SCIENTIFIC SUPPORT PLAN FOR A SUSTAINABLE DEVELOPMENT POLICY

Intermediary report – January 2003

SCIENCE AND PRECAUTION IN INTERACTIVE TECHNOLOGY RISK MANAGEMENT
OA/001

UFSIA - FTU

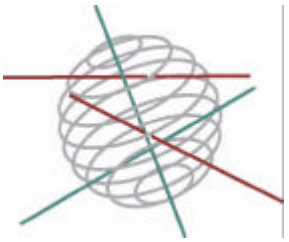
SPSD II

PART 1
SUSTAINABLE PRODUCTION AND CONSUMPTION PATTERNS

- GENERAL ISSUES
- AGRO-FOOD
- ENERGY
- TRANSPORT

This research project is realised within the framework of the Scientific support plan for a sustainable developmentpolicy (SPSD II)

Part I "Sustainable production and consumption patterns"



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Scientific support plan for a sustainable development policy (SPSD II)

Part I "Sustainable consumption and production patterns"

Intermediary scientific report of the project with the title:
Science and Precaution in Interactive Technology Risk Management

1 Introduction

1.1 Context and summary

In our research project we question whether there is truly a diametrical opposition between a scientific approach on the one hand and a precautionary approach on the other. Indeed, we argue that the two approaches comple ment one another: science guarantees a more systematic debate on values, while a critical attitude towards scientific presuppositions and methodologies that is based on a normative framework can lead to better science. Science is not pushed aside in this model. It is however recognised that the inherent characteristics of the policy issues on sustainable development (uncertainty, irreversible consequences, plurality of values) are such that the established approach in applying knowledge to policymaking must be called into question. 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 policy issues on technology and risk management from a precautionary perspective? The focus of attention will be on the actual interface between science and policy, on the assessment procedure and on the interactions and argumentations that take place within this process among scientists themselves and between scientists and government experts.

Our research project is situated at the crossroad of three domains of concern in scientific research and in public policy with regard to sustainable development:

- the relationship between science and policy
- the interpretation and implementation of a precautionary approach in public policy
- open and interactive policymaking

1.2 Objectives

The aim of our research project is to develop a more effective arrangement for the relationship between knowledge and policymaking, whereby the dichotomy between science and precaution is transcended. The project intends to contribute to the development of practical procedures and methods in relation to technology and risk management in a manner that is both scientific and precautionary.

Our broad approach to technology risks (i.e. a view that is both scientific and precautionary) entails that the research project will focus on two aspects:

- decision-making in technology development in companies: this part of research focuses on the relationship between experts within private enterprises and experts within government institutions involved in technology and risk management (FTU focus).
- decision-making in the assessment and evaluation of technology risks: this part of research focuses on the formulation of scientific policy recommendations in the relationship between external experts and experts working within government institutions involved in risk analysis and management (STEM focus).

1.3 Expected outcomes

The project will yield three types of results:

- a vision of science and precaution in the management of technology and risks. A confrontation between the results of a literature study and several case studies will result in an empirically tested argumentation regarding the necessity and the nature of an effective arrangement of the relationship between science and policy in a precautionary perspective. This argumentation will relate to:
    - the inherent characteristics of policy issues (uncertainty, irreversibility of hazards, plurality of values) that go hand in hand with new technology and risk management
    - the social construction of science (risk analysis) for policy
    - the significance of making more explicit a social assessment of technological risks.

- An audit of various cases. Each research team will analyse cases (some concerning the relationship between scientific advisory committees and experts from within the civil service and some concerning the relationship between experts from private enterprises and experts from within the civil service). For each of these cases a separate report will be drawn, which in effect constitutes an audit of the functioning of the public scientific institution with regard to its relationships with experts. These audits will be compromised of the following components:
    - An analysis of the problem areas that manifest themselves in the interactions between and arguments put forward by external experts, as well as in their relationships with experts from the civil service during the assessment process, and the application of assessments in policymaking.
    - Formulation of common problems and solution strategies with which the actors involved in each case study can identify maximally.

- A guide for establishing an effective arrangement for the incorporation of knowledge in policy on technology and risks in a precautionary perspective. The final product of our research is a guide, on the basis of which authorities and experts can make a critical assessment of their own arrangement for the relationship between science and policy in the context of the complexity of the policy issue at hand, and from a general concern with precaution. The guide will consist of:
    - a checklist of focal points for identifying the logic, structure and bottlenecks in interactions and arguments during the assessment process and application of knowledge in decision-making.
    - A list of suggestions regarding the development of an effective arrangement for the criteria of effectiveness, organizational possibilities, adequate procedures and tools.

2 Detailed description of the scientific methodology

Our research project is built up in four distinct phases. Each phase has its specific objective, method and expected results.

1. Phase 1: A more accurate definition of the issue at hand: science and precaution in interactive technology management
    a. **Objective** : a more accurate phrasing of the research question, namely the alleged dichotomy between science and precaution in relation to technology policy aimed at sustainable development
    b. **Method**: a survey research literature. The project is related to three areas of research on sustainable development policy:
        i. The relationship between science and policy
        ii. The implementation of a precautionary approach in policy
        iii. The application of interactive methods of policy development

c. **Expected results**: a formulation of the principal arguments for an effective arrangement of the relationship between science and policy in a precautionary perspective, including arguments from:

i. the social construction of science

ii. the numerous scientific uncertainties in relation to technological risks

iii. the significance of the social appreciation of technological risks

2. Phase 2: Casestudies

a. **Objective** : an analysis of the manner in which knowledge about technology assessment and management is built up and applied

b. **Method**: Document analysis, personal interviews and focus groups

c. **Expected results**:

i. An analysis of the interactions between the actors involved in the knowledge-building process, the arguments they put forward in this process and the application of their expertise in decision-making

ii. A list of bottlenecks and suggestions for a 'different' role of knowledge and science in the management of technology risks

A starting-point for criteria for an appropriate selection of cases:

- The focus of the research project is on two types of relationship that provide support for decision-making wit regard to technology and risk management:
  - The relationship between external experts and experts working within government institutions involved in risk analysis and management. By external experts, we mean academics and consultants who, either on a regular or an ad hoc basis, reside in advisory committees that provide support in decision-making to experts within the civil service (e.g. bio-safety board, food-safety agency, government body that manages professional hazards, …) (Partner STEM).
  - The relationship between experts within private enterprises and experts within the civil service. Experts from private companies include technology developers, environmental and safety experts. Often, these experts are supported by external consultants and intermediary scientific advisory committees (Partner FTU).

- The principal technology-related risks of which policy should take account are:
  - the risks of nuclear power
  - risks relating to dangerous substances in fixed installations
  - risks relating to the release of biological agents and GMO's into the environment and the food-chain
  - environmental health risks posed by the distribution of dangerous substances
  - risks of non-ionising radiation (mobile telephone masts, mobile phone use)

It may be worthwhile to divide the cases on the basis of the technology involved, as different technologies (biotechnology, energy technology, chemicals) imply different risks (in terms of both scope and effect) and different uncertainties.

- Expertise is incorporated into policy on technology and its risks in various contexts and phases of the policymaking process: policy development, regulations, conflict management, crisis management. One could argue that the choice of cases should be limited to a single decision context, as this would yield data that are more readily comparable. Such an approach could focus on the policy-context of

'regulation and recommendation', as here the emphasis lies on technology in the R&D phase prior to market distribution. This development phase would also keep open the possibility of switching to alternatives. However, one could also select cases from varying decision contexts, as developments in the different phases of policy-making influence one another (e.g. the manner in which the planning of research priorities regarding GM -foods is approached will have an impact on the speed with which field testing is regulated, which in turn will have consequences in terms of possible protests against such tests).

Research methodology for case studies:

We intend to demonstrate on the basis of case studies the complexity of the relationship between science and policy. The main focus will be on the interactions between and the arguments put forward by external experts and experts within the civil service who are involved in the assessment phase, and on the use of assessments in decision-making.

Possible focal points:

- How is scientific knowledge built up?
- What is the role of expert-advice and how is it applied in decision-making?

A document analysis (commissioning of experts, composition of a file, public files, records of meetings, etc.) and a number of interviews with privileged witnesses will provide insights into the history and the network of the relevant actors in the selected cases. In other words, it will provide insights into who was involved at what time and for what reason in a specific case.

Subsequently, external experts and experts within the civil service will be asked to indicate any problems they may have encountered, and to suggest possible causes and solutions. As the ultimate goal of this study is to formulate a practicable arrangement for the relationship between scientific knowledge and policy, it is important in this phase that the problems and possible solutions should be formulated in such a way that the actors involved can identify maximally with it. The method that will be employed to this end is that of repeatedly going through argumentation circles. The external experts and the experts form the civil service will be interviewed individually on the basis of the aforementioned focal points. During each interview, a test will be conducted of the problems and resolutions which researchers were able to derive from the previous interview. On the basis of the data collected and the repeated run-throughs of the argumentation circle, the researcher will then suggest a tentative formulation of common problems and possible solutions. Finally, this formulation will be submitted to a group of interviewees (focus-group method).

3. Phase 3: A first test of our findings against the literature on precaution
    a. **Objective** : design of a new perspective on the relationship between science and policy
    b. **Method**:
        i. A critical analysis of the research literature and principal policy documents on precautions.
        ii. An estimation of the proposed interpretations and possibilities for implementing precaution on the basis of our own field-test results.
    c. **Expected results**:
        i. An appreciation of the relevance of precaution to the relationship between science and policy, such as the distinction between precaution as a principle and precaution as an approach
        ii. A starting-point for a broader focus on the analysis and the management of technology and risks. Precaution is not only a formal principle, it also involves a search for a more systematic approach towards answering society's questions about technology risks, the various perspectives on risks, possible alternatives, and methods to conduct scientifically sound debates on values and norms. We expect that our critical survey of the literature on precaution and the confrontation with results from

our own case studies will allow us to formulate a more comprehensive definition of what a scientific approach to technology risks should entail.

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4. Phase 4: The development of an effective arrangement for the relationship between science and policy in a precautionary perspective
    a. **Objective** : to develop an effective arrangement for the relationship between science and policy in a precautionary perspective.
    b. **Method**:
        i. Critical analysis of research literature and policy documents in which examples are proposed with regard to a more effective arrangement for the relationship between science and policy in a precautionary perspective.
        ii. Three consecutive Delphi-rounds (two written questionnaires and a concluding meeting) in which proposals for an effective arrangement for the relationship between science and policy in precautionary perspective will be formulated and tested in terms of their feasibility.
    c. **Expected results**: suggestions with regard to an effective arrangement for the relationship between science and policy in a precautionary perspective will pertain to:
        i. The formulation of criteria with regard to the quality of the arrangement
        ii. The establishment of procedures in the relationship between scientific knowledge and policy
        iii. The application of tools

In the final phase of our research, we shall call on a broader group of experts, and, by means of consecutive Delphi rounds, try and arrive at concrete suggestions with regard to an effective arrangement for the relationship between science and policy in a precautionary perspective. Relevant experts include officials from various administrations, politicians who formulate advice and help decide on procedures, and experts who may be called on in this final phase because of their experiential expertise. The purpose of the two consecutive written questionnaires is to allow an open-minded approach that will generate as many concrete suggestions as possible, followed by a meeting to discuss their feasibility and to determine priorities.

We shall examine which prerequisites/criteria should be fulfilled by the arrangement for the interface between science and policy in a precautionary approach. These criteria will, in the first place, concern the effectiveness of the arrangement in terms of how conducive it is to reaching solutions, either consensual or not (procedural criteria). Further criteria will pertain to the quality of the arrangement in terms of whether it results in decisions that are legitimate (normative criteria). It is pointed out in the literature, for exa mple, that the following aspects are important:

- The possibility for social learning
- The possibility for competent actions (quality of the participants' arguments)
- The possibility for fair participation (equal opportunities to participate, to put forward arguments)
- The possibility for an open and transparent *modus operandi*

Organisation and procedures at this interface encompass:

- The manner in which policy calls on experts: when and how do we commission research or ask their opinion? How is the problem presented to the expert (as a purely technical or scientific issue, or as a complex social matter?).
- The extent to which plurality within the scientific community is reflected in the assessment (e.g. less rigid structures for advisory bodies, changing membership, a more dynamic approach, consideration for minority views, open and transparent *modus operandi*).
- The manner in which expertise from various disciplines is integrated; the extent to which a multidisciplinary or transdisciplinary approach is adopted.
- The manner in which scientific results are communicated, i.e. in a report, as a 'single figure', or as different scenarios depending on assumptions, hypotheses and methodological choices.

The tools applied may include:

- Calls for research projects: which aspects tend to receive too little attention and should be dealt with more explicitly (e.g. in relation to uncertainties, the expected results, …). It may, for example, be advisable to make 'framing choices' more explicit.
- Tools that allow one to take into consideration different scientific opinions (survey of different hypotheses, assumptions, assessment of the impact of methodological choices,…) or to attain consensus (Delphi-round involving experts).
- Tools whereby experts from different disciplines can formulate recommendations (problem of incomparability?).
- Tools for inventorying uncertainties (uncertainty map, uncertainty unit).
- Tools for communication of results (gaming, simulations, …instead of research reports)
- Tools for outlining policy options on the basis of expert opinions and other arguments (follow-up to PODO I).

3 Detailed description of the intermediary results, preliminary conclusions and recommendations

3.1 Contribution of FTU

3.1.1 Literature review

The survey of the research literature on "science, precaution and interactive management of technological risks" is intended to contribute to the establishment of a more acute theoretical framework.

The literature review is divided into five parts:

- Literature on technological risks
  - Basic concepts: lessons from an historical approach; lessons from a geographical point of view; typology of risks; limits of the traditional concept of technological risks; new stakes related to risk assessment and management.
  - Tools for risk assessment and management: various paths in the development of assessment methods; meaning and ways for risk management; validity of a clear-cut separation between risk assessment and risk management.
  - New arrangements to face new risks: early warning systems; traceability procedures; emphasis on the feedback from experiment.
  - Contributions from social sciences: social construction of technologies; social acceptability of risks; psycho-sociological research on the concept of confidence; cyndynics.

- Literature on the precautionary principle
    - Precaution as a continuum or as a breaking-down point towards the prevention regime: large scope of prevention; limits of prevention related to uncertainty and problems due to the control on time, problems due to the control on space.
    - Framework for precaution: historical marks from international law, European law and national laws; the normative value of the precautionary principle; the overwhelming invocation to the precautionary principle.
    - Setting up of a precautionary strategy: prerequisites; facultative or obligatory starting-up of the precautionary regime; the real contents of a precautionary regime; sectorial features.

- Literature on science/policy relationships
    - Public policies in the field of science and technology: economic grounds for public intervention; three waves in the S/T policies; critics about public action.
    - Development of procedural policies and deliberative models
    - Status for the experts: the role of the experts; the diversity of the context of expertise; the judgment of the experts: the legitimacy of the experts; the organisational management of the expertise; the functioning of deliberative commissions in the field of S/T.
    - Controversies as an assessing tool

- Literature on the concept of participation
    - The context of participation.
    - The times for participation.
    - The various degrees of participation.
    - The critical dimensions of participation.
    - The mechanisms of participation: procedural rights; institutional participatory arrangements, inclusive assessment methods.
    - The effects of participation.

- Literature on the management of security within the enterprise
    - Legal regimes concerning the prevention of risks inside Belgian companies: the federal system for the social security related to work accidents and occupational diseases; the rules for occupational health and safety; the environmental rules; the rules concerning major hazards.
    - Internal competencies relating to security management: competencies related to occupational health and safety; competencies related to environmental duties; competencies related to major hazards; financial risk management competencies.
    - Tools for prevention of risks: managerial norms dealing with safety-environment-quality; methods for risk assessment
    - Precautionary regime and its obligations for the enterprise: a new obligation for the private sector; a new stake for the relationship between firms and insurance sector.

Following that literature review, one may express the following preliminary conclusions:

- The traditional concept of prevention against technological risks shows its intrinsic limits:
    i. The obvious distinction between natural risk and manufactured risk is not always pertinent.
    ii. Geographical density of risks and domino effects need to enlarge the scope of prevention's

mechanisms.

iii. The traditional thresholds of noxiousness aren't adequate to capture all kinds of technological risks, for instance some very small doses should induce heavy and irreversible damages on the long term.

iv. Safety norms may make the risks common and, due to that, nobody should take really care of them.

- New configurations of technological risks are appearing. These are some of their characteristics:
  i. There is an urgent need for new and valid ways to alert public decision-makers and public opinion on new risks.
  ii. It is hard to determine by advance the concerned stakeholders.
  iii. It isn't easy at all to establish responsibility related to very long-term risks or networked risks and to cover them.
- The traditional mechanisms tailored for the assessment and management of well-known technological risks have been developed along three paths:
  i. Safety of systems and processes (reliability studies)
  ii. Ecological and sanitary effects of facilities or processes (ex: occupational health and safety regulation; major hazards regulation)
  iii. Ecological and sanitary effects of products (ex: rules related to the food chain security)
- 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.
- The decision-making process leads the public authorities to rely more intensively on scientific expertise to assess risks in several fields like environment, health, and food. However, when the role of the experts is becoming more and more crucial, at the same time, their legitimacy seems to be progressively eroded. The scientific competence (attested by academic curricula, peer review, quotations, etc) is not anymore sufficient to legitimate the role of the experts. This legitimacy depends also on procedural guaranties (collective assessment, contradictory assessment, independent assessment, transparent assessment).
- The challenge for technical democracies is to establish a bridge between the experts and lay people because sustainable development requires acceptability of risks. The experts aren't in the right position to decide whether a risk is acceptable or not, whether a risky product or process is justified or not. The involvement of lay people could consist into procedural rights (like right to information), or participatory institutional arrangements or new methods of assessment, which include the expression of values.
- 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. Precautionary measures are in fact temporary measures, as far as the concerned risks remain uncertain.
- In order to reflect the way the expertise on technological risks is built up within the firms, one has to consider two things:
  i. The assessment and management of well-known risks (prevention regime)
  ii. The assessment and management of uncertain risks (precautionary regime).
- The private expertise on technological risks relies not only on internal experts but also on external people (insurance companies, external services for prevention and protection, etc). Therefore, one has to reflect the interactions among those partners.

On the basis of the preliminary conclusions, we suggest to pay attention to these questions during the empirical phase of the research project:

- Is the private sector definitely concerned by the precaution regime?

- How is built up the expertise on emergent risks within the firms?
- Which hierarchical levels and functions are concerned with the assessment and management of classical as well as emergent risks?
- Is there social dialogue concerning emergent risks?
- Are there specific arrangements into the firm concerning precaution?
- How far the prevention regime could be a basis of reference to deal with uncertainty?
- Which are the appropriate tools to set up a precautionary strategy within the private sector?
- How to inform and to educate workers to deal with uncertainty?
- Are there good practices among firms about precautionary measures?
- Does anyone notice specificities of precaution depending on the sector of application?
- Which are the appropriate channels through which the private sector could contribute to a collective care of new risks?
- What kind of involvement the experts from private sector make into public advisory bodies or agencies dealing with emergent risks?

3.1.2 Preparation of the case studies

Through the empirical phase, we pursue three objectives:

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

In order to reach these objectives, we will analyse case studies in ten companies.

There will be three kinds of studies:

1. Case studies on enterprises dealing with classical risks, facing prevention requirements
2. Case studies on enterprises facing technological risks which are not yet well-known
3. Case studies on intermediary bodies in risk management (advisors, insurers, etc.).

There are several reasons why we have decided to split the case studies into three 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 due to the fact 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 among the private sector is a diffused process that one has to reflect adequately through empirical research.

Personal interviews will be held to collect opinions from security managers, environmental managers, quality managers, and members of the internal prevention and protection service, R&D managers.

This is the basic check-list for interviews:

- 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 into 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 of threats, internal precautionary measures, follow-up, exchange of information with public authorities and bodies).

3.2 Contribution of STEM

At the moment we can present several results. To begin with, we built a framework defining our theoretical perspective (first phase of the research project). We further have the first results of one of our case studies, namely the Belgian Biosafety Council (second phase). We made an analysis of the documents present at the secretariat of the Council concerning the dossiers on GMO-releases for experimental purposes during the year 2002. We can present our hypotheses distilled from this document analysis and the questionnaire made for taking interviews with various actors concerned. For the moment, we have completed these interviews and we are working on the results. At the same time, we are preparing a second case study, namely the (Belgian) Federal Agency for the Safety of the Food Chain (FAVV – Federaal Agentschap voor de Veiligheid van de Voedselketen). Hereafter, I will elaborate on our theoretical framework and on the hypotheses deduced from the document analysis of the Biosafety Council. In the final subsection you will find the questionnaire made for the round of interviews.

3.2.1 Theoretical framework

3.2.1.1 Problem definition

Nowadays scientific information does not suffice to solve complex problems of public policy, for several reasons. Scientific knowledge is restricted: it cannot provide sufficient information concerning possible impacts of technological innovations. It is moreover contested, both internally - from within the community of scientists – as externally – by lay people -. Consequently, scientific knowledge can no longer be considered a firm basis for policy decisions. Consequently, we have to look for a different reference point to evaluate the quality of a procedure of scientifically underpinned policy decisions. Since scientific objectivity can no longer be the reference point, we consider *trust* to be a crucial concept. In order to discover the elements needed to build trust, we first question what trust in a democratic institution means. Further we reflect on the characteristics of a Risk Society. These characteristics indeed influence the meaning of trust.

Internationally the Precautionary Principle is put forward as a guiding principle to deal with scientific uncertainties in policy contexts. We ask ourselves whether this Principle can contribute to the building of trust and, if so, under what conditions. We moreover question the relationship between science and the Precautionary Principle. Is a precautionary approach part of a scientific approach or does precaution start where science ends? Do a scientific and a precautionary approach exclude one another or is a precautionary approach a logical consequence of a scientific one?

Our final aim is to translate the concept of 'trust' in guiding lines for developing scientific advice in policy contexts. We thereby take a pragmatic model of the relationship between science and policy as a theoretical starting point.

3.2.1.2 Trust

A democratic institution is trustworthy on condition that we can consent with its *idée directrice* and that we can assume that sufficient citizens share our consent. According to Offe, 'truth' and 'justice' are the two fundamental values that should be manifest in the *idée directrice* (Offe 1999, 72-76). Offe distinguishes between a passive and an active version of these values. The passive version of 'truth' is 'honesty'; its active version 'promise-keeping'. The passive version of 'justice' is 'impartiality' or 'fairness'; its active version 'solidarity'. The assumption – that I share my consent with most of the other members of the community to which the institution applies – becomes corroborated in case all parties have a minimum base of common interests. In political situations – these are situations that by definition are characterised by conflicting interests and identities – specific mechanisms have to be institutionalised in order to deal with existing conflicts, either to tone them down are to create a minimal common base.

In complex democratic societies trust fulfils two functions. On the one hand, trust is a complement to deliberative processes. Citizens do not have sufficient political capital – time and knowledge – to participate directly in the wide variety of policy questions that are of concern to their daily life. Therefore it is desirable that they can rely on competent persons or institutions to take most decisions in their place. This trust is complementary. It allows citizens to use their political capital for hot topics: topics that are of a very special importance for their private life or topics that cause a lot of societal unrest. On the other hand, trust is a condition for and a possible result of deliberative processes. Relations of trust allow for constructive discussions and constructive discussions can contribute to mutual trust relationships.

3.2.1.3 Risk Society

At the beginning of the 21st century industrial societies are complex societies. Ulrich Beck introduced the term 'Risk Society' to distinguish these societies from previous versions. In this section, we will recapitulate some characteristics of a Risk Society.

In a Risk Society, technologically and scientifically induced risks have become inherent, not merely exceptional phenomena. These risks are, moreover, of a particular type: not detectable by our common senses, with a collective scope, irreversible, not restricted in space and time and very complex. The nature of this new type of risks places scientists in an ambiguous position. On the one hand, society is in need of their help to detect these risks and to deal with them. On the other hand, scientists are not really capable to deal adequately with the many uncertainties accompanying these risks.

According to Beck and Giddens Risk Society can be interpreted as a further phase of modernity. They therefore speak of 'reflexive modernity'. 'Reflexive modernization […] is supposed to mean that a change of industrial society which occurs surreptitiously and unplanned in the wake of normal, autonomized mo dernization and with an unchanged, intact political and economic order implies the following: a *radicalization* of modernity, which breaks up the premises and contours of industrial society and opens paths to another modernity (Beck *et al.* 1994, 3).

The term 'reflexivity' points in the first place to the fact that ongoing developments within modern societies cause modern institutions to be confronted with their own limits. Reflexivity means a confrontation of the foundations of modern societies with its own consequences. This confrontation implies that these consequences cannot be managed from within existing modern institutions. This incapacity forces us to consider again the very nature of modern institutions. Hence, reflexivity in its first sense – self-confrontation – entails reflexivity in its second – cognitive – sense. A *Gestalt* switch from a positivist to a constructivist interpretation of science – as occurred in many communities of sociologists and philosophers - could be considered an example and result of – cognitive – reflexivity concerning science.

3.2.1.4 Uncertainty and Precaution

Not all risks in a Risk Society are of a new type. We can, therefore, distinguish between structured and unstructured problems. In case of structured problems the problem definition does not cause much dissent. A societal consensus exists concerning the for the problem relevant facts and values. Consequently, also the relevant scientific approach of the problem goes without saying. In case of unstructured problems things are completely different. Uncertainty reigns not only concerning facts, but also concerning values. As a consequence, it is not clear immediately on which scientific disciplines and disciplinary paradigms to fall back.

In literature different typologies of uncertainties exist. One useful typology distinguishes between uncertainty, ignorance, indeterminacy and incommensurability (Craye *et al.* 2001a, 18). In case of **uncertainty** the chance that known or identified harm will occur, is unknown. In case of **ignorance** uncertainty does not only exist concerning this latter chance, but it is even not clear whether all possible harm is identified. In case of **indeterminacy** the evolution of complex systems cannot be defined, not because of a lack of scientific knowledge, but because of the nature of the systems. Systems can be chaotic or near to phase changes. Or systems can be unpredictable because of the unpredictability of human action. **Incommensurability** refers to the impossibility of translating different disciplines and paradigms into each other or into one overarching theory (Deblonde 2002, 94-96).

The acceptance of the Precautionary Principle as a guiding principle in public policy implies the recognition of different types of (scientific) uncertainty (Hunt 1994, 117). The Precautionary Approach is a trial to deal with scientific uncertainty in an acceptable and reasonable way. In the course of our research project it should become more clear which Pracautionary Measures make the application of the Principle acceptable and reasonable indeed.

3.2.1.5 Precaution: scientific or political rationality?

We suggest that a precautionary approach does not contradict a scientific approach. The idea that a precautionary and a scientific approach are not compatible with each other is based on the assumption that science is objective, i.e. true for everybody and every time and neutral, and that politics is subjective. In line with the constructivist interpretation of science, we agree that scientific objectivity is nothing else but intersubjective consent. Intersubjective consent is what closes scientific discussions, what makes that facts are seen as facts and laws as laws. Scientists make use of a specific method in order to close discussions. Characteristics of this method are transparency, a systematic approach, scepticism, control by peers, independence, responsibility, openness to learning (Striling 1999, 7). This scientific method helps to reach agreement within the community of scientists. It also helps to define the limits of scientific knowledge, i.e. to clarify scientific uncertainty and ignorance and the value-ladenness of a particular scientific perspective. This demarcation between knowledge and uncertainty is an important first step towards a precautionary approach. In this sense a precautionary approach is perfectly consistent with a scientific approach.

Once the scientific work is done – i.e. (preliminary) consent concerning the border line between knowledge and uncertainty is reached – the political job to deal with remaining uncertainty and with remaining plurality of values remains. As long as controversies are not solved, the accusation that political decisions are subjective because they are not sufficiently founded on sound science lurk. The core problem, however, is not that policy decisions are, at the end, of a political nature. The crucial problem is that some people expect policy questions to be reduced to pure science.

3.2.1.6 Trust in an Advisory Body

In case of unstructured problems traditional, positivist models of the relationship between science and policy necessarily fail. The pragmatic model that is based on a social-constructivist interpretation of science urges itself. What do social-constructivist insights learn us about the values 'truth' and 'justice' that, according to Offe, are necessary to win or maintain citizens' trust in science?

The passive version of 'truth' – honesty, authenticity – regards an active striving to eliminate untruth, i.e. lies or errors. This value is nothing else but the traditional scientific pursuit of objectivity: the mutual testing, controlling, questioning of preliminary scientific knowledge by the members of a scientific community. Scientific objectivity always remains an ideal one has to strive for. It never is a matter of fact.

The active version of 'truth' – the keeping of promises – starts with an active search for scientific uncertainties. Scientists' capability of keeping their promises depends on their capacity to reveal uncertainties. Making uncertainties explicit keeps them from loss of confidence in their predicting power.

The social-constructivist interpretation of science does not allow an interpretation of impartiality, the passive version of 'justice', as neutrality. Scientific knowledge cannot be neutral, because it is always value-laden. Scientific impartiality refers to the capacity to make power relationships explicit (Deblonde 2002, …). Scientific impartiality is an outstanding political concept. Political action is, according to Arendt, impartial on condition that people can act as free and equal individuals. Scientists are free to the extent that they are conscious of their own interests and that they know the interests of other members of the scientific community. They are equal to the extent that they are able to make their own perspective heard in scientific discussions. To stimulate creativity in the process of scientific production, a wide variety of perspectives is, again according to Arendt, needed. Consequently, a balanced representation of different perspectives is a precondition of impartial science.

Finally, solidarity implies that research concerning the *distribution* of risks – in which different ways does human action hit persons in different social positions – should be an indispensable part of public policy research. It also implies that one should avoid excessive risks. From Warren we learn that trust will vanish where risks threaten to get out of hand.

3.2.2 The Biosafety Council: hypotheses

The Belgian Biosafety Council is, among other things, responsible for providing scientific advice on planned introductions of GMO's for experimental purposes. We made an analysis of the documents relevant for the production of scientific advice concerning the notifications done during the year 2002. From this analysis we distilled several hypotheses.

- Members of the Scientific Committee do not restrict themselves to the provision of scientific information. Their discussions have a political content.
- Members of the Council do not restrict themselves to the presentation of possible policy options. They provide a univocal advice.
- All actors agree that scientific debates are of a different nature than policy debates. However, a lot of disagreement exists concerning how to interpret this different nature.
- For the moment the process of scientific advice seems to be confronted with two main challenges. The first challenge is to look actively for uncertainties and ignorance and to be open about them. The second challenge is to prevent that opponents misuse scientific uncertainty and ignorance to hide their real concerns and objections.
- Disagreement exists concerning the scientific meaning and the scientific value of the familiarity principle.
- A gap exists between the legally defined scope of the Biosafety Council, namely evaluating the biosafety of GMO-releases for experimental purposes, and the scope of public concerns.
- In the present situation, the specific role of the members of the Council - next to the tasks already fulfilled by the Scientific Committee and the Secretariat - is not sufficiently clear.
- In order that notifiers and citizens keep trust in the advice of the Biosafety Council, a certain continuity in the political decisions concerning GMO-releases should be guaranteed.
- Many actors have problems with interpreting the Precautionary Principle.
- The Secretariat should provide the Scientific Committee with insights regarding existing political concerns, in order that the Scientific Committee can offer the precise scientific information that fits these particular concerns.
- There seems to be little or no attention for the distribution of possible harm and benefit between citizens in different societal positions.

3.2.3 The Biosafety Council: Questionnaire

- How do you evaluate the process of developing scientific advice from the very beginning – when a research institute offers a notification – till the final political decision?
- How do you evaluate the role and the performance of the different types of actors in this whole process?
- In which type of actors do you have more or less trust? Why?
- What is your main motivation or concern? What drives you while participating in this whole process?
- Does the distinction between a scientific and a policy discussion makes sense for the process of developing scientific advice?
- Would you agree with the following hypothesis? “Members of the Scientific Committee and of the Biosafety Council do not restrict themselves to providing scientific information. They are involved in policy discussions”.
- Would you agree with the following hypothesis? “Members of the Council do not restrict themselves to providing politicians in charge with policy options. They provide a univocal advice”.
- Would you agree with the following hypothesis? “Offering a multitude of policy options stimulates that politicians in charge make their underlying arguments explicit”.
- How would you make the distinction between a policy and a scientific discussion explicit?
- How should the precautionary principle be interpreted, according to you?
- Would you agree with the following hypothesis? “The Secretariat of the Biosafety Council asks for scientific experts’ bonds. It is desirable that, next to these bonds, their motives and fundamental visions are also known.”
- Would you agree with the following hypothesis? “It is desirable that, next to the bonds and visions of the experts, also the bonds and visions of the other actors in the process are known”.

- Can you give examples of uncertainties that you were confronted with during the process?
- Which various types of uncertainties were you confronted with?
- Does it make sense to detect uncertainties in more active way?
- Does the idea that scientific uncertainties can easily be misused by opponents of GMO-releases hamper scientists to make them explicit and to communicate them?
- What does the familiarity principle mean? Do you know about different interpretations of this principle?
- Would you agree with the following hypothesis? "The Precautionary Principle is used to hide other than biosafety concerns".
- Would you agree with the following hypothesis? "In order to maintain scientists' and notifiers' trust in the Biosafety Council, citizens and politicians should make their real concerns explicit."

4 Future prospects and future planning

4.1 Contribution of FTU

4.1.1 Description of case-studies

Without committing oneself, we intend to analyse the security management in those companies

- ***Prevention case-studies***
  - Watco Tecni Absest
  - CHR
  - Air Liquide
  - Fabricom
- ***Precaution case-studies***
  - Pfizer Animal Health
  - Chimac Agriphar
  - Provital
  - NMC
- ***Intermediaries case-studies***
  - Gerling
  - Prevent

4.1.2 Horizontal analysis

- Characterisation of risks
- Analysis of risk-related functions
- Risk assessment methods
- Knowledge management related to classical and emergent risks
- Analysis of the relationships between experts from private companies and public authorities and bodies.

4.1.3 Reporting of the case-studies

After the fulfilment of these tasks, the next steps are:

- Integration of empirical material provided by the two research teams,
- New study of the literature on precaution,
- Development of an effective arrangement for the relationship between science and policy in a precautionary perspective.

4.2 Contribution of STEM

4.2.1 The Biosafety Council: Analysis of the interviews

The analysis of the interviews will take as a starting point the conclusion that the various actors, scientific experts as well as policy makers, are not really aware of different types of uncertainties. Therefore, we will make examples of these different types explicit as well as the corresponding proposed precautionary measures. We will consider whether essential gaps exist regarding the actors' understanding of particular types of uncertainties and precautionary measures.

Secondly, we will evaluate to what extent the present procedure followed by the Biosafety Council fits its legal commission.

Thirdly, we will evaluate to what extent the legal commission of the Biosafety Council fits the actual political context. Considering that citizens' trust is a crucial criterion, is it justified to restrict the evaluation of GMO-releases to biosafety considerations? And is it jusitified to restrict the evaluation to new applications of the GMO-technology and not to apply such evaluation to new applications of other technologies?

4.2.2 The FAVV

For the moment, we are negotiating with a representative of the FAVV to take the dossiers treated by them as the object of our second case study. Here again, we plan an analysis of relevant documents, interviews with several actors involved and an analysis of these interviews.

4.2.3 Focus group

The material gathered from both our case studies will help us to formulate some suggestions to improve the process of giving scientific advice in a policy context with regard to unstructured problems. In order to check the feasibility and acceptability of these suggestions and to look for valuable adaptations to them, we will organise a focus group with actors involved.

4.2.4 Next steps

After the fulfilment of these tasks, the next steps – as indicated in section 4.1.3 - are:

- Integration of empirical material provided by the two research teams,
- New study of the literature on precaution,
- Development of an effective arrangement for the relationship between science and policy in a precautionary perspective.

5 Annexes

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