit in this regard. In particular, the government insisted that the detergent industry was to develop detergents free of phosphates to replace existing products. The detergent industry opposed this and, moreover, did not share the government's view that phosphates were the biggest culprit in every single region of the country. What is more, the detergent industry maintained that phosphate pollution could not be attributed solely, or even principally, to the use of detergents. That is why they commissioned the Institute for Environmental and Systems Analysis (IMSA) to test the validity of these assumptions.

Using an interactive process, which lasted from 1981-1984, IMSA developed a systems analysis model of the pollution of surface water with phosphates (Van den Berg et al., 1984). In another interactive process, this model was used to test the accuracy of the assumptions underlying the government's policy. The suppliers and the embedders of the disputed technology (detergent producers, and the Ministry of Housing, Physical Planning and the Environment together with the Ministry of Transport and Public Works) were asked to participate. In addition, environmental associations and the suppliers and embedders of another culprit, i.e. fertilizers (stock farmers and the Ministry of Agriculture, Nature Management and Fisheries), were also invited. The reason to consider an interactive process desirable was that an important participant in the policy making process (the detergent industry) felt that the existing policy was based on inaccurate assumptions: situation iii (a gap between politics and target groups). The interactive process had to ensure that a new policy would not end up stranded in the same way. That is why the parties concerned with the overfertilization problem were also invited to participate.

The examples make clear that if one wants the outcomes of a TA to be considered valid by a given group, it is necessary (but not sufficient,
see Chapter 1) for a representative of that group to be allowed to contribute to the TA. It has also become clear that an interactive TA project can, at times, have several functions, and that each function is accompanied by its own criteria for the selection of participants.

### 2.4 Interactive TAs aimed at influencing technology development

In this section, we discuss two examples of TAs aimed at influencing technology development. A possible motive can be the need of a single policy actor for interim assessment and adjustment of an ongoing technology development program. Another motive could be the instigation of an actor with stakes at a given technology. The guidelines for choosing both the methodical approach and the selection of participants are the same for interactive TAs aimed at influencing technology development as for policy oriented TAs. Here too applies the assumption that the TA is tackled in a methodically sound manner and that it is tuned with the process to be influenced.

#### 2.4.1 Prioritizing research and development for small-scale farmers in developing countries

The first example of an interactive TA method aimed at technology development concerns the *Interactive Bottom-Up Method* (IBU), referred to in the previous chapter. The purpose of the IBU-TA-project was to bring biotechnological research in harmony with the needs of small-scale farmers in developing countries (Bunders & Broeze, 1992). The government would be able to use the outcomes of the TA as a guideline to stimulate research aimed at meeting these people’s needs.

The involvement of the farmers themselves was supposed to guarantee that the new technology would both indeed meet their needs and would be used in practice. The involvement of technological researchers and corporate managers was supposed to help ensure that the priorities set were both scientifically and economically feasible. Without such a contribution, there was little chance that the recommended technologies will ever be developed and marketed. Thus, the following situations were present: i (creative innovation as part of an interactive process between several parties), ii (the need for an overview of what happens when development paths are implemented) and iv (suppliers and other parties have a large influence on the paths chosen) from Section 2.2.2. Policy makers had to participate in order to ensure that the outcomes could be incorporated in their policies. Depending on the relationship between their value system and that of the people involved in developing the technology, the problem is either a moderately structured scientific problem or an unstructured problem.

#### 2.4.2 More environmentally friendly product design through collaboration

The second example concerns a Dutch study carried out by Den Hond et al. (1992) and a workshop sponsored by the Rathenau Institute, titled ‘More environmentally friendly product design through cooperation.’ The expectation was that cooperation between those involved in the various phases of a given product’s life cycle would create opportunities to timely influence decisions on technology and materials. This would help prevent environmental problems. Based on an example from the car industry, it was made clear that if actors from the various phases of a given product’s life cycle get together, they can come up with solutions to the environmental problems. The workshop was then held to examine whether this approach might be worthwhile for other products. In the workshop, designers, producers, researchers, consumers and redesigners came together. Thus, the issue here was innovations that require interaction between several parties (Situation (i) from Section 2.2.2).
3 What is essential in an interactive process of analysis?

3.1 Introduction

Chapter 1 discussed the main goal of the interactive approaches to TA. That is: the results of the TA should take as much as possible into consideration, and offer insight into the degree to which certain development paths are considered meaningful by all parties involved. The technology assessment is not performed by a TA analyst alone. It comes into being through a process of interaction between the analyst and participants recruited from the actors involved. Through the interactive approach, relationships can be established between the contributions of the various parties. This also makes it possible to arrive at a joint construction, a synthesis between the participants' different beliefs.

The difference between a synthesis and a compromise was made clear by Van de Graaf & Hoppe (1989, p. 320) with the story of two sisters quarreling about an orange. After arguing for some time, the two sisters eventually decided to compromise, agreeing to cut the orange into two equal parts. One of the sisters peeled her half of the orange and ate it with great relish. The other grated the rind of her half and mixed it into the batter of the cake she was making. In itself, the compromise restored peace and harmony between the two sisters. However, it is clear that they missed a chance for a synthesis that would have been of greater benefit to each sister individually. In order to achieve that synthesis, not only should the sisters have told each other that they wanted the orange, they should have also told each other what their underlying motives were.

How can one reveal such motives in a TA? Under what conditions can such a synthesis be achieved? If these conditions were indeed met in a TA, how would one then proceed to create the actual synthesis? And how can one maximize the chances that the synthesis will receive the support it needs in the real world? This chapter provides methodological guidelines for answering these questions.
3.2 On the way to a synthesis?

The action theories of those involved

**Action theories**

What is the relationship between the various beliefs of a given person and his actions? For a long time, the answer has been simple: people opt for certain actions out of self-interest. A disinterested observer could be able to reveal objectively a person's particular interests in a given situation. According to the advocates of this *rational actor model*, interests can be objectively known. Later on, it was admitted that different people with the same position in the same situation could define their interests differently: the *subjectively rational actor model*. The model helped to explain why, at times of growing environmental awareness, one car manufacturer sets out to make engines drastically more efficient, while another does not.

Both models are based on the assumption that the interests underlying the actions of an actor in a given situation can be known in advance. *Constructivism*, by contrast, assumes that an individual constructs his interests and the preferred action option in a given situation. What is more or less fixed in advance are more *generic notions*. People use these generic insights in order to define 'the' problem in a particular situation, and therefore what their interests are, and to look for solutions that suit them. These underlying insights determine the leeway an actor allows himself in *real-life* situations.

Apart from the epistemological literature in which this idea is elaborated, there are also publications which give accounts of empirical evidence for this standpoint. Following in particular the work of Donald Schön, which is based on actual observations, Grin and van de Graaf have indicated elsewhere what the more *generic notions* of certain actors consist of, and to what type of problem definitions and solutions they lead in specific situations. (Grin & van de Graaf, 1994, 1996a) The authors distinguish between four types of elements, two of which pertain to a given situation and two of which pertain to an actor's view of that situation.

Specific notions regarding a given situation (*first order beliefs)*:
- How does the actor assess the costs, effects and side-effects of various solutions to the problem as he or she sees it?
- What exactly does the actor see as the problem in a given situation (the challenge, the opportunity)? This problem definition indicates what is going on in the eyes of the actor.

**Underlying, more generic notions (second order beliefs):**
- What *background theories* (ways of thinking and acting) does the actor employ?
- What deeper preferences does the actor eventually want to satisfy?

It should be possible to link these elements by means of a why question:
- Why does one have a particular assessment of a given solution?
- Because one sees the problem this way or that;
- Why does one see the problem this way or that? Because, based on one's own background theories, one observes and evaluates the situation in a given manner;
- Why does one employ those particular *background theories*? Because they are a good guide for satisfying one's ultimate preferences.

All these elements together are referred to here as the *action theory* of an actor. The *action theory* of an actor is, thus, the whole of the beliefs of that actor, both the more generic ones and those pertaining to a specific case. The contents of the various layers of an action theory has been summarized in Box 3.1 for the different types of actors. For each type of actor, various *schools of thought* may exist, which order the more generic, *second order elements* in different ways. Such differences in underlying beliefs can lead to significant differences in specific actions. A good example is the reaction of two supermarket chains to the polyethylene bag as a milk-package material (Box 3.2).

**Syntheses**

What are the implications of the above for the possibility to achieve joint constructions, i.e. syntheses? In other words, how does one find *development paths* which the affected parties judge positively and which suppliers, sponsors and *embedders* find realistic and interesting?

A synthesis is possible if *development paths* are conceivable which are meaningful in the context of the *action theories* of all parties concerned. The actors involved in an interactive TA can revise their original problem descriptions and solutions. This takes place within the boundaries of their underlying insights and preferences. Normally speaking, these also demarcate the limits of a possible synthesis.

Only in exceptional cases will the participants in an interactive TA be willing to modify their more *generic notions*, which increases the opportunities for a synthesis. But this only applies to the participants in a TA. Actors in the real world will not happily undergo such a conversion. Drastic measures or a protracted learning process will be necessary.
Box 3.1  
The action theories of various types of actors

The action theory of doctors is based on the work of Van der Wilt (1993, 1995). The information in the rest of the table is based on earlier work, including that of Grin & van de Graaf (1994, 1996b) and the GIDEON project.

<table>
<thead>
<tr>
<th>Type of actor</th>
<th>Notion based on action theory</th>
<th>Solution assessments</th>
<th>Problem definitions</th>
<th>Background theories (empirical and normative)</th>
<th>Ultimate preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manager</td>
<td>Assessments of different business activities and strategies</td>
<td>What challenges faces my company here and now?</td>
<td>Business economics, marketing, microeconomic and macroeconomic insights</td>
<td>Desired company identity (e.g., supplier of top products, or products of reasonable price and stable quality)</td>
<td></td>
</tr>
<tr>
<td>Technologist</td>
<td>Assessments of different development paths of the components of an artefact</td>
<td>How can I design or improve the artefact?</td>
<td>Technological and scientific insights; aesthetic assessment frameworks</td>
<td>Intended meaning of the artefact</td>
<td></td>
</tr>
<tr>
<td>Policy maker</td>
<td>Assessments of effects, side-effects and costs of policy options</td>
<td>What is the policy problem in this area?</td>
<td>Value systems and world views (ideological beliefs); experience with policy making</td>
<td>Desired social order (relationship government-market-citizens; decision-making methods, etc.)</td>
<td></td>
</tr>
<tr>
<td>Consumer</td>
<td>Assessments of effects, side-effects and costs of means available for meeting own needs</td>
<td>What is needed to make sure there is food on the table, clothes to wear, etc.?</td>
<td>Beliefs about hygiene, health, upbringing, etc.</td>
<td>Desired level of well-being and comfort for own household</td>
<td></td>
</tr>
<tr>
<td>Doctor</td>
<td>Assessments of effects, side-effects and costs of different treatments</td>
<td>The diagnosis</td>
<td>Medical insights</td>
<td>Optimization of the determinants of health and illness (genetic disposition, environmental factors, health care); desired attitude as health-care provider</td>
<td></td>
</tr>
<tr>
<td>Agriculturalist</td>
<td>Assessments of effects, side-effects and costs of different crop cultivation methods</td>
<td>What standards must my products satisfy? What is the best form of cultivation?</td>
<td>Agricultural insights, microeconomic and business insights</td>
<td>Desired identity of own company</td>
<td></td>
</tr>
</tbody>
</table>

Box 3.2  
Supermarkets and the polyethylene milk-package

An environmental analysis carried out within the framework of Verpakkingsovereenkomst (a Voluntary Packaging Agreement) concluded that polyethylene bags were the most environmentally friendly option. The Dutch Albert Heijn supermarket decided not to use the bags, but the Dirk van den Broek supermarkets did. The explanation turned out to be directly related to the identity the two supermarket chains were striving at. Albert Heijn felt that the 'inconvenient for clients' polyethylene bag did not suit its image of the best supermarket. However, Dirk van den Broek saw the bag as a cheap package, one which would also enable the company to stand out in a striking way: being cheap and peculiar were core elements of the chain’s identity.

The TA analyst can try to define a development path which the participants find meaningful, by finding out what their initial problem definitions and solution assessments are. Then, in interaction with the participants, the analyst can combine the various solutions and, possibly, add new elements so as to create a more or less complete and coherent development path. The analyst must, however, continuously be aware that the path remains only a solution to the various problem definitions. Therefore, coherent combinations of problems and solutions are discussed with the participants. In Chapter 5, a series of recommendations and examples are given regarding ways in which a TA researcher can tackle this part of the process.

3.3 Methodological guidelines

What are the methodological guidelines for this type of interactive analysis? What guidelines must one follow in order to achieve a synthesis? And how can one ensure that the result will also receive support in the real world? These are the questions to be treated in this section. The methodology for constructivist evaluations, developed by Egon Guba & Yvonna Lincoln (1989), will be taken as a point of departure. A description, specified for use in TAs, is given of the elements that, according to them, are crucial to the methodology.

Working through argumentation circles

The heart of the methodology consists of the argumentation circle, which must be repeatedly worked through. Guba & Lincoln (1989: pp. 149-155; pp. 177-179) call it a hermeneutic-dialectical circle. The essence of this concept is that the various participants' problem...
definitions and solution assessments are brought into connection by the analyst and gradually grow into a joint construction. Repeatedly working through argumentation circles is necessary in order to ensure that the growing construction can be tested by the various participants themselves.

Two forms of argumentation circles are discussed here. In the first one, the analyst interviews a participant and then reconstructs his or her problem definition. The analyst then approaches the second participant and interviews this person in the same way. He subsequently introduces to the second respondent the problem definition and solution assessments of the first respondent. Based on the second respondent's views and the comments on the views of the first respondent, the analyst makes an initial attempt to create a joint construction. He continues in this manner until all the relevant participants have been interviewed. The joint construction can be tested and perfected in a second, and possibly third or fourth round.

The second form of an argumentation circle is to first interview all the participants and reconstruct their problem definitions and solution assessments. Based on all the information gathered, the analyst formulates an initial joint construction. The construction is then presented to the various participants in a second, or even a third round. Other variations are certainly conceivable. However, it is important to keep in mind the reliability of the result regardless of the form chosen.

In general, a number of points on which agreement is difficult to achieve will remain, even after several rounds. The analyst could make this the subject of a special round of discussion which, in principle, also has the character of an argumentation circle. It should be clear from the previous section that also for the understanding of those difficult points, the analyst needs to have some insight into the notions that hide behind the problem definitions and solutions assessments (compare the fourth and fifth columns in Box 3.1). Making such notions explicit is an indispensable part of working through an argumentation circle. It is also an indispensable part of any discussions that follow. A simple and practical tool might be to present the reconstructed definitions and assessments in the form of a table as shown in Box 3.1.

It is important, especially in the first round, that the participants be interviewed as openly as possible in order to clarify their views on the issues at hand. The analyst's task is not to get the participants to answer predetermined questions but to encourage them to put into words the issues, the facts and the assessments as they see them.

Finally, interviews with participants are certainly not the only source of information for a joint construction. Various sorts of written information and results of analyses can play an important role too. It is useful to explicitly reconstruct problem definitions and solutions assessments from such sources as well.

Starting conditions

In order to work satisfactorily through an argumentation circle and to create a sound joint construction, a number of starting conditions have to be met (Guba & Lincoln, 1989: pp. 174-177). These are, in arbitrary order:

1. The process of analysis should preferably take place in a natural setting. It is better to visit farmers on their own premises than to interview them in an office at a university. Appropriate choices of location increase the chance that respondents will provide a reliable picture of what they would think and do in practice.

2. The analyst must combine openness and impartiality towards all participants with the determination to keep the process going, and, sometimes, to take care for substantive closure of a process of analysis (the closure of a process will be discussed later on in Section 3.4). In any event, great demands are made on the analyst's analytical ability, personality and social skills. That is why it is sometimes preferable to work with a multidisciplinary team instead of a single analyst.

3. All participants need clarity about the methods and techniques used. Everyone must understand how the joint construction develops.

4. The analyst would do well to allow a role for his or her personal experience and intuition when presenting the findings, particularly in the initial stages of the process. These could clarify matters and the process might get further. The analyst's own contribution can also be useful at a later stage. The character of the process is itself a guarantee that the analyst's own knowledge, intuition and contribution will not 'sneak in' biases. Indeed, repeatedly working through the argumentation circle is a sovereign remedy against such a risk.

Requirements to be met by the results of an interactive TA

The last two key elements of the methodology (Guba & Lincoln, 1989: pp. 180-183) concern the final result. In the first place, the outcome of a TA is to be a joint construction, a conclusion or a recommendation which is the product of interactive analysis. The analyst's own contribution to the analysis should be modest. His or her primary task has been to get and keep the process going and to make sure that it led to a result.

It seems obvious that the recommendations and conclusions made must be the outcome of interaction between all the participants. In practice, however, matters are more complicated. All kinds of
mechanisms can lead to a foreign stamp being one-sidedly placed on the final result, often at the last moment. We mention a few below:

- An important party in the outside world reacts skeptically to the first draft or protests vehemently against it, whether with ulterior motives or with the best intentions. For the sake of the credibility of the end product, the analyst dresses up the draft here and there, which has an effect on the substance of the end product;
- The commissioner of the TA has certain standards the end product must meet. Sometimes, such standards may influence the substance of the end product;
- While putting together the end products, the analyst makes a considerable effort to anticipate on the reactions of the intended recipients to the end product. Sometimes this anticipation has an effect on the substance of the end product too.

The final key element from the methodology also applies to the end result. The end product must take a form which allows to transfer to non-participants the learning process the participants have gone through. Only then can a development path, created through the learning that took place between the participants, be certain of gaining support in the real world. This vicarious learning effect can be achieved in a wide variety of ways: through language, layout and figures and probably also through other forms of reporting such as scale models, videos, excursions and the like. This will be discussed in greater depth in Chapter 5.

The previous guidelines were formulated very generally, which gives them the advantage to be generally applicable. However, the disadvantage is that, in their current form, the guidelines are not operationalized enough for actually designing an interactive TA process. In Chapter 5, a step-by-step plan is formulated, which offers a firmer footing.

### 3.4 In conclusion: The closure of the process and the quality criteria

**The closure of the TA process**

In the previous section, we repeatedly referred to the closure of a process. As used here, closure concerns both the demarcation of problems and solutions that might come up for discussion during the process (substantive closure) and the decision as to which parties will or will not be involved in a given TA process (participative closure). Of course, these two aspects are interrelated.

In some cases, one can effect a closure in a relatively objective manner. This is the case when the number of parties concerned with

the subject of the TA is limited and their identity is clear to everyone. The closure of the participants is then implicit. The substantive closure can be derived from this: one starts with the subject as originally formulated in the 'contract' and asks the participants to give their views on it. These views serve to define the content of the TA process.

Often however, such a closure is impossible. The TA analyst must then make a choice. In principle, there are two paths that can be followed here: one that begins with a participative closure, and one that begins with a substantive closure. In practice, the process is often an iterative one, in which the TA researcher switches back and forth between both methods of closure.

The first path starts with the desire to involve certain actors in the analysis at any price. This is the case when the main concern of a TA is to broaden the base for decision making. The second path starts with one or other dominant substantive theme. It may be that the commissioner or the client would like a given substantive closure to function as the point of departure. They may have ideological or strategic reasons, which are related to the main concern of the TA. Whatever the motivation, in such cases the TA analyst, or (indirectly) the commissioner or client, restricts participation to a certain extent. In such cases, the participative closure is also partly determined by the substantive closure.

In order to achieve closure, a number of prerequisites must be met:

- The substantive closure must be broad enough to provide a great deal of leeway to the parties concerned. If this requirement cannot be met, is means that the closure turns the issue into a structured problem (compare Box 2.1). It is then probably better to opt for a non-interactive form of TA.
- Both the substantive closure and the participative closure must be completely unambiguous to commissioner, client, analyst and other participants concerned. If this prerequisite cannot be satisfied because the closures have to expand during the process, this must be made clear at the start. In so doing, the TA analyst must vigilantly ensure that agreements with the commissioner, client or participants are not broken (in any event, not unwittingly or implicitly broken).

A commonly occurring mechanism that easily leads to implicit modification of the closure has to do with the availability of the people who want to participate in the analysis. In practice, it is often easy for them to exert an influence on the substantive closure through their presence or absence. In any event, this must never occur unnoticed. After every selection of participants in a given round, one would do well to compare the actual selection with the original closure.
Quality criteria

When can one call an interactive TA 'properly executed'? Traditional criteria such as internal and external validity, generalizability and like are not directly appropriate here. They can be transformed into criteria with which the validity of the results of an interactive TA can be verified.11 We limit ourselves here to two different types of criteria, which fit more closely the idea and the stakes of interactively performed analyses. (Guba & Lincoln, 1989, pp. 244-250).

In the first place, repeatedly working through an *argumentation circle* is in itself a quality control. One can keep checking whether the joint construction is indeed shared by all parties. In this way moreover, the analyst can eliminate all errors or unwanted influences. When presenting the end result, it is wise to indicate that this has happened. Indeed, it is exactly this that gives the analysis its value. In order to capitalize on this feature of the analysis, the built-in quality control must be manifest from the very way in which the result is reported, and not only from the chapter *Method* of the final report. For example, an analysis in which the various parties can clearly see their views and contributions reflected. If the presentation demonstrates that the *argumentation circle* has been repeatedly worked through, this can be taken as an indicator of the end product's quality.

In the second place, one can apply a series of criteria to the process:

- Were the participants equally able to contribute to the analysis?
- Did the process cause the participants to change their views, when this proved to be instrumental to a more tenable standpoint or greater consensus?
- Did the process provide the participants with more insight into each other's beliefs?
- Did the TA process stimulate greater creativity and willingness to act?
- Did the TA process contribute to the discovery of means to equip the parties for action?

These criteria are suitable for verifying whether the TA has fulfilled its initially assigned functions. They also relate to the expectations which the participants will have of an interactive TA (for example, Mayer et al., 1996, pp. 40-41). Also for these criteria the recommendation applies to employ them while the TA is in progress in order to test the suitability of methodical choices.

4 Some examples of interactive Technology Assessment

4.1 Introduction

The methodology described in the previous chapter can be applied in many different ways. This depends on the intended function of the TA, its context and the available resources (time, money, manpower). In this chapter, we present a number of examples as an illustration of possible ways of methodology application.

The examples vary greatly with respect to the length of the TA process (from several months to around three years). Together, they encompass a wide variety of functions and comprise a broad range of methods and techniques. These include various ways of generating *future scenarios*, discussion sessions to reach consensus and/or detect dissent, in-depth interviews, a computer-supported model of the discussed problem, structured discussions between people from highly different backgrounds, etc. The methodological guidelines have not been strictly followed in all cases. In any event, we have included only examples in which the *argumentation circle* has been worked through repeatedly.

The examples are discussed in outline. Only the GIDEON project, which concerned sustainable crop protection, will be examined in greater depth. This project was set up and implemented as a fully interactive TA. For each example, we will discuss the heart of the methodology, the *argumentation circle* and the process closure. For the rest, only those guidelines will be discussed that have been applied in an interesting way in the example concerned. Reference will be made to the literature, where comparable applications are described. In each example, the guidelines are indicated between square brackets as follows:

- natural constellation [NC]
- openness, impartiality, maintaining process pace [OP]
- methods and techniques clear [MT]
- use of knowledge and experience of analyst [KA]
- argumentation circle [AC]
- joint construction [JC]
- vicarious learning [VL]
4.2 A consensus conference and a public debate on car mobility policy

As mentioned in Chapter 2, the Danish Board of Technology (DBT) and the Rathenau Institute organized shortly after each other an interactive TA on car mobility. In both cases, the issue was how to manage a technology with such a long history and so deeply interwoven in the fabric of society as the car, and the whole system created around it. In both TAs, the problem was fairly sharply focused on the role price measures could play in reducing car mobility.

The Danish project was a consensus conference, held to a large extent in line with the model developed for such events by DBT (Agersnap, 1992; Grundahl, 1995; Klüver, 1995). Its goal was to develop a consensus between a panel of lay people, partly on the basis of a discussion between the lay people and a panel of experts. The Rathenau Institute's project had the form of a debate on a number of statements, and was focused more on clarifying points of consensus and disagreement between the members of a lay panel than on reaching consensus. Here too, the analysis included a discussion with experts.

The reason to start the Danish consensus conference was the Danish public's fierce criticism of a policy plan for environment and development which was presented by the Ministry of Transport in January 1991. The same year in September, DBT decided to set up a conference on the subject. A follow-up meeting with experts was held in October. Based on this meeting, as well as on interviews with experts and her own knowledge and experience [KA] in the area, the person responsible for the project reached the just mentioned substantive closure (one could see these steps as a start TA). The closure largely determined the further course of the process. The four scenarios which were to be used in the project, were defined in the closure's context. The closure also determined the way an information package for the conference was put together.

A lay panel was then formed through the usual procedure (selection according to both demographic and sociological characteristics and travel habits), from a group of people who had reacted to an advertisement in regional newspapers. The information package was sent to the members of this panel. One weekend was set aside for questions about the package and for the presentation of the four scenarios. The questions and remarks of the lay panel were incorporated in the definitive version of the scenarios [AC1]. During this first weekend, the lay panel was also given an opportunity to indicate the type of experts they would like to meet in the second weekend. On the basis of the obtained information, the soundboard group for the project then drew up a list of experts. This led, during a second weekend, to an exchange of ideas on a range of topics that extended far beyond the limits of the closure [AC2]. Still, at the insistence of the person in charge of the project, a great deal of attention was paid to the four scenarios too [OP]. The lay panel was asked to imagine the respective scenarios as realistically as possible, and to ask themselves what they would do in a particular scenario given their specific circumstances and views [NC, albeit based on their powers of imagination, but there was little choice].

After these two weekends, the actual consensus conference took place, with a lot of attention from the media. On the first day, the experts (including representatives of those involved in the problem) answered a series of questions drawn up by the lay panel during the second weekend [AC3]. In the evening, the lay panel deliberated on the answers and formulated new questions. They presented these to the panel of experts on the second day [AC4]. The lay panel then spent one and a half days drawing up a draft version of a final report, after which the experts were asked for their comments. Finally, the lay panel drew up a definitive final report [AC5], which represented a consensus within the panel [JC]. Although the core of the report remained within the closure, the lay panel placed price measures in the broader context of other types of measures. In all the rounds [AC1-5], participants often tried to find out why certain questions were asked and certain answers were given. The iterative steps played an important role in this regard.

The idea about the Rathenau Institute's project came into being during the discussions in the Netherlands and the European Union about car mobility and the environment. The feeling was that the political discussion, which from the very beginning had been restricted to politicians, civil servants and established special interest groups, had come to a grinding halt. The project was seen as a means to break through the political deadlock by means of inclusion of ordinary citizens' views. The institute published a call for tenders from research groups to set up a project of this spirit. Of the three proposals seriously considered, the institute eventually selected the one which focused on the price of transport options and the issue of external costs. This project was selected primarily because of its relevance to existing policy and the political climate at the time. Also, the project was seen as compatible with the Rathenau Institute's mission: to contribute to public opinion forming and debate. This is how a substantive closure came into being.

In the spring of 1994, Werkgroep 2duizend (Work Group 2000) was commissioned to carry out a study of the actual costs of personal transport. Together with the Netherlands Economic Institute (NEI), Work Group 2000 drew up a document on the costs of personal transport.
transport, and on the expected effects of possible price measures. The document contained existing knowledge as well as insights into the preferences of politicians, ordinary citizens, and public and private organizations. For the purpose, WG 2000 had carried out a literature study. Also, six representatives of European public and private organizations were interviewed, and telephone interviews with 250 ordinary citizens were carried out [AC1]. Based on this study, the Rathenau Institute drew up a Report to Parliament.

Although this study demonstrated that a mix of policy instruments was necessary, the Rathenau Institute decided to limit the project to economic instruments only. This further closure was considered necessary to keep the project manageable. NEI used the insights from the WG 2000 study to construct four scenarios. An initial formulation of the scenarios was drawn up by NEI and subsequently discussed with the representatives of a number of special interest organizations in November 1994. Two scenarios were modified in response to the meeting.

The first scenario was a no-change one. The second scenario emphatically pleaded for a reduction of car mobility by means of drastic economic measures. The third one focused on a combination of accessibility measures and context-specific economic measures, including tolls. The fourth scenario consisted of a combination of the second and third scenarios with a 50% increase in public transport. With 2010 as the reference year, the effects of these scenarios were assessed in terms of traffic safety, the cost of reducing noise pollution, emissions, and mobility growth for different means of transport.

A lay panel was then formed in the manner described above for DBT. At their first meeting, held in January 1995, the panel discussed the information package, which included the outcomes of the second study. During the second meeting which followed soon after, the panel discussed 10 statements. This was the material selected by Work Group 2000 and the Rathenau Institute. It had been obtained by telephone interviews, earlier studies and the panel’s remarks during its first meeting. The statements were selected on the basis of their apparent controversiality and political relevance. This version was drawn up in February 1995.

In February, Work Group 2000 interviewed researchers, representatives of special interest groups, (such as the association of car dealers, the Royal Dutch Touring Club (ANWB), the Consumer Association, various environmental groups, organizations for public transport). In this way, their views on the scenarios and the issues from the selected statements were identified, and an insight was obtained into the differences of opinion between the special interest groups and the lay panel [AC2]. The information was used by the organization to prepare the themes and statements for the definitive debate.

The debate between the lay panel and five representatives of special interest groups took place in March 1995. It was followed by a debate between the lay panel and five Members of Parliament from the major Dutch political parties [AC3] on March 31, 1995. The Rathenau Institute presented the results in a second Report to Parliament. It contained a discussion of the most important differences in ordinary citizens' and MPs' views. For example, in contrast to MPs, ordinary citizens were against toll roads, and did not believe in the possibility to reconcile accessibility and environmental requirements. Also, the citizens wanted to use the revenues gained from an eco-tax on traffic to help achieve the environmental aims of the existing transportation policy plan (SVV-II), and did not think that the Netherlands should wait with such measures until agreement had been reached at an European Union level. Thus, the joint construction [JC] also contained agreements to disagree. Because the underlying insights and preferences had not been systematically discussed, it is unclear to what extent and in what respects agreement might have been possible. Furthermore, this last point raises the question whether or not it is right to call this round an argumentation circle.

4.3 A TA on the application of biotechnology in Zimbabwe

Between September 1993 and January 1994, a team led by the Department of Biology and Society of the Free University in Amsterdam carried out an interactive TA in Zimbabwe. The TA sought answer to the question of whether and how biotechnology could contribute to ensuring successful crop production by small-scale female farmers who are often poor (Broerse et al., 1995). The TA method used was the Interactive Bottom-Up Approach (Bunders & Broerse, 1992; Bunders 1994), already referred to in Chapter 2. After some preparatory work in the Netherlands, the work in Zimbabwe began in October 1993. The TA team consisted of a Dutch medical biologist/TA specialist, a Dutch biologist and a Zimbabwean economist. A Zimbabwean biologist/policy maker and a Zimbabwean agricultural scientist also took part on an incidental basis. It turned out that the specialized knowledge of the various disciplines was highly useful [KA]. The importance of thorough mastery of the method by all members of the team also became apparent.

One of the first activities was to perform a start TA. This resulted in an overview of the agricultural sector in Zimbabwe, its national
embarking, and a social map. Interviews were held with fourteen people who played a role in policy making or in giving shape to agricultural innovations. In this way, an insight was gained into the various parties’ thoughts on the problems around grain production by small-scale farmers in Zimbabwe, and on possible solutions to those problems. The interviewees were then asked to name any other parties they considered important.

In the interviews, attention was paid to the identification of the underlying views and preferences. The team made active use of the information when drawing up its provisional conclusions. These had the character of a broadly based description of the problem. Also, a development path was sketched in which biotechnology was embedded in a number of other elements, such as new policy measures. Such a synthesis was possible, because the various parties did not dispute the validity of each other’s contribution as such. The differences in the various parties’ views were limited to the different weight they assigned to the various dimensions of the problem and the various elements of the development path [AC1]. A few parties were informally asked for a feedback on the provisional conclusions [AC2].

The second phase of the project consisted of a testing of the provisional conclusions in a workshop attended by approximately 35 people. The participants were researchers, farmers, policy makers, agricultural consultancies, social organizations and farmers’ associations. On the first day, the various parties presented their views on the agricultural situation in remote rural areas and on the contribution biotechnologists might make towards solving the problems. During the second day, the provisional conclusions from the first phase were critically discussed. The discussion was very open and the participants really spoke their minds [AC3].

Finally, a final report was drawn up which could be assured of broad support [JC]. It proved more difficult to convince a circle broader than that of the participants. During the second day, the farmers commented on the provisional conclusions. They said they agreed with them but that it would be very difficult to convince their fellow villagers [difficulties with VL]. They demanded follow-up workshops at a village level. However, it was difficult to organize such workshops.

### 4.4 The phosphates forum

Central to the phosphates forum (Loeber 1994; also discussed in Chapter 2) was a computer-supported, system analysis model, which was built interactively and which could be used to test underlying views. The views in question were underlying the Dutch government’s running policy at that time with regard to the pollution of Dutch surface water with fertilizers (eutrophication). This policy greatly emphasized the role of phosphates in this regard, and detergents were pointed to as the most important source of phosphates. In addition to removing phosphates in sewerage plants, the most significant measure of the government was to force detergent producers to eliminate phosphates from detergents. The Dutch Association of Detergent Producers (NVZ) was very much against this policy. In particular, it was highly critical of the assumptions on which the policy was based. That was why NVZ approached the Institute for Environmental and Systems Analysis (IMSA) with instructions to perform an interactive systems analysis of the phosphate policy according to the forum method developed by the institute (Van den Bergen et al., 1984; Van Dieren et al., 1985; de Man, 1987). The TA process proceeded as follows.\(^{13}\)

In consultation with the detergent production industry, three hypotheses were formulated regarding the biological basis of the existing policy measures. These formed the grounds for source research and interviews with a number of actors in the areas of policy making, industry and science.

During the process, the team held 140 interviews with various actors, who were in one way or another involved in the problem. The interviews were held at the interviewees’ own workplaces [NC]. When rounding off an interview, the interviewer consistently asked for the names of people who the interviewee considered allies or opponents, after which these people were also approached. The team systematically presented the results from the first interviews to the next interviewees [AC1]. After having held a number of interviews in that way, the researchers developed a temporary construction of the nutrient cycle and the problems around phosphates. This construction subsequently functioned as a work hypothesis for a following round of interviews [AC2].

The first few rounds of interviews exposed those subjects on which uncertainty and disagreement existed. Four meetings were organized to discuss these subjects [AC3 and higher]. During the meetings, the participants talked about their ideas and experiences with regard to the topic, and a discussion occurred about difference of opinions. In addition, an attempt was made to reveal the underlying ideas – and any consensus space they presented – with the help of the provisional computer model. The researchers encouraged this by creating an open atmosphere in which the participants could explicitly express, and possibly revise, their opinions and standpoints [OP].
Gradually, the system-dynamic model was constructed in cooperation of a large number of different actors. The data used in the model reflected the assumptions and expectations of the participants in the analytical process. This also applies to the conclusions regarding the hypotheses and other matters, which were eventually drawn with the aid of the model [JC]. The analysis was presented in a final report during a large symposium in 1984 [VI]. The event took place after a high degree of consensus had been reached regarding the causal relationships within the problem area and the expected effects of possible interventions.

In the process, the researchers acted as an intermediary between the various parties. Together, they gained an insight into the aspects that were to be associated with the issue. The different variables and the causal relationships between them in the model were determined in discussions with a large number of parties and, as far as possible, tested against existing literature [KA].

4.5 The GIDEON project

The GIDEON project was introduced in Section 2.3 as an interactive TA on the problem of sustainable crop protection. The results, in the form of a final report and a Report to Parliament, were supposed to help parliament evaluate the Crop-Protection Policy Plan 1992-2002 halfway through its term and to formulate adjustments to the plan.

The preparations

Prior to the actual start of the project, in 1994, a research proposal was drawn up on the initiative of the Rathenau Institute. This proposal was to serve as the basis for the TA. The first part of this proposal could be seen as an abridged version of a start TA. The issues surrounding sustainable crop protection in the Netherlands were analyzed in general terms. The conclusion was drawn, on basis of the analysis, that an interactive approach to TA in this area would be fruitful.

The authors of the proposal were representatives of the three groups who were to jointly carry out the project: the Research Center for the Philosophy, History and Social Aspects of Science of the Free University in Amsterdam (VU-Av), the Center for Agriculture and Environment (CLM) in Utrecht, and the Department of Public Administration at the University of Amsterdam (UvA-BsK). The Rathenau Institute formed the team so as to ensure its multidisciplinary character [KA]. It was possible to perform a rough analysis of the issues fairly quickly because CLM, and VU as well, already had much of the necessary knowledge. UvA-BsK provided expertise on interactive TA.

The preliminary studies

The project was launched in the beginning of 1995. During a period of very intensive contact and meetings, the seven members of the project team got to know each other and made an inventory of the available knowledge and experience in the team. Also during this period, the team was trained in interview techniques.

Up to the summer of 1995, the problems surrounding crop protection were explored in more detail in five studies on the state of affairs in five sub-areas: technology, farming operations, production chains, environmental assessment, and existing policy (a broadening of the start TA). The studies' goal was to provide with adequate information both the project team and the participants in later phases. The studies resulted in an assessment of the existing situation and in suggestions for possible short term improvement. They were based on a literature study, document analysis and interviews with some 60 people throughout the field.

The first round of interviews

A social map was not drawn up explicitly. But already in the period of preliminary studies, there was a sufficient overview of the issues and an insight into the positions of the relevant actors and their mutual relationships. With this overview at hand, the participants were selected in later phases. Also, with the support of the supervisory committee, a list of participants was drawn for the first round of interviews. An important selection criterion was the effort to include a wide variety of perspectives. The interviews were held in October 1995 [AC1]. The main purpose of the interviews was to gain insight into the interviewees' definitions of sustainable crop protection and perceptions of barriers or options for eliminating them. This was done from both short term and long term (2030) perspective.

The second round of interviews

The first round of interviews provided a good picture of the various parties' problem definitions of twenty issues. Also, an insight was gained into the background theories and preferences that led to the problem definitions. In November 1995, an inventory was made of the problems in the twenty interrelated sub-areas.

As far as the possible solutions for the observed barriers were concerned, the interview round was less successful. Eventually, the project team formulated a number of solutions (options) for the respective sub-areas. An attempt was made to choose for options which provided a solution to the problem of each of the most involved parties, by taking into account the leeway implied by the underlying beliefs and preferences. In formulating the options, the project team used the information from the preliminary studies. The study on crop protection policy also helped the project team to stick to a realistic
policy framework. The options were then tested in a second round of telephone interviews with most of the people from the first round [AC2]. This round took place in December 1995. In preparation for the round, a document containing the options was sent to the participants. For each option, the document indicated which specific problem it was intended to solve and which party 'owned' that problem. The project team also indicated the possible disadvantages and problematic aspects of each option. Each participant was asked to react to those options with which she or he was most involved, or which the project team expected her or him to have the most difficulty with. For the rest, the participants were free to react to other options. Based on all the reactions received, the document with options and problems was adjusted in the first two weeks of January 1996 [JC].

**The future-oriented workshop**

Apart from solutions, the interviews in the first round also lacked long-term perspectives. It was decided to include an interim step in the form of a workshop which was held in February 1996. This workshops' goal was interactive formulation of future scenarios and, in addition, generation of development paths that could lead to the future scenarios [JC]. The participants in the workshop were selected according to the same criteria as for the interviews. However, most of the people participating were new. The project team members chaired the discussions and a professional process facilitator assisted them. Due to the creative character of the workshop, the goals were indeed achieved. Three future visions were formulated, each derived from different underlying value systems.

**The work conference**

The results of the two rounds of interviews and the workshop were then integrated. To that end, the future visions (mainly derived from the workshop, supplemented by all the interviews) and the options, grouped into coherent development paths (especially the final document from the interview phase supplemented with the outcomes of the workshop), were each set down in a document. These documents indicated what problems had not yet been solved, what new problems the options entailed, and what points had not yet been agreed on. In the document on development paths, these issues were linked to the three future visions in a manner the project team considered consistent and meaningful. These documents were tested during a work conference in March 1996 [AC3]. The participants consisted for the most part of participants in the interview phase, supplemented by others selected according to the same criteria. In addition, a few strategic thinkers were invited.

The participants were invited to indicate the degree to which they saw the future scenarios as realistic, desirable and positively contributing to sustainable crop protection. Because the main issue was long-term visions (around 2030) and the development paths leading to them, also the testing emphasized conceivable long-term trends to some extent. The discussion sessions' goal was to arrive at joint conclusions. The documents were carefully formulated in a way that made them recognizable and acceptable to all participants involved. The project team then modified its future visions, development paths and their links to incorporate the reactions from the discussions [JC].

**The open day and the final report**

The analysis of the current situation based on the preliminary studies, and the interviews and the long-term future visions along with their associated development paths, finally took the form of Chapters 3 and 4 respectively of the final report. The project team contributed greatly to the integration since there was little chance to elaborate on details during the discussion sessions. The team used for the purpose the insights on action theories, acquired in the process.

The draft versions were presented in outline during an open day [AC4]. All the participants in the preceding phases were given an opportunity to respond to the draft versions. Other parties, including representatives of peak organizations, were also invited to the open day. In addition, a draft version was discussed with the Advisory Committee. The various reactions were incorporated in the final version [JC]. All the remarks, together with the results of the project, were processed by the commissioner (the Rathenau Institute) in the form of a Report to Parliament. Then it became obvious that it was difficult to present the outcomes of the interaction in a way that would suit the Parliament's interest. After all, the Parliament was focused primarily on authorization policy for pesticides.
5 The step-by-step plan

5.1 Introduction

The methodological guidelines given in Chapter 3 were formulated very generally. Section 5.2 contains a step-by-step plan which offers a firmer footing. We give some practical advice on specific details of each step in sections 5.3 to 5.8. The advice includes a series of methods and techniques. Non-interactive methods are only briefly discussed, with recommendations for use in an interactive TA and with literature references for a greater detail. Methods and techniques intended specifically for interactive TA are discussed more comprehensively. In this chapter, we assume that step zero has been completed, i.e. a start TA has been conducted, as discussed in Section 2.1 and 2.2, in order to find out whether an interactive TA is the best approach to the specific situation.

There are three qualifying remarks regarding the step-by-step plan we would like to make. First, the plan cannot be used as a replacement for the guidelines in the previous chapters. The steps and their order should be viewed and employed in the light of those guidelines. Furthermore, the steps do not necessarily have to take place in this particular order. In practice it may be desirable, to temporarily skip some steps or repeat a step a few steps later. In other words, the step-by-step plan should not be seen as linear but as iterative. The methodological guidelines given in Chapter 3 can be useful when choices have to be made. Finally, it should be noted that the step-by-step plan is something in-between a method and a methodology. In other words, one may choose in some situations for different procedures, provided the methodological guidelines are being respected.

5.2 Breakdown of the step-by-step plan

Box 5.1 summarizes the different steps of an interactive TA. For a more thorough discussion and description, we refer to the seventh chapter of the book by Guba & Lincoln (1989).

In the following sections, we add to each step some practical advice and a description of the methods and techniques to be used. These are based both on Guba & Lincoln (1989) and on practical experience with TA.
Box 5.1
The Step-by-Step Plan

1. **Draw up a contract** with the commissioner or client.
The contract must always specify the main goal of the TA and its substantive closure, and contain provisions on the interactive process. This step has two important goals. The first is to formulate a well-considered plan at the start of the process. The second is to commit the various parties concerned (commissioner, client, soundboard or consultative group, participants, external consultants, etc.) to the plan to a greater or lesser degree.

2. **Organize the research work.**
This concerns both the internal functioning of the TA team and arrangements with others.

3. **Establish who is going to participate.**
The choices made at this step are important as they largely determine the further course of the process.

4. **Develop systematically joint constructions.**
The step includes revealing the action theories of the participants as a basis for the development of joint constructions. The latter is not only the goal of this step, it is also the main goal of the interactive TA as a whole.

5. **Test and improve the joint constructions.**
The goal of this step is to confirm whether there are any joint constructions, and to further elaborate on them.

6. **Single out points of agreement.**
Points on which agreement already exists do not have to be dealt with. They can just be included in the final report. The goal of this step is to minimize the breadth of the process for the sake of greater depth.

7. **Schedule the remaining points for discussion.**
Those points on which agreement has not yet been reached must be discussed between the various participants. The goal of this step is to draw up a practically feasible agenda which provides optimal opportunities for the further elaboration of joint constructions.

8. **Gather new information or stimulate new insights and basic attitudes.**
The goal of this step is to devise substantive measures which can increase the chances to create relevant, reasonably elaborated joint constructions during the discussion sessions.

9. **Prepare the discussions between all the participants.**
The goal of this step is to make the final preparations for the discussion session. This includes production of suitable material, selection of appropriate work forms, and selection of discussion leaders.

10. **Hold one or more discussion sessions.**
The goals of the discussion sessions are twofold. The first is to expand the joint constructions to include points on which agreement has not yet been reached. The second is to determine those points on which agreement is impossible, and to find out in what respects and for what reasons this is the case.

11. **Create an effective end product that capitalizes on the unique aspects of the interactive TA.**
The goal of this step is to create an end product in which the interactive process of analysis is recognizable, which relates to the world of the client participating in the TA, and which relates to non-participants, in order to effect a process of vicarious learning (Section 3.2).
5.3 The preparatory movements
(Steps 1 and 2)

Step 1: Draw up a contract with the commissioner
or client

- Specify:
  - the subject of the TA;
  - the main goal of the TA (a number of possibilities are referred to in
    Chapter 2);
  - the closure, to the extent possible (see also Section 3.3);
  - an indication of who is going to be involved in the TA and who
    might not;
  - the methodological guidelines, especially the ideas of a joint
    construction and of openness of the process;
  - rules of interpersonal conduct and confidentiality;
  - where applicable, the right of access to people and information;
  - the form in which reporting will take place (at least a rough indica-
    tion);
  - the responsibilities of the analyst, the commissioner and other
    parties involved;
  - technical matters such as time-schedule, interim products and
    budget.

The first four points can, to a large extent, be derived from the start
TA (see Chapter 2).

- Make sure that the commissioner, the client, the members of the
  advisory group, the external consultants and other parties involved
  commit themselves to this plan so that, when necessary, they make
  time for activities involved with it;

- Make sure the interactive TA participants are familiar with the
  project plan. Make sure they are familiar with the rules of the game,
  commit themselves to those rules and have realistic expectations of
  the process and its outcomes.

Step 2: Organize the research work

- If there is a team of analysts instead of a single person, select, train
  and organize the team:
  - try to create an atmosphere of cooperation and reach clear agree-
    ments on what such cooperation will mean in practice;
  - make sure that everyone in the team is well aware of each other's
    area of expertise and experience;
  - allocate responsibilities clearly and unambiguously;
  - make sure the whole team is familiar with the plan and commits
    itself to it;

- make sure the team understands the methodology thoroughly and
  try to impart an intuitive understanding of what makes the interactive
  approach special;

- Make sure the analyst has access to participants relevant to the
  research and to other necessary sources of pertinent information.
  This requires:
  - a trustworthy attitude;
  - a way to emphasize the importance of the TA and of participating in
    it;
  - empathy;
  - reliable logistics.

5.4 Selecting participants (Step 3)

If the plan (Step 1) does not yet contain a definitive participant list,
the following step must be carried out.

Step 3: Establish who is going to participate

To do this, perform the following activities:

- Draw up a social map, and pay attention to the following types of
  actors: technological designers, researchers, producers and vendors
  of technology, and actors within the larger system of which the
  technology is a part, such as users and policy makers;

- Limit the participant list further by carrying out a selection based
  on the specific aims of the TA.

In Sections 2.3 and 2.4, we explained with a number of examples how
one to limit a participant list for policy oriented or technology oriented
TAs. The orientation of the TA is set out in the plan (Step 1).

- Define a further closure of the participants according to a number
  of criteria, especially the substantive closure of the TA. In the process,
  switch back and forth between participative closure and substantive
  closure.

This iterative way of thinking is discussed in Section 3.3. The
substantive closure is set down in the plan (Phase 1).

- Make a final selection, taking into account the availability of the
  persons, and any time and means-related constraints on the number
  of participants:
  - make sure that the people selected are willing and able to make a
    creative and innovative contribution, and are open to the contribu-
    tions of others;
avoid selecting people who get easily wrapped up in strategic games raging in the real-world;
- if an insight into reactions from the field is wanted, look for people from the work floor, rather than for management representatives or intermediary organizations;
- pay attention to the requirements of variety and representativeness;
- make use of the fact that some people may bring several action theories with them (see Section 3.2);
- if a definitive choice proves difficult, make a provisional selection that leaves space for a number of additional participants. Then apply the snowball method to have the list of participants grow into a final one.

In the following, we discuss some of the above points in more detail. To begin with, it is absolutely essential to prevent any kind of strategic games from developing during the TA. In the real world, it is often such games which lead to the deadlocks or lack of support that create the need for an interactive TA. It is therefore important that the group of participants in the TA does not look too much like consultative groups, committees or other forums in the real world.

Second, we would like to point out that people from intermediary organizations (such as consumer associations, sector organizations) do not always have an adequate view of the ‘work floor’ conditions of their own grassroots support. Moreover, in many cases intermediary organizations only represent a part of their grassroots support, sometimes the most conservative part, and are often involved in strategic games (Doorewaard, 1990; Van de Graaf & Grin, 1996, p. 92).

Third, the balance between variety and representativeness is closely related to the main goal of the TA. Sometimes, it is more important to aim for the broadest possible spread of views than for a balanced representation of viewpoints. This is certainly the case when the TA has as one of its goals ‘broadening of the basis of policy making.’ As regards actors whose cooperation is important for the social implementation of a TA’s results (suppliers, sponsors, embedders), it may be beneficial to aim for as much variety as possible. After all, this allows for an adequate consideration of different contexts for the realization of development paths. In practice however, this approach may lead to an unmanageably large number of participants. If representativeness is the primary consideration, the advice is simple: pay attention to the amount of popular support. Select participants from two or three sides which together represent, say, 80% of the total. However, one may choose to select a different group, e.g. from the circle of actors whose cooperation will help bring about the greatest possible social change. Or, alternatively, in the case of an interactive TA aimed at finding new, more sustainable production process for SMEs in the demolition sector, one might wish to select companies that, although representing only 20% of the market, are nonetheless responsible for 80% of the environmental harm.

Fourth, if a final selection is not immediately possible, the snowball method can be applied. This method involves asking participants to identify the parties they have the most dealings with, disagree with the most, need the most or are obstructed by the most. Enlarge the provisional selection as soon as possible so that participants added at a later stage can participate in the whole TA process.

Finally, we recommend that the following be done after each of the selection steps discussed above:

- Determine the extent to which further selection involves a change in the substantive closure;
- Determine whether the change can be justified on contractual grounds, or on the grounds of new insights or compelling circumstances. If a change is possible, report the change and its justification to the commissioner and client. If the change is not easy to justify, reconsider the selection.

The latter is necessary because of the close connection between who is allowed to have a say and what is said. This connection is crucial for the very rationale of an interactive TA (Chapter 1).

An adequate selection requires a sound understanding of the issues at hand. Also, it requires a clear view of the perspectives of the various actors on the social map and their possible contributions. Sometimes, the start TA carried out prior to definitively opting for interactive TA and included in the contract (Step 1) provide a sufficient basis. Often, however, important information is missing. It may be possible to fill the gaps by means of a preliminary study, as a further elaboration of the start TA. This was the case in the GIDEON project (Section 4.5). The preliminary studies there threw a light upon the problems and the opportunities on the road to sustainable crop protection, and were helpful for the selection of participants as well as for the formulation of questions for the first and the second interview rounds.

5.5 Developing, testing and improving a joint construction (Steps 4 and 5)

The fourth and fifth steps of the plan lay the foundation for the core results of the interactive TA, i.e. a joint construction that enjoys maximum support from the participants. Later steps systematically
expand this core to include points that could not initially count on broad consent, and lay it down in the final report. The fourth and fifth steps require methods and techniques specifically related to Interactive TA.

**Step 4: Develop systematically joint constructions**

First and foremost, this requires a reconstruction of the participants’ action theories. These must subsequently be used to produce the core of the joint constructions.

### 5.5.1 Reconstructing action theories

- Reconstruct the action theories of the participants both by asking questions directly related to the content of the action-theory layers, and by asking 'why' questions that reveal adjacent layers. Use a combination of different question types as a control to detect unreliable information, such as socially desirable answers.\(^\text{16}\)

For techniques that can be used to gather data, we refer to the large collection of social science literature.\(^\text{17}\) Here, we focus on ways to reconstruct action theories on the basis of such data.

Two paths can be followed to uncover the layers of an action theory. First, in document analyses and interviews, one can ask questions directly related to the content of each of the layers. Second, one can inquire into the why of answers to questions regarding the content of a given layer; as was explained in Section 3.2, the answer to such a why question will uncover beliefs from another layer. For example, the question ‘Why is this a problem for you (second layer)?’ will probably lead to an answer that says something about the values (third layer) of the person concerned. Our experience has shown that it is fruitful to explore both paths. The outcomes may complement each other. They can also be used for control purposes, i.e. to verify whether the answers obtained from both paths are consistent. If important differences or even contradictions exist, the additional research may be necessary. Specifically this may mean that a researcher has to go deeper into such issues during an interview. Or, a study of additional documents may be required, or a review of documents that have already been studied.

The inconsistency may persist. Possible reasons are: the participant has difficulties with the issue itself, or with having to reconcile her various roles in relation to the issue. What is more frequently the case however, is that the participant’s initial answers turn out to be incomplete or unreliable (socially desirable for instance), or that they turn out to have been incorrectly interpreted by the researcher. An example of the combination of two question types is given in Box 5.2.

In the example in Box 5.2 a relatively straightforward question was posed: Should information be provided on food products and, if so, in what form? This implies that each party involved can be asked more or less the same question. More complex subjects will often require a large variety of questions.

The GIDEON project on sustainable crop protection (see Section 4.5) is an example of a more complex issue. The factors hindering a substantial decrease of the agricultural sector’s dependence on chemical pesticides turned out to be highly diverse in nature. Farmers lacked confidence in unconventional cultivation methods, vendors were not prepared to accept the consequences of quality and price changes as a result of dependence reducing measures, and suitable cultivation methods and techniques were unavailable. These factors are interrelated with the highly disparate problem definitions of the various parties involved, and with their assessments of the various solutions. Although initially all the questions related to such first-order notions were cast into a single mold, differentiation according to the various types of actors was needed for the further fine-tuning. As far as second-order notions are concerned, it was not even possible to try asking questions in general terms; specification was imperative. Assuming there is some expertise on the matter, the specification is relatively simple to accomplish with the help of Box 3.1. Box 5.3 gives examples of questions that can be asked about the various layers. Why questions were also asked in the GIDEON project, although they are not included in the box.

- Indicate, together with problem definitions and solution assessments, the background theories and ultimate preferences which define the leeway the actors permit themselves for adjusting their problem definitions and assessing solutions.

For example, farmers will choose crop protection solutions on the basis of their own background theories about cultivation methods. A conventional farmer will employ a cultivation method which involves the use of crop variety selection, manuring and pesticide application as three distinct activities. The farmer will be skeptical about a more preventive method for dealing with sicknesses and plagues based on the optimization of crop variety selection and manuring, and he will not gladly accept such a method as a replacement for a wide range of chemical pesticides.

Of course, when creating joint constructions, it is of great practical importance to know exactly how much leeway exists. See Section 3.2 for a more thorough discussion.
Reconstruction of action theories, an example

In the main body of the text, two ways of reconstructing the various layers of the action theory of a participant are sketched:

- **directly inquiring into elements from that layer;**
- **asking questions about the adjacent layer.**

In practice, it is wise to follow both approaches. A good example of how both approaches can be combined in a single interview as part of an interactive analysis is given in Smink & Hamstra (1995, 1996). The study deals with the question whether, and if so how, consumers must be informed regarding the use of biotechnology for the production of foodstuffs by means of labeling or other measures. The study started with interviews of some thirty people representing consumers, consumer organizations, retailers and food manufacturers. Some of the questions asked during the interviews are given below. For each element it is explained which approach was used to reveal that specific element of an interviewee's action theory.

<table>
<thead>
<tr>
<th>Question asked by Smink &amp; Hamstra (1996, pp. 37-38)</th>
<th>Our explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What kind of organization do you work in? What are the objectives of the organization?</td>
<td>Directly asks for the ultimate preferences of the organization.</td>
</tr>
<tr>
<td>2. Should consumers be provided with information with regard to foodstuffs made using biotechnology?</td>
<td>Directly asks for an opinion on a certain, broadly defined solution. Specifications are 'why' questions, which reveal something about the problem definition.</td>
</tr>
<tr>
<td>3. Why should consumers be informed; what effects do you aim to achieve by doing so?</td>
<td>Question asks directly for a problem definition. Specifications are 'why' questions, which reveal something about background theories and ultimate preferences.</td>
</tr>
<tr>
<td>4. To what extent do you expect these effects to occur? What do you want to achieve by informing consumers?</td>
<td>Question and specifications ask for an assessment of conceivable solutions. Second question and its specifications directly inquire into the problem definition.</td>
</tr>
<tr>
<td>5. Why is this the problem?</td>
<td>'Why' question which reveals something about background theories.</td>
</tr>
<tr>
<td>6. What ultimate or ideal situation do you want to achieve with your activities?</td>
<td>Question inquires directly into ultimate preferences.</td>
</tr>
<tr>
<td>7. What do you think is the best way of informing consumers [...]?</td>
<td>Question asks for a solution and its elaboration. Specifications are 'why' questions which reveal dimensions of the problem definition.</td>
</tr>
<tr>
<td>8. What do you think about other ways of informing consumers, such as [...]?</td>
<td>Question and specifications ask for an assessment of the interviewee's own solution and other solutions. In particular, the first and third specifications reveal additional dimensions of the problem definition.</td>
</tr>
</tbody>
</table>

Box 5.2 continued on page 63
Box 5.3
Reconstruction of action theories surrounding sustainable crop protection

In this box we show an example of the way in which the GIDEON project questions were asked regarding the content of the action theories of various actors. 'Why' questions are ignored here.

<table>
<thead>
<tr>
<th>Type of actor</th>
<th>Solution assessments</th>
<th>Problem definition</th>
<th>Background theories</th>
<th>Ultimate preferences</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>What are the costs, effects and side-effects of switching?</td>
<td>What do you see as opportunities for and obstacles to achieving more sustainable crop protection?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Specification for agriculturalist</td>
<td>What are the costs, effects and side-effects of concrete measures?</td>
<td>How does crop protection relate to other cultivation elements, such as manuring and the choice of input material?</td>
<td>What type of company do you want to be (supplier of bulk goods, supplier of reasonable goods for a reasonable price, etc.)?</td>
<td></td>
</tr>
<tr>
<td>Specification for agricultural researcher</td>
<td>What are the costs, effects and side-effects of other research priorities?</td>
<td>What are the obstacles to developing biological methods?</td>
<td>What does a crop protection method mean for the whole crop?</td>
<td></td>
</tr>
<tr>
<td>Specification for retailer</td>
<td>What are the costs, advantages and disadvantages of selling 'out of the ordinary' cultivated products?</td>
<td>In your opinion what aspects play a role in determining consumer preferences?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Take note of the difference between individuals and organizations.

By definition, organizations incorporate several action theories. In general, each unit of an organization will employ its own action theory (or theories). Often however, one's primary interest is not in a particular organization as an actor, but in its marketing department or, less specifically, in any marketing department in a given sector. It may then be sufficient to interview a representative of that department. Furthermore, when analyzing a document, it is important to find out from which department or unit it originates.

- Beware that the statements of one and the same person may be a mix of beliefs from different action theories. Address participants in the role relevant to the TA or, in some cases, reconstruct more than one action theory.

People sometimes act in several roles, and therefore base their actions on several types of action theories. Examples of such 'double roles' are: citizen of a country and consumer, businessman and agricultural expert, industrial laboratory manager and scientist. People will often try to bring different action theories into line with each other. For example, as consumers they may pay attention to the origin of products when deciding to buy. However, this does not happen all the time. Choices of people in their role as consumers sometimes differ from their choices as a country's citizens. This is apparent from the fact that environmentally conscious consumption is developing at a snail's pace while environmental policy can count on voters' wholesale support.

5.5.2 Developing joint constructions (Step 4)

Once the action theories of the participants have been reconstructed, a joint construction's core can be made. Often, the current situation will be charted at the same time as the action theories are described. The description will not merely include the participants' beliefs, but also all kinds of structural factors which fall outside the actors' sphere of influence and determine, so to say, the conditions for their actions.

- Code the information. Use as categories solution assessments, problem definitions, background theories and ultimate preferences of the actors involved, as well as the structural conditions for their actions. For complex problem areas, cross-categories that correspond with sub-areas of the issues can be used;

- Create a rough version of the joint construction's core by linking elements of the problem definitions of some actors with the solution elements of others. Integrate these with more structural factors to
arrive at an analysis of the issues and possible solutions. Register any uncertainties which become apparent in the process.

Creating such a core begins with a contents analysis of documents and of interviews. The analysis must provide an overview of both the action theories of the participants and the subject of the TA. The contents analysis begins with coding the information, specific passages from documents and interviews being assigned to a given category. Coding is a way of quickly creating order in large amounts of material. Five groups of categories can be distinguished (freely adapted from Guba & Lincoln, 1981, pp. 304-306). The first four correspond with the four action theory layers: solution assessments, problem definitions, background theories, ultimate preferences. The fifth group involves factors that influence the actions of the actors involved in the issue. In complex problem fields, one can also create cross-categories that correspond with different sub-areas of the problem. Provided the interrelationships (as viewed by the participants) between the categories are kept clearly in mind, such a categorization can be an important tool for rendering some issues manageable.

The coding enables a TA researcher to roughly formulate the causal and final relationships pertaining to the subject of the TA, as viewed and judged by the various participants. In other words, it leads to a description which contains:
- an outline of the relationships between the problems as viewed by the various participants;
- a discussion of a participant's judgments about the various solutions suggested by himself or by others;
- a linkage of solutions to the interrelated problems, which leads to an understanding of the relationships between the problem definitions:
  i. identical or complementary relationships: a problem definition shared by the various participants is possible;
  ii. congruency: there is a solution that complies with the various problem definitions;
  iii. conflicting relationship: the problem of one party cannot be resolved without maintaining or even exacerbating that of another.
- with regard to all of the above: an account of the remaining actual uncertainties.


5.5.3 Testing and improving joint constructions
(Step 5)

In order to deliver a fully fledged TA result, more detail will have to be added to the core. Also, it must be examined whether the way matters are presented and the proposals for action are realistic in the light of existing knowledge. Furthermore, some of the participants may not have contributed to all aspects of the constructions.

- The provisional joint constructions must be tested and improved on the basis of documents, observations, professional literature and one's own knowledge. If participants from different areas are heard, relate the areas to each other.

It is not excluded that researchers employ knowledge which does not originate from the participants. Sometimes, a fairly substantial contribution by the researcher is an absolute necessity. This might be the case when participants had not elucidated and worked out sufficiently certain aspects or issues. It goes without saying that the validity of the produced joint construction must be tested through the eyes of the participants in a new argumentation circle (Step 5). A number of iterations between Steps 4 and 5 may be necessary.

In order to facilitate the further process, the constructions must have a suitable form:

- Be sure to show clearly the relationship between the joint constructions and the action theory of the various parties involved. In this way the constructions serve as a solid foundation and promote reflection and discussion between the participants;
- In particular, show the leeway the various actors allow for reaching agreement, given their background theories and ultimate preferences (Section 3.2).

This means that the various participants must be able to recognize where elements of their action theories have been taken into account, where the action theories of others have been taken into account, and in what respects agreement have not been reached or cannot be reached in view of the differences in second-order beliefs.

- The joint constructions must be specific in order to promote further reflection by and discussion between the participants.

Fundamental discussions can best be held on the basis of examples. If one clearly links specific problems and solutions with second-order beliefs, then the chance is greater to hold effective discussions on more generic notions, than when these abstract convictions as such
are the sole subject of discussion.

Moreover, the reflection and discussion around specific examples will be of much more immediate relevance to the results of the TA.

Furthermore, a joint construction that satisfies these requirements will, if included in the final report, make a substantial contribution to vicarious learning (Section 3.2). It shows how the construction grew out of consensus between the various parties; a consensus which the participants have discovered during the TA and are now passing it over to others.

In order to ensure that the joint constructions meet the necessary formal criteria, a variety of methods and techniques can be applied. We will mention a few here:

- The use of a technique known in the social sciences as thick description (Geertz, 1973). In this technique, the description is not expressed in analytical terms (as a result of factors a, b and c, trend y occurred with z as its consequence) but in a more narrative style. The case description closely follows reality and the perceptions and experiences of the most important players. A joint construction can be thickly described in its entirety. Or one can include a number of thickly described examples within more analytically formulated constructions. See for example, Denzin (1994, Chapters 4 and 5) for a treatment of thick-description techniques.

- The use of a case (Guba & Lincoln, 1981, pp. 370-373) to describe or characterize developments or to impart insights. For the creation of a case in the context of interactive analyses, see Guba & Lincoln (1981, pp. 373-380); for the creation of a case as a joint construction, see Weiss (1994, pp. 167-179).

- The use of technical models, practical trials, scale models, videos, etc., can help make constructions more specific (Van der Meulen, 1992, pp. 122-130). A number of techniques for the interactive design of prototypes are referred to in Bødker & Gromnbæk (1991); for the use of videos, see for example Suchman & Trig (1991).

5.5.4 Some supporting methods and techniques

In an interactive TA, existing methods and techniques can be used to support individual judgment, or the development of a joint construction. We present a number of possibilities below.

The use of TA models

A wide variety of methods and techniques have been developed in the TA world for linking social problems and technological developments. Bunders (1990, pp. 69-88) describes a method to support participants' judgment. Aided by well-operationalized criteria, farmers in developing countries could assess and compare biotechnological innovations in terms of considerations important to them. The

interactive approach ensures that the outcomes are interesting to everyone involved, also when the primary client is parliament for example. An interactive TA can offer advantages for the strategic development of companies and social organizations, as well.

In Section 4.4, another example was presented, the computer-supported systems analysis model which formed the core of the joint construction created in the phosphate forum. Adequate experience has now been gained with the use of such models for TAs in complex problem areas (see for example Eberlein, 1995). The interesting feature of the phosphate forum is that it demonstrates how such models can also be developed and applied interactively. Their use within an interactive approach can make explicit the normative presuppositions as well as assumptions about, say, human behavior. Normally such assumptions are an implicit part of such models. (Grin, 1997)

In an interactive TA, the use of such analytical models can help to go deeper into the issue, or to achieve more quantitative outcomes. If the models are employed in a truly interactive way, the results of a TA can have more impact.

Designing futures

One of the greater challenges of an interactive TA is to design future scenarios - a prospective TA. Several methods and techniques can be used in this context.

Metaphors can be helpful in designing future visions, during individual interviews or in group workshops. Kensig & Madsen (1991) describe a future workshop which had to help design a new computerized administration system for a library. Various metaphors for a library were used to help the participants suggest design ideas and to stimulate them to critically assess those ideas: the library as a warehouse, the library as a storage cupboard, the library as a meeting place. A thorough treatment of the use of metaphors in TA is given by Mambrey et al. (1995).

Fonk (1994) developed the so-called Future Visions for Consumers method. The method helped to identify the issues which determine if and how consumers will accept a given technology. These can then play a role when choices are made in the process of technology development. Other techniques for designing future scenarios are discussed in the literature. For example, future workshops (Jungk & Müllert, 1987), scenario workshops (Andersen et al., 1992), search conferences (Weisbord, 1992) and policy exercises and simulations (Breuer, 1986; Geurts, 1993, 1994).
Methods and techniques for designing scenarios can also be used. In the Netherlands, two important reports were recently added to the extensive literature on this subject: the report *Scanning the Future*, published by the Central Planning Office (CPB, 1992) in which a number of modeled scenarios of the economic future of the Netherlands are presented, and the report titled *Duurzame risico's een blijvend gegeven* (Sustainable Risks: A Constant Factor), published by the Scientific Council for Government Policy (WRR, 1994), in which the four ideal type scenarios are presented. The WRR scenarios' strength is in the policy oriented translation of cultural theory (Schwarz & Thompson, 1990; Thompson et al., 1990). However, not all the ideal types in the cultural theory are worked out with equal success. The CPB scenarios are attractive, since they lend themselves for use as a framework for quantitative (economic) calculations. From a normative point of view however, the scenarios do not cover the entire spectrum of views.Both reports can help a TA researcher to elaborate ideal future scenarios as a framework for analysis. Of course, that analysis must be presented to the participants for another interactive discussion round.

**TAs on tricky issues**

When the problem definitions are highly diverse and, moreover, it has become apparent that solutions do not exist or are inadequate, the method of narrative policy analysis is recommended. Roe (1994) presents a systematic approach, based on *stories and counter-stories* of the parties involved. These terms refer to the parties' diverse descriptions of the problems and their underlying mechanisms and, consequently, of conceivable solutions to those problems. Then, based on her own reflection on the narratives, the researcher must detect the fundamental dilemmas, feedbacks, etc., which may be the reason a solution to one party's problem exacerbates another party's problem, and vice versa. The analyst can then try to create a *metastory* which presents the dilemmas and suggests new solutions that transcend them. Roe shows how he applied this method to a series of problems in the area of technology, society and the environment. The method fits in well with the interactive approach. Having heard the participants, the TA researcher can use the method to generate a *joint construction*; this will then take the shape of an analysis of the dilemmas that have led to the deep controversy and, possibly, of the ways in which those dilemmas can be transcended.

5.6 Preparing discussion sessions

(Steps 6 to 9)

After the preceding steps have been completed, points of agreement and points of disagreement between the participants will generally be clear. In order to assess the extent to which the differences of opinion might still be bridged, it is necessary to hold one or more sessions during which the participants could discuss the points of disagreement. If necessary, some time can be spent checking whether the *joint constructions* really are supported by the participants. In this section, we will discuss Steps 6 to 9, which serve as a preparation for the discussion sessions.

**Step 6: Single out the points of agreement**

- Single out those points of the *joint constructions* on which agreement has already been reached;
- Verify that the participants really do agree with these points. If a given point has not been (sufficiently) tested, make sure to do it.

In this context, *points* are combinations of problem aspects and solutions put forward by the various actors. *Joint constructions* are built up from such points. For an example, see Box 5.3.

**Step 7: Schedule the remaining points for discussion**

- Decide how much time must be scheduled for discussion of the various points by answering the following questions:
  - How likely is an agreement?
  - How important is the point to the various participants?
  - If agreement on a particular point seems difficult to achieve, would it be possible, despite the lack of agreement on that one point, to arrive at a feasible solution that enjoys broad support? Or, how important is the issue for the *joint construction* as a whole? This should be judged partly in the light of the TA's subject and closure.
  - What kind of discussion is needed on the various points?

In order to answer the first question, a researcher can, based on a knowledge about the *second-order notions* of the participants' *action theories*, assess the leeway of the various participants with respect to a particular point (compare with Section 3.2). The likelihood of agreement can be deduced from this. Furthermore, the researcher can make an accurate assessment of the importance certain participants attach to given points. Together, these two assessments provide a good impression of the time that will have to be spent on discussing...
Box 5.4
Construction of solutions: the example of contracted cultivation in the light of sustainable crop protection

As an example of the way in which problem aspects and solutions can be grouped to form one point, hereby an option is presented from the second round of interviews in the CIDEON project. In rough terms, the solution is to stimulate contracted cultivation. The stimulation of contracted cultivation may help to eliminate the following problems:

I. The risks perception of farmers change because they have their customer's guarantee that they will be able to sell their products.
II. It becomes easier to coordinate the requirements of producers and customers.

In this way, two important obstacles to the adoption of more environmentally friendly production methods are removed. However, contracted cultivation does have disadvantages too. From the perspective of the environmental movement, contracted cultivation can have a conservative effect; the current options become a guideline for the future. From the perspective of a farmer, a disadvantage is that, during the period of the switch-over, his products are usually too expensive for the ordinary market, but too ordinary for the terms of the contract.

In this way, a more refined solution can be constructed:

1: Stimulate contracted cultivation in which a progressive standard is included. Once farmers are more certain of sales, they will have leeway for changes in their business operation. In addition, the contracts may contain requirements with regard to the crop protection methods used.

An alternative is:

2: Stimulate contracted cultivation in which a progressive but flexible standard is included. An example of a flexible approach might be (see above):
- to give farmers who are making the transition to other cultivation methods a chance to learn by trial and error as long as they commit themselves to the project, with sanctions for premature withdrawal;
- to settle with agriculturalists on the basis of their average environmental results over the last four years for example, in order to compensate for poor seasons and, at the same time, to stimulate farmers to continue to do their best.

All of this can be sensibly discussed as one point.

good impression of the time that will have to be spent on discussing the various points.

If one particular point turns out to be intricate and thus requires a great deal of discussion, or even offers little hope of agreement, the researcher may consider removing that point from the agenda and excluding it from the joint constructions. If the point is important, an alternative may be to formulate it as a choice, i.e. a remaining 'Gordian knot', to be cut through by the commissioner or client of the TA.

Based on his insight into the participants' action theories, the researcher can also define the subject of a discussion with respect to a particular point. Sometimes the discussion may focus primarily on finding an effective solution to given problem elements. This is especially the case if there are identical, complementary or congruent problem definitions. However, if the problem definitions of the various participants conflict, there is little sense in discussing particular solutions. It would be more appropriate to discuss whether compromises are possible in a given situation, i.e. both parties accept that one or more problems in their respective situations will not be solved. Such discussions can only be fruitful if they are prepared on the basis of insight into what the various participants consider essential, i.e. based on a knowledge of the second-order notions behind those problem definitions. This knowledge must also be imparted to the participants. In some cases, it may be necessary for the researcher to bring up such second-order notions for discussion. However, this certainly reduces the chances to achieve a result. The likelihood of a result is highest if the researcher manages to structure the discussion in a way that certain participants realize how, in concrete cases, their own second-order notions lead to outcomes they also see as negative.

Step 8: Gather new information or stimulate new insights or basic attitudes

- Determine whether supplementary information would lead to better or more rapid consensus on some points. If so, collect the information needed.
- Try to get the participants to empathize with each other and to take each other's views into account.

Even if the lack of consensus can be attributed to differences in underlying insights and preferences, collecting additional information (provided it is used creatively) sometimes helps to create a workable form of agreement. For example, an option desired by a given participant might turn out to be impossible to implement for
the time being. Or there may be more solutions conceivable than the participants had foreseen.

Now that as yet unresolved points have been scheduled for discussion between all the participants (7), and an attempt has been made to proceed to the next step (8), one more preparatory step remains before the discussion session can be held. It involves the production of material to be used and the selection of procedures to be followed during the session.

**Step 9: Prepare the discussions between all participants**

- In the material to be used during the sessions, describe the points in a way that lets each participant understand how fellow participants view them, and, thus, what the discussion is supposed to be about. Where a particular solution is the key issue, indicate which corresponding aspects of the problem definitions of the particular actors the solution is supposed to address. Explain why the point has not been resolved and why it has been scheduled for discussion;

- Present the information so as to promote open discussion;

- Find out about techniques that might help achieve the goals of the discussions, as a supplement to standard meeting techniques. These could include *role-playing, fantasy exercises, metaphors, etc.*;

- Be clear about the process closure;

- Where possible, try out the material on people who can place themselves in the shoes of the intended participants;

- Provide easily accessible material which requires an acceptable time investment;

- Make a strategic decision as to the wisdom of distributing the material in advance.

We will explain the last two points. When producing material, a researcher must find a balance between two requirements: keeping the amount of material under control and finding a form that gives rise to fruitful discussion (see the discussion of Step 5). Use clear figures, which are properly explained; use a layout that allows readers to quickly find the passages they want to read in more detail, and do not be shy to include some text. Preoccupation with limiting the overall quantity of the material can easily lead to a situations when participants lose sight of the points' mutual relationships and of each other's views. This implies the risk of a poor result, or spending more time to reach agreement.

Our last advice is to prevent participants from making preparations, prior to the discussion session, which focus on strategic behavior and thereby hinder creative and innovative behavior during the discussion. Sometimes this means a drastic limitation of the distributed material.

- Prepare the session as a whole and the various work forms as such: prepare facilities (take care of a flap-over, of a sufficient number of separate rooms for sub-group discussions, of an opportunity for informal contact, etc.) and make sure that there is capable staff (minutes secretaries, discussion leaders, etc.).

### 5.7 The discussion sessions (Step 10)

**Step 10: Hold one or more discussion sessions**

- Ensure the presence of a capable discussion leader. The discussion leader plays a key role and has to satisfy the following requirements:
  - He or she must possess a sound substantive understanding of the discussion topic, command the 'language' of the participants, and understand the participants' culture sufficiently to wield substantive authority;
  - He or she must be thoroughly familiar with the synthesis (joint construction), in order to be able to explain clearly and insightfully the ideas behind given elements of the synthesis. In addition, the discussion leader must, while the discussion is in progress, be able to see, clearly and immediately, what underlies the remarks made and any differences of opinion in order to determine whether the agreement reached is genuine. Finally, he or she must be able to differentiate points of discussion that are more or less essential to the joint construction.
  - He or she must be able to employ the various work forms with a view to the goals to be achieved;
  - He or she must safeguard the character, substantive closure and progress of the meeting, which requires an effective combination of openness, wit and professionalism.

- Say a few words about the following matters at the beginning of the meeting:
  - The goals of the meeting;
  - What is going to be done with the results;
  - The substantive closure of the meeting, preferably in terms which make clear to the participants how the closure does justice to their various action theories;
as well as to the TA findings. Capitalize on the advantages of an interactive analysis: it enables multiple advocacy recommendations to be made instead of (over) advocacy recommendations (Dunn, 1994, pp. 266-269). The report which came into being in a space relatively free of power, must be able to survive the real world debate and to contribute new insights to it.

- Submit a draft version to a group that resembles the real world in composition and atmosphere. Adjust the report's presentation, without changing the substance of the joint construction, to increase its chances to survive a real-world discussion;

- In the report, indicate how it relates to games in the outside world. Explain to the client how the report can be used to advantage in strategic games and to break through the status quo.

In a well-executed interactive analysis, existing relationships, infrastructures, cultural factors, resource allocation and so on – in short: power – do not hinder creativity, innovation and synthesis. After all, an interactive analysis is conducted in a space which is as free from power influences as possible. However, if all goes well, the analysis does provide an insight into the way in which such power factors can affect the degree to which the results of the TA are implemented in the real world. It is precisely such insights that form an important basis for the formulation of recommendations to clients. This is particularly true if the client is able to take steps to reduce the influence of such power factors. A knowledge of political science and public administration theory and/or a knowledge of technology dynamics is indispensable in this regard.

- Include recommendations that indicate how learning can be instigated in the real world.

In general, vicarious learning effected solely by means of a final report will be insufficient for this purpose. Very little research has been done into the way in which policy instruments induce learning. In this regard, we refer to the research carried out by Schot (1996) on generalizing solutions which originate from strategic niches, and a study of several cases of learning induced by policy instruments (Van de Graaf & Grin, 1996c).

We end this chapter by referring to literature that might be helpful in drawing up a final report. As far as recommendations and experiences in the area of interactive analysis are concerned, we refer to Cuba & Lincoln (1981: Chapter 12). Dunn (1994: Appendix 1) provides a checklist of important items for policy oriented reports, and advice regarding executive summaries (1994: Appendix 2). Yin (1994: Chapter 6) provides good advice on reports which are predominantly

5.8 The final report (Step 11)

Step 11: Create an effective end product that capitalizes on the unique aspects of the interactive TA

- Show that the results consist of more than just an analysis or recommendations by the researcher or the commissioner, i.e. that they include a description of the joint constructions of all the participants;
- Let the core of the final report consist of the joint constructions in the form they eventually grew into;
- Present the methodology in an accessible and striking way. Bring the methodology to the fore in the summary and in the presentation of joint constructions. The methodology is the report's most attractive unique selling point.

- Make sure that the report promotes vicarious learning. Consequently, the wording of the joint constructions should demonstrate how and why they took their particular form (see Section 5.4.2);

- Make sure the final report is relevant to the action theory of the party addressed or the client.
- To that end, interview some of the parties addressed or the clients where necessary, or comprehensively discuss a draft version of the report with them.

As we remarked in Chapter 1, the last consideration plays an important role in determining whether the report will actually be used. Sometimes, this is simple to ensure because the client sees his action theories reflected in the report itself and, thus, in the joint constructions. This will be the case if the client was represented as a participant. If this is not the case, a certain amount of translation will have to take place. In so doing, pay attention to the following points:
- The questions addressed, the substantive closure, the participative closure and, preferably, the methodology, must all be related to the way in which the client or clients define the problems;
- The recommendations must be related to these problem definitions as well as to the TA findings. Capitalize on the advantages of an interactive way in which the client or clients define the problems; in so doing, pay attention to the following points:

- The rules of the game, which are intended to give the meeting the desired character and to safeguard its substantive closure.
based on cases. A great deal of useful and practical advice on writing qualitative analysis reports can be found in Weiss (1994: Chapter 7) and in Miles & Huberman (1994: Chapter 12).

Summary

This guide focuses on the actual practice of interactive forms of Technology Assessment (TA). One characteristic feature of this new type of TA is that it takes the viewpoints of all the interested parties into account. On the one hand, these parties include those who are especially affected by the consequences of the technology, and to whom we subsequently refer as parties affected: consumers, patients or employees, and the organizations representing them. On the other hand, there are also those parties who play an active role in the development, implementation and embedding in society of new technologies: players, such as providers, sponsors and technologists. In some cases, however, the distinction is less clear and people or organizations play a dual role. For example, users are often not only affected parties, but players too. They may be actively involved in the embedding of new technologies in society by virtue of the degree to which they themselves use the technology.

A second characteristic is that the analysis takes place as part of an interactive process involving the TA analyst and the aforementioned interested parties, one in which discussion and traditional research (desk research) alternate.

The interactive approach to TA is relatively new. Bearing in mind the limited experience so far with interactive forms of TA, this guide cannot yet claim to be an exhaustive traveler’s handbook. It is more what a large publisher of travel guides designates as a travel survival kit. It is believed that, aided by this guide, TA researchers who want to take the plunge will be able to get off to a sound start. And, in due course, it is hoped to learn from people’s experiences with this guide.

What is the position of interactive forms of TA within the field of technology assessment? Chapter 1 of this guide focuses on this question. The objective of TA is always to help influence technological and social choices. But from what viewpoint is the analysis carried out? In the early days, the TA researcher him/herself often decided what values and preferences should direct the analysis. Later, the viewpoint of the parties affected came to predominate. TA paid much less attention to the viewpoint of active players. It was usually assumed that these interested parties already had sufficient influence.

Where the goal was to influence the technological choices of companies and governments through TA, its strong bias towards the viewpoint of the parties affected – in other words, that of the
outsiders – proved to be a stumbling block. TA only appears to have a serious impact on the interested parties who play an active role in a technological development if they also recognize their own viewpoint in the analyses. Thus, the TA process must take account of the diverse perspectives of all the interested parties. This means that changes must be made to the current TA methodology.

The aim of interactive forms of TA is conventional: to help influence the course of developments in a direction regarded as desirable by the affected parties. The way in which this form of TA is carried out is new: it collects input from the entire range of interested parties in a process of interaction between the TA analyst and those active players. Wherever possible, the analysis must make allowance for, and provide insight into, the extent to which particular courses of development are regarded as meaningful by all these parties.

A few remarks to put TA into perspective will be helpful here:

- An interactive TA will not always result in total agreement.
- The participants in an interactively conducted TA are naturally only a selection out of all the people who are involved in the courses of development concerned in the real world. The fact that the participants go through a learning process, and together construct courses that they all regard as meaningful, does not necessarily say anything about the real world.
- An interactively conducted TA is a kind of social experiment, an attempt to carry out a creative and innovative analysis in as power-free a context as possible. But in the real world power does in fact also play a role, and interactive forms of TA, too, can provide little more than insights which interested parties can use to influence existing relationships and processes. Moreover, we have primarily compiled this guide with a public body, parliament and the government, in mind as the addressee of the TA.
- Finally: interactive forms of TA contribute to social and political judgment, and in so doing they also influence processes of policy formation and technology development. Interactive TA cannot replace these processes, if only because the time available and the number of participants is limited. TA is and remains a form of analysis – based on research and discussion – that sets out to influence these processes.

How can TA as a form of analysis carried out interactively be structured in practice? In the last chapter of this guide a (still incomplete) collection of tools is offered for doing this. But a toolbox, however well stocked it may be, cannot be used effectively if understanding and skills are lacking. Interactive forms of TA make heavy demands on those who coordinate the process – especially when the analysis process does not appear to be going as planned, or when the TA takes place in an unorthodox context.

In what cases is the interactive approach to TA useful, and what functions can it fulfill? An interactive approach can be chosen with two possible functions in mind:

- To take into account a number of different value systems when determining which courses of development will be desirable, and – where possible – to create a synthesis between the different value systems.
- To increase the probability that the recommended courses will actually be put into practice, by explicitly taking into account the viewpoints of suppliers, users, sponsors and embedders of the technology concerned.

In Chapter 2 a way of reasoning is presented that can be used to decide to what extent one, or both, of the foregoing functions applies in specific cases – and if so, how exactly those functions should be interpreted.

**Function 1: Synthesizing several value systems**

A start is made by distinguishing between four types of problems, based on the degree of uncertainty about facts and the degree of value dissent. Problems that involve both uncertainty and dissent can be described as unstructured: the combination of certainty and consensus produces structured problems. The two remaining cases involve moderately structured problems of a factual or normative nature.

A technique known as a start TA can be used to determine the type of problems with which one is confronted in a specific case. One then considers what kind of TA approach would be preferable in that specific case. Interactive forms of TA are particularly valuable for solving problems that are perceived as unstructured: they can help to structure these problems.

A warning is appropriate in this context: a problem can be widely perceived as structured, even though there is no consensus about the values that must be taken into account. Structured problems are in principle only structured in a particular context. Outside that context the formulation of the problem and its solution may be questioned. A TA researcher (or the party commissioning the TA) may decide that the TA must help to bring a dominant problem definition up for discussion.

**Function 2: Making the results more implementable**

The likelihood that the recommended courses of development will actually be put into practice can be increased by involving people from the circles of suppliers, sponsors, embedders and users of the technology concerned in conducting the TA. An interactive approach need not necessarily be used for this: interested parties such as these...
can also be approached at particular points in the process, and asked to evaluate the feasibility of particular ideas and say to what extent they would be ready and able to help put those ideas into practice. In any event, an interactive approach can offer substantial benefits in any of the following situations:

a. Where one of the aims of the TA is creative innovation: to achieve this, various different interested parties will need to think outside the existing frameworks and to examine together how this can lead to significantly new courses of development;

b. Where one of the aims of the TA is to obtain a detailed picture of what is and is not possible in actually producing and implementing courses of development;

c. Where there is a gulf between what is desirable from a political point of view, and the preferences of the interested parties who must put this into practice.

The way in which the participants in the TA process are selected is important for both functions. The selection of participants must be based on the precise function that the TA is desired to fulfill. The outcome of a TA acquires greater significance in the eyes of a particular group of interested parties when a representative of that group has contributed to the analysis.

An interactive TA process, as is explained in Chapter 3, does not so much set out to achieve a compromise between the interested parties as to produce a synthesis between their different positions. A compromise requires each of the different parties to give up some part of their position (the way in which they define the problem and evaluate solutions). A synthesis, conversely, looks for a new position that makes sense to all the parties: a joint construction.

The goal is thus, on the one hand, to achieve as great a synthesis as possible among the parties affected, i.e. between different beliefs and preferences; and on the other hand to achieve a synthesis between the parties affected and the active players concerning the technology in question, with their underlying professional beliefs. In order to create such a synthesis, the underlying preferences and beliefs of the parties must be surfaced and discussed. An understanding of these underlying beliefs can also help to clarify in what respects and to what extent a synthesis is not probable, or in any event requires further discussion. Bearing in mind both these requirements, action theories (interpretive frames) are introduced at this point as a classifying concept which can be used to make visible the relationship between specific positions and more generic notions and preferences.

The nature of the central methodological approach for an interactive TA follows directly from this: a process of repeating circles of argumentation in which underlying beliefs and preferences are explicitly raised as the subject of discussion. This is an excellent method for discovering syntheses, joint constructions. Other methodological guidelines concern the preconditions that are needed for, or contribute towards, the production of good joint constructions:

1. The analysis process should preferably take place in a natural constellation.

2. The analyst must know how to combine openness and a detached attitude towards all the participants with the ability to keep the process moving: and also, sometimes, with the ability to respect limits on the content of the analytic process.

3. The methods and techniques used must be comprehensible to all the participants.

4. The analyst is advised to draw on his/her own experience, knowledge and intuition in interpreting the findings, especially in the initial stages of the process.

The last two guidelines concern the result of the TA. Firstly: that result is a joint construction, and hence a conclusion or recommendation that is the result of an interactive analysis to which all the participants have contributed. Secondly: in order to influence parties in the real world who have not been involved in the process, the end product must be designed such that the learning process the participants have undergone can be transmitted to non-participants: transfer of learning.

What quality criteria should an interactively conducted analysis satisfy? The process of repeating argumentation circles is a kind of guarantee of quality in its own right, since this process involves constantly checking whether the constructions are acceptable in the eyes of the participants, and it also weeds out any mistakes and unintentional bias on the part of the TA analyst.

Several further criteria can also be specified for the process:

- Were all the participants equally capable of helping to generate the analysis?
- Did the process cause the participants to change their views, when this proved to be instrumental to a more tenable standpoint or greater consensus?
- Have the participants gained more understanding of each other's views?
- Has the TA process inspired creativity and readiness for action?
- Has the TA process helped to find ways to equip the parties for action?

As is described in Chapter 4, these methodological guidelines can be applied in a wide variety of ways. The practical examples presented there differ widely, both in terms of the methods and techniques used, and in terms of the amounts of time, money and resources
required. The results also vary, from purely qualitative to highly quantitative.

The series of steps that make up an interactively conducted TA can be presented in the form of a step-by-step plan. Chapter 5 contains a sample step-by-step plan, but it should be noted that each step must be seen and interpreted in the light of the methodological guidelines already discussed. In practice, therefore, one may well wish to deviate from the given sequence and repeat particular steps. Nevertheless, the following step-by-step plan provides a basis to work on:

1. Draw up a contract with the commissioner or client.
2. Organize the research work.
3. Decide who is to take part.
4. Develop effective joint constructions.
5. Test and improve the joint construction.
6. Single out points of agreement.
7. Draw up an agenda for the remaining points.
8. Collect new information, or inspire new insights and basic attitudes.
9. Prepare for the discussions between all the participants.
10. Convene one or more discussion sessions.
11. Produce an effective end product that emphasizes the unique qualities of the interactively conducted TA.

Practical recommendations are given for preparing the steps of the step-by-step plan. Besides specific indications and considerations to be taken into account when defining the steps, these recommendations also include a range of diverse methods and techniques. Most are not themselves of an interactive nature, but they can be used in an interactive project. We only presented a limited collection of methods and techniques here; little experience has yet been built up with interactive forms of TA. Nevertheless, the knowledge and insights presented here provide a sufficient basis for embarking on this adventure wisely, and for discovering new approaches.

**Literature**


Caplan, N. (1979). The two communities theory and knowledge utilization, American Behavioural Scientist, 22 no. 3., pp. 459-470


Kensing, F. M. Kyng (eds.), work shops and metaphorical design. Systems.


Man, R. de. (1987). Wasmiddelen, technologische innovaties en maatschappijlik sturing: de vervanging van fosfaten (Detergents, Technological Innovations and Public Steering: the Replacement of Phosphates), Chapter 4 in Daey Ouwens et al., pp. 31-56.


Schot, J. (1995). *Wat is CTA en wat heeft CTA te bieden? (What is CTA and What Does it Have to Offer?)*, internal paper, University of Twente, Centre for the Study of Science, Technology and Society.


Notes


2. Here, *synoptic* refers to the technical term for the type of decision rationality just described: *synoptic rationality* (or comprehensive rationality) refers to actors basing their decisions on a comprehensive and complete understanding of their action options and the effects of those options. This contrasts with the approach based on limited rationality.

3. In particular, see socio-constructivist studies in the field of technology dynamics, as can be found in anthologies such as McKenzie & Wacjman (1985); Bijker et al. (1987); Bijker & Law (1992).

4. For example, see the work of Nathan Caplan (1979, 1982), William Dunn (1980), Lindblom & Cohen (1979) and Carol Weiss (1977, 1980). The journal *Knowledge: Creation, Diffusion and Utilization* which has existed for about a decade, focuses specifically on these types of issues.

5. This does not mean that an interactive TA would not be interesting to anyone else. Indeed, the interactive method used will make the results interesting to all those involved, also when the primary client is parliament. Moreover, an interactive TA can be conducted for the benefit of a company or social organization for example. The insight provided by an interactive TA might also be of benefit to them when developing a strategy.

6. If they act primarily from a political perspective, the taxonomy referred to in the first part of this section applies.

7. This summary implies all the brief remarks contained in the previous section: complete agreement is not always possible; the group of participants can never fully reflect the real-world situation and there will always be a difference between the 'power-free' space created during an interactive TA and that which exists in the real world. We will not refer to this again here or elsewhere in this guide. See also Section 1.1.

8. This view of human rationality has, in recent decades, gained a lot of support both in philosophy of science (see for example philosophers of science such as Thomas Kuhn (1962) and Imre
13. A good insight into these discussions is given by Bernstein (1983). This so-called hermeneutic vision on rationality has also been developed by researchers that studied the way highly educated professionals work. Donald Schon, for example, investigated empirically how professionals like psychotherapists, engineers, managers, planners and architects address problems. Similar descriptions of 'reflection-in-action' have been made for policy makers (Harmon, 1980) and advisers on ethical problems (van Willigenburg, 1991, and Arrington, 1990).

14. Here, the term 'contract' is not meant in a formally legal sense per se: it might also be a 'project plan'.

15. In this context, 'points' are combinations of problem aspects and solutions as put forward by the various actors.

16. The situation where the question is not current but relates to the relative past is a special case. Such consistency verification, together with a thorough knowledge of developments in the past derived from other sources as well, can help detect and rectify incorrect or incomplete assumptions.

17. Specifically for the way in which such information must be collected for the purpose of an interactive analysis, we refer to Guba & Lincoln (1981: Chapters 6-8, 11). For more depth, we refer to the literature in the field of social science focusing on qualitative research methods and techniques in particular: in addition to the literature referred to by Guba & Lincoln, we refer here to Chubin et al. (1986), Van Dijk et al. (1991), Junne (1986), Schatzman & Strauss (1973), Segers (1989), and Yin (1994: Chapter 4). Because interviews play such a crucial role in interactive TAs, we would like to add a number of works in which open interview techniques are nicely described to the list: Weiss (1994: Chapters 3-5) and Meulenberg (1990). Researchers who have little experience with such interviews would do well to practice the techniques, perhaps under a professional trainer's supervision.


19. Guba & Lincoln (1981) distinguish various types of descriptors (concerns and issues); in their book published in 1989, they add: claims, which can be seen as problem definitions and solution assessments. They also refer to values, to be compared with part of what we have referred to in this guide as the second-order notions of an action theory.


21. This is on the same track as the epistemological tradition with which the idea of interactive analysis has the closest link. According to Bernstein (1983), in the hermeneutic tradition, reflection on concrete actions (praxis) is the source of more fundamental discussion (phronesis) between various value systems.

22. It should also be noted that, in its report, the WRR, in departure from cultural theory, argues that based on the issues at hand, a particular scenario should be selected. In contrast, the 'requisite variety' principle used in the field of cultural theory states that a
society benefits when an issue is approached from all ideal types of perspectives. The latter idea corresponds more closely with the idea of interactive TAs.

23. In terms of cultural theory, the egalitarian (maintaining the scenario of the WRR) culture is highly under-represented.

24. This can take place in addition to or instead of discussing those constructions with individual participants.