SPSD II

SCIENCE AND PRECAUTION IN INTERACTIVE RISK EVALUATION - SPIRE

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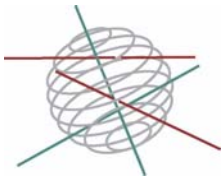
SUPPORTING ACTIONS

SCIENTIFIC SUPPORT PLAN FOR A SUSTAINABLE DEVELOPMENT POLICY
(SPSD II)



FINAL REPORT

SPIRE – Science and Precaution in Interactive Risk Evaluation

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1. Introduction

Context

In late-modern societies new scientific and technological applications often provoke risks. Some of these risks are well-known, others are not. The latter kinds of risks are characterized by many - fact-related as well as value-related – uncertainties. Therefore, they can be classified as 'unstructured' problems. Various risks, moreover, imply a threat to the ideal of Sustainable Development, because the negative effects they possibly induce are irreversible and can, together with other negative effects, have cumulative and synergetic effects.

The ideal of Sustainable Development invites us to reconsider the role of scientific and technological knowledge with respect to the evaluation and management of technological risks. This reconsideration is needed in both the public and the private context. We should reinvestigate the role and functioning of scientific advisory councils within a context of both public policy and private enterprises. Therefore, the research question that is put forward in this project proposal is the following: how can scientific knowledge be appropriately applied to resolve complex and unstructured problems concerning the evaluation and management of technological risks? The inherent uncertainties of complex and unstructured problems prompt us to take the Precautionary Principle as a normative starting point.

Objectives

The aim of our research was to develop guidelines for the organization of the process of scientific advising. Our research project contributes to procedures in relation to risk evaluation and management that are both scientific and precautionary. This implies that we challenge the often raised contrast between science and precaution.

Our research project was split up into two parts:

- Implementation of the Precautionary Principle in scientific councils advising public authorities: this part of the research focuses on the interactions between academic scientists, scientists within civil services and political representatives (STEM focus).
- Consequences of the implementation of the Precautionary Principle by public policy for companies: this part of the research focuses a) on the interactions between privately funded experts (experts internal and external to the enterprise in question) and the private enterprise and b) on the interactions between privately and publicly funded experts (experts of relevant civil services) (FTU focus).

Outcomes

The SPIRE-project yielded three types of results:

- *Theoretically derived precautionary guidelines*. Several topics have been the object of a literature study: the conceptual, legal and judicial history of the Precautionary Principle, resemblances and differences between prevention and precaution, ethical theories founding the Precautionary Principle, Precautionary approaches, the nature of scientific knowledge, characteristics of Risk Societies, the meaning of trust in democratic institutions, models of interaction between science and policy. Out of the results of this literature study we derived preliminary guidelines for the organization of processes of scientific advising.
- *Empirically gathered precautionary practices*. Each research team analysed cases (some concerning the relationship between scientific advisory committees and public authorities and some concerning the relationship between private experts, public experts and private enterprises). The aim of these case studies was:

- to investigate the practical implementation of the precautionary principle in scientific advisory councils in a public as well as private context
- to make an inventory of bottlenecks concerning the translation of the precautionary principle in processes of scientific advising in both contexts.
- *to define policy oriented precautionary guidelines.* One of the chapters of the final report (chapter 6) is designed as a guide with suggestions for a precautionary use of scientific knowledge concerning technological applications and their possible risks. These guidelines can help the actors concerned to make a critical assessment of their own current procedures. A French version and a Dutch version of this chapter are annexed to this final report.

2. A theoretical framework

2.1 Risk Society

Industrial societies are complex societies at the beginning of the 21st century. In 1986 sociologist Ulrich Beck introduced the concept 'risk society' to describe them. Typical for late-modern industrial societies is the frequent occurrence of risks. Environmental and health risks nearly systematically accompany new scientific and technological applications. We cannot any longer regard such risks as exceptions, excesses or manageable negative side effects of a far advanced process of industrialisation. Moreover, these risks are far reaching. The reverse of late-modern scientific and technological success is a fragile world: we are able to destroy the whole planet earth, to influence biodiversity thoroughly, to make a proper mess of climate. The conclusion that risks are more frequent and more intense than ever before urged Beck to make mention of a new type of society: risk society.

Many risks in a risk society are of a new type. They are not directly observable through the senses. They are of a collective nature: nobody can adequately shield from them. They are irreversible and extend in time and place. They are pre-eminently complex. Consequently, scientific and technological experts find themselves in an ambiguous position. Scientific and technological experts are both the originators of possibly huge harm and at the same time risk societies need their expertise to detect harm and to look for possible solutions. Scientists are, moreover, not able to respond adequately to the uncertainties characterizing these new risks. Firm scientific foundations are lacking: knowledge gaps exist and/or scientists find themselves at odds with each other.

Next to scientifically induced risks, late-modern societies are characterized by social risks. Two trends can explain these social risks: individualisation and de-traditionalisation. The traditional authority of church, (extended) family, political parties and science vanished. In the past they provided for a relative predictable future. The introduction of the welfare state, however, allowed citizens to delineate their private life plan, to free themselves from tradition and to draft their own biography. For many people, this freedom became an obligation. Citizens have to invent their own responses and to make private choices to organize both their private and their public lives. They are continuously confronted with new challenges and new (social) risks.

According to Beck and Giddens, risk societies are the product of an extreme process of modernization. Extreme modernization ends in what Beck calls 'reflexive modernisation'; Giddens prefers the concept of 'institutional reflexivity'. The concept of 'reflexivity' helps to interpret the institutional problems of a risk society.

The concept of reflexivity refers to a radical transformation of industrial societies (Beck *et al* 1994, 2-13). This transformation is not intended nor planned. It happens unnoticed and is induced by the same forces and institutions that set up industrial society.

Beck distinguishes two stages in this process of reflexive modernization. In the first stage the current institutions of industrial societies systematically produce negative effects and threats, without them to become the object of public debate or political conflict. The notion of an industrial society still prevails. This notion allows that risks and threats become more frequent and are understood as side-effects. This stage is the stage of a 'residual risk society'. The second stage starts as soon as the dangers of an industrial society become dominant topics of political, public and private conflicts and debates. The conviction that some characteristics of industrial societies are not acceptable gets firm ground. At the one hand societies continue to take their usual course. On the other hand the many conflicts provoke a questioning of the judicial system and of public policy. At the same time awareness grows that current industrial societies are not capable of managing existing dangers.

The second kind of reflexivity takes place in deliberative processes in the public and political field. The aim thereof is to reduce existing tensions between the foundations of late modernity and their effects. This aim is based on the presupposition that society is able to regain some autonomy against the processes that are responsible for a continuing modernisation. It presupposes, among other things, a deeper insight in existing relationships between politics and economics or, in other words, between the powers of argument and the powers of the market. In late-modern societies, the powers of argument get deformed by the powers of the market (Deblonde 2002). The logical hierarchy that exists between politics and economics – politics as defining the preconditions for economic acting – is, with the dominance of free market ideologies in western countries, translated in a reversed practical hierarchy – economic reality and its power relationships heavily influence the preconditions for political acting. A first necessary condition for repairing the powers of argument and, consequently, restoring the foundations of modernization is to make the powers of the market explicit and how they formally and substantially influence policy processes.

Beck distinguishes between two stages of reflexivity in order to stress that the concept of reflexivity does not refer in the first place to a cognitive process. The concept refers in the first place to the fact that inherent dangers and threats of industrial societies confront modern institutions with themselves. Modern institutions bump into their own limits. This self-confrontation implies that it is impossible to manage these effects from within existing institutions.

The concept of risk society questions, among other things, the institutions of science and politics. Trust in scientific knowledge and in societal applications thereof gradually got affected. Modern sciences that are a driving force in industrial societies bump into the limits of their own success. They not only generate products and processes. At the same time they bring about all kinds of risks and accidents. Scientific progress does not any longer automatically stand for societal progress. In short, public trust in the ethical quality of scientific applications is unsettled.

Scientists' inability to provide certain knowledge further undermines the traditional authority of science. The more complex the research domain is and the longer the interval of time of predictions required for, the more difficult it is to supply risk analyses that are reliable and acceptable for various parties concerned. Boundaries between scientifically founded predictions, informed guess, prophecy and scientific fantasy become blurred.

This fading trust in science and technology puts political authorities in a difficult situation. People expect them to manage risks and uncertainties adequately. Who defines, however, which actions are adequate. Since scientists are not able to provide public authorities with unambiguous answers, final decisions will be of a political nature (Von Schomberg 1997). But politicians and their civil servants cannot do without the assistance of scientific and technological experts. This instrumental appeal on experts will however confront them with dissenting opinions of other societal actors that make an appeal to their own scientific and technological experts. Finally the political reflex to call on the authority of science turns out to be noxious to both science and politics. 'Science loses its authority because it speaks with different voices. It cannot relieve political debates, but it constitutes a strategic source of which one has to dispose inevitably' (Von Schomberg 1997, 136).

Fading trust in public authorities does not only relate to scientific controversies. Economic globalization on the one hand and individualization – resulting from de-traditionalisation and cultural globalisation - on the other are likewise responsible. National authorities seem too small to react on the effects of economic globalization and too big to deal with local situations. The centre of political processes seems to shift both to larger (IMF, WTO, World Bank) and smaller (self help groups, new social movements, action groups) unities. Beck introduced, therefore, with regard to the latter shift the concept of 'sub-politics' (Beck *et al.* 1994, 13-23). Sub-politics is a bottom up politics that occurs outside the official political institutions. Policy decisions

taken by parliament, government or segregated interest groups become discussed, questioned and contested by enterprises, scientists, the media, courts and individual citizens. Sub-politics do, hence, not refer to the assignment of a restricted political mandate to persons or groups that do not belong to the official political institutions. It refers to a bottom up politics that partly has taken over the steering powers of centralized, national public authorities. Sub-politics are occasional participations at political discussions by unexpected actors.

2.2 Scientific knowledge

A social-constructivist interpretation of science

Risk societies invite us to think over the nature of scientific knowledge. Their reflexivity supports a constructivist interpretation of science. A constructivist interpretation recognizes that scientific concepts, laws and theories are socially constructed. This implies, to start with, that they are never neutral, but result from particular value-laden perspectives. Since the perspective influences the theory and many perspectives are possible, many theories can exist that are both valid and that nevertheless are not simply consistent with each other. Moreover, the choice for a particular theory cannot be justified in a scientific way.

It implies, further, that scientific objectivity should not be understood in the sense of an unequivocal reflection of reality. Scientific knowledge is objective to the extent that it enjoys a certain consent within a particular scientific community. Scientific objectivity means intersubjective consent. This consent depends on a variety of decisions that cannot be justified in a completely rational way. This interpretation of scientific objectivity explains why scientific theories are always susceptible to revision. The common acceptance of particular facts, laws and theories as scientific ones depends on processes of negotiation. During these processes factors such as power, rhetoric, charisma, financial means play their part. These processes are needed to close scientific disputes.

A social-constructivist interpretation of scientific knowledge does not necessarily result in total relativism. Striving for scientific objectivity, i.e. for intersubjective consent, remains indispensable, because it implies a continuous testing of scientific statements. A constructivist interpretation of science does, however, urge scientists as well as public authorities and the wider public to consider deviating insights and a plurality of value-laden scientific perspectives.

Unstructured and/or complex problems

In scientific literature one distinguishes between structured and unstructured problems. In case of structured problems, the problem definition is hardly questioned. Various parties consent with each other concerning relevant facts and values. Consequently, agreement exists concerning relevant scientific disciplines and disciplinary paradigms. The opposite is the case with unstructured problems. Moreover, unstructured problems are often complex problems. This implies that experiments that take place under laboratory conditions provide insufficient insight in existing complexities. On the other hand, experiments that take various complexities into consideration are for actual or ethical reasons not practicable. In case of complex problems the laboratory extends to real life and in real life one is not allowed to experiment unrestrictedly. Consequently, in case of complex situations scientists do not dispose of methods to test their hypotheses, to produce ‘facts’ and to confirm or falsify theoretical laws.

Unstructured (or complex) problems provoke various types (and typologies) of uncertainties (Craye *et al.*2001a, 18). Stirling, for instance, distinguishes between uncertainty, ignorance, indeterminacy and incommensurability. In case of uncertainty the chance that identified harm will occur is not sufficiently known. In case of ignorance not only uncertainty exists concerning this chance; one does moreover not know whether all possible harm is taken into consideration. In case of indeterminacy the evolution of complex systems cannot be determined, not because of a lack of knowledge, but because of the nature of the systems themselves. Systems can be

chaotic or near to border situations, or they can be unpredictable because of human interventions. Incommensurability refers to the impossibility to translate various disciplines or paradigms into each other, to reduce one discipline or paradigm to another one or to construct one big, overarching theory. Scientific theories are not mere partial descriptions and explanations of reality; they are perspectivist in nature and, for that reason, incomparable. The norms and values constituting the diverse perspectives are responsible for this incomparability.

Funtowicz and Ravetz distinguish two types of uncertainties. The first type emerges where the acts of observation and analysis become part of the activity of the system under study and so influence it in various ways. Think, for instance, of the phenomenon of self-fulfilling prophecy in reflexive social systems. The other type, that is more characteristic of complex systems, derives from the fact that any analysis and observation must deal with an artificial, usually truncated system. The concepts in whose terms existing data are organized will only accidentally coincide with the boundaries and structures that are relevant to a given policy issue. Consequently, they need interpreting or massaging to make them relevant to the problem at hand. Along with their obvious, technical uncertainties resulting from the operations of data collection and aggregation, the data will have deeper, structural uncertainties, not amenable to quantitative analysis, which may actually be decisive for the quality of the information being presented.

The analysis that a plurality of legitimate perspectives exists, parallels the constructivist idea of science. The criteria for selection of data, truncation of models, and formation of theoretical constructs are value-laden, and the values are those embodied in the societal or institutional system in which the science is being done. No unique, privileged perspective on a system exists. This is, according to Funtowicz and Ravetz, not a proclamation of relativism or anarchy. It is rather a reminder that the decision process on environmental policies must include dialogue among those who have an interest in the issue and a commitment to its solutions. It also suggests that the process towards a decision may be as important as the details of the decision that is finally achieved. The task of decision makers is to recognize the various perspectives and to find or create some overlap among them all, so that there can be agreement or at least acquiescence in a policy. For those who have this integrating task, it helps to understand that this diversity and possible conflict is not an unfortunate accident that could be eliminated by better natural or social science.

These two key properties of complex problems, radical uncertainty and plurality of legitimate perspectives, show why environmental policy can not be shaped around the idealized linear path of gathering and applying scientific knowledge.

Normal and Post-normal Science

The concept of post-normal science is introduced by Funtowicz and Ravetz as a scientific approach that is suitable for environmental policy under conditions of complexity[1].

The insights leading to post-normal science are that, in the sorts of issue-driven science relating to environmental debates, facts are uncertain, values in dispute, stakes high and decisions urgent. Consequently, the conditions are not normal, neither for science nor for policy. In “normality” the process is managed largely implicitly and is accepted unwittingly by all who wish to join in. This assumption of normality does not hold in relation to the environment.

[1] See http://www.nusap.net and:

Futures, 1999, Special Issue: Post-Normal Science, J. R. Ravetz (ed), 31:7.

Funtowicz, S.O. & Ravetz, J.R. (1992). Three Types of Risk Assessment and the Emergence of Post-Normal Science. In S. Krimsky & D. Golding (eds). *Social Theories of Risk*, Westport (CN), Praeger, pp. 251-273

Funtowicz, S.O. & Ravetz, J.R. (1993). Science for the post-normal age, *Futures* 25:7, 739-755.

Funtowicz, S.O. &Ravetz, J.R. (1997). The Poetry of Thermodynamics, *Futures*, 29:9, 791-810.

Under post-normal conditions the previous distinction between "hard", objective scientific facts and "soft", subjective value-judgements is inverted. We must often make hard policy decisions where our only scientific inputs are irremediably soft. Under such conditions the normal-scientific goal of achieving truth or at least factual knowledge may be a luxury. The guiding principle of post-normal science rather is 'quality'. Here, quality refers to process at least as much as to product. In complex environmental policy issues, where neat solutions are lacking and support from all stakeholders is required, the quality of the decision-making process is absolutely critical for the achievement of an effective product in the decision. This quality relates to the extent that the decision-stakes of the various people concerned are reckoned with. It depends on open dialogue between all those affected, the "extended peer community".

The concept "post-normal science" summarizes very well in what sense a scientific approach tailored to the principle of Precaution differs from the usual or "normal" scientific approach. Post-normal science does not imply a rejection, but rather a broadening of the normal scientific method. Sketched briefly, one can grasp this broadening under the following three denominators: 1) not only quantitative, but also qualitative information, 2) no rigorous separation between facts and values, and 3) from an external to an internal perspective. We will amplify on these three dimensions in the following three paragraphs.

To start with, a precautionary approach requires, besides an analysis of risks, insight in relevant uncertainties. "Normal" sciences soon interpret uncertainties as deficient scientific information (Funtowicz en Ravetz quoted in Tickner 2003a). Where uncertainties pop up, one is inclined to underestimate the research results, to deny the existence of a problem or to minimize the importance thereof. A prerequisite of a science tailored to precaution is that scientists recognize uncertainties. A post-normal science ought to be explicit about uncertainties and possible mistakes. It should provide a more embracing quantitative and qualitative analysis and description of a) the sources, the type and the degree of uncertainties, b) the feasibility of reducing uncertainties with the help of further research, and c) the implications of uncertainties. In traditional risk analyses stress is on quantitative, statistical information. Effects that cannot be quantified often disappear beyond "normal" scientists' scope. At the same time quantitative analyses do not provide the kind of information that is relevant in a context of public policy: information concerning the meaning of quantitative results and the extent and type of evidence these results are based on, concerning the factors that lead to these results, concerning the specific context the results are valid for, concerning the meaning of these results for specific groups and individuals. Certain aspects of scientific knowledge – for instance regarding the complexity of a problem, the interconnectedness of various relevant factors, the experience the scientific judgement is based on – cannot simply be presented in a numerical way.

Second, normal science is based on the positivist supposition that facts can be separated form values. Post-normal science recognizes that facts and values can at most be distinguished, but not separated. Observation and description of facts are not unrelated to the perspective – and hence to values and norms – of the observer. Various perspectives, domains of relevant phenomena and decision contexts lead to various descriptions. These descriptions are non-equivalent (Haag & Kaupenjohann 2001). No privileged methodical approach of complex systems exists that results in one single objective description. Various perspectives lead to various, legitimate descriptions. Consequently the quality and validity of scientific information concerning uncertainties is under debate. One can only decide on quality and validity in a debate representing different scientific disciplines and actors concerned. "Quality control can no longer be performed by a restricted corps of insiders [...] Knowledge of local conditions […] can also determine which data is strong and relevant" (Funtowicz en Ravetz, quoted in Haag & Kaupenjohann 2001). Post-normal science replaces the instrumental and strategic rationality of a normal scientific approach with a communicative rationality. Consultation of and discussion between the various actors concerned are needed to identify relevant phenomena, to define the problem and to frame the observations. Consequently, post-normal science implies a participative approach. It, moreover, makes higher demands on transdisciplinarity (Tickner

2003a, 11). It does not suffice to put insights form different disciplines next to each other. It is important to come to an integration of insights. It is, finally, not compatible with a strict separation between assessment and management of risks and uncertainties.

Finally, normal science is built up from the perspective of an external observer (Haag & Kaupenjohann 2001). Scientists are outsiders with regard to their research domain. This allows them to describe their research domain in terms of constant, essential features and regularities. The system described is caught in a static model. Post-normal science, on the contrary, considers the research domain to be variable, developing, open to new phenomena and characteristics. Post-normal scientists understand themselves as part of their research domain. They are no external, but internal observers: their observation co-influences the evolution of their research domain. This implies, to start with, that post-normal scientists make use of procedures that allow them to detect new phenomena (e.g. monitoring) and to integrate new scientific and experiential knowledge and changing political concerns (Tickner 2003a, 14-15). This implies, secondly, that they strife for a contextualized scientific knowledge (Haag & Kaupenjohann 2001). In case of complex problems, the reliability of information does not depend so much on its universality, i.e. its independence from concrete circumstances in a specific human and natural environment. It depends, on the contrary, on its sensibility to the concrete and local. The value of scientific models and knowledge depends on the specific policy problems to which they apply and the specific social, economic and ecological context in which they occur. Here again the importance of participative procedures is shown: a variety of internal perspectives helps to tailor the problem definition and the scientific approach to the local situation.

A precautionary approach calls for an adapted, i.e., "post-normal" scientific approach. Post-normal science meets other needs than normal science does. For that reason Nowotny suggests that an institutional distinction is needed between academic science (mainly built on a "normal" scientific approach) and public policy science (mainly based on a "post-normal" scientific approach) (Nowotny 1999 quoted in Haag & Kaupenjohann 2001).

2.3 The Precautionary Principle

Definition

Since the Stockholm Conference for the Environment in 1972 the concept 'Precaution' can be found in many national and international policy texts, texts regarding pollution of the seas, climate change, loss of biodiversity, dangerous chemicals and introductions of genetically modified organisms. An influential description of this principle is the one mentioned in the 'Bergen Ministerial Declaration'[2]: 'In order to achieve sustainable development, policies must be based on the Precautionary Principle. Environmental measures must anticipate, prevent and attack the causes of environmental degradation. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'.

Various definitions of the Precautionary Principle exist (Sandin 1999). According to Sandin, they can be reformulated as a statement consisting of four dimensions: '*If* there is (1) a threat, which is (2) uncertain, *then* (3) some kind of action (4) is mandatory'. The various definitions differ, according to Sandin, with respect to the precision and strength of these four dimensions.

O'Riordan explains the difference between the various definitions in another way (O'Riordan *et al.* 2001). According to this author, the history of the Precautionary Principle has

[2] *Ministerial Declaration on Sustainable Development in the ECE Region*, United Nations Economic Commission for Europe, Bergen, May 1990. (This definition is quoted in Sandin 1999, p. 903). This definition is partly repeated in the Rio Declaration on Environment and Development, 1992, though the concept of 'measures' is replaced by the concept 'cost-effective measures'.

shown a gradual shift. Initially the principle functioned within a perspective of ecological modernisation. Now it derives its meaning more from a perspective of sustainable development. This distinction is not unimportant. Ecological modernisation is based on a political and technological philosophy that holds a specific vision on the robustness or fragility of ecosystems and that is rather confident in the technological capacity to allow for a rising wealth production without damaging the carrying capacity of the environment. Sustainable development is a concept of which the starting points differ sufficiently. 'Above all, sustainability applies to the maintenance of life support from within its own capabilities, the protection of social trust and connectedness, or their restoration when these have been damaged, and the emergence of an economy guided by natural principles, linking global processes to local autonomy' (O'Riordan *et al.* 2001, 14).

We doubt whether the application of the precautionary principle is nowadays really linked to the concept of sustainable development (though the Bergen definition suggests the opposite)[3]. We will explain our doubt later on, where we analyse some policy texts that are relevant for the Belgian context (see the section 'Precaution and policy documents' under 2.4).

To conclude, the precautionary principle is meant to (legitimize and) orient public action in case of scientific and societal uncertainties, i.e. when societal controversies exist regarding relevant values and scientific disputes concerning relevant facts and perspectives.

Precaution versus Prevention

Precaution is not the same as prevention. The distinction between structured and unstructured problems helps us to clarify the difference between both concepts. Prevention applies to structured problems, while precaution is a guiding principle in the case of unstructured problems. Since intermediate forms exist – badly and moderately structured problems – it is not always obvious where prevention stops and precaution starts.

Table 1 – Structured and non-structured problems

		Consensus concerning values	
		No	Yes
Consensus concerning empirical data	No	**Unstructured problems** Learning policy	**Moderately structured problems** Negotiation policy
	Yes	**Badly structured problems** Pacification policy	**Structured problems** Regulation policy

A Precautionary Ethics

According to Boehmer-Christiansen the German concept of *Vorsorge* integrates three meanings: caring for or looking after, fretting or worrying about and obtaining provisions or providing for (Boehmer-Christiansen 1994, 34). The interpretation of these three verbs in concrete situations depends on the value framework one holds.

Responsibility for the future

Hans Jonas gave the Precautionary Principle an ethical base in his book *Das Prinzip Verantwortung* published in 1979 (Hergon et al. 2001, 438-439). In the view of Jonas, the ethical base of the Precautionary Principle is an ethics of responsibility. An ethics of responsibility is needed, according to Jonas, because of the technological capabilities present in our modern western societies (Jonas 1984). Contrary to pre-modern times, human technological

[3] See also Deblonde. & du Jardin (2005).

and scientific powers are such that the natural conditions of human existence can be altered, either gradually or suddenly. Nature – both the nature of living beings and their environment - proves to be susceptible to the interferences of modern technologies. We are capable of radical changes, both in the short and the very long run and both locally and globally. And because we are capable, we are responsible. It is the dimension of modern, industrial technological powers and the possible threats they entail for the natural conditions of human existence that make a recalibration between the values and choices inherent in technological applications on the one hand and human concerns and expectations on the other unavoidable.

From now on, according to Jonas, acting technologically is acting in an ethically sensitive way. Our responsibility for humans urges us to take responsibility for nature, since human conditions of existence depend on it. However, this responsibility does not any longer remain restricted to what happens here and now, because the – often unpredictable, cumulative and irreversible - effects of our technological actions extend widely in time and space. Our responsibility is, therefore, a responsibility for the future arising from our collective technological acting.

Responsibility for the future as culpable ignorance

This responsibility is, moreover, rather handicapped, for our technological power for acting largely goes beyond our scientific power for predicting the effects thereof and our moral power for judging them. Ian Hacking's concept of 'culpable ignorance', nevertheless, prevents an easy evasion from our responsibility because of this handicap (Kaiser 2003). The responsibility connected to the Principle of Precaution is an example of 'culpable ignorance'. 'The precautionary principle implies the need, as a matter of cultural change, for society's institutions to enlarge existing notions of ethical responsibility to encompass these unknowns, which are predictable in principle even though not in specifics' (Harremoës 2002, 215).

A rupture?

Jonas does not convince us completely. We admit that the scope of modern technological effects on the natural conditions of human existence, both in time and in space, is many times larger than it was before. This conclusion, however, does not justify the radical rupture Jonas seems to draw between modern and less modern technologies. In his view modern technologies are ethically sensitive, while previous ones are not. In our view, not only modern technological applications can induce societal discontent. Throughout human history we can find examples of technologies that had very negative effects on the conditions of existence of particular groups in society. Admittedly, these conditions of existence are often no less related to social than to natural circumstances. We see, however, no reason why our technological capability of changing social conditions is less important than our technological capability of changing natural conditions. Both capabilities (or both dimensions of our capabilities) can induce the need for a recalibration between technological applications and societal expectations. Both capabilities imply responsibilities.

The relevance of the economic context

And sure, the social or natural effects of a technological application are not necessarily intrinsically connected with the technology itself. The economic context in which and the economic objectives for which a specific application is selected and put into action can often (help to) explain the extent and gravity of its effects. Not so much our technological acting, but our technological acting within a particular economic context is an ethically sensitive acting. The need for a recalibration exercise thus rather emerges from a lack of adjustment of the norms

and values embodied in the economic freedoms to select and implement particular technological applications on the one hand and (considered) societal norms and values on the other[4].

Sustainable Development as the sense of the recalibration exercise

According to Jonas, the sense of a recalibration exercise is to safeguard the humanity of the conditions of existence of both present and future generations. Maintaining humane conditions of existence (in the near and far future) has become a decision criterion for our technological acting. This responsibility is total, continuous and future-oriented.

We could apply a more recent terminology to Jonas' ethics of responsibility: the sense of a recalibration exercise is sustainable development. The responsibility emerging from our technological possibilities regards the realisation of sustainable conditions of existence. This responsibility does not remain restricted to the natural/environmental dimensions of human conditions of existence, it regards no less their social and economic dimensions.

A public ethic

The ethics of responsibility for sustainable development belongs to the sphere of public policy, not so much to the private sphere of human relationships. It applies to the collective acting of humans because of the possible effects of this collective acting on the continued existence of humanity. This interpretation sounds like an anachronism. We are not used any more to think of public authorities as moral entities. We are rather used to interpret public authorities as utilitarian institutions that should defend the safety of their citizens, but without interfering with the (predefined) freedoms of producers and consumers[5].

An ethics of co-responsibility

The ethics of responsibility for sustainable development is, moreover, an ethics that should be publicly defined or, in the words of Mitcham and von Schomberg, an ethics of collective co-responsibility (Mitcham & von Schomberg 2000). In order to make the concept of sustainable development concrete with regard to technological developments, public debates are needed. Individual scientists, engineers and experts cannot take responsibility for their discoveries and engineering designs, because these discoveries and designs get transplanted into the subsystems of economy, politics and law and, hence, transformed according to the specific logics of these subsystems. These system logics are not traceable to the intentions of particular individuals, nor are the possible, but unintended and often not assessable consequences of the transplanted and transformed scientific and technological applications.

Therefore, all citizens should respond personally. Personal responsiveness means that individual participation in public debates is the default position: persons must give reasons for being excused from such a duty. Public deliberation serves the function of presenting different relevant issues to the more or less autonomous systems and subsystems of society, i.e. to politics, law, science, and so on. Appropriate exchanges between the various subsystems and the wider public are needed. Representatives of these subsystems need to respond to publicly identified and articulated issues. Conversely, they are drivers for new debates when they publicize particular aspects of an issue that cannot be fruitfully resolved within the limits of the typical specialized discourse of the subsystem they belong to.

Sustainable Development is the sense, Precaution is the attitude

Sustainable development is the *sense* of our responsibility; precaution is the *attitude* that is necessary in order to realise it.

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[4] See, for instance, the recent FAO report *The State of Food and Agriculture 2003-04* (http://www.fao.org/docrep/006/Y5160E/Y5160E00.HTM; date of consultation: 27/05/04).

[5] Compare with Calman & Smith (2001, 193)..

Why do we need to be precautionary? New technological applications place us before ever new situations. Consequently, in order to judge these new situations we cannot fall back on previous experiences. If our scientific predicting power were reaching as far as the causal scope of our technological acting, we would not need to be precautionary. This is, however, not possible. And this is, according to Jonas (and Arendt), not a completely new phenomenon. Scientific predicting power is by definition not adequate with respect to political acting: the spontaneity typical for political acting makes it 'irrational' from a scientific perspective. The possibly huge scope, both in time and space, and irreversibility of the effects of new technologies add, however, a new dimension. We are aware that present-day technological applications can possibly disturb the human conditions of existence thoroughly and without leaving us the opportunity to regain control. It is this dimension that urges us to take responsibility in a precautionary way.

What does such a precautionary attitude stand for? Since precaution is an attitude needed to realise sustainable development it should be translated into goal-oriented procedures[6]. In a goal oriented approach precaution plays its part during the whole process of selecting public goals and feasible alternatives. It does not only come in when there is sufficient evidence that a certain activity or technological application turns out to be sufficiently harmful. The central question is: which range of activities is feasible and acceptable to reach a specific goal? Considering a sufficient variety of alternatives in function of a predefined goal influences the quality of risk evaluations in a positive sense. Less reason exists to avoid uncertainties. It is important to make our uncertainties and ignorance – emerging from the lead of our technological power on our scientific predicting power – explicit with dedication of all the scientific knowledge and skills we have. However, every alternative is considered and the evaluation is not restricted to an evaluation of risks and uncertainties. The appraisal of possible advantages is as important. In addition the concept 'evaluation' gets a wider sense. Not only the effects for the environment or for human health are relevant for the goal aimed at, but also social, cultural, political, economic, aesthetic and distributive effects. The final decision regards the choice of the most promising alternative (or the most promising set of alternatives) in function of the goal aimed at. In this sense, a goal oriented approach stimulates technological innovation. A goal oriented approach presupposes a continuous learning process, for scientists concerned as well as for citizens and policy people. Since the implementation of various alternatives involves many uncertainties a continuous monitoring of effects is necessary. Some alternatives can be more and others less harmful than initially expected. Or it can turn out that one urgently needs to look for new alternatives. Cooperation from all sides of a society and transparent participatory political processes are a condition to achieve public environmental and public health goals.

Precaution versus science

The question how to make the precautionary principle operational provokes many discussions. The vagueness of the principle allows for divergent interpretations concerning the extent of societal changes needed ranging from rather small to very radical. This variety of interpretations occurs in a societal context in which citizens and stakeholders have different, often conflicting and important interests and divergent underlying visions. Consequently, it does not surprise the authors of the Stirling report that the value and utility of the principle became the object of an intensive and polarized debate (Stirling *et al.*1999, 6-9). An important matter in dispute is the question how a precautionary approach relates to scientifically founded policy. According to some authors, a precautionary approach is at odds with a scientific one[7]. Other authors contradict that a precautionary approach is not compatible with a rational, scientific method (Tickner 2003, xiv).

[6] The distinction is introduced by Mary O'Brien (O'Brien 2003).

[7] See, for instance, various contributions in Morris (2000).

This controversy between those who do and do not see a contradiction between a scientific and a precautionary approach is based on divergent interpretations of science. The former ones find that public policy should be based on 'sound science': scientific information based on (quantitative) risk assessments. The latter ones find that current 'sound science' practices fall short in various respects. Normal 'sound science' practices refuse to recognize the value-laden dimension of scientific controversies. They are rather reductionist and mono-disciplinary, so that they tend to lose sight of wider interconnections. They strive for reduction of uncertainties and tend to hide irreducible uncertainties (ignorance, indeterminacy, incommensurability) from view.

According to McGarvin, it does not make sense to ask whether the precautionary principle is scientific or not (McGarvin 2001, 44). In his view, as a principle, it is exactly that: a social norm to guide public policy. Science is simply a tool for testing assertions of fact. Scientific appraisal is needed in order to implement the principle: to assess the options available for providing a service. And this assessment will score better in terms of precaution in case the scientific approach represents a broad, multi-disciplinary framing of questions, is not summing incommensurable factors, evaluates in a methodical way all fields and claims to knowledge, avoids domination by any one discipline, implements defensive research strategies to limit exposure to ignorance, and fiercely strives for independence from interest groups.

2.4 Precaution and Public Policy

Science and Policy

Following Jürgen Habermas, two models of the relationship between science and policy are predominant: the technocratic and the decisionistic. According to the technocratic interpretation, policy is rational on condition that it is scientific. Policy argumentation must rely on scientific rationality, which predominates on other considerations (values, opinions, culture, etc.). According to the decisionistic interpretation, on the contrary, policy has to make value-laden choices. This interpretation is derived from the works of Max Weber. Nevertheless, even in the decisionistic model, sciences fulfil an essential role. Scientists are deemed to point possible choices and the consequences thereof out to persons engaged in public policy. In this way they provide public authorities with the necessary stuff in order to allow for well-funded political decisions. Both interpretations have the basic conviction in common that science is separated from politics and policy. Science offers neutral knowledge; public authorities use it. Science provides for "truth"; public policy negotiates about "values".

In the second half of the previous century philosophers of science developed a new interpretation concerning the relationship between policy and science (Craye *et al.* 2001a, 23). Since scientific knowledge is constructed by men of flesh and blood operating from specific social contexts, it is liable to influences of power and interest. In a certain sense scientists are part of the political process. Weinberg even speaks of a co-production of science and policy. For the questions scientific advisory committees should respond to, are formulated by one or more stakeholders in the policy process. Scientific research questions are not neutral, but socially constructed, value-laden entities. The values embedded in the social context influence the outcomes of scientific research. For that reason sciences cannot be considered apart from the context in which research questions are generated. There is not any longer a neat separation between science and policy. Instead of separation, there is a continuous interaction. Habermas termed this model of the relationship between science and policy *pragmatic*. In this pragmatic model the role of the wider public is indispensable. 'Dans le modèle pragmatique, les recommandations techniques et stratégiques ne peuvent s'appliquer efficacement à la pratique qu'en passant par la médiation politique de l'opinion publique. En effet, le dialogue qui s'établit entre les experts spécialisés et les instances de décision politique détermine la direction du progrès technique à partir de l'idée qu'on se fait de ses besoins pratiques, en fonction d'une certaine tradition, tout autant qu'il critique et mesure cette idée aux chances que la technique lui

donne de voir ses besoins satisfaits; et ce dialogue doit justement être en prise directe sur les intérêts sociaux et les orientations d'un mode vécu social donné par rapport à certaines valeurs'[8].

Trust

The many uncertainties surrounding scientific knowledge bring the concept of trust into prominence. Since science cannot provide political decisions with unquestionable information, the acceptability of both scientific input and of political decisions will depend on the extent that the wider public has confidence in the procedures leading to them. What does 'trust' in a democratic institution – as is for instance a scientific advisory committee - however mean?

Trust presupposes, to start with, openness and transparency. Both are needed to provide citizens with the opportunity to test existing relationships of trust and to restrict possible misuses. Trust in science and policy can only remain on condition that a healthy form of distrust gets institutionalised, for instance via the dissemination of information and the guarantee of openness and transparency.

Openness and transparency are necessary, but they are not sufficient preconditions for trust. Trust presupposes that citizens can agree with the norms and values – Offe talks about the *idée directrice* – that democratic institutions and procedures represent (Offe 1999). According to Offe 'truth' and 'justice' are the two fundamental values of which this *idée directrice* should testify. 'Truth' refers both to honesty – the search for truth and the elimination of intentional or non-intentional falsehoods – as to the 'keeping of promises'. 'Justice' refers both to impartiality as to solidarity.

Scientific research is one prominent and indispensable way to find out truth. Scientific 'objectivity', gained via known scientific procedures – the mutual controlling, testing, checking, questioning and doubting of preliminary scientific statements by members of a scientific community -, signifies, however, at most a timely consensus. It is, therefore, rather an ideal where scientists aim at than a matter of fact.

In case of complex problems scientists experience difficulties to keep to their promises. A minimal condition is that they actively search for factual and normative uncertainties. Only to the extent that scientists and experts render account of the limits of their knowledge and learning and succeed in making uncertainties explicit, will they be able to keep to their promises. Making uncertainties explicit preserves scientists from loss of trust in their predictive capacity. For that reason scientists cannot restrict themselves to risk analyses in the narrow sense of the word. Risk analyses ask for known causal relationships that can be applied to predict (possibly in a probabilistic way) the effect of a specific technological intervention. In case no causal relationships are known that predict an adverse effect – which is, for instance, often the case with genetically modified products – one declares the intervention safe for human health and the environment. Scientists restricting themselves to such risk analyses – and basing themselves chiefly on scientific certainties – are in danger of having to revoke their reassuring messages later on. This certainly does not encourage citizens' trust in scientists (Strand 2001).

Impartiality is not the same as neutrality. Scientific knowledge cannot be neutral, it is always value-laden. Elaborating on the work of the philosopher Hannah Arendt, we can conclude that scientific impartiality refers to the capacity to make power relationships explicit (Deblonde 2002). One condition is, therefore, that scientists are aware of their own interests and that they make them explicit before their colleagues. Mutual recognition of interests enables the participants to place interests "between brackets" for a while and to reflect, from a position that is intellectually speaking more disengaged, on a more fundamental base of shared interests and

[8] Habermas, J. Scientification de la politique et opinion publique. In: *La technique et le science comme idéologie – La fin de la métaphysique.*

values. Another condition is to admit and even stimulate a variety of perspectives. A balanced distribution of opportunities is needed for all actors concerned to introduce their own perspective, related to their specific experiences, in the process. This implies, to start with, that all relevant disciplinary and paradigmatic perspectives are represented in the process. It implies, moreover, that not only the perspectives of the various stakeholders, but also of the wider public are represented. Arguments other than scientific ones should receive due attention and chances.

Solidarity, finally, presupposes that one takes into account that various groups can be struck by the effects of technological applications or products in various ways and to various extents. Where impartiality asks for an equal treatment of differing groups of people, solidarity asks for a different treatment. In both cases the intention is to act fairly with regard to the chances people have/get in order to organise their lives in a meaningful way.

A new model of decision making

A Precautionary approach implies that decisions concerning possible unacceptable negative effects cannot be taken once and for all. Decisions with regard to non revealed risks are always preliminary. They are open to revisions depending on the rising of societal controversies or of new scientific information. They will regard temporary measures to ameliorate scientific knowledge concerning hypothetical risks. New scientific information will urge for a new societal consensus with regard to the risks perceived and for new or adapted measures to deal with these newly or differently perceived risks.

In the following table, the iterative model is compared to the traditional model (Callon *et al.* 2001, 307).

Drastic choice (Decision-making as usual)	**Iterative choices** (Decision under uncertainty)
A unique moment	A sequential process
An assessment made by acknowledged experts	An involvement of different actors and stakeholders
A decision assumed by scientific and political authorities	Reversibility and gradual integration of new information or new frame of reference.

Societal controversies can play an important role in the decision-making process. According to Callon, Lascoumes and Barthe controversies allow for an exploration of the actors concerned, of the problems perceived and of the solutions conceived (Callon *et al.* 2001, 50).

1. The distribution of interests and identities of the various actors concerned is not known in advance. It is formed and revealed in the course of the controversy. Controversies, thus, allow for detecting what types of actors and what kind of interests are relevant, in a particular society, with regard to a particular problem domain.
2. Controversies also allow for discovering the various aspects connected to a particular problem domain. The problem definition is, again, constructed and reconstructed while the controversy is going on.
3. Controversies, finally, clarify which solutions are conceivable. The original solution developed by the promoters of a particular technological application can be supplemented with other possible solutions popping up while the controversy is raging.

‘Parce qu’elles mettent en forme un triple inventaire, celui des acteurs, des problèmes et des solutions, les controverses constituent un très efficace dispositif d’exploration des états du

monde possibles lorsque, du fait des incertitudes, ceux-ci ne sont pas connus' (Callon *et al.* 2001, 55). This latter conclusion urges us to integrate direct lines of communication between experts and lay-people in the decision-making process. Direct communication can result in discovering other viewpoints and mutually transforming them, so that they can turn into socially robust solutions.

Precaution and policy documents

In a European context the Communication of the Commission on the Precautionary Principle (COM/2000/0001 def) is an important policy document[9]. This document should be situated in a context of international disputes, especially among Europe and the United States (McNelis 2000, 546). These discussions pop up explicitly within the WTO when disputes between these powers - for instance concerning international trade in meat that is treated with growth hormones – have to be settled. For the Belgian context the advice of the Federal Council for Sustainable Development (FCSD) concerning the European Communication is instructive. In this section the interpretation of precaution as expressed in these documents is analysed.

Precaution as a public ethics?

According to the Communication the precautionary principle should strive for a balance between the freedoms and rights of persons, enterprises and organisations on the one hand and the necessity to restrict risks of harmful effects for the environment and the health of people, animals and plants on the other (COM 2000, 1). Jensen explains this balancing exercise as an expression of an ethics of political liberalism (Jensen 2002, 40-44). According to this ethics restrictions to free trade can only be justified to prevent harm to third parties.

This European liberal interpretation of precaution is not compatible with the interpretation of precaution as an attitude in the service of a public ethics in the sense of Jonas and von Schomberg & Mitcham. A public ethics has societal objectives as its starting point and, consequently, defines the rights and freedoms of economic actors in accordance with these societal objectives.

The European interpretation of precaution is a harm-oriented one. According to the Communication, the precautionary principle should only be applied when suspicion of potential risks exists (COM 2000, 7). 'The trigger for precautionary action is that the desired level of protection for the environment or health could be jeopardized' ((McNelis 2000, 547).

This harm-oriented interpretation poses some severe problems. If not linked to explicit objectives it is not clear what counts as 'unacceptable harm'. Identification of possible harmful effects inevitably implies value-laden judgements (Carr 2002, 34-35). As long as this lack of clarity is not solved, it will be difficult for the EU to realise its objective to apply the precautionary principle in a coherent way.

According to the Communication the conclusion of possible harm is a precondition to appeal to the precautionary principle. Whether one effectively applies it or not depends on a political decision (COM 2000 9). This political decision depends on what the society that will have to bear the risks deems acceptable. The next and third step then consists of defining appropriate precautionary measures. Criteria for defining the suitability of precautionary measures are, according to the Communication, proportionality, non-discrimination, coherence, study of advantages and disadvantages of acting and non-acting, study of scientific developments. According to Carr, these criteria strongly stress the 'objective', scientific base of applying the precautionary principle and veil the inevitable role of values therein (Carr 2002, 36-37).

The Belgian FCSD comments on the European liberal interpretation of precaution (FCSD 2000). The FCSD argues from the very beginning that societal priorities – sustainable

[9] Henceforth I will refer to this document as to the 'Communication'.

development, democratically defined levels for the protection of environment and health – should be the foundations for a legitimate application of the precautionary principle. This implies that the domains of application extend the domains of health and environment. According to the FCSD it would be interesting to consider applying the principle also in other domains where both scientific uncertainty and a possibility of severe damage exist. These domains can regard social security, the law, social cohesion and this both on a national and international scale (FCSD 2000, 5).

To conclude, we could state that the European interpretation of the precautionary principle rather belongs to a tradition of political liberalism than to a tradition of a public ethics of responsibility. The FCSD comments on this interpretation because of its stress on sustainable development.

Precaution as a publicly defined ethics?

In its Communication the Commission hardly pursues the question of the contribution of the public to the process of risk evaluation and management. It, however, refers to the Aarhus agreement of 1988 to underline the importance of transparency and accessibility of information and of the involvement of all parties concerned 'as soon as the results of a scientific evaluation and/or risk evaluation are available' (COM 2000, 10).

The FCSD goes much further than the European Commission[10]. It argues that application of the precautionary principle should testify of transparency and of democratic legitimacy in the three dimensions – scientific knowledge concerning possible harm, the decision to appeal to the precautionary principle, precautionary measures – that characterize the policy process (FCSD 2000, 4).

Regarding the first dimension, the FCSD argues, first, for transparency of the procedures used and of scientific research. It asks, second, for making explicit simplifications, estimations and choices to neglect some aspects. 'Even in case one can justify these simplification or estimations from a scientific point of view, one should explain them from a context of societal choices and priorities' (FCSD 2000, 7). Third, the FCSD asks that the scientific information makes explicit mention of credible minority positions (FCSD 2000, 9). It asks, fourth, to create room for a contribution of social sciences in order to provide policy makers with insights into public risk perceptions. It argues, fifth, for the organisation of public debates. Finally, it is in favour of taking other than scientific expertise – 'the experience of people that will be confronted with the suspected problems' – into consideration.

The second dimension regards the question whether a possible risk is acceptable or not. In order to decide on acceptability research should be performed regarding the usefulness of a product or process under discussion and regarding possible alternatives to fulfil the same functions with fewer risks (FCSD 2000, 9).

The FCSD does not specifically treat transparency and societal legitimacy with regard to the third dimension, namely defining appropriate precautionary measures.

Precaution and the process of scientific advice to government

In a previous section we derived four preconditions for democratic trust in the process of scientific advice: 'objectivity', the keeping of promises, impartiality and solidarity.

In the Communication the Commission does not focus on the role of scientists. She only mentions that the decision to appeal to the precautionary principle should be based on a scientific evaluation of the assumed risks. This evaluation should not only offer an overview of existing knowledge and available information, but also of remaining uncertainties. The

[10] 'The Council is, however, of the opinion that the conditions that guarantee this transparency and involvement are very vaguely described in the text of the Commission' (FCSD 2000, 8).

Commission, however, works with a rather limited interpretation of 'scientific uncertainty'. 'Scientific uncertainty mostly is a consequence of 5 elements of scientific analysis: the variables chosen, the measurements performed, the samples drawn, the models applied and the causal connections found' (COM 2000, 8).

More information concerning the contribution of scientists to the process of policy development can be found in the *Guidelines on collection and use of expert advice* (COM 2002). In these guidelines the European Commission starts from the observation that scientific expertise is needed to develop good policy. Two problems arise, however. Firstly, it is often unclear who takes decisions: the experts or responsible politicians. Second, a public that gets better informed doubts the content and independence of scientific advices delivered. To this the Commission adds that this problem becomes more pressing whenever the precautionary principle has to be applied.

The *Guidelines* mention, next to openness and effectiveness, 'quality' as the main criterion for scientific advice. The quality of experts depends on three factors: excellence, independence and plurality. The latter factor implies that a wide variety of viewpoints has to be gathered. This variety can arise because of a variety in disciplinary or paradigmatic approaches, because of differing institutional connections or because of differing fundamental presuppositions. The Commission expressly mentions in one of its other communications, the *White paper on governance*, the necessity not to stick to natural-scientific expertise. Other than natural-scientific expertise is needed in order to be able to respond in a justified way to moral and ethical questions arising as a result of new technological applications (COM 2001, 15).

We can conclude that the Commission emphasizes the principle of 'objectivity' (understood as 'scientific excellence') and of impartiality (via plurality). She pays less attention to the principle of 'keeping one's promises', because of its rather limited interpretation of scientific uncertainty. She hardly pays attention to the principle of solidarity.

The FCSD goes further than the Commission. It explains the principle of 'objectivity' with the help of usual criteria for scientific quality, namely scepticism, publicity and control. It recommends applying uncertainty audits in order to accommodate the principle of 'keeping one's promises'. Such an uncertainty audit should explicitly mention the types of uncertainties and the limits of scientific knowledge with which scientists are confronted. The Council thereby uses a wider interpretation of 'uncertainty' than the Commission does. It distinguishes, inspired by Stirling, between scientific and systemic uncertainty (FCSD 2000, 4). It, further, expressly asks to take incommensurable, often qualitative elements into consideration and to treat them as of equal value as quantitative elements (FCSD 2000, 9). In order to realise the principle of impartiality the Council pleads for multi- and interdisciplinary research. It thereby assigns an important role to the social sciences in order to allow not only for quantitative but also for qualitative considerations (FCSD 2000, 2). It argues, further, that one has to guarantee the integrity and independence of the researchers and experts to a maximal degree (FRDO 2000, 8). Therefore, researchers and experts have to explain clearly their commitments in a 'declaration of dependence'. The council does not mention the principle of solidarity as of scientific concern. It argues, however, that special attention should be paid to possible inequalities when defining appropriate protection levels (FCSD 2000, 10). 'Situations exist, indeed, where differing groups of the population are differently exposed to possible harm. This inequality has to be avoided'

2.5 Precaution and companies

The precautionary regime is not entering in an empty world: a large number of rules, obligations and managerial norms pre-exist in the field of prevention. The traditional mechanisms tailored for the assessment and management of well-known technological risks have been developed within the companies along three paths: safety of systems and processes (reliability studies); ecological and sanitary effects of facilities or processes (e.g. major hazards

regulation) and ecological and sanitary effects of products (e.g. rules related to the food chain security).

However, the traditional concept of prevention against technological risks shows its intrinsic limits. The obvious distinction between natural risk and manufactured risk is not always pertinent. Geographical density of risks and domino effects need nowadays to enlarge the scope of prevention's mechanisms. Furthermore, the traditional thresholds of noxiousness aren't adequate to capture all kinds of technological risks, for instance some very small doses could induce heavy and irreversible damages on the long term. And finally, safety norms may create a feeling of security and, due to that, nobody should take really care of the risks.

Those traditional mechanisms aren't adequate to face up uncertain risks. Within instable environments, characterized by uncertainty or ignorance, the precautionary regime helps to set up alert and traceability procedures and mechanisms, it requires to deepen the scientific knowledge about the risks and to adopt temporary measures in order to avoid irreversible and heavy damages.

Some authors (Ewald 2001, 54) argue that the precautionary principle exclusively concerns public policy but others (Boy 2001) argue that the judge may refer to the precautionary principle in order to force companies. We are in favour of the second argument. We do contend that the companies' duties regarding emergent risks are derived from the duties of public authorities. The duties of companies are related to provision of information. The companies have to inform public authorities through:

- The provision of initial information concerning their activities and the associated risks (risks related to the production, risks related to the consumption)
- The provision of additional information about risks (as soon as they get more information about emergent risks)
- The setting up of traceability systems throughout their whole chain of production
- The involvement into contradictory expertises organised by public authorities.

2.6 Conclusion

From our literature study, we derive an interpretation of precaution as an attitude that is a necessary condition to contribute to the goal of sustainable development. This interpretation has some procedural and substantial implications. The substantial features of a precautionary attitude are that it takes a) predefined goals as its starting point, b) defines technologies and technological practices in function of these goals, c) evaluates and compares the risks and benefits of this variety of suitable technologies and practices with regard to both their environmental, ethical, social, and economic impacts. The procedural characteristics are that a precautionary attitude is a) a continuous learning process and an iterative decision process b) that integrates public concerns and visions during the whole process and c) that takes the economic context with its particular power relationships into consideration.

This interpretation of the precautionary principle has particular implications for its translation into processes of scientific advice to governments. Processes of scientific advice a) should be transparent and open, b) allow for the integration of publicly defined objectives and of public values and concerns in the problem definition, the definition of risks and benefits and the choice of appropriate technologies or products, c) should be impartial by guaranteeing disciplinary and paradigmatic pluralism, ideological pluralism and diversity in the institutional backgrounds of the experts, d) should make the sources, type and degree of uncertainties explicit, discuss their implications for concrete and local contexts and the feasibility of reducing them, e) should not only be quantitative, but also qualitative and f) should be sensitive to scientific and societal changes and developments.

3. Case studies: precaution and scientific advisory committees to government

A first empirical part of our SPIRE project consists of several case studies. Some case studies investigate how the precautionary principle is translated into existing procedures of scientific advice to government. Other case studies question the implementation of the precautionary principle in enterprises.

The scientific advisory committees studied by STEM are the Belgian Biosafety Advisory Council and the Belgian Health Council.

3.1 The Biosafety Advisory Council

Research method

We started our case study with an analysis of the documents relating to authorisation requests for releases of genetically modified plants (GMP's) into the environment for experimental purposes in the year 2002. These documents – invitations towards experts, reports of meetings of the Scientific Committee for GMP's, information exchange by e-mail, letters of the responsible minister, responses of the Section on Biosafety and Biotechnology (SBB) of the federal Institute for Public Health, the final advice, the final political decision, press releases, reactions of notifiers – are saved in the archives of the SBB.

We complemented this document analysis with an analysis of some twenty interviews taken from various actors – experts, members of the SBB, political representatives, representatives of companies, members of the competent authorities, members of the BAC - that were, during this period, involved in the process of scientific advice. We should thus stress that our analysis is restricted to a given moment.

To complete both these analyses we organised a workshop in April 2003 with a group of actors involved in order to discuss our preliminary results.

The research results mentioned hereafter are a summary of the results of these three sources. For more detailed information we refer to the SPIRE Working Paper nr. 4 on our research website (www.ua.ac.be/SPIRE).

The Biosafety Advisory Council

Its structure

The Biosafety Advisory Council (BAC) is one pillar of the common scientific evaluation system that has been set up in Belgium to advise the competent authorities about the safety of activities involving genetically modified organisms and/or pathogens (www.biosafety-council.be). The Council consists of representatives of the Regional and Federal authorities.

Four scientific committees or experts groups assist the BAC in its scientific work. Members of these scientific committees are experts from universities or other research institutions. Experts are consulted on a case by case basis, depending on the specific expertise needed in the course of the evaluation of a dossier.

The secretariat of the Council is ensured by the SBB, the Service of Biosafety and Biotechnology of the Scientific Institute of Public Health.

Its mandate

The Belgian Biosafety Advisory Council (BAC) has the task to evaluate the biosafety of genetically modified organisms[1]. "Biosafety" means safety for human health and the environment including the protection of biodiversity when using genetically modified organisms or micro-organisms. The scientific evaluation has to take place step by step and case by case. Moreover the precautionary principle applies as a first priority and the familiarity principle as a second one[2]. The evaluation has to be scientific in order to contribute to an objective and harmonious treatment of dossiers. This task seems to be based on the idea that assessment and management of risks can be separated.

Procedures for a scientific evaluation of biosafety are not only used to protect human health and the environment. They are also used for the purpose of scientific and economic interests. Objective and harmonious procedures are meant to support and stimulate scientific research regarding genetically modified organisms, to avoid unequal conditions of competition, to eliminate impediments – both between member states of the EU and within the federal state Belgium - for the development and the bringing onto the market of products containing genetically modified organisms. They are further intended to provide notifiers with a comprehensive and transparent legal and administrative framework.

Precaution

European and Belgian regulatory texts provide some recommendations concerning how to translate precaution in scientific risk evaluation processes of GMP's. The fact that all deliberate releases of GMP's – either for experimental or commercial purposes – have to be submitted to authorisation procedures is a first expression of a precautionary approach. Also the case-by-case and step-by-step approach is considered to be a manifestation of precaution.

In the Belgian Royal Decision of December 18, 1998 one can find prescriptions for informing the public. Each dossier applying a licence for a field trial has to contain a proposal for informing the wider public with regard to:

– the description of the genetically modified organism, the name and address of the notifier, the location and the purpose of the field trial

– methods and plans concerning monitoring and management of accidents

– the evaluation of foreseen effects for human health and environment.

The SBB publishes the public dossier on the Belgian Biosafety Server (http://biosafety.ihe.be), next to the advice of the Council, the decision of the competent minister(s) and the protocol for cultivating the crop concerned. Belgian scientific advisory processes with regard to GMP's can thus be considered rather transparent and open.

The European directive 2001/18/EG of March 12, 2001 – that is, as yet (January 2005) not transposed in the Belgian legislation - contains some changes, compared to the previous

[1] See the EU Directive 90/220/EEG, the Royal Decision of December 18, 1998 and Goorden *et al.* (2003)

[2] According to Rüdelsheim, familiarity takes 'substantial equivalence' as its starting point. Substantial equivalence is a principle according to which a genetically modified plant can, in principle, be compared with its non-genetically modified equivalent. The principle of substantial equivalence presupposes that both are mainly comparable. But this presupposition is only a starting point. The precautionary principle forces us to challenge this presupposition. We have to imagine and test various scenarios that take possible problems into consideration in order to build up better knowledge and insight into the extent of comparability. Familiarity comes at the end. Familiarity increases when our knowledge increases. Slowly but surely one knows more, is less uncertain about the extent of camparibility. No agreement exists – between the various actors in the GM-debate - whether taking 'substantial equivalence' as a starting point for building up 'familiarity' is legitimate..

directive that regulates deliberate releases of GMP's for experimental purposes. These changes regard the scope of the risk analysis on the one hand and the interpretation of the concept 'public participation' on the other. The evaluation of biosafety should henceforth regard both direct and indirect and immediate and delayed effects of GMP releases. The new directive leaves, moreover, the door open for ethical considerations. The European Commission can seek the advice of the European Group on Ethics and New Technologies; member states can seek the advice of ethical committees. This consultation process should be transparent, open and publicly accessible. The results thereof should be communicated to the public by the responsible authorities. From 2003 on also socio-economic effects of deliberate releases would count as an element in the evaluation. According to some, references to an ethical and socio-economic evaluation should be considered a sop. Arguments referring to the biosafety of GMP releases remain decisive for the authorisation procedure. The older European directive provided for public access to information. It left it to the national competent authorities to decide whether to consult the wider public or particular groups. The new directive imposes both information and participation of the public. Member states have to consult the public and relevant groups concerning field trials that are planned. They have to inform local communities regarding all the field trials that are planned on their territory.

To conclude, scientific advisory processes of the BAC are rather transparent and open (the relevant information is accessible), but the integration of publicly defined objectives and of public values and concerns still leaves a lot to be desired.

Trust and distrust

From contacts with various actors concerned and from an analysis of the documents present in the archives of the SBB both signs of trust and of distrust can be derived.

Members of the SBB are satisfied about the contributions of the scientific experts. The SBB knows sufficient scientific experts that are possible candidates for membership of the scientific committee for Genetically Modified Plants. However, only a restricted number of them actively participates to the advisory process. According to the SBB, the group of collaborating experts is large enough and has a sufficient variety to exclude one-sided scientific judgements. The SBB appreciates, moreover, the efforts made by this restricted group of scientists.

Regarding one particular dossier the notifier does not completely trust the experts of the scientific committee. The notifier suspects that one of the experts is a scientific competitor. This explains a certain reluctance both from the side of the notifier and of the SBB itself to release all the scientific information just like that. In general, however, sufficient trust exists between the notifiers on the one hand and the members of the scientific committee and of the SBB on the other. Some experts signal their methodical distrust regarding notifiers, because they acknowledge that notifiers are in the first place safeguarding their economic interests and that they dispose of the best knowledge, since they construct new applications of genetic modification.

The supposition that arguments concerning scientific uncertainties can be misused to manipulate public opinion points to some distrust between scientists and part of the public. The experience that activists destroy authorised field trials still enforces this distrust. But again this kind of activism testifies that part of the public distrusts the decisions of political representatives.

The confidence that notifiers nowadays put in political representatives suffers when final decisions run counter to the advice of the scientific committee and of the BAC. Also a lack of consistency in the decisions taken concerning similar dossiers is detrimental for notifiers' trust in public authorities. One particular notifier questions the way the responsible minister applies the precautionary principle and lodges a complaint against its decision. Another aspect of this complaint concerns the fact that the minister motivates its decision on general societal concerns that, according to the notifier, are not relevant for the field trial concerned. The SBB further

supposes that the initiatives taken by the Belgian authorities to found evaluations of authorisation requests not only on arguments of biosafety, but also on socio-economic and ethical arguments will thoroughly obscure trust relationships between notifiers and political representatives.

While dealing with the dossiers of 2002 discussions already raised within the BAC (and to a lesser amount within the scientific committee) whether one should restrict considerations to a pure risk evaluation or whether also other topics – concerning the scientific and societal use of a field trial, concerning alternatives to technologies of genetic modification, concerning the feasibility of control, concerning the protection of organic and conventional fields against contamination – could be debated. These discussions obscured the trust relationships between the SBB and the BAC. This distrust is still enforced by the fact that members of the BAC do not necessarily have competences in the domain of biotechnology. Some members of the BAC question the procedure of scientific advice. They are not happy with the fact that they have to formulate an advice immediately after the meeting of the scientific committee. They experience that they do not have enough time and they feel the need to consult their own colleagues.

Some members of the BAC question the way the scientific committee works. They criticise that some experts give their advice without having personally studied a particular dossier. They label this practice as an irregularity. The SBB, however, objects that it decided to appoint expert-reporters, because this procedure proved to be practical and recommended. Other members of the BAC mention that they have sufficient trust in the evaluation performed by the scientific committee. They do not feel the need to have access to all technical dossiers.

The SBB charges that the responsible minister asks, as a reaction to the advices provided by the scientific committee and the BAC, for further information regarding general matters that apply to the evaluation of GMPs in general and are an expression of concerns that pop up in society, but that are not specific to the particular field trials under request. The fact that this information is asked for when legal terms (and sowing dates) for several dossiers are already exceeded causes due resentment.

Quite a number of actors express their distrust in political representatives. The reason for this is that these representatives do not sufficiently motivate their decisions. These actors do, moreover, not appreciate that political representatives sometimes try to influence scientific judgements. Finally, party political aspects – e.g. an agreement within the party of the responsible minister not to allow applications of genetic modification – hamper an unprejudiced evaluation of the dossiers.

Bottlenecks

We summarize the most important bottlenecks we perceived with regard to the work done by the BAC (starting with the notifications submitted and ending with the final political decisions taken)

1. The various actors have no clear idea about how to interpret the precautionary principle.
2. The various actors dissent about the necessity and the content of uncertainty research.
3. It is not clear how to communicate about uncertainties.
4. How can one make sure that the scientific advice fits in with societal concerns?
5. How to present a scientific advice to the BAC and to the competent authorities: how extensive should it be, should it give several options or only one option?
6. Most actors deem the distinction between a scientific and a policy discussion meaningful, but no clear idea exists what this distinction is about.
7. How to guarantee the impartiality of the scientific committee (which disciplines should be represented, how can one make sure that the representatives of the various

disciplines are present at the meetings, how to make sure that the – economic as well as political - interests of the experts are sufficiently known)?

8. What information does the BAC need in order to translate the scientific advice of the scientific committees in a sound policy advice? What does the precise task of the BAC consist of? What actors should the BAC be composed of: experts only or also political representatives?

3.2 The Health Council

The Health Council

The tasks of the HC are[3]:

- To study, investigate and formulate suggestions concerning all topics that can contribute to public health;
- To give advice concerning health questions that are given to them by government, provincial or local public authorities or on its own initiative;
- To work together with the Commission of the European Communities and provide it help with the scientific research concerning questions of public interest related with food products;
- To organise and stimulate consensus conferences and conferences of health workers and expert gatherings;
- To evaluate health practices and their developments;
- To advise on national food policy.

The HC has five divisions: mental health, care facilities, chemical and biological agents, food and health, physical agents. These sections formulate, among other things, advices for working out laws, regulations and guidelines concerning the introduction on markets, the use, the processing and removing of products and preparations that can influence public health in various ways.

Research method

The research method used in the case of the BAC could not be repeated in the case of the Health Council (HC) for practical reasons. It took STEM a lot of time to find a second scientific advisory committee to government – staff members of the various federal and regional scientific advisory committees that were approached by STEM turned out not to be able to respond positively to our request to participate in our research project, because of various reforms -. Given the work planning of our research project, we felt obliged to perform our second case study in a short period of time. In consultation with the chair of division V Physical Agents, Prof Dr Gilbert Eggermont, we organised a workshop under the authority of the officers of the HC. This workshop took the form of a temporary working group. STEM prepared this workshop together with division V. At the workshop itself also members of other divisions and of the scientific secretariats of the HC participated.

The workshop consisted of three parts:

- Reflection on the relationship between science and precaution. This reflection was based on information presented by members of the working groups Interventional Radiology and Non-Ionising Radiations and by the division Chemical and Biological Agents.

[3] See http://www.health.fgov.be/CSH_HGR

– Reflection on the ethical load of precaution.

– Reflection on the criteria for the process of scientific advising from a precautionary perspective.

Precaution and science

STEM formulated some questions in order to assess how the experts of the HC that presented their dossiers interpret the precautionary principle.

1. What are the negative effects that you worry about?
2. Which negative effects are, according to you, an example of
    a. A risk: the extent and nature of the negative effect and the probability of its occurrence are known
    b. An uncertainty: extent and nature of the negative effect are known, but the probability is not
    c. Ignorance: scientists know that some negative effects are possible, but the causal relationships are not known (scientific gaps)
    d. Indeterminacy: scientists know that some negative effects are possible, but causal relationships cannot be known because of systemic freedoms
    e. Incommensurability: scientists disagree with each other regarding the extent and nature or the probability of negative effects because of their particular disciplinary or paradigmatic approach.
3. Which precautionary measures should be taken, according to you, with regard to the possible negative effects you see?
4. Do you exclude some precautionary measures because of present-day economic reality?
5. Which persons or groups of persons do you have in mind when considering possible negative effects and possible precautionary measures?
6. Did the competent authorities follow the advice of the HC with regard to the dossier you present?
7. What is the difference between your task as an expert and the task of policy makers regarding the evaluation and management of possible negative effects?
8. Does the wider public perceive the possible negative effects related to your dossier in the same way as you do? If not, how do you deal with this difference?

With regard to the three dossiers presented the public authorities seem to be less strict – in these cases where they did not follow the advice of the HC – than the HC itself, considered from the perspective of public health. This statement is directly opposite to what we stated in the BAC case study: when the competent authorities did not follow the advices of the BAC with regard to authorisation requests for field trials with GMP's, they were more stringent, considered from the perspective of biosafety, than the BAC.

The fact that in case of GMP's much and in case of radiological applications, GSM-use and biological and chemical agents few societal disagreement exists, can partly explain this difference. Moreover, the fact that the health of individuals – patients, users – is the first matter of importance to the HC can explain why the advices of the HC are relatively stringent. First, the same is at stake both for the wider public and scientific (medical) experts. Second, human health is so high in the priority list of defensible values that stringent claims will hardly be openly resisted.

Both the experts of the BAC and the HC complain about a lack of feedback from the competent authorities concerning the way they integrated the scientific information provided for into their final decision. Both members of the BAC and the HC complain, moreover, that competent authorities sometimes circumvent the scientific advices of advisory committees and fall back on personal advices of individual scientists. This instrumental use of scientific information is not conducive either for scientists' or citizens' trust in public policy.

The SBB makes sure that the BAC strictly keeps to its mandate – the evaluation of the biosafety of deliberate releases of GMO's into the environment (among other things) -.This implies that it does not tolerate that (explicit) arguments of a social or economic nature co-influence the BAC's final advice. It looks – in the dossiers presented by members of the HC – as if the HC is, explicitly at least, less strict in this respect. It is not always clear which type of arguments are admitted or not. In the past the HC took, next to pure health arguments, also arguments regarding the environmental and psychological effects and regarding the feasibility of detection into consideration. Some members of the HC, consequently, ask themselves what precisely is the scope of the HC's mandate and if the expertise that is represented within the scientific committees is sufficiently diverse to provide for a scientific justification of a wider variety of arguments.

Many questions arise as a result of this conclusion. First, can competent authorities correctly apply the precautionary principle if they do not dispose of social-scientific and ethical information, next to natural-scientific knowledge? Second, should an advice based on social-economic and/or ethical information, be developed by a separate advisory committee? If so, (how) should mutual consultation or exchange be organised between natural-scientific and social-scientific advisory committees? What does the establishment of a separate social-scientific advisory committee imply for the development of a natural-scientific advice? Or should one integrate social- and natural-scientific arguments in one and the same advisory committee?

Both within the BAC and the HC the question spontaneously arises whether a risk-evaluation can be restricted to the evaluation of a particular product or technological application, without comparing these risks with the risks that possible precautionary measures can entail.

Neither the BAC nor the HC can, with regard to their external communication, operate independently of the public authorities. One can ask whether this does not hamper their autonomy and, hence, their trustworthiness. Both experts of the BAC and the HC experience that a subtle, but at the same time accessible communication is a difficult task. Some members of these councils doubt how far their responsibility for active communication with the wider public regarding possible risks extends. Some others doubt, moreover, whether the councils dispose of the necessary expertise in order to fulfil their communication tasks.

The ethical foundation of precaution

The precautionary principle has an ethical load. This ethical base comes to expression in the way new technological applications or products are evaluated and adjusted. In order to make this ethical base more explicit, STEM constructed a dichotomy.

The producers' and consumers' freedoms should be subordinate to visions on humane conditions of existence for both present and future generations	Existing freedoms of producers and consumers should be maximally protected on condition that they do not imply a threat to third parties
New technological applications and products should be evaluated at the very beginning of R&D processes	New technological applications and products should be evaluated when they are ready for introduction on the market
The concept of harm refers to both the short and the long term, cumulative and synergetic effects and considers both the product and the production process	The concept of harm refers to the short term and is restricted to the product

One can clarify what both positions mean for scientific advisory processes. Therefore STEM asked the members of the HC to reflect on the advantages and disadvantages of both positions, on their feasibility and on the preconditions for bringing these positions into practice.

Because of a lack of time, the participants at the workshop of the HC did not straightforwardly respond to our questions. As a first general reaction, they stated that all members of the HC would agree with the position presented in the left column. The discussion following this bold statement showed, however, that some comments should be made. To start with, many dossiers for which the HC develops an advice consider products that are already or will soon be introduced on the market. The HC then is supposed to evaluate their possible risks. An evaluation that is based on a comparison with alternative products is, hence, not obvious. In case of pesticides it is even legally forbidden to refuse a product because it is less good than an existing alternative.

The separation between the various (natural- and social-scientific) disciplines hampers a comparison of alternative products or technological applications. One should add, moreover, that a scientific comparison of alternatives is not so easy, because it is often not clear what can count as an alternative and because the possible risks of these possible alternatives are not very well known either. The fact that R&D activities taking place within enterprises are often subjected to confidentiality clauses adds another hindrance to a timely scientific comparison of possible alternatives. The ALARA-principle – As Low As Reasonably Achievable – that is applied in the domain of ionising radiation rests, on the contrary, on the idea that technological alternatives have to be weighed against each other.

Members of the division of Chemical and Biological Agents consider the study of synergetic effects an illusion. They do not experience, moreover, the occurrence of such effects as a real problem, contrary to their colleagues of the division of Radiation.

Some participants at the workshop suggest that the HC is not supposed to contribute to sustainable development. This implies that alternatives that are possibly taken into consideration during the evaluation cannot be understood as alternatives from the perspective of sustainability, but alternatives from the perspective "as low as reasonably possible for human health (and for the environment)". This observation makes us conclude that the HC's interpretation of precaution is rather harm- than goal-oriented.

Criteria

STEM derived four criteria for precautionary scientific advisory processes: 'objectivity', 'keeping one's promises', impartiality and solidarity. In order to stimulate the discussion on the usefulness and feasibility of these criteria, STEM asked the following questions:

- How do members of the HC interpret 'objectivity'?
- How can one guarantee that public concerns are appropriately represented in processes of scientific advice?
- To what extent do you agree that a scientific advice should be open and transparent with regard to the various types of uncertainties?
- What does an open and transparent communication stand for?
- Is an evaluation of products or technological applications that is based on a comparison of alternatives feasible within the context of the HC?

Some participants argue that problems regarding the objectivity of a scientific advice relate to the completeness of the scientific approach. What does this mean, however? Does it mean that the experts introduce all the relevant existing scientific knowledge into the advisory process? Or does the concept of completeness refer to possible gaps within the existing scientific knowledge?

In order to be objective the process of scientific advice should be self-reflexive. This means that the process itself should be transparent, i.e. that the participating experts should make

explicit towards each other which are the presuppositions from which they look at the data. It means, moreover, that the process should be open.

Some participants do not agree that a 'temporary consensus between members of a particular scientific community' is a good standard for scientific objectivity. Such consensus is relative. Consensus can be created as a consequence of a globalisation of interests. Scientific advisory committees can be composed so that the consensus that is deemed desirable will soon be realised. Other participants argue, on the contrary, that also a globalisation of the evaluation of data can be discerned thanks to new communication technologies which allow for an easier access to and exchange of data. This latter trend can discourage too quick a consensus.

It goes without saying that scientists are open and transparent rather about certainties than about uncertainties. Openness and transparency concerning uncertainties imply that experts indicate on which elements they found their certainties.

Which variety of disciplines is relevant in order to construct an impartial scientific advice? Do social-scientific disciplines belong to this variety? Some experts experience the social sciences as rather soft, as of another kind than exact, technical sciences. At the same time they recognize that a social-scientific point of view can thoroughly influence technical discussions.

Inside the HC a procedure is being worked out to advance the independence of the cooperating experts. Experts have to submit a declaration of interest. The aim of this declaration is not to prevent that experts have interests, but that they mingle them. In case experts make their interests known, they allow the other members of the group to judge whether a mingling of interests occurs or not. The problem of mingled interests does nowadays not pop up sufficiently in debates. That this problem is real appears from the fact that individual experts that have contributed to a particular advice are not able or do not dare to defend it publicly afterwards. Therefore, one should spend more attention to this problem.

The HC does not systematically apply an integral approach, i.e. comparing alternatives, weighing risks and benefits. The ALARA principle – As Low As Reasonably Achievable -, however, is based on the idea of comparing alternatives. With regard to concrete dossiers dealt with within the division of Chemical and Biological Agents several trials have been undertaken to compare alternatives, but the success of such trials depends on the information one gets from industry (problem of intellectual property rights). European legislation regarding biocides does not provide for a comparison of alternatives. The European Commission explicitly argues, however, in its *Guidelines for gathering and using expert advice* for weighing risks and benefits of technological alternatives (COM 2002).

A comparison between the two case studies

The workshop allowed us to formulate some hypotheses concerning resemblances and differences between the case BAC and the case HC.

- Scientific advisory committees that are composed in a balanced way are important to counterbalance an instrumental use of science (i.e. selecting and using the particular scientific information that legitimizes already existing opinions). Neither the BAC, nor the HC can prevent such instrumental use of science by responsible politicians. Regularly politicians prefer to base their decisions on the informal advice they gain form individual scientists rather than on the advice provided by a scientific advisory committee.
- In order to maintain or restore trust between scientific advisory boards and responsible politicians the latter ones should motivate their final decisions and explain how it is based on the scientific advice provided.
- In both advisory committees the question regularly pops up how information concerning alternative technological applications should be considered in the evaluation of a particular product.

– The influence of interest groups and/or economic pressure groups on the final decision of the responsible minister apparently applies less in the case of the BAC than in the case of the HC. Probably the fact that genetically modified crops cause much public unrest, contrary to the individual use of GSMs or radiological applications, provides for a certain counterbalance.

4. Case studies: precaution and enterprises

4.1 Presentation of case studies

Case studies at the enterprise level pursue three objectives:

- to properly represent the constitution of expertise on technological risks within companies;
- to figure out the relationships between companies and public agencies in charge of the assessment and/or management of new risks;
- to assess the implications of the precautionary principle for the private sector.

Two kinds of case studies were carried out:

- Case studies on enterprises dealing with classical risks, facing prevention requirements, and enterprises facing technological risks that are not yet well documented, confronted to the challenge of precaution.
- Case studies on external bodies in risk management for enterprises (advisors, insurers, public inspection, etc.).

There are several reasons why we have decided to split the case studies into these categories. The first one is that the private companies have already an impressive background in the field of prevention; therefore, we need to know more precisely how the companies are facing prevention requirements, who are the key persons dealing with risk assessment, which difficulties they meet in the strategic and operational management of classical risks. Having in mind the way the companies are facing up with classical risks, one will be in a more appropriate position to analyse the implications of precaution for the private sector. The second one is that companies already rely on external support for risk assessment and risk management (for instance, bodies in charge of occupational health and safety education, insurance companies). The construction of expertise within the private sector is a diffused process that one has to map adequately through empirical research.

Personal interviews have been held to collect opinions from security managers, environmental managers, quality managers, and members of the internal prevention and protection service, R&D managers. The basic check-list for interviews includes:

- General overview (core business, collective bargaining with occupational safety and health aspects, sub-contractors, internal committee for prevention, internal department for prevention, certification related to quality-environment-safety, Seveso labelling).
- Characterization of the workflows and processes.
- Classical risks related strategy (prevention within the company's general strategy, legal and conventional duties concerning prevention, methods of risk assessment, prevention measures, follow-up, crisis management, insurance portfolio).
- Emergent risks related strategy (dealing with threats, internal precautionary measures, follow-up, exchange of information with public authorities and bodies).

Cases studies have been carried out in 12 organisations: 2 public organisations (1 hospital and 1 transport company) and 10 private enterprises, belonging to the chemical and pharmaceutical industry (5) and the industry of transformation of raw materials (5).

Structured interviews have also been carried out in external bodies in the area of prevention and precaution: Agronomic Research Centre of Gembloux ; Municipal Administration of Namur, Service for classified establishments ; Enterprise department of the Christian Confederation of Trade Unions (CSC) ; Directorate General for Natural Resources and Environment of the Walloon Region (DGRNE), division of risks and major accidents + division

of environmental police + Seveso inspection ; Prevention and safety service of the Belgian Enterprises Federation (FEB-VBO) ; Federal fund for occupational diseases ; Public federal service for employment and labour, directorate of chemical risks + medical inspection + technical inspection ; Walloon scientific institute of public services (ISSEP) ; two external providers of occupational medical services for enterprises ; one re-assurance company specialised in risk insurance and evaluation.

4.2 Transversal analysis of case studies

The place of safety in corporate strategy

A priority objective? Various factors influence safety in a company: dangerous products, environmental factors (for example the proximity of railways), security management, as well as the financial strength of the company. Indeed, finding solutions for identified risks at times requires major investments. We also observe that the sector to which the company belongs has a strong incidence on the integration of security in its strategy, although the company's specific characteristics (particularly in terms of working conditions) also exercise an influence on maintaining health and safety. Control over security seems to pose more problems in sectors using technologies than in producing sectors.

The integration of safety in corporate strategy is really effective when controlling safety has a direct influence on the company's viability (meaning when security directly concerns the means of production, the installations, or when access to the subcontracting market is contingent on security). In the agro-food sector, the number of hygiene and quality certificates has grown considerably and represents a high cost for producers, who are under pressure from their clients, particularly in supermarkets. Small companies tend to be passive when it comes to taking charge of safety: certain medical inspectors say that they hear things like: "we pay for an external prevention and labour protection service – let them do the prevention".

When it comes to the risk of major accidents, we see the influence of a just-in-time working organisation on reducing products of stocks, including stocks of dangerous products, which has an influence on the "Seveso" classification of a company. Insofar as possible, companies try to avoid a "high Seveso classification" by limiting their inventories. The safety report is often perceived as a purely administrative obligation and it is often turned over to an outside consulting bureau. It shows little integration with other safety studies done elsewhere in the company. The Seveso classification nevertheless gives the guarantee of true security management.

Concern with coordination. Various coordination procedures are imagined at strategic level: the presence of a safety manager in the management committee, a prevention advisor who meets with the hierarchy every six or seven weeks, a safety coordination mechanism in the form of a system of computerised procedures. Several structures, not always stipulated in the safety regulation, are set up to ensure the necessary relays from the safety standpoint. Coordination takes place on several levels: setting up training programmes, establishing a report system, setting up safety procedures, and particularly mechanisms for validating safety decisions, internal audits, detection of risks not covered by the regulation.

A desire for communication: we also see concern with communication and transparency: a desire to organise real top-down communication of safety objectives to the various echelons; the prevention advisor stressing the validation of procedures that must be used continually to meet security objectives; discussions and exchanges well upstream. Certain trade union delegates and workers still feel uncomfortable about the fact that coordination is not good between the policy on workers' health and safety on one hand, and the policy for purchasing products on the other. We see concern for covering regulated risks, as well as unregulated risks, like this internal audit mechanism for regulated and unregulated risks.

An attempt at integration. We saw that many of our respondents want to gradually set up an integrated system for managing health, the environment, quality, hygiene and safety as well as management of financial risk. Certainly, awareness of the need for a global, systemic approach to all these aspects is increasing in the business world. Transforming this awareness into strategic objectives, operational objectives, procedures and instructions obviously takes a fair amount of time and work. Nevertheless, even where there is clear concern for coordination, we observed that the security of products is handled by channels that are often totally separate from the workers' safety.

Prevention management

A keystone - the prevention plan

Prevention is based on risk analysis including identification and assessment. For good prevention, the risk factors must be well known. For a good definition of the concept of risk analysis, the employment and labour administration took inspiration from OSHAS 18000. By emphasising risk analysis, the authorities are less anxious to prohibit certain practices that cause insecurity or certain agents that are risk vectors than to impose a general safety management system.

In Belgian welfare regulations, the working world is at the centre of the analysis: in considering the risks an employee runs, it is no longer possible to get around doing an analysis of the organisation and the group.

The obligation of an overall prevention plan laid down in the law on workers' welfare indicates, not that the plan must be renewed every five years, but rather that the time frame on which security objectives are based should be a five-year horizon and that this is a sliding programme. When the risk analysis depends on several agents, this poses major problems.

Identifying risks

Everyone agrees that the phase of identifying risks is crucial and that it is the most difficult, necessitating a description of all risks – not just residual risks. This is still the weak point in prevention in companies. Conversely, the phase of analysing accidents does not pose too many problems. This phase of identifying risks first requires a description of workstations and assignments, but in the public sector, even this elementary description is often missing, particularly for local administrations.

In some companies, we find safety monitors trained in participative methods: they are on the front line of identifying risks and sending information up to management.

Knowledge of risks means being familiar with the risks specific to all activities in the company: for example, risks associated with sorting are not the same as those associated with incineration. Knowing risks must cover risks related to waste, rejections, cleaning techniques, waste water treatment techniques (for example cleaning filters). The objective is to rank a set of risks. A gradual analysis of a whole risk process should be done to progressively correct the technologies and techniques used. Changing a process can take time and money. Insofar as possible, the risk analysis process should come in at the project development stage.

Many respondents pointed out that, in their companies, if an installation is modified or a process is changed, the management would then require the establishment of a new system of records to know more about the risk associated with that new installation or process.

In large process industries, it is quite common to use a method that is not suitable for the analysis of the entire process, but rather for analysing part of a process. These industries are aware of the need to achieve more integrated risk analyses. Many risk analyses are in fact done on separate areas with a specific perspective in mind.

Purchasing policy is also becoming more of a consideration on identifying risks, because this is an important vector of risk policy in companies. In companies in the food sector, changes in raw materials and ingredients must be duly validated and motivated by suppliers.

Risk assessment

To identify and particularly to analyse risks, involving multiple disciplines is desirable, but this is rarely done, even in external prevention and protection services, because it entails coordination costs and time for exchanging information.

As concerns methods of risk analysis, some are in favour of deterministic methods, others prefer probabilistic methods. Beyond these methodological quarrels, using gradual risk analysis methods adapted to the type of risks is the important aspect.

Risk management

The job of successively identifying and assessing risks and then deciding on priorities in the company needs to be done in a loop: it should be considered like a cycle. When risks are identified and analysed by an outside service, it is up to the client to establish the priorities among the security objectives to be achieved. This means a breakdown of responsibilities that is not always very well understood in small businesses.

- *Establishing a system of procedures*: strict compliance with procedures for incoming and outgoing products, acceptance of inputs, traceability of waste, can limit certain risks.
- *Safety indicators*: safety budgets are generally not very representative because often project management includes a security aspect that is hard to separate from the other features. Some prevention-advisor respondents said they were very attentive to the choice of pertinent indicators for their company, and also attentive to re-assessing the indicators chosen (for example, when processes are modified), and finally to the use to be made of the indicators: indicators provide gross figures that must be correctly interpreted. There are many parameters involved that could explain a drop in a given figure. One mustn't conclude too quickly that the prevention policy is satisfa*ctory*.
- Compliance with standards: in the risk prevention field, our correspondents emphasized the difficulty associated with the lack of harmonization of maximum exposure levels at European level.
- *Monitoring workers*: medical supervision of workers lasts for the duration of their activity, but the latency period for certain diseases is quite long, which means that former workers should be monitored and treated after pension age (like the new system set up for diseases associated with asbestos).

Accident management

According to our respondents, the analysis of accidents presents no particular difficulty in Belgium, unlike the identification of risks. In intra-group comparison exercises done by companies set up in several European countries, internal benchmarking produces fairly poor results as concerns industrial accidents in Belgium. But differences in regulations must be taken into account: Belgian regulations require employers to declare industrial accidents for relatively minor incidents. Corporate culture has a strong influence on the rate of accidents and incidents. According to some prevention advisors, the number of accidents and incidents explained simply by poor communication must not be underestimated.

Companies have various schemes for reporting accidents, near accidents and incidents. The analysis of accidents involves labour inspection, insurance experts and, more recently, external experts. Medical officers from external prevention and protection services are not involved in analysing accidents. Sometimes, an effort is made to show that the worker is at fault. During

inspection visits after an accident, it is very important to maintain secrecy to avoid rocking the boat in case of a judicial inquiry.

Accident reports are often done using a standard form provided by the insurance company. The insurance company sometimes also supplies software to monitor accidents, review the type of accidents, do a department-by-department review, etc.

– *Analytical methods*. Often, a causal tree is used as a method for analysing accidents. This method has the advantage of involving the line of hierarchy and ensuring good feedback of information.

– *Crisis management*. In many companies, handling of production apparatus crises is totally separate from the treatment of crises at product level. In crisis management, a dual aspect is present in most companies: handling the technical aspect of the problem on one hand, and, on the other hand, communication about the crisis. In fact, crisis cells are springing up in many companies – their objective is to establish contact with administrative authorities, emergency services, local authorities, the media, neighbours, clients, shareholders and to insure coherent corporate communication in time of crisis. Some companies have drafted a crisis manual, trying to envisage all possible cases and the methods to be used to limit the critical problems that might occur. These crisis manuals include a list of persons to be contacted in the event of a crisis.

– *The objective of continuous improvement*: the reason for organising debriefings after crises is specifically to improve the safety management system so as to prevent reproduction of past errors. A change in processes to be made after an accident or a (possibly repetitive) incident can sometimes take time and require major investments: in that case the company may take transient, safeguarding measures.

Managing uncertainty

With regard to workers' welfare, several respondents, particularly external prevention services, consider that precaution has always been applied more or less, in the sense of trying to detect risks very early. Others feel that the application of the "*best technology available*" covers both prevention and precaution.

In dealing with uncertainty, companies and their partners adopt very diverse preventive measures. These measures can be grouped into four main categories:

– *Establishing a safety zone larger than the regulation requires*. For example, safety circles are cropping up that try to identify risks not subject to regulation requirements; an external prevention service organises meetings of medical inspectors every other month to look into new pathologies and attempt to develop a means of coding the risks encountered.

– *Investigation and in-depth research.* A few examples:

  - With regard to occupational accidents, a company is doing in-depth examination at group level and possibly additional investigations in cases where literature is insufficiently explicit on the subject.
  - An intensive dialogue has been established between external prevention and protection services, the medical inspection service, toxicologists and researchers when the doctors from the prevention service are confronted with new risks (for example: cement works and incineration of waste, substitute fibers for asbestos).
  - The Belgian Seveso fund is doing research and organising workshops on risks that are still little known.

- Some companies are becoming aware that one of their major challenges consists of learning more about their products, up to and including the decomposition phase.
- Frequently, feedback of information and experience is encouraged when a risk associated with a manufacturing process is detected.

– *Setting up mechanisms to avoid, filter or reduce risks.* A quality analysis is becoming a mandatory step in many project structures. Certain R&D departments or regulation services pay particular attention to risks (established or not) at all stages of development of new products and have acceptance procedures at these various stages. "Simplified risks studies" are done – these are similar to rapid scanning exercises for early detection of risks. Choices are made to substitute less toxic products; bacteriological characteristics are sought for any new ingredient; suppliers are asked to provide their HACCP analyses; conditional acceptance mechanisms are set up.

– *Setting up priori mechanisms for monitoring risks*. In one case, each type of waste processed in an incinerator is kept to meet an obligation of traceability.

Within the company itself, the difficulty consists of convincing the management of the need to identify and assess an emerging risk and to adopt provisional measures against it. One of our correspondents talked about three stages: the stage when the company takes account of a risk that has already occurred, the stage when the company takes account of a potential risk for which probability can be calculated, and finally, the stage when the company takes account of a risk for which scientific hypotheses must still be recognised and supported by the scientific community. He considered that his company was in the second stage and that, for an unconfirmed risk, the difficulty is to make the company management aware of it. Another correspondent commented that when there is a hint of a risk and that the problem is "for the future", the management tends to adopt a wait-and-see attitude: "We'll wait until regulation standards stabilise, so that we can use them as a reference". From the purely economic standpoint, this attitude is of course perfectly justified.

External expertise

The indispensable quality of external prevention and protection services

The trend to outsource medical supervision is very marked. Companies that have maintained their own medical officer are rare. Small businesses are greatly dependent on their external prevention and protection service, which is why the quality code of those services is so important and trade unions have devoted great efforts to this. The largest companies are more likely to refer to their external prevention and protection service for very specific problems.

Medical supervision activity within external prevention and protection services is more profitable than risk management. Risk management interventions are becoming more numerous because there is a lot of demand given the legal obligation to establish an annual and a five-year prevention plan. Nor should one forget the activity of the external prevention and protection services in providing documentation and records. Within external prevention and protection services, there are also problems in working with a multi-discipline team: the organisation is closer to a rotation of various risk specialists from one risk management intervention to another.

The habitual intervention of an external prevention and protection service is as follows: establishing a list of persons at risk, analysing the risks, targeted medical supervision (targeted particularly for organs at risk). The frequency of medical checkups by the external prevention and protection service is established on the basis of characteristics of the sector as well as characteristics of the company itself. For an external prevention and protection service, checkups are not more frequent in Seveso companies, but in these companies the medical inspector has more detailed information on working conditions and the risks run by the workers.

Relations with both the external prevention and protection service and the insurance company can be very much based on consensus.

The growing role of insurance companies

On the basis of the information at our disposal, it would be difficult to assess the importance of the prevention plan imposed on companies by insurers. The intervention of insurers in companies is far from limited to the visit of the agent who establishes a price assessment. This would be a very incomplete image of the insurers' role. In fact, it can take various forms: jointly developing safety procedures; training programmes, particularly in case of fire; help in developing a global prevention plan; audits by risk technicians; supplying documentation; supplying software for analysing and monitoring risks. For companies, they are a very close partner for prevention.

Subcontracting to universities

Among the research projects ordered from universities, some, certainly, may deal with knowledge of emerging risks. Certain companies encountered take care to see that their external prevention and protection service is associated with these research projects in one way or another so that they can incorporate the results of the knowledge developed by the contracted research project as fully as possible. Ensuring a good interface between the researchers under contract and executives in the company, who must provide their very specific knowledge of processes and take advantage of the research results, has always been the main challenge for companies that outsource research.

Using consultants, sometimes organised as a real monopoly

With regard to security reports for Seveso classified companies, in the Walloon Region we see the domination of a consultancy, imposing probabilistic methods deemed hardly adequate by the administration. When companies call on consultants or approved bureaus, large companies are often concerned about adopting the consultants' methods internally as quickly as possible, because the interface between the methods recommended by outside consultants and knowledge of manufacture processes is not always easy.

Inescapable certificate providers

Formerly, placers of large orders had their own audit systems; now, more frequently independent certification mechanisms are used. Supplying security certificates has become a prerequisite in the entire subcontracting sector, like supplying HACCP certificates is inescapable for the entire food chain.

Support of professional federations

In the field of knowledge and documentation of risk, several correspondents emphasised the key role played by the federation for the sector, at regional, federal or Belgian level. From a precautionary perspective, pooling knowledge and collective support of research on occupational risks concerning an entire sector of activity are certainly desirable, because this splits the costs of tackling a risk early, and gives feedback to a larger base. Collective research centres are of course also concerned by this mobilisation of knowledge at sector or inter-sector level.

An effective network of prevention advisors

Exchanges within a professional corporation with prevention advisors must be kept in mind: either on the basis of the sector, as is the case in the hospital sector, or on a basis related more to promotion, in association with the body providing level I and II training to prevention advisors or, finally with the support of organisations that help circulate information throughout the entire corporation.

The significant role of neighbours in launching an alert

Sometimes, neighbours' complaints about noise or odours are the reason for an installation such as a monitoring station to take objective measurements of pollution.

Relations with the public authorities

Contacts with public authorities concerning risks often coincide with applications for permits (or renewals of permits) or inspections. Sometimes, contacts with the authorities are limited to a sort of Who's Who: the company has the name and address of the administrative agent responsible in the event of a crisis, etc. The same is true for the European alert network set up in the food safety field for example. Ideally, of course, knowledge should be transferred between the company and the authorities well before a project development stage.

Our respondents were unanimous in saying that, at federal level, both technical and medical inspection services for regulations on workers' welfare are understaffed: the ratio of inspectors to companies controlled is lower than the ratio recommended by the international labour office, although Belgium ratified the convention on this issue. Some feel there is a danger of distortion here – of seeing the safety certificates issued to companies by certifying bodies used to adopt a low danger index, thus justifying a low rate of inspection.

The environmental aspect of inspection is more recent than the aspect of health and safety at work and certainly requires deployment of inspection methodologies.

In the food safety field, the interventions of the authorities have recently been reinforced, particularly in the form of audits, after the major crises that upset the sector in the last decade. The authorities take account of food risks over the entire food chain. This more systemic approach represents considerable progress in the way the authorities intervene in the economic circuit.

The difficulty for companies is to be confronted with methods of analysis that are not always consistent from one administration to another, and with the absence of maximum exposure values in certain cases. The interpretation of certain regulations can be ambiguous and this causes concern to companies as well. Finally, the inspection agenda sometimes upsets the order of priorities set by the company in its prevention plan.

Main problems identified

The problems mentioned repeatedly by our respondents concern:

- a lack of labour inspection resources (except for the chemical risk department);
- too much attention given in recent years to non-traditional established risks (stress, muscular-skeletal disorders) to the detriment of chemical and biological risks;
- medical monitoring after retirement of workers who are now leaving the working world at an early age;
- the absence of medical statistics that could establish a link between medical problems and a patient's professional itinerary;
- the low level of sharing of intellectual resources between external prevention and protection services;
- risk identification, a crucial phase which is still problematic in many companies, particularly in small and very small businesses;
- separation of mechanisms for handling process risks and product risks in companies;
- in Belgium, the lack of the status for experts, of a good practice code, of payment schedules.

4.3 Conclusions of the business case studies

Contributions and limits of case studies

Case studies in companies no doubt give a better understanding of how exchanges are organised on technological risks between experts in the industrial world and "external" experts from other areas. They also give a perception of how the labour bodies appointed by the public authorities to assess and manage technological risks discern possible specificities by sector. However, the main contribution of these case studies consists of identifying elements of comparison between a prevention system and a precautionary system.

A prevention system in a company entails considerable deployment of procedures, instruments and the assignment of responsibilities to easily identifiable agents (prevention officials, internal prevention and protection service, internal prevention and protection committee, external prevention and protection service). On the other hand, a precautionary scheme acts at a stage where the procedures are hardly formalised within companies: there is a certain amount of "fiddling about" in the sense that companies develop informal procedures to analyse, control and limit emerging risks.

For certain types of risks only (ionising radiation, biosecurity), regulations impose a stricter framework on companies for the management of unestablished risks. In the food sector, management tools for hygiene in processes for the manufacture, storage and distribution of food products contribute to better identifying emerging risks. Otherwise, generally speaking, there is a certain wait-and-see attitude in companies with regard to controversial risks: "we are waiting for stable standards".

Types of uncertainty

In the interviews done, the uncertainties mentioned particularly refer to causal relations between certain new risk factors and potential damage. Uncertainties are related to the difficulty of isolating exposure to risk in the context of professional activity from exposure to risk that the worker incurs elsewhere. There is also a difficulty in determining the share of an individual predisposition in the development of an occupational illness.

Procedures established to better define uncertainty

Procedures for feedback of information, reporting and communications set up in the context of a prevention policy in companies also serve for precaution – there is certainly synergy here. Beyond the alert stage, there is an interest-promoting stage: how can one convince the management of a company to take measures with regard to a risk which has not yet been established, that has not yet caused damage recognised without controversy by the scientific community, for whose occurrence the probability is not yet calculated?

If the management of company is convinced of the need to take charge of an emerging risk, it can take several paths to do so: *investigation* and in-depth research of the emerging risk; *avoidance of risk* by adopting or developing alternative technologies, the use of substitute inputs; *adopting of transient measures* (suspending or ceasing R&D activities, withdrawing from the market, removing certain workers, reinforcing medical supervision, reinforcing supervisory schemes for certain parameters in the vicinity of the company).

Companies sometimes make choices under pressure from the media, associations or the scientific community. In this case, corporate crisis management mechanisms used in the context of a prevention policy are a fortiori needed to reassure public opinion and clients with regard to emerging risks, and insofar as possible to keep the perception of risk from growing and snowballing in the mind of the general public. Companies have several kinds of concerns about their exchanges with the authorities: knowing the contact point in the administration and services concerned; correctly interpreting the regulations in force; waiting for standards to stabilise; risk assessment methodologies that differ from one department to another.

5. Delphi-research

5.1 Methodological background

As explained in the SPIRE working paper on Delphi-based methodologies (Barriat & Warrant 2004), the Delphi method is a basic standard tool, from which it is possible to design several variations. Taking into account the complexity of the issues of risk management and the precautionary approach, the genuine Delphi method does not appear to be applicable to the SPIRE topics, as far as it may be quite difficult – and somewhat contradictory with our analytical hypotheses – to reach a consensus or a full convergence between the various opinions of experts about the use of the precautionary principle (Roubelat 1993). The purpose of our Delphi survey is not to reach full consensus, but to make the experts testing feasibility and reliability of a set of proposals and settings related to knowledge, precaution and decision making.

One of the variations of the Delphi method, named "Policy Delphi", seems much more relevant and appropriate to our case. Indeed, the Policy Delphi does not seek first of all a consensus among consulted experts, but rather to consider and assess the widest range of alternative proposals and settings. It is rather a tool for analysis than a tool for consensus building on decisions to be taken (Slocum 2003). One key advantage of this method is to allow to take all opinions into consideration, should they get the agreement of the majority or of minorities.

As identified by H. Linstone et M. Turoff, the purposes of a Policy Delphi are (Linstone & Turoff 1975):

- To ensure that all possible options and alternatives are taken into consideration
- To assess impacts and consequences of every option
- To examine and assess the level of acceptability of every option

The methodology of the Policy Delphi includes several steps. According to its authors (Linstone and Turoff), six phases can be considered in a "standard" policy Delphi – which remains however open to possible variations:

- *Formulation of the issues:* What is the issue that really should be under consideration? How would it be stated?
- *Exposing the options:* Given the issue, what are the policy options available?
- *Determining initial positions on the issues:* Which are the ones everyone already agrees upon and which are the unimportant ones to be discarded? Which are the ones exhibiting disagreement among the respondents?
- *Exploring and obtaining the reasons for disagreements:* What underlying assumptions, views or facts are being used by the individuals to support their respective positions?
- *Evaluating the underlying reasons*: How does the group view the separate arguments used to defend various positions, and how do they compare to one another on a relative basis?
- *Re-evaluating the options:* Re-evaluation is based upon views of the underlying evidence and the assessment of its relevance to each position taken.

A "standard" policy Delphi should include five rounds. However, in most cases, the amount of rounds can be reduced to two or three, taking into account that:

- In the questionnaires of the first two rounds, the topics and problems can be formulated in a clear and documented way.

– Questionnaires can already list a series of possible options and alternatives, but also allow the panel members to complete, modify or comment the prepared list.

– Panel members are expected to express and comment their opinion not only on the items formulated in the first round of questionnaire, but also on the hypotheses and statements resulting from the analysis of the first round.

If the process of the Policy Delphi remains similar to the genuine Delphi, it is however important to design relevant adaptations to the purposes of the successive rounds, and to the contents and the style of the questionnaires.

According to Linstone, the implementation of a policy Delphi can generate two different phenomena:

– The procedure can start with disagreements or divergences among the panel members but, after the whole process, end up with a consensus. In a Policy Delphi, reaching such a consensus is neither a goal nor an expected result, but rather a built-up outcome.

– The reverse scenario may occur. The procedure starts from a general agreement among experts but ends up with considerable divergences among the panel members, when the Delphi process makes the experts more aware that a problem setting, which appeared simple at the beginning, may result much more complex than expected or foreseen. This scenario is as interesting as the first one.

As a conclusion, a Policy Delphi must not be considered as a policy tool for decision making, but as a tool for policy analysis. The role of the methodology is to provide the widest range of information and opinions, whilst the final decision belongs to the political authority.

5.2 Methodological options of the SPIRE Delphi survey

After an internal discussion in the research team and a meeting with the users committee, it was decided that our Delphi survey should rely on the objectives, principles and methods of a Policy Delphi, with targeted adaptations according to the needs of the project.

Our Delphi survey includes two successive rounds of written questionnaires, to be sent to a wide panel of experts involved in scientific advising or stakeholders' representation in advisory bodies or processes. These rounds of questionnaires aim at collecting a set of ideas and opinions and to understand the various logics behind these opinions. Afterwards, the Delphi survey is concluded by an interactive workshop with panel members. This workshop is designed to validate the proposals collected and selected from the first two rounds.

Table 3 – Structure of the SPIRE Delphi survey

First questionnaire	Second questionnaire	Workshop
To raise open questions on the main issues of the precautionary approach, resulting from the theoretical and empirical parts of the project. Experts will have to appraise and assess key principles, practices and scenarios. The questionnaire must lead to an understanding of the subjects of agreement or disagreement, and their perception of strengths and weaknesses of the proposed items.	Following the key issues and comments analysed in the answers to the first questionnaire, the second questionnaire has to analyse the different variables and to highlight divergences among experts in their arguments about the acceptability and feasibility of proposed measures.	In a first step, the workshop will analyse the reasons why some scenarios are selected by the experts or not, and why consensus is reached or not. In a second step, the workshop will investigate to what extent bridges can be established between different opinions, and to consider the possible gaps in procedures or practices.

The Delphi survey addresses a target group of experts involved in scientific advising in federal or regional consultative bodies. These experts come from the academic world, industry, NGOs, and public administrations. In the selection of the expert panel, an important criterion was to achieve a balanced composition between university, industry, administration and NGOs. A second selection criterion was to select experts who had an experience within advisory committees at the Belgian level – federal or regional. A representative linguistic balance was a third criterion, and gender balance was also taken into consideration as a fourth criterion. The composition of the panel was a long task, mainly because several consultative bodies do not easily disclose the names of the experts involved in scientific advising, without duly authorised request.

A panel of 205 experts is used in the first Delphi round. The first questionnaire was sent by postal and electronic mail. It was answered by 26 experts (answer rate 12.6%). Among these, there is a large masculine majority, as well as a majority of experts coming from universities or public research institutes. NGOs were also represented. Industry was under-represented. Most of the respondents have a background in natural sciences or engineering.

5.3 Main results of the Delphi-questionnaires

The first Delphi round

The purposes of the first Delphi round are:

- To identify the main *problems* linked to the working of scientific advising in consultative bodies: the composition of scientific advisory bodies, the code of conduct of experts, the elaboration process of scientific advices, the communication of scientific advices, the use of scientific advices, and the transparency of the work carried out in advisory committees.
- To identify the relevant *criteria* for the implementation of the precautionary approach: respective roles of experts and members of consultative bodies, pluri-disciplinarity, openness of the expertise process, scientific excellence, independence, transparency, confidentiality of data, protection of "bell ringers", actualisation of scientific data.
- To select appropriate *procedures and tools* in order to achieve both objectives, i.e. a better working of scientific advising and an increased concern for precaution: the selection process of topics to be investigated by the advisory committees, selection of experts, elaboration of advices, expression and communication of advices, use of scientific advising in policy decisions.

The questionnaire is structured according to these three purposes. At the end of each section, the respondents may add their own comments and suggestions. The answers are processed in order to measure both the degree of agreement with the proposed items, and the dispersion of opinions.

The main results concerning the *degree of agreement* are:

- A strong agreement on key items such as the need for transparency in the contents of the advices; the avoidance of promotion of experts' particular interests; the need for an understandable argumentation for the general public; the need for a code of conduct of experts.
- Few items with "no opinion".
- Disagreement on the following items: the precautionary principle is too ambiguous; societal concerns are badly integrated; communication among experts is difficult; advices are used for rhetorical purposes; sources of incertitude are difficult to identify.

– No consensus on the following items: under-representation of some disciplines; need for regular attendance of experts to the meetings; the relevance of specific participatory methods (citizens' juries, focus groups, consensus conferences).

The main results concerning the ***dispersion of opinions*** are:

– No item getting full unanimity, but quasi-unanimity on: the need for a declaration of independence by each expert; the need for transparency of the contents of the advices; expression of consensus in the advices.

– Dispersion of opinions is important about: the proposed scenarios for openness of expertise; the participatory settings; the mentioning of minority opinions in the final advices.

The key ***problems*** identified in the first Delphi round are:

– Composition of advisory committees: no consensus on the representation of various disciplines and the need for regular attendance of experts.

– Advices are often considered as not understandable enough for a non-scientific audience.

– Too little attention to the lacks or gaps of scientific knowledge, no planning of follow-up.

– Organisational problems: experts overload, multiplication of advisory bodies, communication problems, imprecise terms of reference in experts assignments.

The main results concerning the ***criteria*** for selecting experts and organising their work are:

– Degree of importance of criteria: first scientific excellence, secondly independence, thirdly pluridisciplinarity, fourthly transparency.

– Evaluation of the proposed scenarios of "openness": the scenario in which the process of scientific advising must allow non-experts to express their opinion within the advisory committee is weakly supported. The scenario in which these non-experts can contribute to additional input beyond the process of scientific advising gets more support. The scenario in which the advisory process does not distinguish the involvement of scientific specialists and non-specialists is rejected.

The main results concerning ***procedures and methods*** are:

– Strong support to the capacity of selection of topics by the experts themselves, by NGOs and by business organisations. Less support to selection of topics by the authorities regulating risk management.

– Agreement on increased diversification in experts recruitment, disagreement on selection of experts through public call for application.

The second Delphi round

The purpose of the second round was to send back to the expert panel the key results and trends emerging from the first round, to get more precise evaluations and opinions on the controversial issues, and to develop the statements on which there was an agreement.

The second questionnaire was sent to the same database of 205 persons, and 18 answers were collected. Most of the respondents had already answered the first questionnaire. The composition of the panel is similar to the first round.

In comparison to the fist round, there are more agreements on the proposed items, less disagreements, les "no opinion", less dispersion in the opinions. In this sense, the second round confirms consensual items and reduces dispersion. It is precisely what is expected from a second round.

Concerning key *problems*:

- Confirmation of the results of the first round concerning the composition of advisory committees; making the advices more understandable by non-scientific audience; too little attention to the lacks or gaps of scientific knowledge, no planning of follow-up.
- Changes of opinion between first and second round: about confidentiality of data, the problem of trade secret is often mentioned; no consensus anymore on communication difficulties among experts.
- Enhanced items: the need for an "expertise contract"; the dispersion of opinions about the declaration of independence (although there is an agreement of the majority).

Concerning *criteria*:

- The ranking of criteria is the same as above. The second round confirms the agreement on the fact that incertitudes have to be explicitly mentioned in the advices.
- Openness of expertise: agreement to integrate non-experts in the consultation process, either within or outside advisory committees, but disagreement to consider experts and non-experts on the same level.
- Agreement on a need of clarification of the different roles within advisory committees, but no consensus on the importance of a separation between the functions of evaluation, management and communication.
- Other results of the first round are confirmed.

Concerning *procedures and tools*:

- Strong confirmation of the results concerning the agenda setting of advisory bodies; the selection process of experts; the formulation and communication of advices; the use of advices.
- New results on participatory methods: there is an agreement on the need for a large participation of concerned actors (through participatory techniques) in the problem definition and at the final stage of the formulation of an advice. Among these participatory techniques, consensus conferences and focus groups receive a positive appraisal, but there is no consensus on scenario workshops and citizens juries.

5.4 Main results of the Delphi-workshop

The third phase of our Delphi-research consisted of a concluding workshop. To this workshop a number of experts that have experience with processes of scientific advice were invited. The workshop aims at weighing the various procedures proposed and investigating which proposals are acceptable in most contexts.

The participants to the workshop mutually exchange ideas, suggestions, experiences. In order to structure this exchange, the organizers defined four topics (these topics reflect the process of scientific advice): the participants or actors, the problem definition or agenda setting, the elaboration of an advice, the use of an advice. For each topic, a number of statements were formulated. The members of the workshop worked in two (language) groups. They first chose – via deliberation and voting – two statements for each topic. These statements were the ones they considered most important from the perspective of precaution. They, consequently, discussed these statements with the aim of developing suggestions in order to translate the precautionary principle into scientific advisory procedures.

The statements proposed to the workshop members, the statements selected for in-depth discussion by the workshop members and the main results of the discussions per topic are presented hereafter.

First topic: participants in the expertise process

Statements proposed to workshop members

- ✓ The disciplinary backgrounds of the various experts should be sufficiently diverse
- ✓ The economic and political backgrounds of the experts should be sufficiently diverse
- ✓ The institutional backgrounds of the experts should be sufficiently diverse
- ✓ Experts should fill in a declaration of dependence
- ✓ Experts should sign a contract mentioning their tasks, duties and rights
- ✓ Experts should comply with a code of conduct
- ✓ Experts should attend meetings of the scientific committee on a regular base
- ✓ The selection process of experts should be made transparent
- ✓ Bell ringers should receive juridical protection

Selected statements for in-depth discussion

- ✓ The selection process of experts should be made transparent
- ✓ Experts should fill in a declaration of dependence

Results from the discussion

- A transparent selection procedure for members of a scientific committee regards both the research and the selection procedure
- In order to guarantee diversity within a scientific committee one can stimulate the members to attend the meetings on a regular basis via various preconditions (financial remuneration, a clear time schedule, a positive atmosphere, a good secretarial support).
- Transparency offers a procedural guarantee that disciplinary and institutional diversity and a balanced representation of economic and social interests will be respected.
- Transparency offers a procedural guarantee that the whole field of expertise will be well presented.
- Transparency should be realised during the whole scientific advisory process. It is important that persons outside the process can understand the process and can record how the advice gradually comes to its final form through the subsequent steps in the process.
- Transparency should be realised wherever possible: with regard to the motives for either or not selecting particular experts, with regard to the mandate of the experts, with regard to the definition of the problem.
- It is necessary to define a clear framework within which the questions will be put before the experts.
- A declaration of affiliation tries to describe as good as possible from which perspective the expert concerned acts and thinks. Therefore experts can explain for whom they work, for which groups or organisations they engage themselves, what their expertise consists of and with which disciplinary schools they join in.
- One should watch that experts' privacy is not invaded. It can be necessary to define sharper the borderlines between professional and personal life.

Second topic: problem definition

Statements proposed to workshop members

- ✓ Experts, stakeholders, public authorities and citizens should decide together which risks and uncertainties are relevant to discuss
- ✓ Adequate procedures to select relevant risks and uncertainties are needed
- ✓ Adequate procedures and techniques to organize the participation of citizens and stakeholders are needed
- ✓ Public perceptions of risks and uncertainties should be integrated adequately in the problem definition
- ✓ Stakeholder perceptions of risks and uncertainties should be integrated adequately in the problem definition
- ✓ The perceptions of citizens, stakeholders and experts should be integrated in a balanced way
- ✓ Procedures should be planned that allow for quick reactions facing alerts and new risks.
- ✓ Studies should be realised to investigate and evaluate first evidences of emerging risks
- ✓ The process of problem definition should be made transparent by archiving relevant documents and making these archives accessible
- ✓ The process of problem definition should be actively communicated to several groups

Selected statements for in-depth discussion

- ✓ Experts, stakeholders, public authorities and citizens should decide together which risks and uncertainties are relevant to discuss
- ✓ Adequate procedures to select relevant risks and uncertainties are needed
- ✓ The process of problem definition should be actively communicated to several groups

Results from the discussion

- In cases where the precautionary principle has to be applied, one has to decide and to act while norms and values are not fixed (yet). When public support for a particular problem definition is lacking, there will be a heavy burden on the policy decisions ensuing from it.
- Within scientific advisory committees one should distinguish between two intervention levels:
  1. the level where questions are allowed to arise. At this level one should take care that all visions and perspectives get their chance.
  2. the level where questions are selected that the members of the scientific committee should investigate and that are in conformity with the experts' mandate.
- In order to define an agenda that takes public concerns into consideration, various ways are possible. One can organise participatory exercises for a wide audience or for stakeholders or one can look for the various issues via literature and media studies, questionnaires, the study of international developments within similar advisory councils.

- The mandates of the various participants to the whole scientific advisory process should be compatible with the problem definition. If necessary it should be possible to redefine mandates.

Third topic: elaboration of an advice

Statements proposed to workshop members

- ✓ Participants should gather information concerning the nature, sources, quality and relevance of the data concerning risks and uncertainties
- ✓ Participants should collect relevant data concerning possible benefits of a possibly harmful technological application or product
- ✓ Participants should collect relevant data concerning possible alternatives for a possibly harmful technological application or product
- ✓ An adequate methodology is needed to discuss uncertainties
- ✓ Possible alternatives should be compared with regard to their respective risks and benefits
- ✓ Experts should define useful follow-up programmes
- ✓ Experts should define knowledge gaps and topics for further research
- ✓ Dissension should be dealt with adequately
- ✓ The process of elaborating an advice should be made transparent by archiving relevant documents and making these archives accessible to various groups
- ✓ The process of elaborating an advice should be actively communicated
- ✓ The final advice should consist of the following components: results of the comparison of alternatives, useful follow-up programmes, topics for further research, topics of consensus and dissension, minority and majority positions, possible management strategies

Selected statements for in-depth discussion

- ✓ Participants should gather information concerning the nature, sources, quality and relevance of the data concerning risks and uncertainties
- ✓ The process of elaborating an advice should be actively communicated
- ✓ The final advice should consist of the following components: results of the comparison of alternatives, useful follow-up programmes, topics for further research, topics of consensus and dissension, minority and majority positions, possible management strategies

Results from the discussion

- It is necessary to reach consensus regarding the subject matter that the scientific committee will deal with, regarding the scientific questions for which a scientific evaluation should be developed.
- Consequently, one should reach consensus concerning the uncertainties arising from scientific investigations.
- Finally, one should come to an agreement with regard to how to elaborate on uncertainties.
- While elaborating on uncertainties, one should take both actual and normative aspects into consideration.
- No clear links exist between the kinds of impact or the gravity of risks and the risk perceptions of the wider public.

- The two subgroups have different opinions with regard to the components of a scientific advice. One of them is in favour of mentioning all components (results of the comparison of alternatives, policy options, possible management strategies, topics of consensus and dissension, majority and minority positions, follow-up programmes, topics for further research), while the second subgroup deems that this is asking too much from a scientific advisory council.
- One should make clear what counts as an 'alternative' for a product or technological application. And one should make clear under which circumstances information concerning alternatives should be introduced into the debates. Alternatives are often even less known than the original products or technological applications under evaluation. Further research is useful here.
- A scientific committee or advisory council should restrict itself to the composition of a list of topics for further research.
- In order to define follow-up programmes, one should develop indicators. It is important to give feedback on the results of follow-up programmes to the advisory council.
- Unanimity is not always appropriate. Especially when the topics have socio-economic relevance it is important that the stakeholders and the public authorities that are responsible for the final decisions know who have which positions.
- The construction of management measures cannot happen simply on the base of scientific information. It is necessary to involve those stakeholders that have knowledge of the daily practices within which the management measures will be implemented.

Fourth topic: use of an advice

Statements proposed to workshop members

- ✓ The final advice should be translated into a language that is comprehensible for a lay-public
- ✓ The process of decision taking by public authorities should be organised adequately
- ✓ The process of deciding on management measures should be organised adequately
- ✓ The process of decision taking should be made transparent
- ✓ The decision taking of any public authority has to be motivated and argued.
- ✓ Decision takers should provide feedback towards experts
- ✓ The final decision should be communicated adequately via the media
- ✓ The decisions taken should restore and/or maintain public trust
- ✓ Risks and uncertainties should be re-assessed regularly
- ✓ Precautionary measures should be reversible. This has to be guaranteed.
- ✓ The final responsibility for a decision rests partly with decision takers and partly with experts

Selected statements for in-depth discussion

- ✓ The decision taking of any public authority has to be motivated and argued.
- ✓ The final decision should be communicated adequately via the media
- ✓ Risks and uncertainties should be re-assessed regularly

Results from the discussion

- It is very important to avoid that knowledge about risks gets fixed in time.
- One has to construct an agreement regarding the conditions or circumstances that give rise to re-evaluations.
- Some degree of freedom should be assigned to experts: the possibility to transcend their mandate should be provided for.
- Experts should have the right to take initiative.
- Offering complete information regarding the motivations underlying particular decisions following scientific advices is not without risks. Nevertheless, in present-day circumstances it is a necessary condition in order to (re)gain public trust in science and politics.
- It is useful to work out a communication strategy. Communication strategies should be tailored to the various target groups.

5.5 Conclusion

Organising a Delphi does not go without saying**.** The recruitment of experts is not an easy task. Effective participation of experts cannot be expected unless they feel personally involved in the problem of concern or issue being reviewed, have pertinent information to share, are motivated to include the Delphi task in their schedule of competing tasks, and feel that the aggregation of judgments of the respondent group will include information which they too value and to which they would not otherwise have access (Ethical Delphi Manual, can be consulted on www.ethicaltools.info from January 2006 on). Since the topic of our Delphi research is rather abstract – the translation of precaution in processes of scientific advising – it is no surprise that from the 205 experts invited to respond to the questionnaires only around 20 of them participated (a participation of 12 % is, moreover, a normal percentage). Also the recruitment of members for the Delphi-workshop took quite some time and effort from the researchers.

On the one hand, the results of the Delphi-research cannot be called representative in a statistical sense, because of the restricted amount of participants. On the other hand, these empirical results are in line with the preliminary problems, criteria and procedures we derived from the previous research phases, namely the literature study and the case studies. Moreover, the Delphi research gave us the opportunity to make the preliminary results more concrete, thanks to the contribution of the participants who brought in their daily experience from within different institutional contexts.

6. The SPIRE guide: milestones for the use of scientific expertise in a precautionary approach

The SPIRE guide is under-titled in Dutch “leidraad” and in French “points de repère”: it means that it addresses the potential users of the project results, to whatever institution they belong, and provides them with a series of guidelines and suggestions in order to integrate the precautionary approach into the concrete practice of scientific advising.

The French and Dutch versions of the guide are annexed to this final report.

6.1 Using the precautionary principle in procedures and methods

If the relation between a precautionary approach and sustainable development is to be taken seriously, a number of implications must be accepted in contexts where precaution is important and in the way precaution is to be included in procedures and methods (Mitcham & Von Schomberg 2000).

Implications for concerned actors

Collective responsibility and precaution

If precaution is needed to achieve the objective of sustainable development, this must entail collective responsibility. This type of co-responsibility means that, in principle, all citizens must be involved in technological developments via public debates. These discussions are needed to give concrete content to the guidelines on sustainable development, and to assess and integrate various visions and concerns pertaining to the available alternatives and their advantages and disadvantages. Individually, researchers, engineers and experts cannot take on full responsibility for their discoveries and their projects, whose control slips away from their authors in contexts that are not exclusively scientific and technological, but are also economic, political and legal. Technological projects take shape in keeping with the particular logic of these contexts. This logic cannot be limited to the intentions of a restricted number of individuals, nor can the unintentional and often unforeseen consequences of implementing these scientific and technical applications. By using points of view that are not covered by these various types of logic, citizens can test, question and enrich the knowledge, expectations, judgments and forecasts of experts.

Trust: openness and transparency …

Because of the many uncertainties on facts and values, there can be no solution, - not even a temporary one – to complex problems requiring a precautionary approach if the public at large does not have confidence in democratic institutions in general and in the use of scientific knowledge in particular.

This confidence presupposes an open, transparent approach first of all. This is needed to give citizens an opportunity to test the existing relations of confidence and to limit potential abuse of trust. Confidence in policies and science can only be maintained by institutionalizing healthy questioning, for example by means of providing information and guaranteeing openness and transparency.

An open, transparent approach is a prerequisite, but it is not enough. Citizens must also understand the norms, values and postulates underlying democratic procedures and institutions. According to Offe, truth and fairness are two fundamental values of this postulate (Offe 1999). Truth refers both to honesty – seeking the truth and eliminating intentional and unintentional misrepresentations – and to the capacity to keep promises. Fairness refers both to impartiality and to solidarity.

… but also impartiality and equity

Scientific knowledge is one of the imperative means to reach truth. Scientific objectivity, which is obtained by means of well-known procedures - mutual control, experimentation, testing and questioning of hypotheses provisionally accepted by the scientific community – actually refers to a temporary consensus. Objectivity is closer to an ideal to which scientists aspire than to an actual fact.

In the case of complex problems, it is not easy for scientists to keep their promises (Strand 2001). At the very least, they must actively seek out uncertainties concerning facts and values. Scientists and experts will succeed in making uncertainties explicit, and will be in a position to keep their promises, only insofar as they are aware of the limits of their discipline and their knowledge. Otherwise, they run the risk of overestimating their capacity to foresee the future and may find themselves obliged to disavow their reassuring messages. As a result of this kind of experience, general distrust of science has increased.

Impartiality is not the same thing as neutrality. Scientific knowledge cannot be neutral as it always incorporates values. Scientific impartiality means that the points of view of different disciplines and paradigms are represented in a balanced way and that experts ensure transparency of political, ideological and economic interests. Impartiality also means that public authorities take account of the concerns and viewpoints of the general public and integrate them in a responsible way in the decision taking processes.

Finally, solidarity supposes that the fact that different groups of people can be affected in different ways, or in a variable way, by the effects of technological applications or products is taken into account. While impartiality requires equal treatment of all groups concerned, solidarity demands differentiation in that treatment. In both cases, the idea is to promote fairness in view of the opportunities that people may have or encounter to give meaning to their own lives.

Implications for innovation and evaluation policies

Technological diversity

When precaution is associated with sustainable development, then a precautionary approach implies a comparison of technological alternatives for applications or products, which is only possible if sufficient technological diversity exists. This interpretation also implies that research policies and technological innovation stimulate diversity in applications and practices, in a context of publicly defined sustainable development objectives. From the precautionary perspective, technological diversity is no doubt at least as important as scientific pluralism.

Consistent innovation and assessment policies

In many cases, there is a gap between the policies that promote certain technological developments and the policies that assess those same technological developments and subject them to authorization procedures (Todt 2004). Better coordination between innovation policies and evaluation policies is needed to ensure, on one hand, that technological investments (sometimes quite large) are not threatened by lack of support in society, and, on the other, to be sure that the precautionary principle is not ignored in authorization procedures for economic reasons.

Implications for concerned authorities

An integrated evaluation

A precautionary approach based on sustainable development requires an integrated evaluation including three aspects. First, the approach can be called integrated if it envisages social, economic, cultural and ethical aspects as well as aspects associated with the environment

and public health. Secondly, the term "integrated" also means that technological applications and products must be evaluated not just from the standpoint of risks and uncertainties, but also in terms of their potential advantages. An integrated evaluation is based on weighing risks and uncertainties compared to utility and advantages. Finally, an integrated evaluation means that technological applications and products should be assessed in comparison to other alternatives. It is helpful to assess the advantages and disadvantages of various alternatives in view of the specific objectives of sustainable development.

An iterative exercise

The precautionary approach consists of considering decisions taken on the acceptability or unacceptability of uncertain definitive or temporary negative effects (Callon *et al.* 2001, 307). These decisions can be revised, in view of the development of scientific knowledge or controversies in a society. A precautionary approach requires provisional measures and measures to improve scientific knowledge on hypothetical risks. New developments can force society to seek a new consensus on the perception of risks and the adaptation of precautionary measures. The following table compares an iterative model and a traditional model.

Decisive choice (traditional decision)	**Series of rendez-vous (decision in uncertainty)**
A specific moment, an act	An iterative process
Taken by a legitimate player	Committing a network of diverse players as per their responsibilities
Closed by the scientific or political authority	Reversible, open to new information or to new formulations of the issue.

Implications for enterprises

Procedures set up by companies to cope with uncertainties in risk management

The schemes for feedback of information, reporting and communication set up as part of a prevention policy within companies also serve for precaution – they act in synergy.

If the management of a company is convinced of the need to take charge of a non-established risk, it can take several paths to do so: *investigation* and in-depth research of the non-established risk; *avoidance of risk* by adopting or developing alternative technologies, the use of substitute inputs; *adopting of transient measures* (suspending or ceasing R&D activities, withdrawing from the market, removing certain workers, reinforcing medical supervision, reinforcing supervisory schemes for certain parameters in the vicinity of the company).

Corporate crisis management mechanisms used in the context of a prevention policy are a fortiori needed to reassure public opinion, clients, neighbours and even shareholders with regard to emerging risks. They also prevent a process whereby perception of the risk grows and snowballs in the mind of the general public.

Needs of companies confronted with uncertain risks

Documentation on the risk. What companies need most with regard to uncertain risks can be summarised in a single word: documentation. Documentation on the risk helps them know more about the risk and adopt pertinent measures on a more rational basis, as well as to collect evidence in the event of a liability conflict and to have written records on the scientific state of the art at a given time. Documentation on the risk puts companies in a position to defend their applications for authorisations with public authorities and to dialogue with their financial partners, their clients and the press. This documentation on the risk entails intellectual and

financial resources that are not always available to the company generating the risk, particularly for small businesses. Producing knowledge on emerging risks is inevitably costly. Private initiative may be deficient when it comes to R&D on the subject of such risks

Co-producing knowledge. In all likelihood, the production of knowledge on emerging risks will essentially be co-production of knowledge: pooling of intellectual resources of external prevention and protection services; close partnership between individual businesses and insurance companies; circulation of information within the corps of corporate prevention advisors, environmental advisors, quality advisors; collective research at sector level (particularly at European level).

Public support for producing and distributing knowledge on risks. The authorities have a role to play both in producing this knowledge and in broadcasting knowledge on emerging risks. As concerns the production of knowledge, public incentives, research programmes and financing are needed to encourage collective research: better documentation of a risk will prevent the development of technological niches that may subsequently prove to put health or the environment in jeopardy. (European) research consortia should be created on risks associated with emerging and developing technologies. Circles in charge of professional risks need to develop a prospective vision of risks, so that they do not limit themselves to a prevention dynamic.

Obligations of companies in dealing with uncertain risks

In a precautionary system, obligations for which economic agents are responsible derive from the obligations that are incumbent on the authorities. These derived obligations consist of filling the authorities' knowledge gap on risks that are not yet established. This contribution to better knowledge of risks and removing uncertainty comprises several obligations:

– An *obligation to provide information* on the company's activity and the risks it may entail. This obligation could be limited by industrial and commercial confidentiality, but the imperative need for confidentiality must not void the information on the risk of its substance.

– A *subsequent obligation to inform* the competent authority or an alert network set up by the authorities *in the event the company learns of new aspects*. Updating knowledge of risks is fundamental to ensure public management of risks that keeps abreast with the state of art of scientific knowledge.

– An *obligation to be a party to expert evaluations raising questions of contradictory interests* organised by the authorities concerning risks caused by the company in question.

Corporate expectations with regard to the public authorities concerning uncertain risks

Corporate preoccupations concerning their exchanges with the authorities are on several levels: they are concerned about: having a contact point in the appropriate administrations and departments; correctly interpreting current regulations; stabilisation of standards; divergent methodologies used to assess various risks that differ from one public service to another.

6.2 The formulation of scientific advices

Expertise is one on the cornerstones of the precautionary principle in coping with the emergence of new risks and the limits of scientific knowledge. Before taking a decision concerning collective risks, the authorities increasingly ask for the advice of one or several experts, in order to assess the risks in a wide variety of fields concerning the environment, health, food. Thus, within the decision taking process, the experts' role consists of giving scientific advices that can throw light on the question for the final decision maker.

"A scientific advice is the conclusion drawn from a competent evaluation that takes account of scientific data, including uncertainties. It can consist of an appreciation of the consequences of one or several options based on an analysis of available scientific data and on a scientific judgment. It should make an express statement on any uncertainty due to insufficient current knowledge or as concerns the unsatisfactory nature of available data. If necessary, it should indicate other possible interpretations of the data" [1].

This entire chapter analyses how relations between scientific experts and political decision takers are structured and it presents mechanisms for providing scientific advices. Four phases are identified in the process of establishing a scientific advice: the phase of "determining membership of the advisory committee and its terms of reference", the phase of "defining problems and establishing priorities", the phase of "drafting an advice" and the final phase, "the use of the advice".

We will see that the expertise process is a complex process because it plays a role in periods of crises, controversy, urgency and uncertainty. Then we will look into the impact of the precautionary principle on the operation of expert committees.

Membership and terms of reference of scientific advisory committees

Before going into greater detail on how advisory committees operate, it is important to look into the form of these committees. The membership of the committee should be clearly structured, using a procedure for recruiting experts and establishing precise criteria developed in the selection procedure. In fact, the quality of the work and the success of the expertise process will depend on the membership of the committee.

Membership of scientific advisory committees

The membership of a scientific advisory committee is subject to a requirement of transparency: the terms of reference clearly define its structure, membership, objectives, working methods and operation.

Before looking at the details of committee membership, it is important to think about the kind of expertise desired. Scientific advisory committees are increasingly shifting to multidisciplinary, adversarial expertise. Specialists in various fields of expertise are sought:

– scientific and technical specialists,

– specialists in public decisions and operation of administrations (analysis of the feasibility of policies, consideration of areas that do not function well)

– specialists in social-economic evaluations (costs and benefits analyses).

The issues of transparency and multidisciplinary representation are crucial, since confidence building and a multi-party discussion are prerequisites for the quality of the process.

Expert evaluations cover a very large range of questions (such as setting objectives for the quality of the air, or setting health and safety standards). These questions are increasingly interdisciplinary and deal with different levels of authority. Arbitration of questions associated with the implementation of the precautionary principle is left less and less to experts alone, because these questions often go beyond the scope of their scientific knowledge, however "interdisciplinary" the advices consulted. Expertise is opening up to a "non-expert" public: membership of the committee is increasingly hybrid and is enhanced with the presence of MPs, representatives of associations and citizens. Our Delphi survey did show certain reservations, however, with regard to attributing the same status to these "non-experts" and to experts.

[1] Rapport d'atelier conjoint FAO/OMS (2004), *Fourniture d'avis scientifiques au Codex et aux Etats membres*, Consultation sur la sécurité sanitaire des aliments, Genève.

The role of the selection committee

The committee's assignments were defined beforehand by the authorities concerned.

Establishing the profile of a potential expert. The profile of the potential expert is established not only in terms of his/her scientific background, but also in view of his/her experience of assessing risks. It is important to devote the resources needed to dispose of available experts. Ideally, a potential expert should have:

- scientific excellence recognized by his/her peers and a public reputation;
- a list of publications or any other form of certification of capacity;
- professional experience (national or international) related to the application;
- experience in risk assessment (experience acquired in the fields of consumer safety, public health and the environment);
- analytical skills (skills in analyzing information and files, experience in assessing scientific work and publications);
- a predefined level of language skills in the national languages and in English;
- management and organizational skills.

Implementing a procedure for seeking and selecting experts. Transparency in the membership of an advisory committee must also concern the recruitment and selection of experts.

How are the experts to be contacted? The most transparent approach is to issue a public call for expression of interest in becoming a member of a scientific committee. This solution allows for a first selection from among the candidates. In the context of this public appeal, candidates are asked to assess their skills and knowledge that could justify their participation at a scientific committee.

Nevertheless, in practice, the recruitment of experts is often done in a more informal way by exploiting a personal network of experts who are contacted directly. A continually updated pool of experts can also be used and they can be recruited from different circles (universities, companies and associations). This second possibility is much less transparent than the first, but it has the advantage of making it easier to convince the experts contacted to accept the job. The procedures for recruiting experts will differ when looking for permanent experts or ad hoc experts. The latter are contacted on the basis of their specialization in very specific technical questions.

The precautionary principle should lead to maximum diversity (in terms of disciplines, institutions and representation of economic and social interests) to encourage discussions between all points of view. On establishing selection criteria, the issue is to insure great diversity of committee members, as well as to deal with the difficulty of subsequently managing these differences.

Establishing a procedure for lodging objections. A procedure for lodging objections must be foreseen in the event that the membership chosen for the committee is not well balanced. This means that terms must be set for lodging objections and making modifications.

Guarantee of transparency. We have seen that the process of seeking and selecting the future members of scientific advisory committees could take several forms. However, one important observation should be made. In practice, it is difficult to agree on a common definition of selection criteria for experts. Transparency is the only guarantee that the selection procedure will function well and that all the fields of expertise will be covered. In fact, it offers many guarantees: diversity in selection, diversity of scientific background, diversity in the institutional origin of the participants and diversity in the representation of economic and social interests.

How can the process of choosing the members of advisory committees be made more transparent?

- At the first meeting: ask the experts about the reasons for their presence: why were they chosen and look into the grounds for their acceptance;
- Ask the members about any gaps or shortcomings observed in the selection procedure;
- Know the reasons motivating the choice or exclusion of a given expert.

The expertise contract

For advisory committees to function well, an expertise contract is indispensable. It clarifies the rights and obligations of the experts, defining the scope and nature of their obligations.

Experts have a right to:

- a clear assignment: the expert must be clearly appointed and informed of the exercise of his/her expertise assignment by the contracting public authority. In addition, the criteria for his/her appointment should be clearly mentioned.
- accessibility of data: the expert should have access to any existing public documents pertaining to the assignment and be entitled to enter both public and private organizations.
- remuneration: it is helpful to budget allowances in certain cases for both attending and preparing meetings. These allowances would be used to pay the experts. However, the amount should be reasonable: profit seeking should not be the motivation for a potential expert. The experts' work can be recognized by means other than financial remuneration: recognition of the quality of the work, valorization of the expertise within the experts' university.
- protection of the experts' work: the expert must be ensured full protection during his/her expertise activities particularly in sensitive fields.
- protection of personal data: the borderline between professional and private data should be clear.
- initiative: the right to look into subjects considered pertinent and sensitive by the members of advisory committee as a group. Freedom in the exercise of the experts' duties is often necessary. Each expert has his/her field of knowledge and competence in his/her own fields of research as well as in related fields. In practice, the expert is often obliged to go beyond the framework of the assignment to answer a question.
- secretarial support: administrative jobs should not be an obstacle to the committee members' activities as experts. For this reason, the presence of a secretariat is crucial. The secretariat helps prepare the scientific files (data collection, keeping the discussions on course, summarizing the advice). It can define the agenda, attend plenary meetings (subject to the reservation that it does not intervene in the discussions), draft the activity report and contribute to drafting the advices.

The experts' obligations:

- regular attendance and compliance with deadlines: the expert undertakes to take part in all the working meetings stipulated in the contract. Working deadlines must be met.
- declaration of affiliation: this declaration should try, as accurately as possible, to reflect the context in which the expert in question carries out the expertise. It is preferable for experts to mention the name of the organization for which they are working, the name of professional associations of which they are members, their field of competence and the schools of scientific thought to which they belong. The problem with the declaration of

affiliation is not to overflow into the private field: this must be limited to professional and public activities.

- the obligation to work transparently: the expert undertakes to supply accurate information and to mention any lack of knowledge he/she may have that could be a cause of serious consequences in the more or less near future. And, finally, the expert should mention any alarming events or warning signals that he/she has observed.
- confidentiality: the expert cannot comment publicly on the data gathered and on the contents of the internal debates.
- undertaking to maintain an open mind: the expert often deals with disciplines other than those in which he/she is specialized. He/she undertakes to dialogue with the other experts.

Defining the problems

The definition of the problems is a crucial phase which establishes the framework of the expertise process. The terms of reference often define the problematic beforehand. An agreement must be reached on a common basis for defining the problems to be treated.

Putting themes on the agenda

It must be possible to express various advices and sensitivities. The authorities, experts, stakeholders and citizens should decide together on the risks and uncertainties to be considered.

Selection of the topics

The choice of themes submitted for evaluation should be made transparently and independently of any contracting authorities.

Responsibility for the choice of themes. In practice, the authorities in charge of managing suspected risks are not the only ones in a position to choose the priority themes. They may be confronted with conflicts of interest or see sensitive themes ignored. Conversely, it is important to give the advisory committee the right to consider a subject of its own volition. Similarly, it seems pertinent to grant citizen associations or (inter-) professional associations the right to decide to consider a subject that is not necessarily included in the assignment (particularly on social-economic questions).

The selection criteria. Themes should be chosen for which there is suspicion of risk on a scale ranging from a simple conjecture to an observed risk. A simple conjecture is not enough to trigger a precautionary scheme. An observed risk triggers a prevention scheme. The exercise of a precautionary scheme falls between these two extremes. Examining scientific or technical controversies is an opportunity to pinpoint uncertainties. For Callon, Lascoumes and Barthe; ‘Controversy takes a real inventory of the situation; its purpose is less to establish truth of the circumstances than to make them intelligible’ (Callon *et al.* 2001). In the inventory of problems, controversies are an exploratory tool because they identify the various dimensions of the issues related to the project. The initial framework of the problems becomes clear as the controversy progresses. Members of the committee should particularly investigate grey areas and zones of ignorance. Risks for which serious or irreversible damage is suspected must also be selected; otherwise, there is no need to mobilize a broad expertise. Finally, risks that threaten the community should be chosen and priorities established among these risks, given the costs for the community that could result from not having dealt with them in time.

The methods

The emergence of themes. The procedures to stimulate the emergence of questions should target as broad an expression of opinions as possible; otherwise there is a risk of limiting the scope of the decisions taken. Various themes can be developed on the basis of literature reviews, surveys, screening, and international developments. But themes and questions can also

be defined more broadly by using participatory procedures based on exercises for participation of a broad audience or stakeholders (evaluation techniques explaining subjective values, consensus conferences or focus groups), in order to reinforce the contribution of players who are less represented. Members of advisory committees are required by their terms of reference to define positions they represent. Nevertheless, the possibility of redefining their assignment should be foreseen.

The procedure for sorting questions. The committee's scientific secretariat can draft a list of various perceptions of citizens, stakeholders and experts; this has the advantage of fully establishing the scope of the question. It would then be up to the members of the committee to go into detail on the questions they feel have priority to get the best response to the questions mentioned in their terms of reference. In a back-and-forth process between the assessors and the managers, themes can also be selected in a dialogue between the authorities in charge of organizing risk assessment and the authorities in charge of managing those risks.

Different roles, functional distinctions

It is important to differentiate the respective roles of the experts, the stakeholders, the public authorities and the citizens, and to avoid merging stages of the assessment with those of risk management; the function of the stakeholders should be recognized.

In the process of giving scientific advices, care must be taken to be sufficiently clear and transparent. There are several levels of intervention. But for the first two levels, participation procedures can be foreseen:

- the technical groups or subcommittees do a scientific assessment. Each group has a specific assignment and does an independent scientific assessment of the risks for the environment and health, or takes account of social-economic impacts. The work of the subcommittees can also be organized in a more flexible way. It can provide for citizen participation.
- the wording of the final advice is decided at a plenary meeting of the advisory committee. At this level, stakeholders representing economic and social interests can sometimes be present.
- the final decision is up to the public authorities.

Flexibility in handling the themes

The committee has the power to organize its work and particularly to define the subjects to be handled in priority. The committee members must reach a consensus on the choice of themes to be considered. They can also establish a series of rules of procedure. The first could be as follows: no question considered can be eliminated without a consensus on its elimination. Another rule could help establish criteria for agenda setting: if a risk is acceptable and if it can be controlled realistically, the risk must not be put on the agenda. If the risk is hard to accept, it must be taken into account from different perspectives.

We know that the terms of reference clearly define the themes to be considered. However, on selecting the themes, a large number of questions can arise that are directly or indirectly related to the main problematic. It is important to give elements of an answer to these questions even if they do not fall under the strict context of the assignment. Much of the credibility of the committees' work depends on its capability to deal with these questions and not leave them unanswered. The way the information is provided to the public is fundamental, because no one should feel cheated.

Determining the scientific questions precisely

The committee members should jointly define the scientific questions precisely: the subjects to be studied, the scientific questions subjected to assessment and the uncertainties and controversies that these questions raise. To do this, dangers must be well identified and

described. The process of risk assessment requires collecting sensitive data. The data on which the scientific advice is based must be of good quality with serious references. A very clear commitment must be made to limit disclosure of this data, in order to protect private or commercial data. Finally, it is important to ascertain that the problems are not determined exclusively on the basis of their scientific aspects, but also in view of social-economic concerns.

The work on harmonizing methods is helpful to develop the best basis for establishing credible scientific judgments, comparing information on risk assessment, understanding the elements on which exposure threshold values are based and promoting transparency and good communication. The more complex the questions on which a scientific advice is requested – for example, comparisons between risks, risk/benefit analyses or integrated risk assessments – the more harmonization is important.

Drafting scientific advices

The procedure for drafting scientific advices needs to be clear, precise and transparent in dealing with uncertainties and in discussing the content of the final advice. The main issue in assessing risks that have not occurred is to carefully identify the points on which there is a scientific consensus, those where divergences exist and finally those that require further investigation. The final advice should contain these three points.

Fields to be explored

Advantages and disadvantages of technological developments. The relation to risk has changed considerably today: we no longer envisage incurring or bearing risks of which we were not informed, which have not been accepted and which have not been discussed democratically. The tendency is to develop citizenship participation to discuss these questions and to integrate the precautionary principle.

In addition, technological choices sometimes entail radical changes that are characterized by the appearance of new risks (ecological and health risks associated with industrial facilities and with the production or circulation of products). The context of uncertainty is growing: uncertainties related to taking decisions, related to the consequences of these choices and related to the limits and uncertainties of scientific knowledge. This is why questions concerning mastering technological risk traverse both public policies and corporate strategies.

Alternatives to potentially risky products and technological processes. On doing a risk study, when the level of risk is considered unacceptable, looking at alternatives is recommended. These alternatives will not necessarily be considered automatically. In truth, the alternative products and processes also have their share of uncertainty. This means taking the risk of replacing a recognized risk, or one that is in the recognition process, by another risk. There are many real examples to illustrate the difficulty associated with massive recourse to substitute products, like the case of a substitute for asbestos fibers. Further research or studies are often needed to evaluate and analyze these uncertainties. Thus, when an advice is provided, it is important to examine the alternatives with their limits and their uncertainties.

How can we know whether recourse to an alternative is appropriate? The scientific advice should present the advantages and disadvantages of possible alternatives. Taking account of social-economic considerations also gives a basis for comparison between products and alternatives. Comparing the various applications of new products with each other can help guide the choice. The scientific advice should include a general definition of the criteria used to clearly differentiate the alternative products and processes, with the risks they entail, and to compare them with each other.

The choice of preferring one alternative to another is not up to the scientists but to the authorities. Scientific experts are not in fact authorized to make policy choices because often they are not aware of the social-economic impacts of the choice. Similarly, scientific advisory committees are not competent for doing research on alternatives themselves (risk of partiality,

fund-raising for their own field of research). At best, experts can draw up a list of themes and questions to be investigated in the future.

Methodology for explaining uncertainties

It is crucial to define the methodology to be used to assess risks upstream of the committee's work, endeavouring to identify danger, describe danger, evaluate exposure and describe risk. The way to handle uncertainties should also be considered. What attitude should be adopted with regard to uncertainties? How can they be managed? Must a consensus be reached at all costs? Several problems can be identified. Determining the type, degree and source of uncertainty is not an easy thing to do.

Advisory committee members should agree on the factors determining uncertainty. They should discuss the various aspects: the possible fields of impact, factors of gravity, gravity of the impact, the various groups at risk, values to be taken into account, the question of acceptability of risks and management of uncertainties.

In a discussion between various experts, the methodology can contribute to the expression of value judgments and scientific judgments. The precautionary principle is there to underline the differences between social judgments (related to advice) and scientific judgments. These value judgments must be explained. A methodology is needed to pinpoint the differences between social perceptions and scientific perceptions, but it is not up to the scientists to resolve the question.

An agreement should be found on how to manage uncertainties, particularly by defining a procedure to deal with points on which participants do not agree or about which they are uncertain. Note that participants may agree on the need to deal with uncertainties without necessarily agreeing on the way to handle and to manage them.

The final advice: content, place of minority advices and records

Many definitions are given for the content of the final advice. Some people favour an extremely broad advice including the results of comparisons of alternatives, follow-up, additional research perspectives, subjects of consensus and divergence, minority and majority positions and possible management strategies. Others feel that the content of a final advice should not be too broad, given the risk of looking like a real policy programme. A scientific advice is still an advice, with its own limitations. It is the most accurate possible response to a question asked in advance within the limits set by the authority responsible for risks. It is not a real scientific creation.

In the report, each participant should be able to illustrate his/her reasoning and the positions he/she defends using analyses and scientific data. The experts must endeavour to reach a consensus insofar as possible. However, when visions are too divergent, this should be indicated in the final advice. It is important to allow for expression of minority positions in the advice, so that these divergences are not glossed over. Minority positions should thus be found in the public conclusions. It is important both for the authorities in charge of the decision and for the various parties active in the issues to be able to identify the authors of a given advice.

The minutes of the discussions of advisory committees should be kept. This traceability is helpful both to promote public confidence in the institution and to trace the evolution of the state of scientific knowledge. This is capital information in a precautionary scheme, which is a temporary scheme until the hypothesis of risk is validated or invalidated.

It is important to draft the final report, which gives the scientific advice, in clear terms. Its presentation depends on the needs of the contracting authority. Consequently, if the needs of various audiences must be met, it can be presented in several forms (technical documents, summary, for example) going into more or less detail. Having specialists in communication on risks participate in the groups of experts from the outset of the process will facilitate the drafting of conclusions in clear terms. We recall that there has been a previous discussion on how to

organize communication of the conclusions. In other words, this means deciding who to contact, how to deal with touchy questions, how to inform the persons who will present the report, what press releases should be published.

The use of scientific advices

The phase referred to as the utilization of final scientific advices depends greatly on communication and follow-up.

Breakdown of tasks between the committee, the administration and the authorities concerned

There is a difference in function between the person who takes the decision and the person who gives an advice. The scientific advice given at the end of an assessment process must meet the needs of the contracting authority. The experts' responsibility is to supply a report whose content meets demand: a clear explanation of the question asked, the data available to answer that question, the data on which the conclusion is founded, the reasons for which certain data are excluded, an explanation of the reliability of the data used (including uncertainties), the strength of the hypothesis on which the advice is based.

Responsibility for using the advice and taking a decision lies with the competent administration and authorities.

Policy options are prepared on the basis of the advice given. This preparation is done in light of the most recent scientific knowledge and should be updated as knowledge evolves. Various measures to be taken should also be envisaged and their implications should be considered. The decision is often taken on the basis of a cost/benefit calculation (what is the potential benefit of taking a risk?). The various options are described, particularly in terms of the worst scenario hypothesis, and particular attention is given to the reversibility of measures in case one of the hypotheses is disproved.

An obligation to give the grounds for decisions taken on the basis of an advice

It is imperative to give the grounds for the position adopted, the measure chosen and to see that the arguments are understandable to the general public.

Final decisions should necessarily be reasoned and the arguments in their favour described. It is important to give as much information as possible on risks, in a comprehensible style, and the reasons that contributed to taking a decision. This obligation also holds in cases when the authorities follow the recommendations of the advice, and when they do not.

Communication on decisions taken

Requirements in terms of disclosure of decisions taken (channels used for broadcasting, distribution of all or part of the work, distribution of the names and capacities of the experts consulted, etc.) must be clear. By distributing all the information, there is a risk of reinforcing controversy within groups of persons or of triggering a panic. Wouldn't it be less dangerous not to communicate certain scientific information? A public communication no doubt entails risks but it promotes confidence in the political and scientific institutions.

Updating the data

One of the basic concerns of members of an advisory committee is not to freeze an advice made on the basis of data available at a given time.

Setting up a monitoring system that can keep abreast of future evolution is mandatory. It is important to define the criteria to be taken into account to determine changes that require a reassessment, because a reassessment cannot be done for each change in the state of knowledge. Committee members certainly have the necessary competence to determine a series of pertinent technical-scientific and social-economic indicators.

Feedback from the results of this monitoring system should be submitted to the committee for revision of their latest advices. Experts may at times be asked for an assessment of the influence of policy initiatives taken. A reassessment can be envisaged in certain cases:

- at the request of members of the advisory committee who may decide to look into the problem again themselves, notably on the basis of monitoring results.
- on the basis of a committee advice when sensitivity to given questions has decreased.
- when an authorization request to bring a product to the market is submitted.
- in the event of a change in policy, because this influences the framework of values.
- at the request of the population: the perception of risks changes over time.

Summarising

The table below summarises the procedures and proposals that are put forward in order to make scientific advising more compatible with the guidelines of precaution.

Membership and terms of reference of scientific advisory committees	*Membership*. Caring for interdisciplinarity and for the balance between scientific disciplines; being open to non-experts, according to the types of problems at stake. *Selection*. Establishing clear profiles of the expected experts; implementing a procedure for seeking and selecting experts; using a wide diversity of networks of relationships; guaranteeing the transparency of selection and decision criteria. *Expertise contract.* Establishing an expertise contract, defining the rights and obligations of experts (among the obligations, the relevance of the declaration of affiliations should be highlighted).
Defining the problems	*Putting themes on the agenda*. Enabling an initiative capacity of the advisory body and external actors in the selection of themes; selecting themes according to the specificity of precaution as regards to prevention; distinguishing respective roles of experts, stakeholders, public authorities and citizens' participation. *Flexibility in handling the themes.* Handling the problems in differentiated ways, according to their level of complexity or uncertainty. *Determining the scientific questions precisely.* Relying on existing data, studies, and controversies, but also taking socio-economic concerns into account.
Drafting scientific advices	*Fields to be explored.* Advantages and disadvantages of technological alternatives; comparison between alternatives. *Methodology*. Investigating the nature and scope of uncertainties; implementing working methods dealing with controversial topics; revealing underlying value judgements. *Contents of the final advice.* Arguing consensus and dissension points; reporting the minority opinions; keeping records of the debates; planning a follow-up.
The use of scientific advices	Organising distribution of tasks between advisory bodies, administrations and political authorities; motivating decisions with reference to scientific advices; planning a communication campaign; organising a process for updating data and knowledge.

7. The involvement of stakeholders in the project

FTU and STEM involved the stakeholders in the research project in various ways. In the course of the project they developed a research website (www.ua.ac.be/SPIRE) and they introduced a newsletter (SPIRE Info). Twice a year they organised meetings of the user committee. Finally, the workshops, surveys and interviews that were necessary research instruments were at the same time ways to involve the stakeholders.

The SPIRE-website

The idea to develop a research website emerged in the Delphi-phase of our research project. We deemed a research website a convenient instrument to communicate with the addressees of the Delphi-questionnaires. Via this website we could offer these addressees all useful information about the subject matter, the structure and the preliminary results of our research. At the same time the addressees could download the questionnaires from the website. Once FTU and STEM had gathered and analysed the completed questionnaires, the addressees could, again, consult the results at the SPIRE-website.

The SPIRE-website proved to be not only a useful research instrument, but also a useful communication instrument, especially to researchers external to the research project.

SPIRE Info

SPIRE Info is a newsletter that was published twice and was sent to some 70 persons. This newsletter intends to communicate in an active way our research progress with persons that possibly have an interest in the topics treated. In order to compose our database of addressees, we gathered the names of persons affiliated to scientific advisory councils to government and of persons working out security and safety procedures or performing evaluations within the private sector. Of course, we offered the opportunity to unsubscribe from the list of addressees. Some persons spontaneously put forward their membership of the subscriber list.

The user committee

We organised five meetings of the user committee with an intervening period of approximately 6 months. Members of the user committee are civil servants from federal and regional administrations (public health, environment, science policy), representatives of federal and regional scientific advisory committees, representatives of trade unions, representatives of private organisations that support the safety and security policy of private enterprises, representatives of sector federations and of non-governmental organisations.

During the meetings of the user committee, intermediary research results were presented and future research plans were discussed. FTU and STEM made a report of each meeting and sent it to all the members of the user committee. Attendance to the user committee was rather low: only three to five persons were present on a regular basis. Nevertheless, the meetings offered the researchers a useful feedback on their research work.

Participatory research instruments

Several research instruments used in the course of our research project are participatory in kind. This holds for the interviews organised during our case studies, the questionnaires sent during the Delphi research and the workshops organised during our case studies and our Delphi-research. Such participatory exercises do not only provide the researchers with research data; at the same time they involve various stakeholders in the research project.

During the phase of case studies FTU interviewed 26 persons within private enterprises and federal and regional administrations that are concerned with safety and security matters within enterprises. STEM interviewed 19 persons related to the Biosafety Advisory Council (political representatives, experts, representatives of competent authorities, representatives of private

enterprises, members of the SBB and of the BAC). Only three persons attended a workshop organised for the BAC case study, while some 15 persons attended a workshop organised for the Health Council case study.

The data base constructed for the Delphi-questionnaires consisted of some 180 persons. At the Delphi-workshop 8 persons were present. They are representatives of advisory councils, of trade unions, of sector federations and of the regional administration for Science and Innovation.

8. General conclusions

From the SPIRE research project, we can draw some general conclusions.

To start with, the conclusion derived from our literature study that two main trends exist regarding the interpretation of the precautionary principle – a harm-oriented and a goal-oriented one – is fundamental. Our analysis of relevant European and national regulatory documents tells us that the prevailing interpretation within present-day policy contexts conforms to the harm-oriented position: the precautionary principle is understood from within a framework of risk assessment. This harm-oriented interpretation helps to explain problems arising in scientific advisory processes.

A goal-oriented interpretation of the precautionary principle allows for reconnecting precaution with the ideal of sustainable development. A goal-oriented interpretation considers sustainable development as the *sense* of a co-responsible public technology policy and precaution as the *attitude* needed to make a realisation of this ideal possible.

This interpretation has some procedural and substantial implications. The substantial features of a precautionary attitude are that it takes a) predefined goals as its starting point, b) defines technologies and technological practices in function of these goals, c) evaluates and compares the risks and benefits of this variety of suitable technologies and practices with regard to both their environmental, ethical, social, and economic impacts. The procedural characteristics are that a precautionary attitude is a) a continuous learning process and an iterative decision process b) that integrates public concerns and visions during the whole process and c) that takes the economic context with its particular power relationships into consideration.

This interpretation of the precautionary principle has particular implications for its translation into processes of scientific advice to governments. Processes of scientific advice a) should be transparent and open, b) allow for the integration of publicly defined objectives and of public values and concerns in the problem definition, the definition of risks and benefits and the choice of appropriate technologies or products, c) should be impartial by guaranteeing disciplinary and paradigmatic pluralism, ideological pluralism and diversity in the institutional backgrounds of the experts, d) should make the sources, type and degree of uncertainties explicit, discuss their implications for concrete and local contexts and the feasibility of reducing them, e) should not only be quantitative, but also qualitative and f) should be sensitive to scientific and societal changes and developments.

In short, scientific advisory processes should aim at an integral assessment of new products and technological applications. This means three things. First, a precautionary assessment does not only consider biosafety aspects, but also social, economic, ethical aspects. Second, it does not only take possible risks into consideration, but also possible benefits. Third, it weighs and compares the advantages and disadvantages of appropriate alternative technologies or products. Scientific advisory processes should, moreover, be open to public perceptions and concerns. Finally, scientific advices regarding technologies or products with uncertain risks cannot be made once and for all. They rather result from iterative exercises depending on evolutions in scientific knowledge and in societal perceptions and expectations.

The implications of a goal oriented interpretation of precaution do not remain restricted to the domain of scientific advisory processes. A goal-oriented interpretation has implications for various types of actors: for all the stakeholders concerned, for innovation and evaluation policy, for competent authorities and for enterprises.

Precautionary policy in the service of sustainable development assigns responsibility to the various stakeholders. Public authorities, scientists, enterprises, non governmental organisations and citizens all have a responsibility to participate, whenever it is appropriate, in deliberative processes. In order to maintain mutual trust, they should, moreover, be as open and transparent

as possible and they should be keen to act in an impartial way and to show their solidarity with groups that are possibly endangered by the application of new technologies.

From the perspective of precaution, technological diversity is perhaps as important for a 'healthy' society as is biodiversity for a 'healthy' environment. For this reason, innovation policy should stimulate technological diversity (rather than focus one-sidedly on particular high-technological developments that are, indeed, promising for reasons of economic competitiveness). Innovation policy and authorisation policy should, moreover, be made more consistent to avoid, on the one hand, that technological investments are threatened by lack of support in society, and, on the other, that the precautionary principle is ignored in authorization procedures for economic reasons.

The precautionary principle has several functions both within a public and a private context: a function of early warning, of recognition of the limits of scientific knowledge, of risk documentation and of management of transitory phases.

Enterprises have their own role to play in order to realise these functions. They have to set up procedures to cope with uncertainties in risk management. Therefore, they need, among other things, to document on risks. Co-production of knowledge regarding emergent risks is unavoidable because of the huge costs of this kind of research. Together with other enterprises within their sector, with external prevention and protection services, with insurance companies the necessary research activities can be performed. Enterprises have an obligation to provide competent authorities with the necessary information concerning the possible risks they produce. They also have an obligation to take initiative to send alerts to the competent authorities whenever needed. Finally, they should participate at expert evaluations that are organised by public authorities to consider possible risks caused by the company.

9. List of reports and publications

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(Please note that the reports mentioned can be downloaded from the SPIRE-website www.ua.ac.be/SPIRE.)

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Annexe 1 – Expertise scientifique et principe de précaution: des points de repère

1. La traduction du principe de précaution en procédures et méthodes

1.1 Les implications pour les acteurs concernés

Prendre au sérieux la relation entre la démarche de précaution et le développement durable, c'est accepter une série d'implications pour les acteurs concernés et pour la traduction de la précaution en procédures et en méthodes. Si la précaution est une attitude nécessaire pour atteindre l'objectif de développement durable, alors elle suppose l'exercice d'une responsabilité collective (Mitcham & Von Schomberg 2000).

Responsabilité collective et participation

Ce type de responsabilité collective signifie que tous les citoyens devraient en principe être impliqués dans les développements technologiques, à travers des débats publics. Ceux-ci sont nécessaires pour donner un contenu concret aux lignes directrices du développement durable, ainsi que pour mener une évaluation et une intégration des différentes visions et préoccupations relatives aux alternatives en présence et à leurs avantages et inconvénients. Individuellement, les chercheurs, les ingénieurs et les experts ne peuvent pas assumer l'entière responsabilité de leurs découvertes et de leurs projets, parce que ceux-ci font leur chemin indépendamment de leurs auteurs, dans des contextes qui ne sont pas exclusivement scientifiques ou techniques, mais économiques, politiques et juridiques. C'est là que les projets technologiques prennent forme, selon les logiques propres de ces contextes. On ne peut pas circonscrire ces logiques, pas plus que les conséquences non intentionnelles et souvent imprévues de la mise en œuvre des applications scientifiques et techniques, aux intentions d'un nombre limité d'individus. À partir de points de vue qui échappent à ces logiques, les citoyens peuvent tester, mettre en cause ou enrichir les connaissances, les attentes, les jugements et les prévisions des experts.

La confiance : ouverture et transparence …

A cause des nombreuses incertitudes sur les faits et les valeurs, des problèmes complexes, qui requièrent une démarche de précaution, ne peuvent pas recevoir de solution, même temporaire, si le grand public n'a pas confiance dans les institutions démocratiques en général et dans l'utilisation de la connaissance scientifique en particulier.

La confiance suppose en premier lieu l'ouverture et la transparence. Celles-ci sont nécessaires pour donner aux citoyens l'occasion de tester les relations de confiance existantes et de limiter les abus de confiance possibles. La confiance dans la politique et la science ne peut persister que si une "saine défiance" est institutionnalisée, par exemple à travers la fourniture obligatoire d'informations et la garantie d'ouverture et de transparence.

L'ouverture et la transparence sont des conditions nécessaires, mais pas suffisantes. Les citoyens doivent aussi s'y retrouver dans les normes, les valeurs et l'idée directrice qui sous-tendent les procédures et les institutions démocratiques. Selon Offe, la vérité et l'équité sont les deux valeurs fondamentales de cette idée directrice (Offe 1999). La vérité renvoie aussi bien à l'honnêteté – rechercher la vérité et éliminer les contre-vérités intentionnelles ou non – qu'à la capacité de tenir ses promesses. L'équité renvoie aussi bien à l'impartialité qu'à la solidarité.

… mais aussi impartialité et solidarité

La connaissance scientifique est une des manières incontournables pour atteindre la vérité. L'objectivité scientifique, qui est obtenue par l'intermédiaire de procédures bien connues – le contrôle mutuel, l'expérimentation, le test et la mise en doute d'hypothèses provisoirement acceptées par les membres d'une communauté scientifique – signifie plutôt un consensus temporaire. L'objectivité est davantage un idéal vers lequel tendent les scientifiques qu'un fait accompli.

Dans le cas des problèmes complexes, il n'est pas facile pour les scientifiques de tenir les promesses de la science (Strand 2001). Une condition minimale est qu'ils se mettent activement à la recherche des incertitudes relatives aux faits et aux valeurs. C'est dans la mesure où ils prennent en compte les limites de leur discipline ou de leurs connaissances, et où ils réussissent à expliciter les incertitudes, qu'ils sont capables de répondre aux attentes. Sinon, ils courent le risque de surestimer leurs capacités de prévision et se retrouver plus tard dans l'obligation de revenir sur leurs messages apaisants. C'est suite à de telles expériences que la méfiance des citoyens à l'égard de la science s'est accrue.

L'impartialité n'est pas la même chose que la neutralité. La connaissance scientifique ne peut pas être neutre, elle est toujours chargée de valeurs. L'impartialité scientifique signifie plutôt que les points de vue des différentes disciplines et paradigmes sont représentés de manière équilibrée et que les experts garantissent la transparence des intérêts politiques, idéologiques et économiques. L'impartialité signifie aussi que les pouvoirs publics tiennent compte des préoccupations et des points de vue du grand public et les intègrent de manière responsable dans les processus de décision.

La solidarité, enfin, suppose que l'on tienne compte du fait que différents groupes de personnes peuvent être affectés de manière différente ou dans une mesure variable par les effets des applications technologiques ou des produits. Là où l'impartialité demande un traitement égal de tous les groupes concernés, la solidarité demande un traitement différencié. Dans les deux cas, il s'agit de promouvoir l'équité par rapport aux opportunités que les gens peuvent avoir ou recevoir pour donner du sens à leur propre vie.

1.2 Les implications pour les politiques d'innovation et d'évaluation

La diversité technologique

Lorsqu'on lie la précaution et le développement durable, alors une démarche de précaution implique une comparaison d'alternatives technologiques pour les applications ou les produits, ce qui n'est possible que s'il existe une diversité technologique suffisante. Cette interprétation implique également que les politiques de recherche et d'innovation technologique stimulent la diversité des applications et des pratiques, dans un contexte d'objectifs de développement durable publiquement définis. Dans une perspective de précaution, la diversité technologique est sans doute au moins aussi importante que le pluralisme scientifique.

La concordance entre politiques d'innovation et d'évaluation

Dans de nombreux cas, il y a un fossé entre les politiques qui promeuvent certains développements technologiques et les politiques qui évaluent ces mêmes développements technologiques et les soumettent à des procédures d'autorisation (Todt 2004). Une meilleure concordance entre politiques d'innovation et d'évaluation est nécessaire, d'une part afin d'éviter que des investissements technologiques, parfois importants, ne soient menacés par manque de support au sein de la société, d'autre part, afin d'éviter que, lors des procédures d'autorisation, le principe de précaution ne soit mis à l'écart pour des raisons économiques.

1.3 Les implications pour les autorités compétentes

Une évaluation intégrée

Une démarche de précaution basée sur le développement durable nécessite une évaluation intégrée, qui comporte trois aspects. D'abord, une démarche peut être qualifiée d'intégrée si elle envisage non seulement les aspects liés à l'environnement et la santé publique, mais aussi les aspects sociaux, économiques, culturels et éthiques. Ensuite, le terme "intégral" signifie aussi qu'il faut évaluer les applications technologiques et les produits non seulement sur le plan des risques et des incertitudes, mais aussi de leurs avantages potentiels. Une évaluation intégrale repose sur une pondération des risques et des incertitudes par rapport à l'utilité et aux avantages. Enfin, une évaluation intégrale signifie que les applications technologiques et les produits doivent être jugés en comparaison avec d'autres alternatives. Il est utile d'évaluer les avantages et inconvénients des différentes alternatives par rapport à des objectifs spécifiques de développement durable.

Un exercice itératif.

Une démarche de précaution consiste à considérer que les décisions prises sur l'acceptabilité ou la non-acceptabilité d'effets négatifs incertains ne sont pas nécessairement définitives, mais provisoires (Callon *et al.* 2001, 307). Elles sont susceptibles de révision, en fonction du développement des connaissances scientifiques ou des controverses dans la société. Une démarche de précaution demande des mesures provisoires et des mesures qui peuvent servir à améliorer les connaissances scientifiques sur les risques hypothétiques. De nouveaux développements peuvent contraindre la société à rechercher de nouveaux consensus sur la perception des risques et sur l'adaptation des mesures de précaution. Le tableau suivant compare le modèle itératif et le modèle traditionnel.

Choix tranchant (décision traditionnelle)	**Enchaînement de rendez-vous (décision en incertitude)**
Un moment unique, un acte	Une décision itérative
Pris par un acteur légitime	Engageant un réseau d'acteurs diversifiés selon les responsabilités
Clôturée par l'autorité scientifique ou politique	Réversible, ouverte à de nouvelles informations ou à de nouvelles formulations de l'enjeu.

1.4 Les implications pour les entreprises

Les procédures mises en place par les entreprises face à des incertitudes dans la gestion des risques

Les dispositifs de remontée d'informations, de reporting, de communication mis en place dans le cadre d'une politique de prévention au sein des entreprises servent aussi en matière de précaution. Il y a une synergie.

Si la direction de l'entreprise se laisse convaincre de la nécessité d'une prise en charge d'un risque non avéré, plusieurs voies s'offrent à elle : la *voie de l'investigation* et de la recherche approfondie sur le risque non avéré ; la v*oie du contournement du risque* par l'adoption ou le développement de technologies alternatives, le recours à des intrants de substitution ; la *voie de l'adoption de mesures transitoires* (suspension ou arrêt des activités de R&D, retrait de commercialisation, écartement de certains travailleurs, surveillance médicale renforcée, dispositifs renforcés de surveillance de certains paramètres dans le voisinage de l'entreprise).

Les mécanismes de gestion de crise mis en place par les entreprises dans le cadre d'une politique de prévention sont a fortiori nécessaires pour rassurer l'opinion publique, les clients, les riverains ou encore les actionnaires face à des risques émergents. Ils permettent d'éviter que s'enclenche un processus d'emballement et d'amplification dans la perception du risque par le grand public.

Les besoins des entreprises confrontées aux risques incertains

La documentation du risque

Le principal besoin des entreprises par rapport aux risques incertains tient en un seul mot : documenter le risque. La documentation du risque permet à la fois de mieux connaître le risque et d'adopter des mesures pertinentes sur des bases plus rationnelles mais aussi de se ménager des preuves en cas de conflit de responsabilité, de disposer de traces sur l'état de l'art des connaissances scientifiques à un moment donné.

La documentation du risque met les entreprises en mesure d'argumenter leurs demandes d'autorisation auprès des pouvoirs publics, de dialoguer avec leurs partenaires financiers, avec leurs clients, avec la presse. Cette documentation du risque implique des moyens intellectuels et financiers qui ne sont pas toujours à la portée de l'entreprise génératrice du risque, en particulier pour les PME. La production de connaissance à propos de risques émergents est inévitablement élevée. Il y a un risque de déficience de l'initiative privée en matière de R&D au sujet de tels risques.

Une co-production de connaissances

Il est vraisemblable que la production de connaissances en matière de risques émergents sera essentiellement une co-production de connaissances : mise en commun de ressources intellectuelles au niveau des services externes de prévention et de protection ; partenariat étroit entre entreprises industrielles et compagnies d'assurance ; circulation de l'information au sein de la corporation des conseillers en prévention, des conseillers en environnement, des conseillers en qualité au sein des entreprises; recherche collective au niveau sectoriel (notamment au niveau européen).

Un soutien public à la production et à la diffusion de connaissances sur le risque

Les pouvoirs publics ont un rôle à jouer à la fois dans la production de ces connaissances et dans la diffusion des connaissances sur les risques émergents.

En ce qui concerne la production des connaissances, il faut des incitants publics, des programmes de recherche, du financement pour encourager la recherche collective : mieux documenter le risque évitera de développer des niches technologiques qui se révéleraient par la suite dommageables sur le plan de la santé ou de l'environnement. Il faut créer des consortia (européens) de recherche sur les risques liés aux technologies émergentes et en voie de développement. Il faut développer une vision prospective des risques dans les milieux en charge des risques professionnels afin de ne pas se contenter d'une dynamique de prévention.

Les obligations des entreprises face aux risques incertains

Les obligations qui incombent aux acteurs économiques dans un régime de précaution sont des obligations dérivées de celles qui incombent aux pouvoirs publics. Ces obligations dérivées consistent à remédier au déficit de connaissances dans le chef des autorités publiques sur les risques non encore avérés. Cette contribution à la meilleure connaissance des risques et à la levée de l'incertitude recouvre plusieurs obligations :

– Une *obligation de fourniture d'information* sur l'activité entreprise et les risques qu'elle peut générer. Cette obligation est susceptible d'être limitée par le secret industriel et

commercial, sans que cet impératif de secret ne puisse vider de toute sa substance l'information sur le risque [1].

- Une *obligation subséquente d'information* vis-à-vis de l'autorité compétente ou vis-à-vis de réseaux d'alerte mis en place par les autorités *en cas de connaissance de nouveaux éléments*. L'actualisation des connaissances sur les risques est en effet fondamental pour assurer une gestion publique des risques tout à fait en phase avec l'état de l'art des connaissances scientifiques.
- Une *obligation de participation aux expertises contradictoires* qui seraient organisées par les autorités publiques au sujet de risques générés par l'entreprise concernée.

Les attentes des entreprises vis-à-vis des pouvoirs publics au sujet des risques incertains

Les préoccupations des entreprises concernant leurs échanges avec les pouvoirs publics sont de plusieurs ordres : souci de connaître le point de contact dans les administrations et les services concernés, souci d'interpréter correctement la réglementation en vigueur, attente d'une stabilisation des normes, méthodologies d'évaluation du risque différentes d'un service public à un autre.

2. La formulation des avis scientifiques

L'expertise scientifique est une des clés de voûte du principe de précaution. Toutefois, celui-ci impose de nouvelles exigences aux experts et nécessite des procédures plus ouvertes et plus démocratiques dans la formulation des avis scientifiques.

Face à l'émergence de nouveaux risques et aux limites des connaissances scientifiques, l'expertise est une des clés de voûte du principe de précaution. Avant de prendre une décision concernant les risques collectifs, les autorités publiques sollicitent de plus en plus souvent l'avis d'un ou de plusieurs experts, afin de procéder à l'évaluation des risques dans des domaines très variés touchant à l'environnement, à la santé, à l'alimentation. Ainsi, au sein du processus de décision, le rôle de l'expert consiste à apporter un avis scientifique susceptible d'éclairer le décideur final. « Un avis scientifique est la conclusion tirée d'une évaluation compétente qui tient compte des données scientifiques, y compris des incertitudes. Il peut consister en une appréciation des conséquences d'une ou de plusieurs options fondées sur l'analyse des données scientifiques disponibles et sur un jugement scientifique. Il doit faire expressément état de toute incertitude due à une lacune des connaissances actuelles ou quant au caractère satisfaisant des données disponibles. Il doit, si nécessaire, indiquer les autres interprétations possibles des données » [2].

Cette partie du guide d'action analyse la façon dont les rapports entre les experts scientifiques et les décideurs politiques se structurent. Il présente les divers mécanismes d'élaboration des avis scientifiques. Quatre phases dans le processus d'avis scientifique ont été

1 Ainsi, l'arrêté du gouvernement wallon du 18 avril 2002 (MB, 24 avril 2002) sur l'utilisation confinée d'OGM ou d'organismes pathogènes prévoit à l'article 27 ter 3/ que « les données à caractère confidentiel ou liées au secret de fabrication et aux brevets que le demandeur peut indiquer dans sa demande de permis d'exploiter ne peuvent porter sur le nom et adresse de l'exploitant et de l'utilisateur, la description des OGM ou agents pathogènes, la classe et le lieu de l'utilisation confinée ainsi que des mesures de confinement, l'évaluation des effets prévisibles, notamment des effets pathogènes ou écologiquement perturbateurs et les informations publiées dans une quelconque presse ou par un office de brevet.(…) Le fonctionnaire technique et l'expert technique ne divulguent à des tiers aucune information confidentielle, (…) et ils protègent les droits de la propriété intellectuelle afférant aux données reçues. (…) »

2 Rapport d'atelier conjoint FAO/OMS (2004), *Fourniture d'avis scientifiques au Codex et aux Etats membres*, Consultation sur la sécurité sanitaire des aliments, Genève.

identifiées : la phase de *composition de la commission et de la détermination de son mandat*, la phase de *définition des problèmes et d'établissement des priorités*, la phase d'*élaboration d'un avis* et la phase finale d'*utilisation de l'avis*.

Nous allons voir que le processus d'expertise est un processus complexe car il s'inscrit dans des périodes de crise, de controverse, d'urgence et d'incertitude. Nous nous interrogerons sur l'impact du principe de précaution sur le fonctionnement des commissions d'experts.

2.1 La composition et le mandat des comités d'avis scientifiques

Avant d'aborder plus en détail le fonctionnement des commissions consultatives, il est important de s'interroger sur la forme de ces comités. La composition du comité doit être clairement structurée à l'aide d'une procédure de recherche d'experts et l'établissement de critères précis élaborés dans la procédure de sélection. En effet, de la composition du comité, vont dépendre la qualité du travail et le succès de la procédure d'expertise.

La composition des comités d'avis scientifiques

La composition du comité d'avis scientifique est soumise à une exigence de transparence : un mandat définit clairement sa structure, sa composition, ses objectifs, ses méthodes de travail et son fonctionnement.

Les comités d'avis scientifiques se dirigent de plus en plus vers une expertise multidisciplinaire et contradictoire. Des spécialistes de divers champs d'expertise sont sollicités :

- des spécialistes d'origine scientifique et technique,
- des spécialistes de la décision publique et du fonctionnement des administrations (analyse de la faisabilité des politiques, examen des zones de dysfonctionnement)
- des spécialistes de l'évaluation socio-économique (analyse des coûts et des bénéfices).

Les enjeux de la transparence et de la pluridisciplinarité sont cruciaux puisque l'établissement de la confiance et du débat contradictoire sont des pré-requis pour la qualité du processus.

Les évaluations d'experts recouvrent un très large éventail de questions (telles que la fixation d'objectifs pour la qualité de l'air ou la fixation de normes de sécurité sanitaire). Ces questions sont de plus en plus interdisciplinaires et touchent des niveaux de pouvoir différents. L'arbitrage des questions liées à la mise en œuvre du principe de précaution est de moins en moins laissée aux seuls experts car ces questions excèdent souvent leur champ des compétences scientifiques, quel que soit le degré d'interdisciplinarité mis en œuvre pour les aborder. On assiste donc à une ouverture de l'expertise vers un public de "non experts" : la composition d'un comité est de plus en plus hybride et s'enrichit de la présence de parlementaires, d'associations ou de citoyens. Un certain nombre de réserves face à l'attribution d'un statut identique de ces "non experts" par rapport aux experts ont été exprimées lors de notre enquête Delphi.

Le rôle de la commission de sélection

Les tâches de la commission ont été définies au préalable par les autorités requérantes.

L'établissement d'un profil-type du candidat expert

L'établissement d'un profil-type du candidat expert se fait, non seulement en fonction du bagage scientifique, mais aussi de l'expérience en matière d'évaluation des risques. Il est important de se donner les moyens de disposer d'experts disponibles et possédant les qualités requises. Idéalement, un candidat expert devrait posséder :

- une excellence scientifique reconnue par ses pairs et une notoriété publique ;

- une liste de publications ou de toute autre forme d'attestation de sa qualité ;
- une expérience professionnelle (nationale ou internationale) en rapport avec la candidature ;
- une expérience en évaluation des risques (expérience acquise dans des domaines de la sécurité des consommateurs, de la santé publique et de l'environnement) ;
- des compétences en matière d'analyse (analyse d'informations et de dossiers, expérience dans l'évaluation de travaux et de publications scientifiques) ;
- un niveau de connaissance des langues nationales et de l'anglais prédéfini ;
- des compétences en matière de gestion et d'organisation.

La mise en œuvre d'une procédure de recherche et de sélection d'experts

La transparence dans la composition d'un comité d'avis concerne tant la recherche que la sélection d'experts. Comment contacter les experts ? La démarche la plus transparente est de faire un appel public à manifestation d'intérêt à devenir membre d'un comité scientifique. Cette solution permet de procéder à une première sélection de candidature. Dans le cadre de cet appel public, il est demandé aux candidats d'évaluer leurs compétences et leurs connaissances pouvant justifier leur participation à un comité scientifique.

Néanmoins, dans la pratique, le recrutement d'experts se fait souvent de manière plus informelle par l'exploitation d'un réseau personnel d'experts que l'on contacte directement. On peut recourir à un vivier d'experts constamment actualisé dans un fichier et on peut recruter dans différents milieux (universitaires, entreprises et associations). Cette deuxième formule est beaucoup moins transparente que la première mais elle a l'avantage de convaincre plus facilement les experts pressentis à accepter cette charge. Les procédures de recherche d'experts diffèrent encore selon qu'il s'agit d'experts permanents ou d'experts occasionnels (ad hoc). Ceux-ci sont sollicités sur base de leur spécialisation sur des questions techniques très précises.

Le principe de précaution doit conduire à ce que la diversité (disciplinaire, institutionnelle et représentation des intérêts économiques et sociaux) soit maximale pour favoriser des débats contradictoires. L'enjeu de l'établissement des critères de sélection réside donc bien dans la faculté d'instaurer une grande diversité dans les membres d'une commission, mais aussi, dans la difficulté de gérer ces différences par la suite.

L'établissement d'une procédure de réclamation

Il est nécessaire de prévoir une procédure de réclamation pour les cas où l'on jugerait que la composition de la commission sélectionnée est mal équilibrée. Il faudrait prévoir alors les conditions de réclamation et des procédures de modification possibles.

La garantie de transparence

Nous avons vu que le processus de recherche et de sélection des futurs membres de comités d'avis scientifique pouvaient prendre plusieurs formes. Cependant, un important constat doit être fait. Dans la pratique, il est difficile de se mettre d'accord sur une définition commune des critères de sélection des experts. La transparence est la seule garante du bon fonctionnement de la procédure de sélection et de la bonne couverture de l'ensemble des champs d'expertise. En effet, elle offre de nombreuses garanties : une diversité dans la sélection, une diversité de bagages disciplinaires, une diversité dans l'origine institutionnelle des participants et une diversité dans la représentation des intérêts économiques et sociaux.

Comment peut-on instaurer plus de transparence dans la sélection des membres des comités d'avis ?

- Lors de la première réunion : interroger les experts sur les raisons de leur présence : pourquoi ont-ils été sélectionnés et explorer les motifs de choix ou de refus ;
- Interroger les membres sur les lacunes ou les manquements observés à propos de la procédure de sélection ;
- Connaître les raisons motivant le choix ou l'exclusion de tel ou tel expert.

La contractualisation de l'expertise

Un contrat d'expertise clarifiant les droits et les obligations des experts s'avère indispensable pour le bon déroulement du travail en comité d'avis.

Les droits de l'expert

Les droits de l'expert, à garantir dans un document contractuel, sont les suivants

- Droit à la *clarté du mandat* : l'expert doit être clairement désigné et informé de l'exercice de sa mission d'expertise par l'autorité publique commanditaire. De plus, les critères de sa nomination doivent être clairement mentionnés.
- Droit à l'*accessibilité des données* : l'expert doit pouvoir accéder à tout document public existant relatif à sa mission et doit pouvoir se rendre au sein d'organismes publics et privés.
- Droit à la *rémunération* : il serait utile de prévoir des indemnités dans certains cas, à la fois pour la participation et pour la préparation à des réunions. Ces indemnités servent à défrayer les experts. Toutefois, les montants doivent être raisonnables : ce n'est pas la recherche lucrative qui doit motiver le candidat expert. La reconnaissance du travail de l'expert peut se faire autrement que par la rémunération financière : reconnaissance de la qualité du travail, expertise valorisée au sein de l'université d'origine de l'expert.
- Droit à la *protection du travail de l'expert* : il doit être assuré d'une protection totale lors de ses activités d'expertise notamment dans des domaines sensibles.
- Droit à la *protection des données personnelles de l'expert* : une frontière doit être établie entre les données qui relèvent de ses activités professionnelles et celles qui concernent sa privée (notamment ses opinions ou ses engagements personnels).
- Droit d'*initiative* : un droit de saisine sur des sujets jugés pertinents et sensibles est souhaitable pour l'ensemble des membres d'un comité d'avis. La liberté dans l'exercice du mandat de l'expert est aussi nécessaire. Chaque expert a son domaine de connaissance et de compétence sur des domaines de recherche propre et aussi sur des domaines connexes. Dans la pratique, l'expert est souvent obligé de dépasser le cadre de son mandat pour répondre à une question.
- Droit à un *appui du secrétariat* : les tâches administratives ne doivent pas gêner les activités d'expertise des membres des comités. C'est pourquoi la présence d'un secrétariat est fondamentale. Le secrétariat aide à la préparation des dossiers scientifiques (collecte de données, cadrage du débat, synthèse de l'avis), peut définir l'ordre du jour, assiste aux séances plénières (avec une réserve de non-intervention dans les débats), rédige le rapport d'activité et contribue à la rédaction des avis.

Les obligations de l'expert

Les obligations de l'expert, à garantir dans la même procédure contractuelle, peuvent être formulées ainsi :

- La *présence* régulière et le respect des *délais* : l'expert doit s'engager à participer à l'ensemble des réunions de travail prévues par le contrat et les délais de travail doivent être respectés.
- La *déclaration d'affiliation* : elle doit essayer de refléter le plus possible le contexte à partir duquel l'expert concerné exerce son expertise. Il est préférable que les experts mentionnent les organismes pour lesquels ils travaillent, les associations professionnelles dont ils sont membres, leur champ de compétences et les écoles scientifiques auxquelles ils appartiennent. Le problème de cette déclaration d'affiliation est de ne pas empiéter sur le domaine privé : il faut se limiter aux activités professionnelles et publiques.
- L'obligation de travailler dans la *transparence* : l'expert doit s'engager à fournir des informations exactes, à mettre à jour ses connaissances et à ne pas dissimuler les incertitudes qui pourraient avoir des conséquences graves dans un avenir plus ou moins

proche. Et, enfin, l'expert se doit de mentionner les faits alarmants ou les signaux d'alerte qu'il a constatés.
- La *confidentialité* : l'expert ne peut pas commenter publiquement les données collectées ni les contenus des débats internes.
- L'engagement à l'*ouverture* : l'expert aborde souvent des disciplines autres que celles sur lesquelles il a une spécialité. Il s'engage à dialoguer avec d'autres experts.

2.2 La définition des problèmes

La définition des problèmes est une phase essentielle qui permet le cadrage du processus d'expertise. Le mandat définit souvent au préalable la problématique à traiter. Il est nécessaire de se mettre d'accord sur une base commune pour la définition des problèmes à traiter.

La mise à l'agenda des thèmes

Il faut permettre l'expression des divers avis et sensibilités. Les autorités publiques, les experts, les parties prenantes et les citoyens devraient décider ensemble des risques et des incertitudes à traiter.

La sélection des thèmes

La sélection des thèmes soumis à évaluation doit se faire dans la transparence et de façon autonome par rapport aux autorités requérantes.

La responsabilité de la sélection. Dans la pratique, les autorités chargées de la gestion des risques soupçonnés ne sont pas les seules aptes à sélectionner les thèmes à aborder en priorité. Elles risquent de se voir confrontées à des conflits d'intérêt ou de voir des thèmes sensibles écartés. Il est important d'accorder également un droit d'auto-saisine à la commission consultative. De même, il semble pertinent d'octroyer un droit de saisine à des associations citoyennes ou des organisations (inter) professionnelles (surtout sur les questions socio-économiques).

Les critères de sélection. Il convient de sélectionner les thèmes pour lesquels un soupçon de risque existe, sur une échelle allant de la simple conjoncture au risque avéré. La simple conjecture ne suffit pas pour déclencher un régime de précaution. Le risque avéré déclenche le régime de prévention. C'est entre ces deux extrêmes que trouve à s'exercer le régime de précaution.

Le fait d'examiner les controverses scientifiques ou techniques permet de faire resurgir les incertitudes. Pour Callon, Lascoumes et Barthe, « la controverse réalise un véritable inventaire de la situation, qui vise moins à établir la vérité des faits qu'à la rende intelligible » (Callon *et al.* 2001). Dans l'inventaire des problèmes, les controverses constituent un dispositif d'exploration car elles permettent de relever les différentes dimensions de l'enjeu lié au projet. Le cadrage initial des problèmes se révèle au fur et à mesure que la controverse progresse. Les membres du comité devront particulièrement investiguer les zones d'ombre ou d'ignorance.

Il faut également sélectionner des risques pour lesquels on soupçonne la survenance de dommages graves ou irréversibles, sans quoi il n'y a pas lieu de mobiliser une large expertise.

Enfin, il convient de sélectionner des risques menaçant la collectivité et d'établir des priorités parmi ces risques, compte tenu des charges que cela entraînerait pour la collectivité de ne pas les avoir assumés à temps.

Les méthodes

L'émergence des thèmes. Les dispositifs d'émergence des questions doivent viser l'expression la plus large possible des avis sinon on risque de limiter la portée des prises de décision. On peut élaborer les différents thèmes sur base de revues de littérature, d'enquêtes, de screenings, des développements internationaux. Mais, on peut aussi définir plus largement les

thèmes et les questions en recourant à des modalités de participation se basant sur des exercices participatifs pour un large public ou pour les porteurs d'enjeux (des techniques d'évaluation explicitant des valeurs subjectives, des conférences de consensus ou des focus groups) afin de renforcer l'apport d'acteurs plus faiblement représentés.

Les membres des commissions d'avis sont tenus, sur base de leur mandat, de définir les positions qu'ils représentent. Néanmoins, il faut prévoir le cas échéant la possibilité de redéfinir le mandat.

Le dispositif de tri des questions. La rédaction, par le secrétariat scientifique de la commission, d'une liste intégrant les différentes perceptions des citoyens, des parties prenantes et des experts offre l'avantage de faire le tour le plus complet des aspects d'un problème. Il appartiendrait ensuite aux membres de la commission d'examiner en détail les questions jugées prioritaires en vue de mieux répondre aux questions formulées dans leur mandat.

Dans un processus de va-et-vient entre les évaluateurs et les gestionnaires, la sélection des thèmes peut aussi être faite dans un dialogue entre les autorités chargées d'organiser l'évaluation des risques et les autorités chargées de gérer les risques.

Le partage des tâches : séparation fonctionnelle

Il importe de distinguer les rôles respectifs des experts, des porteurs d'enjeux, des autorités publiques et des citoyens, de ne pas fusionner les stades d'évaluation et de gestion du risque et aussi de valoriser la fonction des porteurs d'enjeux.

Il faut veiller à avoir une clarté et une transparence suffisante dans le processus de fourniture d'avis scientifiques. Il existe plusieurs niveaux d'intervention. Pour les deux premiers niveaux, on peut prévoir des modalités de participation :

- Les groupes ou les sous-commissions techniques réalisent l'évaluation scientifique. Chaque groupe a un mandat spécifique et réalise de façon autonome une évaluation scientifique des risques pour l'environnement et la santé ou la prise en compte des impacts socio-économiques. Le travail des sous-commissions peut aussi être organisé de façon plus flexible. Il peut prévoir la participation des citoyens et du public.
- La formulation de l'avis final se fait au sein de la commission d'avis en plénière. C'est à ce niveau que les "stakeholders" représentant des intérêts économiques et sociaux peuvent parfois être présents.
- La prise de décision finale revient aux autorités publiques.

La flexibilité dans le traitement des thèmes

La commission a le pouvoir d'organiser son travail et notamment de définir les sujets à traiter en priorité. Les membres de la commission doivent obtenir un consensus sur la sélection des thèmes à traiter. Ils peuvent aussi établir une série de règles de procédure. La première pourrait être la suivante : aucune question abordée ne peut disparaître sans qu'il y ait consensus sur sa disparition. Une autre règle permettrait d'établir des critères de mise à l'agenda : si un risque est acceptable et s'il peut être contrôlé de façon réaliste, le risque ne doit pas être mis à l'agenda. Si le risque est difficilement acceptable, le risque doit être pris en compte avec les différentes perspectives.

On sait que le mandat définit clairement les thèmes à aborder. Cependant, lors de la sélection des thèmes, un grand nombre de questions directement ou indirectement connectées à la problématique principale apparaissent. Il est important de donner des éléments de réponse à ces questions posées même si elles sortent du cadre strict du mandat. La crédibilité du travail de la commission dépend beaucoup de sa faculté à traiter ces questions et de ne pas laisser de non-réponses. La manière de restituer l'information au public est fondamentale car personne ne doit se sentir lésé.

La détermination précise des questions scientifiques

Les membres du comité doivent définir en commun avec précision les questions scientifiques : les sujets à étudier, la question scientifique soumise à l'évaluation et les incertitudes et les controverses que ces questions scientifiques soulèvent. Pour ce faire, il faut pouvoir bien identifier et caractériser les dangers. Le processus d'évaluation des risques requiert de collecter des données parfois sensibles. Les données sur lesquelles va se fonder l'avis scientifique doivent être de bonne qualité et bien documentées. Un engagement très clair doit être pris en vue de limiter la divulgation de ces données, afin de protéger les données à caractère nominatif ou commercial. Enfin, il est important que la détermination précise des problèmes ne se base pas seulement sur les aspects scientifiques mais aussi sur les préoccupations socio-économiques.

Le travail d'harmonisation des méthodes est utile afin d'offrir les meilleures bases pour porter des jugements scientifiques crédibles, comparer des informations concernant les évaluations des risques, comprendre les éléments sur lesquels reposent les normes d'exposition et promouvoir la transparence et la bonne communication. L'harmonisation sera d'autant plus importante que les questions sur lesquelles un avis scientifique est demandé seront plus complexes, par exemple pour des comparaisons entre les risques, des analyses risques/avantages ou des évaluations intégrées des risques.

2.3 L'élaboration des avis scientifiques

La procédure d'élaboration des avis doit être claire, précise et transparente pour traiter les incertitudes et discuter du contenu de l'avis final. L'enjeu principal dans l'évaluation des risques non avérés est de bien identifier les points sur lesquels il y a consensus scientifique, ceux sur lesquels des divergences subsistent et enfin ceux qui nécessitent des investigations supplémentaires. L'avis final doit contenir ces trois points.

Les domaines d'exploration

Les avantages et les inconvénients des développements technologiques

De nos jours, le rapport au risque a considérablement changé : on n'envisage plus d'encourir ou de supporter des risques dont on n'a pas été préalablement averti, qui n'ont pas été acceptés et qui n'ont pas été débattus de façon démocratique. La tendance est de développer une participation citoyenne pour débattre de ces questions en y intégrant le principe de précaution.

De plus, les choix technologiques constituent parfois de véritables ruptures qui se caractérisent par l'apparition de nouveaux risques (risques écologiques et sanitaires liés aux installations industrielles et aux procédés ou à la circulation des produits). Le contexte d'incertitude grandit : incertitudes liées aux prises de décision, liées aux conséquences de ces choix et liées aux limites et incertitudes des connaissances scientifiques. C'est pourquoi les questions de maîtrise du risque technologique traversent à la fois les politiques publiques et les stratégies des entreprises.

Les alternatives aux produits et procédés technologiques potentiellement risqués

Lorsque, à la réalisation d'une étude de risque, le niveau du risque est jugé inacceptable, il est recommandé de se tourner vers les alternatives. Le recours à ces alternatives ne se fait pas toujours automatiquement. En effet, ces produits ou procédés alternatifs comportent aussi leur part d'incertitude. On prend le risque de remplacer un risque reconnu ou en voie de reconnaissance par un nouveau risque. De nombreux cas illustrent la difficulté liée à un recours massif à des produits de substitution : par exemple, le cas de la substitution des fibres d'amiante. Des recherches ou des études supplémentaires sont souvent nécessaires pour évaluer et analyser leurs incertitudes. Ainsi, lors de la fourniture d'avis, il est important d'examiner les alternatives avec leurs limites et leurs incertitudes.

Comment peut-on savoir s'il est pertinent de recourir à une alternative ? Un avis scientifique doit donc présenter les avantages et les inconvénients des alternatives possibles. La prise en compte de considérations socio-économiques permet aussi de faire des comparaisons entre produits et alternatives. La comparaison des différentes applications des nouveaux produits entre eux peut aussi aider à orienter le choix. Il est donc pertinent que le contenu de l'avis scientifique comporte une définition générale des critères à prendre en compte pour bien différencier les alternatives des produits à risques ou procédés à risques et pour les comparer entre elles.

Le choix de privilégier une alternative par rapport à une autre n'incombe pas aux scientifiques mais aux autorités publiques. En effet, les experts scientifiques ne sont pas habilités à faire des choix politiques car ils méconnaissent souvent l'impact socio-économique du choix. De même, les comités d'avis scientifiques ne sont pas compétents pour mener eux-mêmes des recherches sur les alternatives en elles-mêmes (risque d'impartialité, recherche de financement pour leur domaine de recherche propre). Tout au plus, les experts peuvent établir une liste de thèmes et de questions à investiguer dans le futur.

La méthodologie pour expliciter les incertitudes

Il est fondamental de définir en amont du travail de la commission, une méthodologie à suivre pour évaluer le risque, en s'efforçant d'identifier le danger, de caractériser le danger, d'évaluer l'exposition et de caractériser le risque. Il faut aussi s'intéresser au traitement des incertitudes. Quelle attitude doit-on adopter face aux incertitudes ? Comment doit-on les gérer ? Doit-on aboutir à un consensus à tout prix ? Plusieurs problèmes sont relevés. La détermination du type, du degré et de la source d'incertitude n'est pas une chose facile.

Les membres des comités d'avis doivent se mettre d'accord sur les facteurs qui déterminent l'incertitude. Ils discutent des différents aspects : les domaines d'impact possibles, les facteurs de gravité, la gravité des impacts, les différents groupes à risque, les valeurs à prendre en compte, la question de l'acceptabilité des risques et la gestion des incertitudes.

Lors d'une discussion entre différents experts, la méthodologie peut contribuer à l'expression de jugements de valeur et de jugements scientifiques. Le principe de précaution est là pour souligner les différences entre les jugements de société (liés à l'opinion) et les jugements scientifiques. Ces jugements de valeur doivent être explicités. Une méthodologie est nécessaire pour pointer ces différences entre société et faits scientifiques, mais ce n'est pas aux experts de trancher.

Il faut se mettre d'accord sur la façon de gérer les incertitudes, notamment par la définition d'une procédure pour traiter des points sur lesquels les participants ne sont pas d'accord ou ceux sur lesquels ils sont incertains. Notons qu'il peut y avoir un accord sur la nécessité de traiter les incertitudes sans qu'il y ait forcément un accord sur la façon de les traiter et de les gérer.

Le contenu de l'avis final : contenu, avis minoritaires et archivage

Le contenu de l'avis final rencontre des définitions très variées. Certains sont favorables à un avis extrêmement large comprenant les résultats des comparaisons entre les alternatives, le suivi, les perspectives de recherches supplémentaires, les sujets de consensus et de divergences, les positions minoritaires et majoritaires et les stratégies de gestion possibles. D'autres jugent que le contenu d'un avis final ne doit pas être trop large, au risque d'apparaître comme un véritable programme politique. Un avis scientifique reste un avis ayant ses propres limites. Il s'agit d'une réponse la plus précise possible à une question préalablement posée et cadrée par l'autorité en charge des risques. Il ne s'agit pas d'une véritable création scientifique.

Chaque participant doit pouvoir illustrer dans le rapport son raisonnement et les positions défendues à l'aide d'analyses et de données scientifiques. Les experts doivent s'efforcer autant que possible de parvenir à un consensus. Toutefois, lorsque les avis sont trop divergents, il faut l'indiquer dans l'avis final. Il est important que les avis rendus permettent l'expression des avis

minoritaires de façon précisément à ne pas gommer les divergences de points de vue. Ces avis minoritaires doivent donc se retrouver dans les conclusions publiques. Il est important à la fois pour les autorités chargées de la décision et pour les différents porteurs d'enjeux de pouvoir identifier les auteurs de telle ou telle opinion.

Les minutes des débats au sein des commissions consultatives doivent être conservées. Cette traçabilité est utile à la fois pour asseoir la confiance du public en l'institution et aussi pour retracer l'évolution de l'état des connaissances scientifiques. Il s'agit d'une donnée capitale dans un régime de précaution qui est un régime transitoire en l'attente de validation (ou d'invalidation) d'une hypothèse de risque.

Il est important que le rapport final, où figure l'avis scientifique, soit rédigé clairement. Sa forme dépend des besoins du requérant. Ainsi, s'il faut répondre aux besoins de différents publics, il est possible de le présenter sous plusieurs formes (documents techniques, résumé, par exemple) qui, chacune, donne plus ou moins de précisions. La participation de spécialistes de la communication des risques au groupe d'experts, dès le début de la procédure, facilite la formulation des conclusions en termes clairs. Pour rappel, la façon dont est organisée la communication des conclusions a été discutée au préalable. En bref, il s'agit de déterminer qui contacter, d'indiquer les questions délicates, d'instruire sur ces questions ceux qui vont présenter le rapport, de publier les communiqués de presse adaptés.

2.4 L'utilisation des avis scientifiques

La phase dite d'utilisation des avis scientifiques finaux est fortement conditionnée par la communication et le suivi.

Le partage des tâches entre conseil, administration et autorités concernées

Il existe une différence fonctionnelle entre celui qui prend une décision et celui qui remet un avis. L'avis scientifique rendu à la fin du processus d'évaluation doit répondre aux besoins du requérant. C'est de la responsabilité des experts de fournir un rapport dont le contenu répond à la demande : une explication claire de la question posée, des données disponibles pour répondre à la question, les données sur lesquelles se fondent la conclusion, les raisons pour lesquelles certaines données ont été exclues, une explication de la fiabilité des données utilisées (y compris les incertitudes), la solidité de l'hypothèse sur laquelle l'avis repose.

La responsabilité de l'utilisation de l'avis et la prise de décision reviennent à l'administration et aux autorités compétentes.

La préparation des lignes d'action politique se fait à partir de l'avis rendu. Elle se fait à la lumière des connaissances scientifiques les plus récentes et doit être réactualisée en fonction de l'évolution des connaissances. Il faut aussi envisager les différentes mesures à prendre et examiner les implications de ces mesures. La prise de décision se fait souvent sur la base d'un calcul coûts avantages (quel est le bénéfice éventuel d'une prise de risque ?). On décline les options possibles, notamment en fonction du pire scénario, et l'on est particulièrement attentif à la réversibilité des mesures, au cas où une hypothèse de risque serait infirmée.

Une obligation de motiver les décisions prises sur base des avis

Il est impératif de motiver la position adoptée, la mesure choisie et de veiller à ce que cette argumentation soit compréhensible par le grand public.

Les décisions finales doivent obligatoirement être motivées et argumentées. Il est important de délivrer, dans un style accessible, un maximum d'informations sur les risques et sur les raisons qui ont contribué à la prise d'une décision. Cette obligation vaut à la fois pour les cas où les autorités publiques suivent l'avis et pour les cas où elles ne le suivent pas.

La communication des prises de décision

Les exigences en termes de divulgation des avis rendus (canaux de diffusion, diffusion de tout ou d'une partie des travaux, diffusion des noms et qualités des experts consultés, etc.) doivent être claires. En diffusant toute l'information, on prend le risque de renforcer la controverse au sein des groupes de personnes ou de déclencher une panique. Ne serait-il pas moins dangereux de ne pas communiquer certaines informations scientifiques ? Une communication publique comporte sans doute des risques mais c'est un gage de confiance dans les institutions politiques et scientifiques.

L'actualisation des données

Une des préoccupations essentielles des membres d'une commission d'avis est de ne pas figer un avis élaboré selon des données disponibles à un moment précis.

Il est impératif de mettre en place un système de monitoring capable de suivre les évolutions futures. Il est important de définir des critères à prendre en compte pour déterminer les changements qui nécessitent une réévaluation, car on ne peut pas procéder à une réévaluation lors de chaque modification de l'état des connaissances. Les membres des commissions ont la compétence nécessaire pour déterminer une série d'indicateurs technico-scientifiques et socioéconomiques pertinents.

Le retour des résultats du monitoring doit être donné au comité pour qu'il puisse faire une révision des avis ultérieurs. Une évaluation des incidences des initiatives politiques prises peut parfois être demandée à des experts. On peut envisager une réévaluation dans certains cas :

- à la demande des membres du conseil d'avis qui peuvent eux-mêmes se saisir à nouveau d'un problème, notamment sur base des résultats du monitoring ;
- sur base d'un avis du conseil lorsque la sensibilité sur certaines questions est émoussée ;
- à l'arrivée d'une échéance d'une autorisation à commercialiser un produit ;
- en cas de changement politique car cela a une influence sur le cadre des valeurs ;
- à la demande de la population : leur perception des risques varie avec le temps.

2.5 En résumé

Le tableau ci-dessous résume les procédures et propositions qui sont avancées dans ce guide, afin que l'élaboration d'avis scientifiques s'inscrive mieux dans la ligne du principe de précaution.

La composition et le mandat des comités d'avis scientifiques	*Composition* : veiller à l'interdisciplinarité et à l'équilibre entre domaines de compétences, ouverture à des non experts en fonction du type de problème traité. *Sélection* : établir d'abord un profil type des experts recherchés, utiliser une large diversité de réseaux de relations, garantir la transparence des critères et des décisions de sélection. *Contractualisation* : établir un contrat d'expertise qui définit les droits et les obligations de l'expert (parmi les obligations : souligner l'intérêt d'une « déclaration d'affiliation »).
La définition des problèmes	*Mise à l'agenda* : permettre une capacité d'initiative de l'organe consultatif et d'acteurs externes dans le choix des thèmes ; sélectionner les thèmes selon les spécificités du régime de précaution par rapport au régime de prévention ; distinguer les rôles respectifs des experts, des porteurs d'enjeux, des autorités publics et de la participation citoyenne. *Flexibilité dans le traitement des thèmes* : traiter les problèmes de manière différenciée selon leur niveau de complexité ou d'incertitude. *Détermination précise des questions scientifiques* : sur base des données, des études existantes et des controverses, mais aussi en tenant compte des préoccupations socioéconomiques.
L'élaboration des avis scientifiques	*Domaines d'exploration* : avantages et inconvénients des différentes alternatives technologiques, comparaison des alternatives. *Méthodologie* : préciser la nature et la portée des incertitudes, mettre au point une méthode de travail pour traiter les sujets controversés, faire apparaître les jugements de valeur sous-jacents. *Contenu de l'avis final* : argumenter les points de consensus et de dissension, mentionner les avis minoritaires, garder des traces des débats, prévoir un suivi.
L'utilisation des avis scientifiques	Organiser le partage des tâches entre les organes consultatifs, les administrations et les autorités politiques ; motiver les décisions prises en se référant aux avis scientifiques ; prévoir une campagne de communication ; organiser une procédure d'actualisation des données.

Annex 2 – Wetenschappelijke expertise en het voorzorgsprincipe: een leidraad

1. De vertaling van het voorzorgsprincipe in procedures en methodes

1.1 Implicaties voor de verschillende actoren

Indien men de relatie tussen een houding van voorzorg en duurzame ontwikkeling ernstig neemt, betekent dit dat men een reeks implicaties aanvaardt voor de betrokken actoren en voor de wijze waarop voorzorg vertaald wordt in procedures en methodes. Indien we voorzorg interpreteren als een houding die nodig is om duurzame ontwikkeling te realiseren, dan veronderstelt voorzorg een gezamenlijke verantwoordelijkheid (Mitcham & Von Schomberg 2000).

Co-verantwoordelijkheid en participatie

Co-verantwoordelijkheid betekent dat alle burgers in principe betrokken zouden moeten zijn bij technologische ontwikkelingen via publieke debatten. Publieke debatten zijn nodig om een concretere inhoud te geven aan het richtinggevend principe van duurzame ontwikkeling en om verschillende visies op en bezorgdheden over mogelijke alternatieven en hun mogelijke voor- en nadelen te (over)wegen en integreren. Individuele wetenschappers, ingenieurs en experten kunnen niet de volledige verantwoordelijkheid nemen voor hun ontdekkingen en ontwerpen, omdat deze los van hun auteurs een weg afleggen in andere dan puur wetenschappelijke contexten, namelijk in de subsystemen economie, politiek en recht. Daar worden deze ontdekkingen en ontwerpen vervormd naar de logica's die eigen zijn aan deze contexten. Deze logica's kan men, net zo min als de onbedoelde en vaak niet te voorziene gevolgen van de implementatie van wetenschappelijke en technologische toepassingen, niet toeschrijven aan de intenties van bepaalde individuen. Burgers kunnen echter vanuit posities die ontsnappen aan deze specifieke logica's de kennis, verwachtingen, oordelen en (toekomst)visies van experten testen, betwisten en/of verrijken.

Vertrouwen : openheid en transparantie…

Vanwege de vele feitelijke en normatieve onzekerheden kunnen complexe problemen die om een voorzorgsbenadering vragen, niet tot een (tijdelijke) oplossing komen als het grote publiek geen vertrouwen heeft in democratische instellingen in het algemeen en in de inzet van wetenschappelijke kennis in het bijzonder.

Vertrouwen veronderstelt in de eerste plaats openheid en transparantie. Openheid en transparantie zijn nodig om burgers de gelegenheid te geven bestaande vertrouwensrelaties te testen en mogelijk misbruik van vertrouwen te beperken. Vertrouwen in wetenschap en politiek kan pas blijven bestaan wanneer een gezond wantrouwen geïnstitutionaliseerd wordt, bijvoorbeeld via het verschaffen van informatie en het garanderen van openheid en transparantie.

Openheid en transparantie zijn nodige, maar geen voldoende voorwaarden. Burgers moeten zich ook kunnen vinden in de normen en waarden – Offe spreekt over de *idée directrice* – die procedures en democratische instellingen vertegenwoordigen (Offe 1999). Volgens Offe zijn 'waarheid' en 'rechtvaardigheid' de twee fundamentele waarden waarvan deze *idée directrice* blijk moet geven. 'Waarheid' verwijst zowel naar eerlijkheid – op zoek gaan naar waarheid en elimineren van intentionele of niet intentionele onwaarheden – als naar het zich houden aan beloftes. 'Rechtvaardigheid' verwijst zowel naar onpartijdigheid als naar solidariteit.

…maar ook onpartijdigheid en solidariteit

Wetenschappelijk onderzoek is één vooraanstaande en onmisbare manier om waarheid te achterhalen. Wetenschappelijke 'objectiviteit', verkregen via de bekende wetenschappelijke procedures – het wederzijds controleren, testen, toetsen, bevragen en betwijfelen van voorlopige wetenschappelijke uitspraken door leden van een wetenschappelijke gemeenschap -, betekent echter hoogstens een tijdelijke eensgezindheid. Het is eerder een ideaal waar wetenschappers naar streven dan een voldongen feit.

In het geval van complexe problemen is het voor wetenschappers niet eenvoudig om zich aan hun beloftes te houden. Een minimale voorwaarde is dat zij actief op zoek gaan naar feitelijke en normatieve onzekerheden. Alleen in de mate dat wetenschappers en experten zich rekenschap geven van de grenzen van hun kunde en kennis en er in slagen onzekerheden te expliciteren, zijn zij in staat zich aan hun beloftes te houden. Anders lopen zij het gevaar dat zij hun voorspellende capaciteit overschatten en zich later genoodzaakt zien hun geruststellende boodschappen te herroepen. Het is vanuit dergelijke ervaringen dat het wantrouwen van burgers in wetenschap gegroeid is (Strand 2001, 193-196).

Onpartijdigheid is niet hetzelfde als neutraliteit. Wetenschappelijke kennis kan niet neutraal zijn; zij is altijd waardegeladen. Wetenschappelijke onpartijdigheid betekent dan ook eerder dat de verschillende disciplinaire en paradigmatische perspectieven op een evenwichtige manier vertegenwoordigd zijn en dat experten openheid verschaffen over hun (politieke, ideologische, economische) belangen. Onpartijdigheid betekent ook dat publieke overheden rekening houden met visies en bezorgdheden van het ruime publiek en deze op een verantwoorde manier integreren in beleidsbeslissingen.

Solidariteit, ten slotte, veronderstelt dat men rekening houdt met het feit dat verschillende groepen mensen in verschillende mate en op verschillende wijze getroffen kunnen worden door de effecten van technologische toepassingen of producten. Waar onpartijdigheid vraagt om een gelijke behandeling van verschillende groepen mensen, vraagt solidariteit om een ongelijke behandeling. In beide gevallen gaat het er om rechtvaardigheid te betrachten in de kansen die mensen hebben/krijgen om een zinvolle invulling te geven aan hun eigen leven.

1.2 Implicaties voor evaluatie- en innovatiebeleid

Technologische diversiteit

Indien men voorzorg verbindt met duurzame ontwikkeling, dan houdt een voorzorgsbenadering een vergelijking van alternatieve technologische toepassingen of producten in. Aan deze interpretatie van voorzorg kan men enkel voldoende vlees en bloed geven als er een voldoende mate van technologische diversiteit bestaat. Deze interpretatie impliceert dan ook dat wetenschaps- en innovatiebeleid voldoende diversiteit in technologische toepassingen en praktijken stimuleert en dit tegen een achtergrond van publiek gedefinieerde duurzaamheidsdoelen. Vanuit een voorzorgsperspectief is technologische diversiteit misschien minstens even belangrijk als wetenschappelijk pluralisme.

Afstemming van innovatie- en evaluatiebeleid

In veel gevallen bestaat er een kloof tussen het beleid dat bepaalde technologische ontwikkelingen bevordert en het beleid dat dezelfde technologische ontwikkelingen beoordeelt en onderwerpt aan toelatingsprocedures (zie bijvoorbeeld Todt 2004). Een afstemming tussen innovatie- en evaluatiebeleid is nodig, enerzijds om te voorkomen dat (vaak enorme) investeringen verloren dreigen te gaan wegens het ontbreken van een maatschappelijk draagvlak en anderzijds om te vermijden dat voorzorg tijdens toelatingsprocedures al te zeer uitgehold wordt omwille van economische motieven.

1.3 Implicaties voor de bevoegde overheden

Een integrale beoordeling

Een voorzorgsbenadering die gericht is op duurzame ontwikkeling impliceert een integrale beoordeling. Met een integrale beoordeling bedoelen we hier drie aspecten. Ten eerste is een beoordeling integraal als ze niet alleen milieu- en gezondheidsaspecten onderzoekt, maar ook sociale, economische, culturele en ethische aspecten. Ten tweede verwijst de term 'integraal' naar de noodzaak om risico's en onzekerheden van technologische toepassingen en van producten niet te beoordelen los van hun mogelijke voordelen. Een integrale beoordeling is gebaseerd op een afweging van risico's en onzekerheden tegenover nut en voordelen. Ten derde betekent een integrale beoordeling dat een technologische toepassing of product niet beoordeeld kan worden los van alternatieve toepassingen en producten. Voor- en nadelen van de diverse alternatieven die kunnen bijdragen tot specifieke duurzaamheidsdoelen dienen met elkaar vergeleken te worden.

Een iteratieve oefening

Een voorzorgsbenadering houdt in dat beslissingen die men neemt over (de onaanvaardbaarheid van) onzekere negatieve effecten niet noodzakelijk definitief, maar eerder voorlopig zijn (Callon *et al.* 2001, 307). Zij zijn vatbaar voor herzieningen afhankelijk van hoe maatschappelijke controverses of wetenschappelijke kennis zich ontwikkelen. Een voorzorgsbenadering vraagt om voorlopige maatregelen en om maatregelen die er op gericht zijn wetenschappelijke kennis over hypothetische risico's te verbeteren. Nieuwe ontwikkelingen nopen een samenleving er toe steeds opnieuw overeenstemming te bereiken over de gepercipieerde risico's en over aangepaste maatregelen. De volgende tabel is een vergelijking van het iteratieve en traditionele model.

Eenmalige keuze (traditionele beslissing)	Iteratieve keuzes (beslissing bij onzekeheden)
Een eenmalig moment, een daad	Een iteratieve beslissing
Genomen door een legitieme actor	Engageert een reeks van verschillende acteurs afhankelijk van hun verantwoordelijkheden
Een wetenschappelijke of politieke autoriteit sluit de discussie af.	Omkeerbaar, open voor nieuwe informatie of voor nieuwe formuleringen van belangen.

1.4 Implicaties voor ondernemingen

Procedures die ondernemingen organiseren om om te gaan met onzekerheden in het risicobeheer

De schema's voor het verschaffen van informatie, verslaggeving, communicatie die plaatsvinden in het kader van een preventiebeleid van ondernemingen zijn ook inzetbaar in geval van voorzorg. Er bestaat een synergie.

Indien de directie van een bedrijf zich laat overtuigen van de noodzaak rekening te houden met een nieuw risico, zijn er verschillende wegen mogelijk: *verdiepend onderzoek* naar het nieuwe risico, *omzeiling* van het risico door toepassing of ontwikkeling van alternatieve technologieën, het teruggrijpen naar vervangende inputs, *adoptie van overgangsmaatregelen* (opschorting of stopzetting van R&D activiteiten, het terugtrekken van commercialisering,

verwijdering van sommige arbeiders, versterkte medische opvolging, versterkte bewakingsmaatregelen voor sommige parameters in de buurt van de onderneming).

De mechanismes voor crisisbeheer die uitgewerkt zijn door ondernemingen in het kader van een preventiebeleid zijn des te meer noodzakelijk om de publieke opinie, klanten, buurtbewoners of actievoerders, gezien de nieuwe risico's, te overtuigen. Zij kunnen voorkomen dat er een proces van paniek en uitvergroting ontketend wordt in de risicoperceptie door het grote publiek.

Behoeften van bedrijven die met onzekere risico's geconfronteerd worden

Documentering van het risico

De belangrijkste behoefte van bedrijven met betrekking tot onzekere risico's kan men in één woord samenvatten : het risico documenteren. Documentering van een risico laat tegelijk toe het risico beter te kennen en geschikte maatregelen te nemen op een meer rationele basis, maar ook om te zorgen voor bewijsmateriaal voor het geval een aansprakelijkheidsconflict ontstaat, om te beschikken over sporen van de stand van zaken van wetenschappelijke kennis op een bepaald moment.

Documentering van het risico stelt bedrijven in staat om hun toelatingsaanvragen te onderbouwen bij de publieke overheden, om met hun financiële partners, klanten, de pers te spreken. Deze documentatie van het risico veronderstelt intellectuele en financiële middelen die niet altijd binnen het bereik zijn van het bedrijf dat het risico genereert. Dit geldt in het bijzonder voor KMO's. Kennisproductie met betrekking tot nieuwe risico's is onvermijdelijk veeleisend. Het risico bestaat dat het privé-initiatief tekort schiet wat R&D activiteiten ten aanzien van dergelijke risico's betreft.

Co-productie van kennis

Het is waarschijnlijk dat de kennisproductie ten aanzien van nieuwe risico's een gezamenlijke onderneming zal zijn : een gemeenschappelijke inzet van intellectuele hulpmiddelen op het niveau van externe preventie- en beschermingsdiensten, nauw partnerschap tussen industriële ondernemingen en verzekeringsmaatschappijen, uitwisseling van informatie binnen het corps van preventie-, milieu-, kwaliteitsadviseurs, gezamenlijk onderzoek op sectorieel niveau (met name op Europees niveau).

Publieke ondersteuning voor de productie en verspreiding van kennis over risico's

De publieke overheden hebben een eigen rol wat zowel de productie als de verspreiding van kennis over nieuwe risico's betreft.

Wat kennisproductie betreft zijn er publieke stimulansen, onderzoeksprogramma's, financiering nodig om collectief onderzoek aan te moedigen: een betere documentering van risico's zal voorkomen technologische niches te ontwikkelen die in een later stadium blijken schadelijk te zijn voor de gezondheid of het milieu. Men dient (Europese) onderzoeksconsortia te scheppen die zich verdiepen in risico's van nieuwe technologieën en dit terwijl deze in ontwikkeling zijn. Men dient een vooruitziende visie op risico's te ontwikkelen in organisaties die belast zijn met professionele risico's; men kan zich niet tevreden stellen met een dynamiek van preventie.

De plichten van ondernemingen ten aanzien van onzekere risico's

De verplichtingen die economische actoren hebben in een voorzorgsregime vloeien voort uit de verplichtingen van publieke overheden. Deze afgeleide verplichtingen bestaan eruit het kennistekort dat aanwezig is bij de publieke overheden ten aanzien van nieuwe risico's aan te

vullen. Deze bijdrage tot de best mogelijke kennis over risico's en tot het opheffen van onzekerheden houdt verschillende verplichtingen in:

- Een plicht tot *het leveren van informatie* over de activiteiten van de onderneming en de risico's die deze kunnen voortbrengen. Deze verplichting is gevoelig voor mogelijke beperkingen vanwege industriële en commerciële geheimhouding, zonder dat deze geheimhoudingsplicht de plicht tot informatie over het risico volledig mag uithollen [1].
- Een *bijhorende informatieplicht* tegenover de bevoegde overheid of alarmnetwerken die door de autoriteiten zijn ingesteld *in het geval van kennis van nieuwe elementen.* De actualisering van kennis over risico's is inderdaad fundamenteel om een publiek beheer van risico's te verzekeren dat gelijke tred houdt met de stand van zaken van wetenschappelijke kennis.
- Een *plicht tot deelname aan expert evaluaties die vragen van tegenstrijdige belangen oproepen* en die georganiseerd zijn door de bevoegde overheden met betrekking tot door de betreffende onderneming voortgebrachte risico's.

Verwachtingen van de ondernemingen ten aanzien van de publieke overheden met betrekking tot onzekere risico's

De bezorgdheden van ondernemingen met betrekking tot hun uitwisselingen met publieke overheden zijn van verschillende orde : zorg om het juiste contactpunt bij de administratie en de betrokken diensten te kennen, zorg om de van kracht zijnde reglementering correct te interpreteren, verwachting dat de normen en de verschillende methodes die diverse publieke diensten hanteren om risico's te evalueren zich stabiliseren.

2. Het opstellen van wetenschappelijke adviezen

Met het oog op nieuwe risico's en beperkte wetenschappelijke kennis, is expertise cruciaal voor het voorzorgsprincipe. Voordat overheden een besluit nemen over collectieve risico's, winnen zij dan ook steeds vaker advies in bij één of meerdere experts, zodat een zeer brede risico-evaluatie kan worden uitgevoerd op het gebied van milieu, volksgezondheid en voeding. Hierbij formuleert de expert tijdens de besluitvorming een wetenschappelijk advies, ter ondersteuning van de bevoegde overheidsinstantie.

'Een wetenschappelijk advies is een oordeel op basis van een deskundige evaluatie, waarin wetenschappelijke gegevens en onzekerheden in acht worden genomen. In het advies kan een inschatting worden gegeven van de gevolgen van bepaalde opties, die zijn geformuleerd op basis van een analyse van de beschikbare wetenschappelijke gegevens en een wetenschappelijke beslissing. Indien sprake is van onzekerheid door een gebrek aan kennis op het moment van advies, of indien twijfel bestaat over de kwaliteit van de beschikbare gegevens, moet dit

1 Zo voorziet het arrest van de Waalse regering van 18 april 2002 (MB, 24 april 2002) over het ingeperkt gebruik van GMOs of van pathogene organismen in het artikel 27 ter 3/ dat « les données à caractère confidentiel ou liées au secret de fabrication et aux brevets que le demandeur peut indiquer dans sa demande de permis d'exploiter ne peuvent porter sur le nom et adresse de l'exploitant et de l'utilisateur, la description des OGM ou agents pathogènes, la classe et le lieu de l'utilisation confinée ainsi que des mesures de confinement, l'évaluation des effets prévisibles, notamment des effets pathogènes ou écologiquement perturbateurs et les informations publiées dans une quelconque presse ou par un office de brevet.(…) Le fonctionnaire technique et l'expert technique ne divulguent à des tiers aucune information confidentielle, (…) et ils protègent les droits de la propriété intellectuelle afférant aux données reçues. (…) »

nadrukkelijk worden vermeld. Waar nodig moeten andere mogelijke interpretaties van de gegevens worden toegelicht' [2].

In dit derde en laatste deel van de leidraad worden de verhoudingen tussen de wetenschappelijke experts en de politieke besluitvormers geanalyseerd. De verschillende procedures die bestaan voor het opstellen van een wetenschappelijk advies komen in dit deel aan bod. In het proces van wetenschappelijke advisering kunnen vier fasen worden onderscheiden : de fase van *de samenstelling van de commissie en de formulering van haar taak*, de fase van de *probleem- en prioriteitenstelling*, de fase waarin *het advies wordt ontwikkeld* en de eindfase waarin *het advies wordt gebruikt.*

We zullen aantonen dat het expertiseproces complex is, aangezien het altijd plaatsvindt in een klimaat van crisis, controverse, urgentie en onzekerheid. We zullen stilstaan bij het effect van het voorzorgsprincipe op de werkwijze van de deskundigencommissies.

2.1 De samenstelling en de taakomschrijving van de wetenschappelijke adviescommissies

Voor we ingaan op de werkwijze van de adviescommissies moeten we de commissies zelf onder de loep nemen. De samenstelling van de commissie moet gestructureerd verlopen, via een procedure voor het aantrekken van experts en door de toepassing van accurate criteria tijdens de selectieprocedure. De samenstelling van de commissie zal namelijk de kwaliteit van de werkzaamheden en het resultaat van de expertiseprocedure bepalen.

De samenstelling van de wetenschappelijke adviescommissies

De samenstelling van de wetenschappelijke adviescommissie moet transparant verlopen: de commissiestructuur, de samenstelling, de doelstellingen, werkmethoden en werking worden duidelijk toegelicht.

Vooraleer verder in te gaan op de samenstelling van de commissies, dient men zich eerst af te vragen welke vorm van expertise men verlangt. De wetenschappelijke adviescommissies evolueren steeds meer in de richting van een multidisciplinaire en tegensprekelijke expertise. Er wordt namelijk een beroep gedaan op specialisten uit verschillende domeinen:

- specialisten met een wetenschappelijke en technische achtergrond,
- specialisten op het gebied van openbare besluitvorming en openbaar bestuur (beleidsmatige haalbaarheidsanalyses, pijnpuntenonderzoek)
- specialisten op sociaal-economisch terrein (kosten-batenanalyse).

Transparantie en pluridisciplinariteit zijn cruciaal, omdat het creëren van vertrouwen en het voeren van een veelzijdig debat voorwaarden zijn voor de kwaliteit van het proces.

De experts krijgen bij hun beoordelingen met de meest diverse onderwerpen te maken, zoals het formuleren van doelstellingen voor de luchtkwaliteit of het vastleggen van veiligheidsnormen voor de volksgezondheid. Dergelijke vraagstukken krijgen steeds meer een interdisciplinair karakter en worden op verschillende beleidsniveaus behandeld. Vraagstukken waarop het voorzorgsprincipe van toepassing zijn, worden steeds minder vaak uitsluitend aan experts overgelaten, omdat de onderwerpen vaak buiten hun expertisedomein liggen, welke ook de mate van interdisciplinariteit is die bij de behandeling van de vraagstukken in acht wordt genomen. We zien dus een opening van expertise naar een « niet gespecialiseerd » publiek : de samenstelling van commissies is meer en meer gemengd en wordt verrijkt door de aanwezigheid

[2] Verslag van een gezamenlijke workshop van FAO/WHO (2004), *Provision of Scientific Advice to Codex and Member Countries*, Advisering over de voedselveiligheid, Genève, Zwitserland.

van volksvertegenwoordigers, van verenigingen of van burgers. Ons Delphi-onderzoek heeft uitgewezen dat het toekennen van een identiek statuut aan zowel « niet gespecialiseerden » als experts op bezwaren stuit.

De rol van de selectiecommissie

De taken van de commissie zijn van tevoren vastgelegd door de overheden die advies inwinnen.

Het opstellen van het profiel van de ideale kandidaat-expert

Bij het opstellen van het profiel van de ideale kandidaat-expert wordt niet enkel gelet op de wetenschappelijke achtergrond, maar ook op de ervaring van betrokkene op het gebied van risico-evaluatie. Het is belangrijk om voldoende middelen uit te trekken om de beschikbaarheid van experts met de nodige kwaliteiten te garanderen. In het beste geval beschikt een kandidaat over :

- een uitstekende wetenschappelijke reputatie onder collega's en bekendheid bij het publiek ;
- een reeks publicaties of een ander bewijs van kwaliteit ;
- beroepservaring (in binnen- of buitenland) die aansluit bij de kandidaatstelling ;
- ervaring op het gebied van risico-evaluatie (consumentenveiligheid, volksgezondheid en milieu) ;
- competentie op het gebied van analyse (informatie- en dossieranalyse) en ervaring in het beoordelen van wetenschappelijke werken en publicaties ;
- goede kennis van de landstalen en het Engels ;
- managementbekwaamheid en organisatorische vaardigheden.

De uitwerking van een procedure om experts aan te trekken en te selecteren

Transparantie bij de samenstelling van een adviescommissie heeft betrekking op zowel het zoeken naar als het selecteren van experts. Hoe worden de experts benaderd? De meeste transparantie bereikt men door een openbare oproep tot het indienen van blijken van belangstelling voor een zetel in een wetenschappelijke commissie. Zo kan worden begonnen met een eerste selectie van de kandidaten. In deze openbare oproep wordt de kandidaten gevraagd om toe te lichten waarom zij met hun kennis en kwaliteiten geschikt zijn voor deelname aan een wetenschappelijke commissie.

In de praktijk verloopt de aanwerving vaak echter informeler en maakt men gebruik van een eigen netwerk van experts die persoonlijk worden benaderd. Ook kan men gebruik maken van een bestand van experts dat voortdurend wordt bijgewerkt en uiteenlopende milieus dekt (academici, bedrijfsleven en verenigingen). De tweede methode is veel minder transparant dan de eerste, maar heeft het voordeel dat de benaderde experts makkelijker te overtuigen zijn om de taak op zich te nemen. Bovendien worden voor permanente en *ad hoc* experts verschillende zoekprocedures gebruikt. *Ad hoc* experts worden benaderd op basis van hun specialisatie op precies omschreven technische gebieden.

Het voorzorgsprincipe moet leiden tot maximale diversiteit - disciplinair en institutioneel, maar ook wat betreft de behartiging van sociaal-economische belangen. Dit stimuleert variatie in de debatten. De selectiecriteria moeten dus een grote diversiteit onder de leden van een commissie mogelijk maken. Tegelijk moet ook rekening worden gehouden met de moeilijkheid om die verschillen vervolgens in goede banen te leiden.

Het opstellen van een bezwaarprocedure

Het instellen van een bezwaarprocedure is nodig voor het geval men van mening zou zijn dat de geselecteerde commissie onevenwichtig is samengesteld. Hierin moeten de mogelijkheden tot bezwaar en de te volgen wijzigingsprocedures worden vastgelegd.

Transparantie als garantie

We hebben reeds besproken dat het zoek- en selectieproces van toekomstige wetenschappelijke adviescommissieleden verschillende vormen kan aannemen. Hierbij moet echter worden opgemerkt dat het in de praktijk moeilijk is om algemene overeenstemming te bereiken over de selectiecriteria voor experts. Alleen transparantie kan een vlekkeloos verloop van de selectieprocedure en een eerlijke vertegenwoordiging van alle expertiseterreinen garanderen. Met transparantie kan veel worden bereikt : een diversiteit in de selectie, diversiteit in de disciplinaire bagage, diversiteit in de institutionele origine van de deelnemers en diversiteit in de representatie van socio-economische belangen.

Hoe kan de ledenselectie voor wetenschappelijke adviescommissies transparanter verlopen ?

- Tijdens de eerste bijeenkomst de experts vragen naar de reden van hun aanwezigheid : waarom zijn ze geselecteerd en waarom wil men zetelen;
- De leden vragen naar de tekortkomingen of gebreken die tijdens de selectieprocedure naar voren zijn gekomen;
- Weten waarom een bepaalde expert is geselecteerd of geweigerd.

De aanstelling van de expert

Een expertisecontract over de rechten en plichten van de experts blijkt nodig voor het goede functioneren van een adviescommissie.

De rechten van de expert

De rechten van de expert, die contractueel moeten worden bepaald, luiden als volgt :

- Recht op een *duidelijke taakomschrijving* : de opdrachtgevende overheid moet de expert in alle duidelijkheid aanstellen en informeren over de exacte inhoud van zijn taak. Bovendien moeten de criteria voor zijn benoeming duidelijk worden vermeld.
- Recht op *toegang tot gegevens* : de expert moet toegang krijgen tot elk openbaar document dat te maken heeft met zijn taak. Ook moet hij toegang krijgen tot openbare en particuliere instellingen.
- Recht op *bezoldiging* : in bepaalde gevallen is vergoeding aan te raden, zowel voor de deelname aan als de voorbereiding op de vergaderingen. Het gaat hier om onkostenvergoedingen, dus de bedragen moeten wel redelijk blijven. Geldelijk voordeel mag nooit de motivatie zijn van een kandidaat-expert. Er zijn ook andere blijken van erkenning mogelijk voor het werk van de expert: erkenning van de kwaliteit van zijn/haar werk en expertise en honorering van expertise door de universiteit waaraan hij/zij is verbonden.
- Recht op *bescherming van het werk van de expert* : de betrokkene moet kunnen rekenen op totale bescherming tijdens zijn expertisewerkzaamheden, vooral op gevoelige terreinen.
- Recht op *bescherming van persoonsgegevens* : er dient een grens te zijn tussen de gegevens die voortkomen uit professionele activiteiten en deze die het privéleven betreffen (met name persoonlijke meningen en engagementen).
- Recht op *initiatief* : een initiatiefrecht met betrekking tot relevante en gevoelige zaken, uitgeoefend door een adviescommissie in haar geheel. De expert moet zijn taak bovendien in alle vrijheid kunnen uitvoeren. Elke expert is gespecialiseerd op bepaalde onderzoeksterreinen en heeft kennis van daarmee samenhangende terreinen. In de praktijk moet hij echter vaak buiten zijn bevoegdheid treden om een vraag te kunnen beantwoorden.
- Recht op *ondersteuning van het secretariaat* : administratieve taken mogen de commissieleden niet hinderen bij hun expertisewerkzaamheden. Daarom is een secretariaat noodzakelijk. Het helpt bij het opstellen van wetenschappelijke dossiers

(gegevensverzameling, organisatie van het debat, samenvatting van het advies), kan de agenda opstellen, woont de voltallige vergaderingen bij (zonder interventierecht), stelt het activiteitenverslag op en werkt mee aan het opstellen van het advies.

De plichten van de expert

De plichten van de expert, die in hetzelfde contract worden vastgelegd, kunnen als volgt worden geformuleerd :

- Regelmatige *aanwezigheid* en het respecteren van de *tijdslimieten* : de expert verbindt zich ertoe om op alle werkvergaderingen die in het contract staan aanwezig te zijn en de tijdslimieten te respecteren.
- De *verklaring van affiliaties* : hierin moet zo duidelijk mogelijk naar voren komen vanuit welke hoek de expert zijn expertise uitoefent. Bij voorkeur vermelden de experts de naam van de instelling waarvoor ze werken, de naam van de professionele verenigingen waarvan ze lid zijn, hun specialisatie en de denkrichting die zij aanhangen. Het probleem van deze verklaring is dat inbreuk op de privé-sfeer voorkomen moet worden. Zij dient zich te beperken tot de professionele en openbare activiteiten.
- De plicht om *transparant* te werk te gaan : de expert verbindt zich ertoe om exacte informatie te geven, melding te maken van zijn kennis en geen onzekerheden te verhullen voor zover hieruit op korte of middellange termijn ernstige consequenties kunnen voortkomen. Ook dient de expert verontrustende vaststellingen of alarmsignalen die hij heeft opgemerkt te melden.
- De *vertrouwelijkheid* : de expert mag in het openbaar geen uitspraken doen over de verzamelde gegevens noch over de inhoud van interne debatten.
- Werken in *openheid* : de expert betreedt regelmatig terreinen waarin hij niet is gespecialiseerd. Hij verbindt zich derhalve om overleg te plegen met andere experts.

2.2 De probleemstelling

De probleemstelling is een belangrijke fase, waarin het kader voor de werkzaamheden wordt opgezet. Vaak staat in de taakomschrijving al welk vraagstuk behandeld gaat worden. Het is noodzakelijk om hierover gemeenschappelijk tot overeenstemming te komen.

De agendering van de onderwerpen

De verschillende meningen en gevoeligheden dienen aan bod te komen. Overheden, experts, stakeholders en burgers beslissen samen welke risico's en onzekerheden behandeld worden.

De selectie van onderwerpen die ter evaluatie zullen worden voorgelegd, moet transparant verlopen en onafhankelijk van de opdrachtgevende overheden.

Selectie van de onderwerpen

De verantwoordelijkheid voor de selectie. In de praktijk zijn de overheden die met een evaluatie van de vermoede risico's belast zijn niet de enigen die in staat zijn om een prioriteitenlijst op te stellen. Het gevaar bestaat namelijk dat belangenverstrengeling optreedt of gevoelige kwesties van tafel worden geschoven. Anderzijds moet de adviescommissie een initiatiefrecht worden toegekend. Ook het maatschappelijk middenveld en (inter)professionele organisaties zouden van dit recht gebruik moeten kunnen maken (met name i.v.m. sociaal-economische kwesties).

De selectiecriteria. Het is aan te raden om de vermoede risico's uit te zetten op een schaal die loopt van 'hypothetisch' tot 'bewezen' risiso. Bij enkel een vermoeden worden geen voorzorgsmaatregelen getroffen, terwijl bij bewezen risico preventieve maatregelen van kracht worden. Het terrein van het voorzorgsprincipe ligt tussen deze twee extremen.

Door stil te staan bij de wetenschappelijke of technische controverses, komen de onzekerheden aan het licht. Voor Callon, Lascoumes en Barthe, stelt een controverse de inventaris op van een situatie, waarbij niet zozeer de waarheid het doel is, als wel het begrijpelijk maken van de situatie ([3]). Bij het inventariseren van het probleem vormen controverses een aanknopingspunt om het probleem te verkennen, want zij verschaffen inzicht in de verschillende dimensies van belangen verbonden met het probleem. Naarmate de controverse zich ontwikkelt, zal het kader van de problemen een steeds duidelijker vorm aannemen. De commissieleden moeten zich vooral richten op de schaduwgebieden of gebieden van onwetendheid binnen de kennis. In alle geval dienen risico's waarbij ernstige of onomkeerbare schade vermoed wordt, geselecteerd te worden; dit is immers de motivatie voor het mobiliseren van een brede expertise. Tenslotte dient men bijzondere aandacht te besteden aan risico's die een gevaar in houden voor de gemeenschap. In deze risico's dient men een prioritering aan te brengen naargelang de kosten die dit voor de gemeenschap zou kunnen meebrengen indien men zich er niet tijdig rekenschap van geeft.

De methoden

Het vaststellen van de onderwerpen. Bij de definiëring van de vraagstukken moeten zo veel mogelijk meningen naar voren komen, om een maximaal draagvlak voor de besluitvorming te garanderen. De onderwerpen kunnen worden geformuleerd op basis van literatuurstudie, enquêtes, screenings en opvolging van internationale ontwikkelingen. Men kan het probleem en de vragen ook breder definiëren door terug te grijpen naar participatieve oefeningen waaraan het grote publiek of de stakeholders deelnemen, zodat de inbreng van de minder zichtbare groepen wordt vergroot. Hierbij kan worden gedacht aan evaluatietechnieken die subjectieve waarden expliciteren, consensusconferenties of focusgroepen. De leden van een adviescommissie worden geacht hun eigen standpunten te bepalen zoals dit vereist is door hun mandaat. Toch dient men de mogelijkheid open te laten om dit mandaat te herdefiniëren.

Het rangschikken van de vraagstukken. Het wetenschappelijk secretariaat van de commissie kan een lijst opstellen van de uiteenlopende opvattingen van de burgers, de stakeholders en de experts. Op deze manier worden de verschillende aspecten van een probleem maximaal belicht. Vervolgens is het aan de commissieleden om hun taken zo goed mogelijk te vervullen en de als prioritair naar voren gekomen vraagstukken nauwkeurig te bestuderen.

De onderwerpen kunnen ook worden geselecteerd middels een dialoog, door terugkoppeling tussen de risicobeoordelende en -beherende instanties.

De taakverdeling: functionele scheiding

Er moet een duidelijk onderscheid worden gemaakt tussen de respectieve rol van de experts, de stakeholders, de overheden en de burgers. Ook mag de evaluatiefase niet samenvallen met het risicobeheer en dient de rol van de stakeholders te worden gevaloriseerd.

Bij het opstellen van wetenschappelijk advies moet tijdens het hele proces voldoende duidelijkheid en transparantie worden betracht. Hiertoe bestaan verschillende interventieniveaus. Voor de eerste twee kan gebruik worden gemaakt van vormen van participatie:

– De technische groepen of subcommissies voeren de wetenschappelijke evaluatie uit. Elke groep heeft een specifieke taak en levert op autonome wijze een wetenschappelijke risicobeoordeling voor het milieu en de volksgezondheid, of voor de sociaal-economische gevolgen. De werkzaamheden van de subcommissies kunnen ook flexibeler worden georganiseerd, d.m.v. participatie van burgers en overheden.

([3]) Callon M., Lascoumes P., Barthe Y. (2001). *Agir dans un monde incertain : essai sur la démocratie technique*, Éditions du Seuil, Parijs.

– Het definitieve advies wordt door de voltallige vergadering van de adviescommissie opgesteld. Soms kunnen op dit niveau ook de organisaties die de economische en sociale belangen vertegenwoordigen aanwezig zijn.

– De uiteindelijke besluitvorming is een taak van de overheden.

Flexibiliteit in de behandeling van de onderwerpen

De commissie mag zelf haar werkzaamheden organiseren en bepalen welke onderwerpen prioritair zijn. De commissieleden moeten een consensus bereiken over de selectie van onderwerpen die behandeld gaan worden. Zij kunnen ook een aantal procedureregels opstellen. De eerste zou als volgt kunnen luiden: geen enkel besproken vraagstuk kan worden geschrapt zonder dat hierover consensus bestaat. Met een andere regel kunnen de agenderingscriteria worden bepaald: wanneer een risico aanvaardbaar is en op reële wijze kan worden beheerst, moet het niet worden geagendeerd. Indien een risico nauwelijks aanvaardbaar is, moet het worden behandeld vanuit de verschillende perspectieven.

Krachtens de taakomschrijving moeten de leden van de adviescommissie hun standpunten kenbaar maken. In sommige gevallen dient de taakomschrijving echter te worden aangepast. Tijdens de selectie van de onderwerpen kan een groot aantal vragen rijzen, die direct of indirect verband houden met de hoofdproblematiek. Het is belangrijk dat op deze vragen wordt ingegaan, ook al staan zij formeel niet in de taakomschrijving. De geloofwaardigheid van de commissie wordt namelijk sterk bepaald door de mate waarin zij in staat is deze vragen te behandelen en te beantwoorden. De manier waarop de informatie aan het publiek wordt voorgelegd is van cruciaal belang, want niemand mag zich benadeeld voelen.

De exacte formulering van de wetenschappelijke vragen

De commissieleden moeten de wetenschappelijke vragen gemeenschappelijk en exact formuleren: de onderzoekspunten, de te beoordelen wetenschappelijke vragen, evenals de onzekerheden en de controverses die deze wetenschappelijke vraagstukken oproepen. Daarom moeten de gevaren duidelijk in kaart worden gebracht. Dit gebeurt aan de hand van een proces van risicobeoordeling, waarvoor gevoelige gegevens moeten worden verzameld. Die gegevens moeten degelijk en goed gedocumenteerd zijn. Men dient zich ertoe te verplichten de verspreiding ervan tot een minimum te beperken, om persoons- of commerciële informatie te beschermen. Tot slot mag de precieze probleemstelling niet uitsluitend gebaseerd zijn op wetenschappelijke informatie, maar moet rekening worden gehouden met sociaal-economische zorgpunten.

Harmonisering van de methoden is nuttig om een zo sterk mogelijke basis te creëren voor geloofwaardige wetenschappelijke oordelen. Bovendien vergemakkelijkt harmonisering het vergelijken van informatie over de risicobeoordelingen en wordt beter zichtbaar waarop de blootstellingsnormen zijn gebaseerd. Ook komt het ten goede van transparantie en communicatie. Harmonisering wordt steeds belangrijker, naarmate de vraagstukken waarover een wetenschappelijk advies wordt gevraagd complexer worden. Hierbij valt te denken aan risicovergelijkingen, analyses van baten en risico's of geïntegreerde risicobeoordelingen.

2.3 Het opstellen van wetenschappelijke adviezen

Bij het opstellen van een wetenschappelijk advies moet een duidelijke en transparante procedure worden gevolgd om in te gaan op de onzekerheden en de inhoud van het definitieve advies te bespreken. Het belangrijkste bij de beoordeling van niet bewezen risico's is dat duidelijk wordt vastgesteld waarover wetenschappelijke consensus bestaat, op welke punten de meningen uiteenlopen en voor welke problemen meer onderzoek nodig is. Deze drie punten moeten in het definitieve advies aan bod komen.

De onderzoeksgebieden

De voor- en nadelen van de technologische ontwikkeling

Tegenwoordig wordt tegen risico's heel anders aangekeken dan in het verleden. Er worden geen risico's meer genomen of getolereerd, waarover niet eerst informatie is verkregen, die niet zijn aanvaard of waarover niet eerst op democratische wijze is gedebatteerd. In het debat over deze vraagstukken wordt steeds meer de nadruk gelegd op burgerparticipatie en integratie van het voorzorgsprincipe.

Bovendien vormen technologische keuzes dikwijls een breuk met het verleden, in de zin dat zij gekenmerkt worden door nieuwe risico's (ecologische en gezondheidsrisico's verbonden met industriële installaties, met productieprocessen of met de circulatie van de producten zelf). De context van onzekerheid vergroot: onzekerheden verbonden met de te nemen beslissingen, met de gevolgen van deze beslissingen en met de grenzen en onzekerheden van wetenschappelijke kennis. Precies daarom overschrijden vragen over het beheer van technologische risico's tegelijk gangbare processen van publiek beleid en gebruikelijke strategieën van ondernemingen.

Alternatieven voor mogelijk risicovolle technologische producten en productieprocessen

Zodra, bij een uitgevoerde risico-evaluatie, het risiconiveau onaanvaardbaar blijkt te zijn, is het aanbevolen alternatieven onder de loep te nemen. Het onderzoek van alternatieven is niet altijd een vanzelfsprekende zaak. Alternatieven voor producten of productieprocessen brengen immers zelf onzekerheden met zich mee. Men loopt dus het risico een gekend of erkend risico te vervangen door een nieuw, minder gekend of nog niet onderkend risico. Vele bekende voorbeelden illustreren de moeilijkheden verbonden met het teruggrijpen naar vervangingsproducten, neem bijvoorbeeld het geval van de substitutie van asbestvezels. Onderzoek en nadere studies zijn vaak nodig om meer inzicht te verwerven in de onzekerheden verbonden met alternatieve producten of productieprocessen. Niettemin is het belangrijk om, in het kader van een adviesverlening, alternatieven en hun beperktheden en onzekerheden te onderzoeken.

Hoe kan men weten of het nodig is om alternatieven mee te nemen in de overwegingen? Een wetenschappelijk oordeel dient de voor- en nadelen van mogelijke alternatieven te presenteren. Ook socio-economische overwegingen kunnen een aanleiding zijn om producten of productieprocessen en hun eventuele alternatieven met elkaar te vergelijken. Een onderlinge vergelijking van verschillende toepassingen van nieuwe producten kan helpen om richting te geven aan te maken keuzes. Het is dus nodig dat de inhoud van een wetenschappelijk advies een algemene definitie geeft van de criteria waar men rekening mee dient te houden om de verschillende alternatieven te beoordelen en met elkaar en met het oorspronkelijke product of productieproces te vergelijken.

De keuze om het ene alternatief te verkiezen boven een ander komt niet toe aan de wetenschappers, maar aan de publieke autoriteiten. Inderdaad, wetenschappelijke experten zijn niet uitgerust om politieke keuzes te maken omdat zij vaak onvoldoende op de hoogte zijn van de socio-economische effecten van een keuze. Tegelijkertijd zijn de wetenschappelike adviesraden niet in staat om zelf onderzoek naar alternatieven uit te voeren (risico op onpartijdigheid, op het zoeken naar financiering voor het eigen onderzoeksdomein). De experten kunnen wel een lijst met thema's voor verder onderzoek samenstellen.

Een methodologie om onzekerheden te expliciteren

Het is fundamenteel om als voorbereiding op het werk van de commissie een methodologie te bepalen voor de beoordeling van risico's. Onderdelen van deze methodolgie betreffen de identificatie en karakterisering van mogelijke gevaren, de beoordeling van de mate en manieren van blootstelling aan deze gevaren en een karakterisering van het risico. Men dient ook

overeenstemming te bereiken over hoe men met onzekerheden om zal gaan. Welke houding dient men in te nemen ten aanzien van risico's? Hoe moet men ze beheren? Dient men tot elke prijs een consensus te bereiken? Verschillende problemen duiken op: het vaststellen van het soort, de graad en de bron van onzekerheden is geen eenvoudige opgave.

De leden van adviesraden dienen overeenstemming te bereiken over de factoren die een onzekerheid bepalen. Zij gaan met elkaar in debat over verschillende aspecten: de mogelijke gebieden waarop onzekerheden een impact hebben, de factoren die de ernst ervan bepalen, de ernst van de mogelijke effecten, de verschillende risicogroepen, de waarden waar men rekening mee dient te houden, de vraag naar de aanvaardbaarheid van de risico's en het beheer van de onzekerheden.

Tijdens een discussie tussen verschillende experten kan de vastgelegde methodologie bijdragen tot een explicitering van waarde-oordelen, naast wetenschappelijke oordelen. Het voorzorgsprincipe is onder meer bedoeld om de verschillen tussen maatschappelijke en wetenschappelijke oordelen te verhelderen. Deze verschillen, die onder andere berusten op verschillen in onderliggende waarden, dienen expliciet vermeld te worden. Een methodologie is nodig om deze verschillen tussen maatschappelijke en wetenschappelijke visies aan te wijzen. Het is echter niet aan de wetenschappers om de knoop door te hakken.

Verder dienen de actoren het met elkaar eens te worden over de wijze waarop men onzekerheden zal beheren, met name door het uiwerken van een procedure om deze thema's te behandelen waarover de deelnemers het niet met elkaar eens zijn of waarover zij onzeker zijn. Wij merken op dat er eensgezindheid kan bestaan over de noodzaak om onzekerheden te behandelen, zonder dat er eensgezindheid is over de manier waarop deze beheerd dienen te worden.

Het uiteindelijke advies: inhoud, minderheidsstandpunten, archivering

Over de inhoud van adviezen bestaan er verschillende meningen. Sommigen zijn voorstander van een heel uitgebreid advies dat de resultaten bevat van de vergelijking tussen de alternatieven, mogelijke follow-up programma's, thema's voor verder onderzoek, punten van overeenstemming en van meningsverschil, mogelijke beheersmaatregelen. Anderen oordelen dat de inhoud van een advies niet al te uitgebreid dient te zijn omdat het gevaar bestaat dat het dan op een echt politiek programma gaat lijken. Een wetenschappelijk advies blijft een beperkt advies. Het gaat om een zo nauwkeurig mogelijk antwoord op een vooraf gestelde en door de bevoegde overheid afgebakende vraag. Het gaat niet om een puur wetenschappelijke oefening .

Iedere deelnemer dient de mogelijkheid te krijgen om in het eindrapport zijn redenering en zijn op wetenschappelijke gegevens en analyses gebaseerde standpunten weer te geven. De experten proberen zo goed mogelijk overeenstemming te bereiken. Echter, indien de meningen te zeer verdeeld zijn, dient dit in het eindadvies vermeld te worden. Het is belangrijk dat het eindadvies minderheidsstandpunten vermeldt op zodanige manier dat de verschillende perspectieven duidelijk zichtbaar blijven. In de beleidsbeslissingen dient dan ook een neerslag van deze minderheidposities terug te vinden zijn. Het is belangrijk, zowel voor de bevoegde overheden als voor de verschillende belangengroepen, dat zij de auteurs van deze of gene positie kunnen kennen.

De verslagen van de debatten van de adviesraden dienen bewaard te worden. Deze traceerbaarheid is tegelijk nuttig om het publiek vertrouwen in de instelling te handhaven en om de ontwikkelingen in wetenschappelijke kennis doorheen de tijd te kunnen nagaan. Dit laatste is zeer belangrijk in situaties van voorzorg omdat er in een later stadium meer gegevens en kennis beschikbaar kan komen over risico's die nu nog onzeker zijn.

Het is belangrijk dat het eindrapport met het wetenschappelijke advies helder is. De vorm ervan is afhankelijk van de behoeften van de doelgroep. Een andere doelgroep vraagt om een andere vorm (bijvoorbeeld een technisch document, een samenvatting). Elke vorm verschaft preciseringen in meerdere of mindere mate. Deelname, vanaf het begin, van specialisten in

risicocommunicatie aan bijeenkomsten van experten vergemakkelijkt de formulering van conclusies in heldere bewoordingen. Ter herinnering, de manier waarop de communicatie over de conclusies wordt georganiseerd, wordt vooraf afgesproken. In het kort gaat het er om te bepalen wie benaderd dient te worden, aan te geven welke de gevoelige kwesties zijn, degenen die het verslag zullen presenteren in te lichten over deze kwesties en aangepaste persberichten te publiceren.

2.4 Het gebruik van wetenschappelijk advies

De fase waarin de uiteindelijke wetenschappelijke adviezen gebruikt worden, is sterk bepaald door de communicatie erover en de opvolging ervan.

De rolverdeling tussen raad, administratie en bevoegde overheden

Er bestaat een functionele scheiding tussen degene die een beslissing neemt en degene die een advies formuleert. Het wetenschappelijke advies dat aangeboden wordt op het einde van een evaluatieproces dient te beantwoorden aan de behoefte van de aanvrager ervan. Het is de verantwoordelijkheid van de experten om een verslag af te leveren waarvan de inhoud beantwoordt aan de behoefte: een heldere uiteenzetting over de voorliggende vraag, de beschikbare gegevens voor het beantwoorden van de vraag, de redenen waarom sommige gegevens niet in de overweging zijn meegenomen, een uitleg over de betrouwbaarheid van de gebruikte gegevens (met inbegrip van de onzekerheden), de robuustheid van de hypothese waarop het advies berust.

De verantwoordelijkheid voor het gebruik van het advies en voor de genomen beslissing berust bij de bevoegde administratie en overheden.

De uitwerking van mogelijke opties voor politiek handelen vertrekt van het geboden advies. Zij gebeurt op basis van de meest recente wetenschappelijke kennis en dient herzien te worden in functie van wetenschappelijke ontwikkelingen. Men dient ook de verschillende te nemen maatregelen te overwegen en de implicaties van deze maatregelen te onderzoeken. De uiteindelijke beslissing gebeurt vaak op basis van een soort kosten-baten analyse (wat zijn de eventuele voor- en nadelen van het nemen van een risico?) Men weegt de verschillende scenario's af, met name in functie van het slechtste scenario, en men let in het bijzonder op de omkeerbaarheid van de maatregelen, voor het geval een hypothese voor een bepaald risico in een lader stadium gefalsifieerd wordt.

Een verplichting om de genomen beslissingen te motiveren op basis van het advies

Het is nodig de ingenomen positie, de gekozen maatregel te motiveren en er op toe te zien dat deze motivering begrijpelijk is voor het grote publiek.

De finale beslissingen dienen gemotiveerd en beargumenteerd te worden. Het is belangrijk om, in een toegankelijke stijl, een maximum aan informatie te geven over de risico's en over de redenen die bijgedragen hebben tot het nemen van een beslissing. Deze plicht geldt zowel in de gevallen dat de publieke overheden het advies volgen als wanneer zij het niet volgen.

Communicatie over de genomen beslissing

De vereisten wat de verspreiding van het verleende advies betreft (kanalen, verspreiding van een gedeelte of het geheel van het geleverde werk, verspreiding van namen en kwaliteiten van de geraadpleegde experten, enz.) dienen helder te zijn. Wanneer men alle informatie verspreidt, loopt men het risico om een controverse te versterken binnen bepaalde groepen personen of om paniek te ontketenen. Zou het niet minder gevaarlijk zijn om bepaalde wetenschappelijke informatie niet te communiceren? Een publieke communicatie brengt zonder twijfel risico's met zich mee, maar het is een waarborg voor vertrouwen in politieke en wetenschappelijke instellingen.

Actualisering van de gegevens

Eén van de essentiële bezorgdheden van de leden van een adviescommissie is om een advies, dat uitgewerkt is op basis van de gegevens die op een gegeven moment beschikbaar zijn, niet als definitief te beschouwen.

Het is nodig een *monitoring* systeem te installeren dat in staat is om de ontwikkelingen te registreren. Het is belangrijk criteria te definiëren waar men rekening mee dient te houden om die veranderingen vast te stellen die tot een herevaluatie nopen, want men kan niet op basis van om het even welke wijziging in de staat van (wetenschappelijke) kennis tot een herevaluatie overgaan. De leden van adviescommissies beschikken over de nodige competentie om een reeks relevante technisch-wetenschappelijke en socio-economische indicatoren te bepalen.

De resultaten van het *monitoring* systeem dienen aan het comité aangeboden te worden, zodat het de laatste adviezen kan herzien. Een evaluatie van de effecten van politieke initiatieven kan ook gevraagd worden aan experten. Men kan een herevaluatie overwegen in sommige gevallen:

- Op vraag van leden van een adviesraad: zij kunnen zelf een probleem opnieuw op tafel leggen, met name op basis van *monitoring* resultaten
- Op basis van een advies van een raad wanneer de gevoeligheid voor bepaalde kwesties is afgezwakt
- Wanneer er een aanvraag ontstaat om een product te commercialiseren
- In het geval van politieke veranderingen want dit heeft een invloed op het waardenkader
- Op vraag van de bevolking: hun risicoperceptie verandert met de tijd.

2.5 Samenvatting

De tabel hieronder vat procedures en suggesties samen die wij in deze gids naar voor schuiven opdat de uitwerking van wetenschappelijke adviezen meer in overeenstemming zou zijn met het voorzorgsprincipe.

De samenstelling en het mandaat van wetenschappelijke adviescommissies	*Samenstelling* : let op interdisciplinariteit en op een evenwicht tussen competentiedomeinen, openheid naar 'anders-deskundigen' in functie van de aard van het behandelde probleem. *Selectie* : werk eerst een profiel uit van het type experten dat men zoekt, gebruik een grote diversiteit aan relatienetwerken, garandeer de transparantie van de selectiecriteria en –beslissingen. *Contract* : stel een expertisecontract op dat de rechten en plichten van experten vastlegt (plichten zijn onder andere : het ondertekenen van een 'verklaring van affiliaties').
De probleemdefinitie	*Bepaling van de agenda* : geef de adviescommissie zelf en externe actoren initiatiefrecht wat de keuze van de thema's betreft ; selecteer de thema's in overeenstemming met een voorzorgsbenadering (in verhouding tot een preventiebenadering); maak een duidelijk onderscheid tussen de respectievelijke rollen van experten, *stakeholders*, publieke overheden en burgerparticipatie. *Flexibiliteit in de behandeling van de thema's* : behandel de problemen op verschillende wijze, onder meer afhankelijk van hun mate van complexiteit of onzekerheid. Zorg dat er op elk (deel)probleem een antwoord geboden wordt. *Preciese bepaling van de wetenschappelijke vragen* : op basis van de gegevens, van bestaande studies en controverses, maar ook rekening houdende met socio-economische bezorgdheden.
Uitwerking van wetenschappelijke adviezen	*Te verkennen domeinen* : voor- en nadelen van verschillende technologische alternatieven, vergelijking van alternatieven. *Methodologie* : preciseer de aard en de draagwijdte van onzekerheden, stel een methode op punt om controversiële onderwerpen te behandelen, en om de onderliggende waardeoordelen expliciet te maken. *Inhoud van het finale advies* : beargumenteer de punten van overeenstemming en van verschil, vermeld minderheidsstandpunten, bewaar de verslagen van de debatten, voorzie opvolging van en een vervolg op het advies.
Het gebruik van wetenschappelijke adviezen	Organiseer een taakverdeling tussen de raadgevende organen, de publieke overheden en administraties ; verantwoord de genomen beslissingen op basis van het geboden wetenschappelijk advies ; voorzie een communicatiecampagne ; organiseer een procedure om de gegevens te actualiseren.