«The future of plant biotechnology in Switzerland »

Forum with researchers, experts and public actors
Monday, 3rd November 2003, University of Lausanne

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This forum has been organised by the following members of the RIBios team :

Alain Kaufmann
Marc Audétat
Barbara Bordogna Petriccione
Claude Joseph
Andràs November
Horace Perret

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RIBios - Réseau Interdisciplinaire Biosécurité - Biosafety Interdisciplinary Network
c/o IUED - Institut Universitaire d'Etudes du Développement
Rue Rothschild, 24 - CP 136 - 1211 Genève 2
www.ribios.ch

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ABBREVIATIONS

SAEFL – Swiss Agency for the Environment, Forests and Landscape

SFOPH – Swiss Federal Office of Public Health

SFOA – Swiss Federal Office for Agriculture

SECB – Swiss Expert Committee for Biosafety

ECNH – Swiss Ethic Committee on Non-human Gene Technology

SAS – Swiss Academy of Sciences

SSA – Swiss Science Agency

SNSF – Swiss National Science Foundation

LIST OF PARTICIPANTS

Swiss Agency for the Environment, Forests and Landscape (SAEFL)

- Dr Philippe Roch
  Director
- Dr Hans Hosbach
  Head of the Section Biotechnology and Substance Flows
- Dr François Pythoud
  Section Biotechnology and Substance Flows

Swiss Federal Office for Agriculture (SFOA)

- Dr Markus Hardegger

Swiss Federal Office of Public Health (SFOPH)

- Dr Thomas Binz
  Head of the biological safety section
- Dr Martin Schrott
  Food safety department, biotechnology group

Swiss Expert Committee for Biosafety (SECB)

- Dr Martin T. Küenzi
  President
- Dr Karoline Dorsch
  Executive secretary

Swiss Ethic Committee on Non-human Gene Technology (ECNH)

- Ariane Willemsen, lic. ur., MA
  Executive secretary

Swiss Academy of Sciences (SAS)

- Prof. Martine Jotterand
  Unité de cytogénétique du cancer
  Division autonome de génétique médicale, CHUV

Agroscope FAL Reckenholz – Swiss Federal Research Station for Agroecology and Agriculture

- Dr Franz Bigler
  Biosafety/Ecotoxicology, research group leader
- Dr Michael Winzeler
  Ecological Controlling, department head

Agroscope RAC Changins - Station fédérale de recherche en production végétale

- Dr Nicolas Delabays
  Responsable de la section Biotechnologie et génie génétique, malherbologie, sol
- Dr Pia Malnoe
  Responsable du groupe de genie génétique

Université de Lausanne (UNIL)

- Prof. Edward Elliston Farmer
  Department of plant molecular biology

Federal Institute of Technology (ETHZ)

- Dr Christof Sautter
  Institute of Plant Science

Université de Fribourg

- Prof. Jean-Pierre Métraux
  Department of Biology

Université de Genève

- Prof. Jerzy Paszkowski
  Laboratory of plant genetics
- Dr Michel Goldschmidt-Clermont
  Department of molecular biology

University of Neuchâtel

- Prof. Felix Kessler
  Laboratoire de Physiologie Végétale
  Institut de Botanique

Observers

- Alessandro Maranta
  Ehemaliger Mitarbeiter
  Professur für Wissenschaftsphilosophie und Wissenschaftsforschung der ETHZ
- Dr Antonietta Di Giulio
  Swiss national Committee of the International Human Dimension on global Environmental Change (IHDP)
  Interfakultäre Koordinationsstelle für Allgemeine Ökologie (IKAÖ), Universität Bern

Members of the RIBios (Biosafety Interdisciplinary Network)

- Marc Audétat
  Observatoire EPFL Science, Politique et Société
- Barbara Bordogna Petriccione
  RIBios / Graduate Institute of Development Studies (IUED)
  University of Geneva
- Claude Joseph
  Interface sciences-société
  University of Lausanne
- Alain Kaufmann
  Interface sciences-société
  University of Lausanne
- Andràs November
  RIBios / Graduate Institute of Development Studies (IUED)
  University of Geneva
- Horace Perret
  Interface sciences-société
  University of Lausanne

INTRODUCTION

The Forum entitled « The future of plant biotechnology in Switzerland » took place at the University of Lausanne on November 3rd, 2003. It was jointly organised by the RIBios (Biosafety Interdisciplinary Network, based at the Graduate Institute for Development Studies of the University of Geneva) and by the Interface sciences-société of the University of Lausanne.

The aim of this Forum was to bring together stakeholders involved in the decisions about experimental field releases of transgenic plants in Switzerland. The participants were representatives of three main groups of stakeholders: public scientists involved in plant biotechnology research, the governmental bodies involved in the decision-making process, and other institutions directly involved in science policy at the national level.

Most of the participants were from the first group, with representatives of two of the federal agronomic stations (Agroscope FAL Reckenholz and Agroscope RAC Changins), of different Swiss universities (Lausanne, Geneva, Fribourg, Bern, Basel and Neuchâtel), and of the Swiss Federal Institute of Technology in Zurich.

In the second group, excepted the Federal Veterinary Office which was not represented, all the governmental bodies involved in the decision-making process were present with one to three representatives; the Swiss Agency for the Environment, Forests and Landscape (SAEFL), the Swiss Federal Office for Agriculture (SFOA), the Swiss Federal Office of Public Health (SFOPH), the Swiss Expert Committee for Biosafety (SECB) and the Swiss Ethic Committee on Non-human Gene Technology (ECNH).

In the third group, the Swiss Science Agency (SSA) and the Swiss Academy of Sciences (SAS) were represented, whereas the Swiss National Fund was not able to attend.

It has to be highlighted that all the participants were invited personally, in order to make clear that they should speak in their own name rather than in their institution's name. This sensitive issue was dealt with by agreeing with the participants that no material would be published on the content of the debates without their prior review of the documents.

Before the forum, the participants received a position paper written by the organisers (see appendix I). This paper was divided into six sections corresponding to important topics that would be discussed during the forum. It was aimed at giving some factual information, but also some analytical overview to stimulate the debate. The participants also received the schedule of the forum and the list of all the participants. The forum lasted the whole day, from 10:00 to 16:30, with a one our lunch break.

According to the schedule, the debates were organised by topics as reported in the position paper. In the morning, three questions were discussed; « Risk

negotiation », « Coordination at the level of assessment and decision » and « Coherence between research and environment policies ». In the afternoon the debates focused on « "Socially robust" research policies », « Biotechnological research in Switzerland » and « Decision-making under uncertainty: the controversial implementation of precaution ».

The organizers decided to adopt a non-directive strategy for the debate regulation. Three persons were assigned to that task. One was in charge of handing over to the participants and to keep the schedule. The two other persons acted as facilitators by introducing factual or analytical elements pertinent to the debate, and by redirecting the discussion when it was clearly out of the topic of this Forum.

This paper aims at presenting the richness and diversity of the discussions during the forum. The core of the text is made of participants' quotations, which are introduced by a short summary. They have been distributed into chapters and subchapters in a way that should reflect the main topics addressed by the participants. This paper is divided into four main sections, addressing respectively the issues of public research, risks, public debate and decision-making. When possible, boxes have been inserted, either to illustrate a point that has been made in the text, or to bring an analytical point of view on the subject matter.

1. PUBLIC RESEARCH

1.1. BIOTECHNOLOGICAL RESEARCH IN SWITZERLAND

Part of the discussion addressed the issue of biotechnological research in Switzerland.

Mr Roch made a general picture of the Swiss biotechnological policy, which has, according to him, two main objectives: the implementation of a strict biosafety policy and the promotion of biotechnological research, as expressed by the national Priority Programme for Biotechnology (PPB). These two objectives are not contradictory, which means that the Parliament can simultaneously seek a high degree of biosafety and the promotion of biotechnology. As Mr Roch noticed:

« If the Parliament votes for a research budget, it certainly gives the signal we want research, we need research, and that is the permanent position in the Swiss Parliament. Even in the last exercise, despite the budget cutting, science went out of the cutting because it is recognised as an important matter, especially in Switzerland. But this does not say that science can do what it wants and if there are social aspects, social problems, science has to take them into account and especially the question of safety is an important question and science cannot be free. So the fact that the parliament asks for a high degree of safety for a given technology does not say that it is in contradiction with the fostering and the support of this technology. »

Mr Roch added that biosafety is a promising high level research area, in which Switzerland could play an internationally recognized leading role.

Researchers then presented the national Priority Programme for Biotechnology (PPB), its design and potential benefits. It was recalled that it contributed, at least at its beginning in 1991, to the identification of agricultural problems in collaboration with the farmers. For Mrs Malnoë :

« The farmers interest was considered by the agronomic stations[1]. Concerning the wheat and potato projects, there was an analysis being done to see whether there would be any benefits having transgenic plants being resistant. From an agronomic point of view, an analysis was done.

[1] The agronomic stations are public research institutions depending on the Swiss Federal Office for Agriculture. There are five agronomic stations in Switzerland, two of which were involved in the PPB : Agroscope RAC Changins and Agroscope FAL Reckenholz.

When the project started, there was not very much opposition against using GMOs, neither from farmers, nor from consumers. »

Had the potato and the other projects covered by the PPB been able to reach the stage of experimental dissemination, they could have served to create a valuable public expertise by analysing the behaviour of the plants in real conditions. This point of view was expressed by Mr Métraux :

« Researchers could have gained enormous amounts of experience out of these experiments, not just whether the product itself is good, but where do the genes go, what do the bacteria do. There were so many things we could have measured in these tests and it was killed. »

Concerning the future of plant biotechnology, some researchers pointed out the risk to see politicians following the fears of the public opinion concerning GMOs, rather than promoting a positive picture of biotechnological research in the general public. As Mr Goldschmidt-Clermont noticed:

« I see the politics respecting the existing fear in the public opinion. But I do not see the leadership saying here is a technology that is worth exploring at least in terms of basic science, let's do it. »

These fears are reinforced by the fact that people do not see real benefits in the plants that are nowadays commercialized. In this perspective, it is important for the future to show consumers that research in plant biotechnology can also have advantages. As noticed by Mr Sautter:

« It is indeed very difficult to convince people not to be against GMO technology, if they don't see the real benefit. »

As far as consumers are concerned, it is difficult to identify potential benefits derived from GMOs. From 1996 to 2003, herbicide tolerance has consistently been the dominant trait followed by insect resistance. In 2003, herbicide tolerance, deployed in soybean, maize, canola and cotton occupied 73% or 49.7 million hectares of the global GM 67.7 million hectares, with 12.2 million hectares (18%) planted with Bt crops. The two dominant GM crop/trait combinations in 2003 were: herbicide tolerant soybean occupying 41.4 million hectares or 61% of the global total and grown in seven countries; and Bt maize, occupying 9.1 million hectares, equivalent to 13% of global transgenic area and grown in nine countries.

Source: ISAAA Briefs, No. 30 « Global Status of Commercialized Transgenic Crops: 2003 »

As Mr Métraux states:

« It is evident that one should define areas where there are problems that potentially could be solved with biotechnology. This definition of research areas should be based not just on a single person, or a small group of people, but it should be an area that is acknowledged as being of major importance ».

In other words, to regain the public's confidence, it is necessary to define research priorities that correspond to agronomical problems which have been clearly identified and which benefit from political support.

For Mr Pythoud, it is important, when adressing the issue of the orientation of plant biotechnology, to keep in mind that the share of plant biotechnology research dedicated to agricultural applications is low:

« What are we going to do in the future in plant research? Are we only doing things that are relevant for the Swiss agriculture, and the rest we forget about it? This would really be a big change from what we are doing now, because I think that most of the plant research carried in Switzerland has nothing to do with agricultural applications. If we work with transgenic plants, does it have to do with agriculture or not? »

As a way to reinforce financial support for public research, Mr Pythoud suggested that the research community should organise itself as a lobbying group. If members of the Parliament want more research, they have to be coherent and provide concrete means to reach this goal:

« There is a strong need for a better lobbying work of the research community at the Parliament level. If you look at the gene technology act, there is a large part of it that is actually dealing with research. There are some references, and also during the discussions at the Parliament, pointing to the fact that we need to do more research, we need more information. So let's put the members of the Parliament in front of their responsibilities. If they want more research, they have to make the resources available. But if you don't ask them or you do not put some pressure on them, they will never do it, especially in light of the present financial situation of the federal government. »

While interesting, this proposition was somehow moderated by Mrs Jotterand. She related the experience made by the Swiss Academy of Science in this field:

« It's not easy. The Conseil des Académies Scientifiques Suisses has already created a "scientific assistant" position consisting of a person who directly meets members of the Parliament. This experience was very interesting but it was really a difficult one because on the one hand, it's important to make a type of lobbying, or at least to provide the members of the Parliament with information; but on the other hand, this scientific presence was not very much appreciated. This scientific assistant was

blamed for exerting some type of lobbying and this was not appreciated at all. We have to think further about the best solution to solve the problem. »

1.2. DISTINCTION BETWEEN FUNDAMENTAL AND APPLIED RESEARCH (COMMERCIAL AND EXPERIMENTAL STAGES)

The discussion addressed the distinction between fundamental and applied research. Almost everyone agreed that there is a sharp difference between commercialisation and experimental releases. The frontier between these two facets of research is nevertheless difficult to draw.

Mr Sautter proposed the following distinction. For him, one deals with basic research:

« As long as one is working with prototypes which are not meant to develop a breeding line, even if it might have as a project an application potential. »

According to Mrs Willemsen, these two stages seem to be often inseparable:

« It is difficult to say where exactly the border is between basic research and applied research. It often seems that research is sold to the public under whatever label one gets the funding. »

This has probably generated a lot of confusion in the public debate. The fact that the public does not always see clearly this difference requires a higher degree of communication on behalf of stakeholders. According to Mr Pythoud:

« There is clearly a misunderstanding concerning the difference between basic and applied research when it goes to plants. In the public, if you work on a wheat like it has been done at the ETH, the public gets the impression it is applied research because it is using a crop which might be planted, which is actually planted in the field next to where you live. I think there is clearly a problem of communication in this regard. »

At the opposite side, it can be argued that the frontier between fundamental and applied research is too blurred to be still effective. The budget cuttings affecting public research are pushing fundamental research towards applications, at least in plant biotechnology. In research projects, one has to show a potential for financial returns to get funds. Mrs Willemsen expressed this point of view:

« It seems that in plant biotechnology there is hardly any basic research. Almost all research is applied because our funding system seems to provide funds only if you can show that it has a value in regard to potential applications. »

Helga Nowotny analysed the changing relations between science and society in the 21st century in her book « Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty », and particularly the transformation of basic research:

« In the latter of the nineteenth century and for much of the twentieth century the purity of science was insulated from its technical utility, by the invention of a category labelled applied science. However, today nearly all science and technology policies seek to strenghten the relationship between university, industry and government on the grounds that basic science is also a common resource, which must take its own economic contribution. As a result basic science has been de facto re-configured in the context of the knowledge-based economy ».

Nowotny H., Scott P. and Gibbons M., « Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty », Polity, Cambridge, 2001, p.53.

For Mr Sautter, the division of labour between these two stages of research is meaningful and thus should be maintained:

« The task of research is to imagine future problems and search for solutions. It is not the task of research to look for applications. We have to look for future problems and their solutions independently of whether the solution will ever be used ».

This distinction is important as soon as risk assessment is concerned. The standards and procedures used in the assessment do indeed depend on the nature of the trials, experimental or commercial. This point was made respectively by Mr Delabays and Mr Bigler, agronomical stations representatives.

According to Mr Delabays:

« When we make an evaluation of these plants, at the level of agriculture, we make the difference between trials and commercialisation. For example, in Changins, I am in charge of the registration of herbicides. When we have a demand for a GMO, for instance a GMO resistant or tolerant to an herbicide, we evaluate of course the trials very differently if it's for research or if it's for commercialisation. »

According to Mr Bigler:

« We make a clear cut between commercialisation – which needs some kind of monitoring - and experimental releases, which take place before the approval for commercialisation. In this case, we are basically driven by risk/benefit hypothesis to which we try to answer on an experimental level. »

The use of different standards in the evaluation process is also justified from an ethical point of view. Mrs Willemsen made this point:

« From an ethical point of view, the benefit in basic research is gaining knowledge and this aim is valid enough. But as soon as you get into applications, you have to take into consideration all the other aspects because you're entering a more complex context and therefore you have to evaluate the risks and benefits. I think that at the level of the evaluation, we already have to include these other aspects. »

1.3. POSITION OF SWITZERLAND ON THE INTERNATIONAL SCENE IN TERMS OF KNOWLEDGE AND COMPETITIVENESS

Participants raised concerns regarding the position of Switzerland on the international scene in terms of knowledge and competitiveness in plant biotechnology.

Some of them put forward the risk to see the competitiveness of Switzerland in the field of plant biotechnology decrease, as a result of industrial delocalisations and disinterest on behalf of students. As Mr Küenzi stated:

« Research on plant biotechnology in general is fading away slowly. We have seen that the number of people interested and courageous enough to really continue in this area has decreased dramatically. Young people have no enthusiasm to explore this area. »

Biotechnology R&D/total government budget appropriations or outlays for R&D

These data provide an indication of the relative importance of biotechnology funding in different OECD member countries. The median contribution of goverment budgets dedicated to biotechnology is 3,5%. However, the spread between the different OECD countries is quite large, ranging between 0,4% (Italy) to 13,8% (Belgium).

Ranking of OECD countries:

1.	Belgium	11.	Norway
2.	Canada	12.	Netherlands
3.	Finland	12.	Portugal
4.	United Kingdom	14.	Greece
5.	Australia	15.	Austria
6.	Germany	16.	Iceland
7.	Ireland	17.	Switzerland
8.	Denmark	18.	Czech Republic
9.	France	19.	Spain
10.	Sweden	20.	Italy

Source: OECD, based on data from the European Commission (Inventory of public biotechnology R&D programmes in Europe, 2000), Eurostat, Statistics Cananda, and national sources and GBOARD from the OECD, MSTI database.

While Switzerland has still a good knowledge base in the field of plant biotechnology, research is locked in, in part because of the difficulty to make field tests experiments. According to Mr Métraux:

« The level of plant sciences in Switzerland is probably fairly reasonable compared to an international standard. There is a lot of knowledge here and it seems to me that this knowledge can be used in the future to tackle appropriate problems that exist in the agriculture. In this perspective, there is a point where we need to have field tests. As long as we temper around with these field tests, back and forth, we will not advance. It will kill this avenue. It will derive students from this field because they don't see any opportunity. »

In contrast to Switzerland and the European Union, the United States are more prone to support basic research in plant biotechnology. Some

participants expressed the regret not to see Switzerland following this path. They also mentionned the fact that the debate in Switzerland does not integrate the data coming from countries which have adopted GMOs, such as China or India. According to Mr Küenzi:

« What is missing is the data which is accumulating from applications abroad. What I fear is that Switzerland again and again just looks at its own internal forty thousand square kilometres and does not really go abroad and accumulate and evaluate the data. »

This isolationist posture may prevent Switzerland from taking advantage of promising applications. For Mr Paszkowski:

« We should really look around, and try not to loose time and competitiveness in Switzerland and in Europe. The climate in America is a bit better and we can discuss why it is so. But in Europe it is very difficult to find a funding for basic research in plant science. Companies are going away. If we look at opportunities, I think that plant biotechnology will solve unsolvable problems like nematode resistance and plant nutrition. »

1.4. RESEARCHERS' POINTS OF VIEWS: CONSTRAINTS AFFECTING PUBLIC RESEARCH

The researchers exposed some of the constraints they are facing in their work, be they economical, political or administrative.

Taking their experiences as a basis, Mr Winzeler and Mrs Malnoë pointed out the difficulties they have encountered in doing field test experiments. These difficulties have prevented them from accumulating the knowledge needed to perform an adequate risk assessment of the plants under development. Indeed, the plants' behaviour is not the same whether they are tested under confined conditions (i.e. laboratories, greenhouses) or directly in the fields. Moreover, being able to test the plants in the fields may contribute to improve the knowledge on risks, since it may help identifying new risks that had not been foreseen.

According to Mr Winzeler:

« We are still trying to make the first field experiment. […] Christof Sautter cannot make a risk/benefit comparison because he cannot prove the benefits of his plant at the moment. He cannot make a risk/benefit comparison because he doesn't know in what system his plants will be used afterwards. He just can make artificial, potential thoughts about it. »[2]

[2] The experimental field release of the ETHZ transgenic wheat eventually took place in spring 2004.

Mrs Malnoë's related her experience on that particular point:

« We have been working with late blight resistant potatoes and this has been considered as being of an ecological interest. We have been carrying out field tests with a French breeding company [Germicopa] in France. Having seen these plants in the field and having seen the difference between the behaviour in the greenhouse and in the field, I have to say that it's absolutely important to be able to go out in the field. It's a very complicated process to get a fungal resistant plant. It's much more complicated than getting a virus resistant plant and we have to be able to work on it in the field otherwise it's no meaning. As long as we don't have the possibility to continue doing it here, we have the feeling that it's not worthwhile going on with it because you can do studies in the greenhouse but it won't help you address the real questions. At the same time, when you are working in the field, you may also be able to identify new risks that you would never have been able to identify under other conditions. That opens up your mind and it opens up the view of the plant and the way the plant is interacting with the ecological system it's living in. That's the kind of knowledge we really need to be able to go on and to be able also to have new concepts on how to produce transgenic plants. So the step of going out in the field is absolutely essential, otherwise you just can forget about working with transgenic plants that would have some kind of interest for agriculture in the future.»

The legal basis was also an issue raised by researchers. Indeed, the legislative process launched in 1992 by the Parliament, called Gen-Lex, was not ratified before 2003. This time lag generated several problems, as Mrs Malnoë recalls it:

« In 1992, there was a legal vacuum. What we needed was to have a legal situation in which we could work. It was supposed to take three years or something like that to get a legal basis for the work. So, at that time, we also started to develop the fungal resistance. We started to work on that in the laboratories and in the meantime, the legal basis was being prepared, but never finished. It never came up to be a real clear situation into which you could work. Then at one point, we had the first fungal resistant plants that we applied for a field test for. When you realise all the energy you need just to apply for a field test, you come to make a choice: either you continue working on the scientific part, or you concentrate on the other aspect, i.e. being in contact with the public, with the different stakeholders and so on. »

The administrative procedure was also an issue that was addressed by other researchers. For Mr Sautter, satisfying the legal requirements represented in his case a real burden:

« I handed in the first application in October 1999. I contacted you [the SAFEL] a day before about the language to use and you said it had to be the language of the place. So I had to use several colleagues to translate

sixty pages of application from English to French, which is a language I cannot comment on a legal text content. Two weeks later, I had a phone call explaining me that I cannot be an applicant, since I am a private person. So I had to step back and ask the Institute to apply. Which I did in November 2000. Then again, I got a call, you might remember that. At this occasion, you asked me whether I mean this seriously. Then, we had a meeting in December in Bern at the railway station with several people. It is only in January 2001 that you accepted the application and treated it. »

As noticed by Mr Sautter, the time lag between the application for an experimental release and the decision of the authority may be incompatible with the scientific rationale. In Mr Sautter's case, the experiment which was supposed to produce the results needed for a potential publication was so much delayed, that it exceeded the duration of the programme funding the experiment:

« My collaborators saw that there were no chances to get a publication about that field test in the available time which you get from the Swiss National Science Foundation, that is two to four years. And I lost a second postdoc on that position. So currently, I'm running that project on the last few Franken until the end of the year with a biological engineer, who is not under the pressure to publish. Then the money is out anyway. I think that's the basic problem of public science, which has to be funded on short term employment conditions. You cannot afford that time. So I can understand my colleagues who are more clever than me to go into a field where they can do their experiments and publish. »

The lack of financial resources of public research was also raised. This generates an imbalance with the private sector as far as field experiments are concerned, as noticed by Mr Delabays:

« I am not very surprised that we don't have very useful plants in Switzerland, because it is too difficult to develop those plants. The only people who know and who have the means and the power to apply this technology on a larger scale are the big companies. They have their own references and objectives. You can accept it or not but they are logical with what to do. »

For Mrs Malnoë, the lack of financial resources for public research handicaps it as far as the application process is concerned:

« The more complicated the process is to have trials, the more it facilitates the big companies rather than public research. Indeed, you need to spend so much money and energy into just setting up the program to be released in the field, that for a public institution it's getting quite expensive. We just need more external money for being able to do it. »

According to Mr Küenzi, the application process is also detrimental to the private sector, because of the administrative work it requires:

« Why set and apply out of Switzerland for more experiments? It's quite obvious. You don't want to have this paper work to do and then be in the newspaper all the time, being accused of wanting to make money. It's not allowed in Switzerland to make money by a big company. And the small ones cannot work in this area because it's too costly and it takes too much time. »

2. RISKS

2.1. RISKS NEGOTIATION

Since the end of the eighties, the European public sphere is recording a growing number of public controversies concerning technological, industrial, environmental or food risks. These changes take place in the heart of the "risk society" and its paradoxes: indeed a very high level of security does exist simultaneously to a higher sensitivity in the public opinion to a certain kind of technological risks. Besides, some innovations such as GMOs raise new hypotheses of risk as well as questions of social, economical or ethical uncertainties. The relations between experts and social actors are in the process of being redefined in the context of: (1) the insufficiency of classical political systems of representation in relation to scientific and technological choices, (2) the limits of scientific expertise as the unique authority in risk management.

To meet these new situations and deal with these controversies, new forms of risk negotiation have emerged in Europe, introducing participation, counter-evaluation, plural expertise such as ethical commissions and technology assessment institutions. They all tend to a greater or lesser extent to explore ways that are likely to encourage assessment and debate about risks and their acceptability within society.

Source: Position paper "The future of plant biotechnology in Switzerland: Forum between researchers, experts and public actors", RIBios, 2003.

Mr Roch exposed his understanding of "risk negotiation":

« I think the expression of risk negotiation is a good one, because everywhere, and especially in a new technology, we cannot just reduce risks to the technological risk directly linked to a product or an experiment. Now we are not just founding on the experts but we need quite a political judgement on the development of this technology. I think the reason is because it is something that people do not know very well. They don't make confusion, but they see a continuity from the very specific experiment to a product that will be commercialised and the whole development of this technology. So we have technological risks and this we can certainly discuss today a little more and we also have the views of the future and the resistance against the G8, against the World Economic Forum, against globalisation. It's also linked to these technologies which introduce a possibility to change the relationships, for example in agriculture. We should not judge this as a wrong perception. We just have to look at it and say: OK, if we make one experiment in one domain we cannot isolate it from the follow up of what will be done with

that. And that's why this technology is a big debate in the population. I think that the members of the security panels in Switzerland and in France, who dismissed or went away from the group because their opinions were not followed, did not perceive that. Scientists have to understand that they are not isolated people. And that's good for scientists also, I hope. The dialogue with the population is very important. Scientists have to show honestly where they are, where are the safety standards put in the experiment or in the product, where there are still aspects which are not well known. Even though risks can be evaluated, there is always a remaining risk. I think that the final decision has to take into account this negotiation. This introduces one aspect in science that scientists do not hear very pleasantly: the fact that the meaning of a project, of an experiment, of a product is also part of the negotiation. You can certainly consider fundamental research as totally independent but as soon as it has or may have direct consequences on the life of people, you cannot totally isolate it. It is not automatically a restriction for research, it can also be an incentive to be better understood by the people. »

Mr Métraux raised some doubts on the possibility to really negotiate risks:

« If I provide all the scientific arguments, I can determine that my test or my trial is not linked to any risk, the regulation authority can always say: Well, but there is this and this and this... And I can say: Well, of course but I cannot test this, I have no tools. Thus, the debate is dead. In other words, can you really negotiate risks? »

For Mr Roch, there is no contradiction between his way of understanding "risks negotiation" and Mr Métraux's example. A risk is negotiated because, even when assessed, uncertainties cannot fully be eradicated. In this perspective, risk negotiation is a tool to define the acceptability of risks:

« You have an experiment - with an experiment it's easier because you have quite a restricted area, product and time – and you have brought the proof that you are safe on this and this. However, there always remains some doubt about something. And then we have to negotiate : can we accept that ? If yes, the experiment can be done. If we cannot accept, we try to limit the risk, and that's exactly what Mr Sautter is doing by protecting the area where he is working with a lot of barriers and then destroying the plants, observing the soil two years after the experiments. That gives an additional interest to the experiment in terms of knowledge about safety. That's typical negotiation and that's clearly my understanding of it. »

Mr Bigler illustrated how ecotoxicological risk related to pesticides which must be approved for commercialisation are negotiated:

« In the field of environmental risks, we have learned over the last fifty years in ecotoxicology of pesticides how to assess, evaluate, manage and communicate risks. It's not a sharp cut edge to decide whether or not to approve, for instance, a pesticide which is used in agriculture. There is always a lot of uncertainty in it. The better the data set we have, the less uncertainty we have in the decision. We always put a safety factor, because we are always feeling that both uncertainty and safety factors are present. So it's always a negotiation to decide how much safety we add, because we are uncertain in our decision making process. »

2.2. RISKS VERSUS BENEFITS OF GM RESEARCH

Several participants questionned the opportunity of talking about risks only. Rather than talking about the risks of doing research, one should also take into account the potential benefits, namely benefits that will derive from this research in the future but are still not known. In other words, the risks of doing research should be balanced with the risks of not doing it.

Thus, for Mr Sautter:

« We have to see research also under that point of view that if we take negative decisions on research experiments or research areas, then it's not just fulfilling the precautionary principle. We might avoid the risk of the technology but on the other side we might go into another risk: the risk of not knowing about the technology. »

Mr Schrott stressed the same point. The risks of applying a given technology must be counterbalanced with the risk of not applying it, since problems could arise in the future that this technology would be the only one capable of solving:

« There are actually risks in terms of applying a technology. We have to be sure that if we apply a technology, it has no very adverse effects on the population and on the environment. But on the other hand, there is a major risk also on not applying a technology. If we put this technology away, it may be that in ten years, in hundred years, in fifty years, there may be problems arising that could have been solved with this technology. If you look at the potato famine in 1846-49, I think that people would have been very happy to have this technology. So we should also talk about the risk of not applying a technology. »

Mr Bigler also expressed this point of view:

« When talking about risks, we should define what are the risks for a society to adopt a technology or refuse a technology? What could be the benefits? I think it's clear for all of us that there are always risks and benefits to consider. And finally, it's also the economical risks that we have to consider. Do we take the risk to refuse a technology? »

For Mr Farmer, risks are relative. Risks related to a new technology such as GMOs must not be discussed in isolation but rather in comparison with the risks of the technology it is replacing. In other words:

« A new technology has a risk relative to an older technology. The problem with our previous discussion is that we have focused all our thoughts on the potential risks of a new technology. Risks should never be discussed alone like that. I think the scientific community has the responsibility to present risk in a more balanced way. We should look at the risk of a new technology relative to the old technology. Risk in itself generates a lot of emotions in the public and we need not to discuss risk in isolation, just in terms of one technology. »

For Mrs Willemsen, not only the risks but also the benefits should be included in the evaluation system, because a given product or experiment that cannot demonstrate any benefits should not be allowed, even though it is considered to be riskless:

« With regard to the future, it would be good to include into the legislation also the possibility to take into account the benefits. From the society point of view, it should not be possible to do experiments that might be considered to be safe enough but useless. In such a case, why should we do it? It's a waste of money and there is no justified reason to take risks for nothing, even if they are minor. At the same time, I think that the public is accepting higher risks if it can clearly see a benefit. »

Mr Paszkowski introduced the idea that a technology must reach maturity to provide all its benefits. In the case of plant biotechnology, one has to be patient, because the controversial products belong still to the first generation of products:

« We have to realise that we need to allow a technology to mature. For example, what were the benefits of the first bicycle, of the first aeroplane? In plant biotechnology, the first products are based on the experiments, which were done in the beginning of the eighties. It means that there are twenty years before the products are going from the research to the market. We are talking about herbicide resistance. This is a single gene but we have much more complex genes in other branches. But if we stop research, then we do not allow the technology to mature. And we cannot have benefits for farmers, for consumers and so on. »

Mr Winzeler adopted the same point of view. He insisted on the fact that research on plant biotechnology is a continuous process and that consequently benefits will come progressively:

« If we look at the development of transgenic plants, we also have to look at the way it's done. In the normal breeding program, you cannot wait for twenty years for the perfect plant. That's a continuous process. You create variability and from about two hundred thousands lines you make one variety. Even though genetic transformation is a more direct process than conventional breeding, it's not a perfect process that makes the perfect plant with the right benefit right away that will be accepted for experimentation. That's not the way it's done. We will have many unperfect plants to deal with, which will bring us further in a continuous process.»

2.3. RISK PERCEPTION

Several participants addressed the issue of risk perception. For Mr Schrott, the perception of risk by the public may sometimes be irrational. Risks related to GM food are typically over-estimated in comparison to other risks:

« People have a perception of risks that is sometimes not very logical, so to say. We are fighting against a lack of perception in the prevention of HIV/AIDS for example. Responsible behaviours have gone down with the arrival of medical treatments. People think that risks do not exist anymore. We have to fight against the idea in the population that the risks are absent, not that the risks are present. Actually the perception of the risks related to GM food is for us a classic example of over-exaggeration and over-estimation of risks in contrast to other risks. If somebody is arguing with very good arguments against GM plants and can at the same time smoke a cigarette after his statement, I have some doubts about the rationality of such a dealing with risks. »

For Mr Binz, the public might associate the word "gene" to something dangerous, since the Initiative for Genetic Protection in 1992:

« I would like to address the perception of the word gene. In your position paper for instance there was the whole history about the gene technology law that has now been adopted. It started already ten years ago, or twelve years ago, with the Genschutz Initiative [Initiative for Genetic Protection] which means protection from genes. So it seems to me that the word gene is perceived as something dangerous, although genes by themselves are not harmful. On the contrary, all of us are made up of genes. A good illustration of this negative image was the Science & Cité Festival where people were very astonished to hear that they were made up of genes. »

Some participants pointed out the fact that communication policies have not been able until now to reverse this trend, and thus generate a positive picture of plant biotechnology in the public.

For example, as raised by Mr Kessler, the term « release » is not the most adequate to describe « experimental release », since they remain to a large extent contained:

« There is a lot of public resistance because of risk perception and that again has a lot to do with how we communicate what we want to do. In particular the risk assessment experiment that Christof Sautter would like to do has been partly blemished by the words which we have used. Let's say « us » because it's the research community and also the politicians. We talk about « release » or in German about « Freisetzung ». However, people don't realize or fail to realize that this is largely a contained experiment. We are actually not releasing something into nature. Especially, I think that the potentially dangerous components of this experiment are largely contained. The way we formulate what we are doing is very important and we need a very precise phrasing and wording of what we are doing. »

For Mr Pythoud, the perception of GMOs by the public would have been different, had there been more demands for field experiments:

« The first field test was made in 1991 by Dr Malnoë and then from 92, which was the second one, until 2003 there were only three applications for field testing. So, I'm just asking the question: why didn't we see, say fifty applications in the last ten years? This could have had an important impact on the way the public is seeing all these discussions. Because now, what we get in the public is the impression there is one case and it's a big problem, and then comes the second case and it's again a big problem. There is, at least in Switzerland, this close association between each case being a big problem. If you go to other countries, you have many applications and the discussion is not so much at the level of research or field test, but it's more at the level of commercialisation.»

Number of field test experiments from 1986 to 1999 in OCDE countries

United States	7575	Sweden	32
Canada	1017	Denmark	21
France	548	Brazil	18
Italy	247	Finland	15
Australia	204	South Africa	11
Belgium	190	Tchek Republic	7
Germany	184	Portugal	4
Netherland	125	Federation of Russia	4
Great Britain	116	Bulgaria	3
Spain	111	Switzerland	2
Japan	77	Austria	2
New Zealand	46		

Source: compiled in May 2004 from the data of "BioTrack database of field trials, OCDE Database of Field trials", http://webdomino1.oecd.org/ehs/biotrack.nsf/by%20country?opendatabase

2.4. RISK ASSESSMENT VERSUS RISK MANAGEMENT

The participants discussed the relationship between risk assessment and risk management. To begin with, one should define these two concepts.

Risk assessment and management

Risk assessment is traditionnally performed by scientific experts and is made of four steps:

1. Hazard identification: the identification of biological, chemical and physical agents capable of causing adverse effects on human health (cancers, allergies, genetic harm) or the environment (reduction of biodiversity, eutrophy). For example, nitrates and nitrites coming from washing powders and fertilisers have well known effects. Nitrates have a negative impact on the environment, for example by inducing the proliferation of algae in lakes and rivers. Nitrites can induce cancers in the gastrointestinal tract when transformed in substances called nitrosamines.

2. Hazard characterisation: the qualitative or quantitative evaluation of the nature of the adverse health or environmental effects. Ideally, a precise evaluation of the relation between the quantity of the substance and its effects is determined (dose/response relation) like in the typical case of drug trials. Epidemiology is used to assess the impact on large populations and toxicological tests are performed on animals. This stage of the process is quite abstract in nature and often removed from the complexity of real exposition conditions.

3. Exposure assessment: the qualitative or quantitative evaluation of the likely intake of food-borne hazards and how the diverse components of environment will be exposed to the effects of the substance, taking into account other exposure pathways where relevant. This stage is more complex because it must evaluate the exposition in everyday life conditions, i.e. outside the laboratory. The exposition and transmission pathways, the categories of population or the compartments of the ecosystem that are affected must be identified. Exposure is dependent on geographical and cultural parameters like food traditions, medical practices, etc. For instance, in the case of nitrites, an evaluation is made of the amount of fertilisers used in the fields, as well as of the percolation processes which lead to the contamination of the watertables. Parents are taught not using drinking water for feeding newborn children.

4. Risk characterisation: the qualitative or quantitative estimation, including attendant uncertainties, of the probability of occurrence and severity of known or potential adverse effects and damages. It tries to calculate for example the number of cancers induced by the absorption of nitrites in a given area by a given sub-population.

Generally, risk management is presented as taking place after the assessment. It consists in the adoption of legislative or regulation measures related to the risk that has been evaluated and refers more fundamentally to the determination of an acceptable level of risk based on the risk assessment. It is made on the assumption that "zero risk" is not achievable.

Source: Hathaway S., "Risk Analysis in Biosecurity for Food and Agriculture", New Zealand Food Safety Authority, 2002, pp. 8-9.

It is generally believed that risk assessment and management are procedures that can be performed separately. According to this view, the division of labour between experts and politicians is clearly defined. It is up to experts to make the scientific work of assessment, while politicians or people working in administrative bodies have to adopt and elaborate measures. The results of assessments, while constituting a necessary basis of the decision, are in no way a substitute to political decisions. In this perspective, this separation has a double stake: it aims at guaranteeing the autonomy of public authorities as well as giving to the decision a rigorous scientific background.

However, such a clearcut separation is not realistic. Two main objections can be raised. In practice, risk assessment and management do seldom follow chronologically each other, but are rather overlapping each other. This is especially true in the context of a crisis when by definition time is lacking to make a precise risk assessment before adopting the adequate measures. Second, this separation takes for granted that it is possible to draw a distinct line between facts on the one side and values on the other; in other words between what is objective and what is subjective, between the questionable and the not questionable. The assessment would therefore rely on objective facts, while the management would be in the sphere of value judgements. Such a dichotomy is too simple. Assessing risks is a process that requires values. Confronted with uncertainty, experts have to make choices, which, as any choices, can be biased by prejudices.

Source: De Sadeleer N., Noiville C., "La gestion des risques écologiques et sanitaires à l'épreuve des chiffres: Le droit entre enjeux scientifiques et politiques ", Revue de droit de l'Union Européenne, 02/2001, pp. 398-99.

According to Mrs Willemsen, risk management is not automatically the result of risk assessment. In other words, the scientific evaluation, while constituting a necessary basis of the decision, is in no way a substitute to a political decision:

« When talking about risk assessment - what the Biosafety Committee is doing - we also have to talk about risk management. This is what the authority is doing and what the authority has to do. I think that risk management is more than risk assessment […]. The Biosafety Committee's task is risk assessment but not risk management. Risk

management is an evaluation of the risk assessment. Therefore, if, for example, the Ethics Committee says « no » from an ethical perspective, the authorities can still say « yes » without ignoring the Ethics Committee. It has looked at it from an ethical point of view and it is advising, not taking the decision. There is more to a decision than just looking at the risk assessment point. »

For Mr Roch, it is clear that the final decision has to be in the hands of the regulatory authority:

« The committees do not decide. They give an advice. And, frankly, that the committee says « yes » or « no » does not interest me very much. Where I'm interested is in the arguments, in the elements. I have to say that for the last week experiment, I really got a full set of arguments and reflections of the committee and this is very useful then to take a decision. At the end, the decision is taken by an agency, by an office. Personally, last week, I took the decision, but after a preparation from my collaborators. It's the end of a process, that's very clear. »[3]

Mr Métraux strongly contested this approach. He proposed to reform the decision-making process, so as to make it more inclusive and transparent:

« I was scandalised by what I heard this morning. I heard that we should manage the risk assessment. We should talk today together, why the decision making process is still in the hand of one person and then this person says « no, no », it's in the hand of one office. I think this is wrong. It should be a commission composed of representatives of all the issues we are discussing today. These people should have this discussion and then there should be a « yes » or « no » in a transparent way. It would be made available publicly. That would be a courageous move and a different approach than to have the decision in the hands of one office. And then the decision falls and you do not really know how they came to this decision. That's something we really have to think about.»

[3] On October 30, 2003, the SAEFL approved the experimental release of the transgenic wheat developed by the EPFZ.

2.5. DEFINITION OF BIOSAFETY

Several participants raised the need to better define the terms "biosafety research" as introduced by the new law on gene technology in its article 6, paragraph 2.

Artikel 6 ***Schutz von Mensch, Tier, Umwelt und biologischer Vielfalt***

§2. Gentechnisch veränderte Organismen dürfen im Versuch freigesetzt werden, wenn:

a. die angestrebten Erkenntnisse nicht durch Versuche in geschlossenen Systemen gewonnen werden können;

b. der Versuch auch einen Beitrag zur Erforschung der Biosicherheit von gentechnisch veränderten Organismen leistet;

c. sie keine gentechnisch eingebrachten Resistenzgene gegen in der Humanund Veterinärmedizin eingesetzte Antibiotika enthalten;

d. und d. nach dem Stand der Wissenschaft eine Verbreitung dieser Organismen und ihrer neuen Eigenschaften ausgeschlossen werden kann und die Grundsätze von Absatz 1 nicht in anderer Weise verletzt werden können.

Article 6 ***Protection de l'être humain, des animaux, de l'environnement et de la diversité biologique***

§2. La dissémination expérimentale d'organismes génétiquement modifiés est autorisée à condition que:

a. les résultats recherchés ne puissent être obtenus par des essais réalisés en milieu confiné;

b. la dissémination apporte également une contribution à l'étude de la biosécurité des organismes génétiquement modifiés;

c. ces organismes ne contiennent pas de gènes introduits par génie génétique qui induisent une résistance aux antibiotiques utilisés en médecine humaine et vétérinaire;

d. d'après les connaissances scientifiques les plus récentes, la propagation de ces organismes et de leurs nouvelles propriétés dans l'environnement soit exclue et que les principes visés à l'al. 1 ne puissent être violés d'aucune autre manière.

For Mr Pythoud, this article raises several questions:

« In the new provisions of the law on gene technology, there is a reference to biosafety research. In principle, as you might all know, each application for field testing of genetically modified organism should be somehow directed towards biosafety research. It is a concept which is pretty vague in a way. What do we mean by biosafety research? It's simply two words put one after the other. Biosaftey research might mean that we need to know more about biosafety, but what is biosafety? That's quite an important issue to address if you think about the future of plant biotechnology. Indeed, if you plan to do field testing with your GMOs, you will have to do some sort of biosafety research. So what is biosafety research? »

According to Mr Delabays, it is by doing agronomic research that you can do also biosafety research. In other words, biosafety research may be a side effect of regular agronomical research:

« One point that is very important for the future is that it's in the field that you will have new concepts which will be useful to evaluate the plant, also on the biosafety concept. It is also very important to realize that you can't study risks per se. I mean you study a plant which has an agronomic characteristic which is not directly concerned with biosafety. First we must have an objective - what we want to do with the technology – and then we can go to the field and have the good question about the biosafety issue. »

For Mrs Jotterand, the definition of biosafety research is also an important question. She wonders whether it would not be interesting to devote one research project entirely to this task, so as to establish an adequate methodology:

« It's very important to go further with biosafety research and the point is really about defining what exactly is biosafety research. For the time being, there is one question that stems from the applications that have been presented in the evaluations: what part of these projects should be related to biosafety research? In other words, the question is whether it is better to have in each project one part devoted to biosafety research or to have specific projects about biosafety research. This latter option could help defining a methodology in the field of biosafety research. For me, it is important because if this methodology is available, then it could be used in the frame of other projects. »

Mr Hosbach made a precision regarding the provisions of the law itself:

« The law does not require that every release is a biosafety study. It just says that every release should contribute to the biosafety question. It is not the only goal or objective of the release. It can have another objective but it must contribute in one way or another to the study of biosafety questions.»

Mr Küenzi pointed out that the question of biosafety concerns not only GMOs, but also non-genetically modified organisms:

« Impacts on biosafety by non genetically modified organisms should also be looked at, because that's something one usually forgets and that must be put in relation. »

3. PUBLIC DEBATE

Public debate is a generic category that encompasses many elements ranging from communication policies to public participation, among others. The way one tackles this issue depends on the way one considers the relationships between science and society. Different models have been designed by scholars to explain the diverse relationships that can be built between science and society.

Basically, three models can be identified. It must be precised that these models are in no way exclusive from one another. They should rather be seen as complementary ways of addressing science and society relations

The first model has been stated in a 1985 document of the Royal Society of the United Kingdom. Called **"public understanding of science"**, it presents science in the public sphere as a unified institution. A clear-cut limit between experts and lay people is established. Rationality is exclusively attributed to scientific knowledge, and other kinds of understanding are only subjective discourses and values. Science is considered as neutral knowledge, and thus ignores social contexts and representations. The exclusive attribution of rationality to scientific knowledge is based on its reputation of reliability. Therefore, when a risk related to a new technology comes in and gives rise to a controversy, its origin is to be found in the lack of understanding of science by the public. In this perspective, the aim of public policy in the management of risk is to re-establish trust by information and education.

In addition to the *public understanding* of science model, two other models decribing the relations of science and technology in democratic procedures exist, the "public debate model" and the "co-production of knowledge model":

The public debate approach: in this model, controversies are not interpreted as a lack of trust and information on behalf of the public, but more likely as a normal process of debate about science and technology's consequences. In addition to the traditional institutions of the public sphere (Parliament, media, etc.), a whole range of policies have been developed to complement the debate and allow a bigger diversity of actors to express their concerns (for example focus groups, consensus conferences, technology assessment). In the model of the public debate, science is accountable, and more sensitive to social contexts. There is recognition that a risk of a new technology can put into question the cultural or professional identity of social groups.

The co-production of knowledge approach: the aim of this model is to show that "lay" people can participate to the elaboration of knowledge. In this perspective, it enlarges the public debate approach, where knowledge from lay people is only taken into account to enrich the official expertise. This co-production process usually takes place when people are concerned by a specific situation like being affected by a disease or living in the vicinity of a nuclear plant. The dynamics of knowledge is seen as the result of a permanent tension between the production of standardised knowledge in laboratories on the one hand, and the production of contextual knowledge that takes into account the complexity of local and particular situations on the other hand. The French Muscular Dystrophy Association, an association composed of people affected by genetic diseases, is a good example of collaboration in the production of knowledge, where users of genetic knowledge became the partners of researchers. Patients and their families directly involved themselves in the collecting of DNA samples, in the setting of specialised medical consultations, and in the financing of laboratories. The Généthon laboratory created on the initiative of the French Muscular Distrophy Association, produced genome maps that made the completion of the Human Genome Mapping Project possible.

Source: "Approaches of risk: an introduction", Cahiers du RIBios n°2, RIBios, mars 2004.

3.1. FEARS RELATED TO RISKS

Some participants raised the issue of fears and the role they play in the public debate.

For Mrs Jotterand, it is important to take into account the fears expressed by the population:

« An additional difficulty when considering risk is the fact that risk is not the only thing. Fears are also related to risk. Risk is something we can evaluate because it is a scientific concept. But when we speak with people about what they feel, they feel some fears that are mostly irrational. We have to take this into account. These fears are very well marked for plant biotechnology because it is directly related to food, which is something totally different from the use of biotechnology for treatments in medicine for instance. So we have to be aware of the fact that behind all these discussions, there are the culture and tradition of people, their way of considering food. This has to be taken into account if we want to go further in the dialogue with the society. I totally support the idea that we need to go further with research. But we also have to take into account what people think and feel. However difficult it may be, I think this would also be a topic that we have to consider in a research project. »

Mr Paszkowski pointed out that it is more difficult to find support in the public for innovation, than to exploit the fears of the public related to these innovations. He wondered how to remedy to this situation:

« It is easier to make a career on fears than on assurance. There are a lot of movements in which people make personal careers by creating fear to others. Neither necessarily rational, nor well documented. People need assurance. Therefore, the question is what can a scientist or a representative of a government do, so that people start to be open and not afraid? How other institutions - not the scientists - could help scientists do it? Because that is not our job. I'm a geneticist and I really don't know how to do it. »

Mrs Willemsen emphasized the fact that fears can generate rational behaviours. The rationality of a given behaviour depends upon the context. The task of the Ethics Committee is therefore to look at this context:

« Emotions are not only on the side of fears. They are also on the side of the people who like taking risks. They took risks and were successfull. Therefore, in their experience taking risks is a successful behaviour. Others have made the experience that fear is a successful behaviour, because it protected them from bad experiences. Ethics is not about consolidating what is the public opinion. It's about what is the ratio behind this kind of approach. »

3.2. COMMUNICATION POLICIES

For several participants, there is clearly a lack of communication in the field of plant biotechnology.

For Mr Pythoud, the fact that the general public misunderstands the difference between fundamental and applied research stems from a lack of communication:

« There is clearly a misunderstanding in respect with the difference between basic research and applied research when it goes to plants. If you work on a wheat like it has been done at the ETHZ, the public gets the impression it is applied research because it is using a crop which might be planted, which is actually planted in the field next where you live. There is clearly a problem of communication in this regard. »

Emphasizing the lack of information of the public, as far as plant biotechnology is concerned, Mr Kessler proposed that the scientific community should do more grassroot work:

« It is important that the parts involved in a dialogue are able to speak the same language. It's quite difficult to have a dialogue with the public when it is probably far less informed than we are. In this perspective, we should probably do more grassroots work; we should try to inform the public

better than what has been done so far. We should also go out and talk to people, talk to the concerned groups. »

Mr Farmer suggested that communication policies on behalf of researchers should be more concrete so as to show the advantages of plant biotechnology:

« I think we should be more concrete when we give examples of potential positive applications of the technology. For example, instead of saying late blight problem in Switzerland we should have the figures that are at our disposition: eight sprays a year on thirteen thousand hectares. If a new potato resistant to late blight lasted ten years, that would say we are spraying a million hectares equivalent. Even if that resistant gene needed to be replaced by another one, it would be a progress. »

For Mr Küenzi, a more positive communication is important, that is a communication focusing more on the potential advantages biotechnology can bring to society:

« One has to take another approach consisting of providing better information to the public. The public has to see also potential advantages. Probably one ought to take examples from outside Europe. Besides, one has to really identify targets, which the normal citizen can understand as being worth trying. For example, targets that can be good for nature, that can bring advantages to farmers and even better to consumers. This should be communicated in a way that superimposes itself to the negative picture that has been spread in the last twenty years. »

For Mr Schrott, one of the ways to build trust in the public is to base actions on science:

« Concerning building trust by action, what an office like ours [Swiss Federal Office of Public Health] can do, or other offices, is really acting « science based ». That means acting in a transparent way, in a way that allows others to control what we are doing. To allow them to check what we are doing and even to find mistakes in the argumentation. This was somehow the case with the application of the ETHZ. It was refused first and then after a process of re-reviewing ended up with the reversal of the decision. In this respect, I think science can be one basis for building trust. »

For Mr Winzeler, it is not only the public but also the media that should be educated:

« We should educate the media to have a fair information about gene technology. »

Several participants expressed another opinion on communication.

According to Mrs Malnoë, the social acceptability of GMOs does not only depend on the level of information. In other words, more information does not necessarily end up with more people accepting the technology:

« If you give more information, that does not mean that people will change their opinion. In a sense, it means that the problem is on a more unconscious level, that people are afraid of it. Perhaps it would be good for scientists to listen to the public and try to understand. »

From an ethical point of view, communication does not mean education. The interlocutors must be considered as equal partners, according to Mrs Willemsen:

« It has been talked about the need to educate the public and the media. It is difficult to educate other people and it is probably better to consider other people as being on the same level. I don't have to educate them, I have to listen to them. I have to try to give as authentic answers as possible. I do not have to try being a public relation specialist. With regard to my own position I learned that if I try to tell journalists what to write, they really don't like this. Therefore, it's better to deal with them as being equal, because they are equal but with a different perspective. We do not have to be communication specialists. If we try to be authentic, I think that is what is very much appreciated. »

For Mrs Jotterand, the public opinion needs time to get used to a new technology. Therefore, one has to be patient about the results of the dialogue. It will bear fruits, but only progressively:

« It takes time to get closer the public opinion and the scientists. I would just like to remind you the time when the first experiments started with GMOs and also when the first medications like insuline were introduced. There were many discussions. Many people said it was dangerous. Now, about ten years later, there are no discussions anymore. I have the feeling that the same might happen with plants. Progress was made continuously thanks to experiences. We have to be patient. The discussion has to go on. »

Mrs Dorsch recalled that communication policies of both the opponents and the proponents of GMOs have sometimes been biased. She recommended therefore to adopt a balanced communication, that is a communication relying on facts rather than propaganda:

« Communication has been for a long time black or white. Greenpeace would see it black, big dangers and everything. On the other hand, the industry - especially Monsanto in one case – and also researchers are putting things too nice. It was very often said we will have these results in ten years like in gene therapy. Unfortunately ten years have passed and it hasn't happened. It is very important that discourses are based on facts, with risks and benefits, without exagerations. »

3.3. MODALITIES OF THE PUBLIC DEBATE

A majority of partipants recognized the need to find new forms of public debate. « Who should be included in the debate, when and how » were among the issues tackled by the participants.

A useful concept to analyse public debates is the "arenas" concept. It is used in political sciences to design symbolic spaces of confrontation which influence collective decisions and public policies. Arenas - be they political, economical, media, legal, scientific or religious – are characterized by specific rules of access and by the type of arguments and resources (money for the economic arena, power for the political one, scientific proof, reputation, ...) which can be used within them. Thus, arenas are characterised by "dominant actors". For instance, it will be very difficult to argue in the scientific arena for actors who are not scientists. Also, each individual actor may have different identities according to the various arenas: in the economic arena, we expect to observe an identity of consumer, as the identity of citizen will be present in the political arena (etc.).

This concept helps determining the intensity of a public debate. The greater the number of arenas mobilized by the issue, the more intense the debate is. Actors begin to move into arenas in which they are not usually "resident", and this may open up the opportunity for a challenge to the established frames of reference, or "symbolic referentials" of specific arenas. It is only when a debate mobilizes more than two arenas and that a growing number of interactions between arenas take place that one can consider a public debate as a controversy. In this case, media coverage is high and the non-organised mass public becomes enrolled: everybody has heard about the issue and has something to say about it.

Source: Joly P.-B., Assouline G., "Assessing Debate and Participative Technology Assessment in Europe", ADAPTA Final Report, Grenoble: INRA Sociologie et Economie rurales, Teys: QAP decisions, June 2001 (http://www.inra.fr/Internet/Directions/SED/science-gouvernance/publications.htm).

The concept of arenas: general characteristics

Arena	Setting	Resource	Symbolical referential	Deviations	Dominant actors and specific identities	Productions
Economic	Market	Money Image	Efficicency, transactions	Domination	Producers consumers	Products
Scientific	Laboratory, Scientific institutions	Scientific proof, method, reputation	Truth, rationality, rigour, impartiality	Lack of rigour, fraude	Scientists, experts, lay people	Knowledge, expertise
Regulatory	Agencies, authorities	Rules, codes, procedures	Control, independence	Corruption	Experts, regulators, producers	Regulation, norms
Legal	Courts of law	Laws, procedures	Justice	Partiality, judicial error	Legislator, judges, lawyers	Jurisprudence
Political	Parliament, street	Power, trust	Democracy	Autism, private interest	Politicians, citizens	Laws, R&D trajectories
Religious	Church	Religious texts, traditions	Absolute truth	Fanatism	Priests, Laity	
Media	Newspapers, TV, radio	Audiences, sources	Information truth, freedom of speech	Simplified « storyline », scoop, lies	Journalists, audiences	Media stories, emotion, awareness, scandals

Source: Joly P.-B., Assouline G., "Assessing Debate and Participative Technology Assessment in Europe", ADAPTA Final Report, Grenoble: INRA Sociologie et Economie rurales, Teys: QAP decisions, June 2001

Rather than seing communication as a one-way process, Mrs Jotterand proposed to see it as a reciprocal process. In this perspective, communication is a process aimed at informing people in order to involve them in a second stage. The ways to allow such a participation have still to be found:

« For the time being, it's very clear that concerning plant biotechnology, communication is mainly negative. Negative effects are communicated and at least perceived by the large public. It's true that we have to involve the public in the future of research in this domain. We have to think about the way to involve the public. Communicate, inform, and then involve people and take into account what they think, even if these people are not specialists in the field. This could be the aim of a research. The Swiss Academy of Natural Sciences has made a proposition going in that direction. »

The participants tried to define the meaning of the term "dialogue", as well as the time frame to organise a dialogue.

For Mr Hosbach, a dialogue is an ongoing process:

« A dialogue is not just something that you do and then it's done and you have ninety percent of all the people convinced with your opinion or something like that. To me, it is an ongoing process on all kinds of level. You can speak with a hundred people in a room or you can speak to a lobby group or you can do it in a publiforum [Swiss version of the Danish consensus conference]. You have to use all kinds of levels, because you do not reach the same kind of people. »

For Mrs Willemsen, a dialogue must satisfy at least two conditions to be successful. It must be open and take place at an early stage, when people have not made up their minds yet:

« I sometimes have the impression that the dialogue comes too late. People are entering a dialogue but they know already what result they want to reach at the end of the dialogue. This is not a dialogue. A dialogue has to be open. If you hand in an application, you already have the clear intention to proceed with this particular research. How do you want to have a dialogue at this moment? I also think that it's not necessary to convince the few people you can never convince, the minority. Even from an ethical point of view it's accepted that if the majority agrees, you can go forward. It's our democratic procedure that the majority decides, within certain limits, of course. But so far, we often have not even reached the majority of the people. We don't have to convince people. It's about a dialogue. »

For Mr Sautter, entering into a dialogue with the public at the stage of the application for a field test is too late. It would be better to initiate such a dialogue at the stage of the application for a scientific project:

« The application for the field test, I agree that it is too late. I think there is hardly any earlier time than the application for a scientific project, because it is impossible to discuss a scientific problem before having a scientific idea. »

However, Mr Sautter emphasized the risks for a scientist to enter into a dialogue at an early stage of research. Making scientific data public at this

stage can be detrimental for researchers in terms of publications and competition with research groups working on the same issue:

« If you talk about involving the public in a kind of dialogue from the very beginning, that would mean for me as a scientist to make all my ideas open from the very beginning. Then, what would a scientific journalist say if I want to publish that two or three years later? It's old coffee. I have to tell that also to the competitors. If I have a website, even if it's in German, where I have to make public all my biosafety experiments for the field tests for instance, the competitors will know what I'm going to do. I think that's a real problem for a scientist who is in competition at international level. »

Mrs Willemsen made a distinction between two kinds of dialogue, one concerning specific projects and the other, more general, concerning the application of a technology:

« There is a difference between discussing a specific project and discussing the application of a technology in general. In the first case, I think the earliest possibility is as soon as you know about the project and your intentions. Concerning more general dialogues, you can enter earlier. Anyway, there is not one solution how to do this dialogue, because communication is such a multi-level thing that it always depends on the context. »

Mr Sautter underlined how difficult it is to make opponents take part in a participative process. For him, one has to find how to integrate these people at an early stage, that is before the application for a field test:

« The ETHZ tried to get into contact with opponents of gene technology but also opponents of nanotechnology. The idea is not only to solve the problem in relation with my experiment [KP4 wheat], but to look for a way to make these groups participate in the decision-making of a larger scientific unit. It was not possible until now to get these people even to preliminary discussions. I think we have to go early, not only when we want to make a field test. It was not thought as a joke that I would ask to approach these people at the very beginning of a project. »

Mr Küenzi raised some doubts on the possibility to include GMOs opponents into a dialogue at an early stage of research:

« There are groups refusing gene technology as an approach completely. Whether you can bring these people on board by organising a dialogue early, I doubt very much. I have the impression that they live on this opposition. You can come with whatever you want, they will always have some arguments against it. »

For Mrs Willemsen, another condition of an open dialogue is to be able to acknowledge that fundamendalists may be on both sides:

« From my point of view, there are fundamentalists on both sides. If you take the perspective of a person who is completely against a project, it might consider the other side as fundamentalist and vice versa. There is a polarization on both sides. Between these extreme groups you can probably not have a dialogue. »

For Mr Farmer, the best way to get out of a controversy is to find a common ground between stakeholders. Though recognizing how difficult this task is, he proposed to start the process by including farmers in the discussion:

« Generally, when there is polarization, there is only one way out as far as I can tell and that is to seek for common ground. Even in the most politically polarized debate, there's always some common ground to be found. So the question is how to find it? Or whom to find it with? The agricultural community does share a lot of common ground in a way with researchers. There is a potential of dialogue there and I think it would be very important somehow to include them in a discussion and in access to information. Of course, it's difficult because of the way farmers elect their own representatives who play political roles. But if farmers could be put on committees or given more access to science and more chance to give their feedback, maybe that would allow us to find more common ground. »

The participants tried to imagine ways to organise a constructive dialogue.

Mr Winzeler suggested discussing specific cases instead of discussing at a general level. In this perspective, he proposed to organise a publiforum of a special kind:

« About one and a half or two years ago, the TA Swiss [The Swiss Office of Technology Assessment] had a project where they wanted to set up a publiforum, a regional publiforum for two cases of releases. They had the idea to start this publiforum very early in the process of planning the experiments so that all the people could contribute to the design. I think this is still a very good idea. We are at a certain point where discussion about the technology as a whole is not fruitful anymore. We need special cases to discuss about and this probably will bring us further. This project of TA Swiss had one disadvantage: there were no cases of release around. We should think about who should do these experiments. I'm not sure that the interested scientists should always do the experiments. Maybe we should talk about a more independent circle of people, a consortium that is planning this experiment of organising a publiforum for a specific case where an interest could be in Swiss agriculture. »

Mr Küenzi proposed to set up a participative process at the beginning of a new project, open to anyone who feels concerned:

« We heard that three potential projects in the area of plant biotechnology have been discussed with farmers and God knows whom. I'm wondering if this would not be a starting point for a broader discussion maybe with the

public, the opponents, and with God knows whom. It would be a good starting point to have concrete projects where one knows we have a problem in Switzerland. To solve it, we have this as a possible solution. The bio-farmers would come and say we have another solution and maybe other people would come and say well let it be, we don't need it. However, this could really be the basis for an open discussion. »

Mr Delabays also shared this point of view:

« This is a very good idea. I would say that we are ready now. We could share all the things we've done on the new project we have developed; we could share how we think about it, which return we had from the farmers, from all the people who followed us in the elaboration of the project. We don't think there will be a field trial next year, so we have a little bit of time. It would be a very good opportunity to see concretely, from the beginning, what we can do and which kind of new arguments or information we can build in this area. »

Other participants suggested that another Forum be organised that could gather other actors. For example, Mrs Dorsch proposed:

« To have a similar type of forum with consumers and NGOs. And maybe to even confront them with the results from today, and see if some points of agreement can be found and if that can be furthered. »

In case of another forum, Mrs Malnoë thinks that it would be interesting to include scientists as observers and not as stakeholders:

« If a forum with farmers and consumers and other participants is organised, it would be interesting to have scientists as observers. It could be interesting to see how people are actually discussing when scientists are not around, because I think we have a problem of expertise also in the way people look at scientists, who sometimes are so sure that they know what is good for all the others. »

3.4. "SOCIALLY ROBUST" RESEARCH POLICIES

Participants thought about ways to include people and groups concerned by new technologies upstream (i.e.when a technology is still at the stage of research), so as to make research policies "socially more robust".

The controversy over GMOs in Switzerland as well as in Europe has shown the need to include people and groups concerned by the applications of new technologies upstream, if one wants to increase their acceptance.

In France, open field experiments were sharply contested by a coalition of organisations led by the farmer union La Confédération Paysanne (CP). Experimental GM fields belonging to private companies as well as public institutions were regularly destroyed by anti-GMO activists. In this context, the National Institute for Agronomical Research (INRA) launched in 2001 a pilot study consisting in developing a research programme on a plant with the participation of the groups concerned by its application. It assumed that the more these groups are included in the research programme, the more the programme - and therefore the plant – would be "socially robust". In other words, the rationale of this methodology is to integrate in the decision-making process of an institution the knowledge as well as points of view of the various stakeholders. In this case, the study concerned a transgenic vineyard resistant to the "court noué" disease. By including wine growers, plant biotechnology researchers, consumers and sociologists, it consisted among other topics in evaluating the opportunity to continue with the development of this GM resistant wine and on the opportunity to make field test experiments.

For more information: http://www.inra.fr/Internet/Directions/SED/science-gouvernnace/TA-Vignes/

For Mr Bigler, it is clear that a "socially robust" GM plant must respond to the needs of its users, be they farmers, consumers or whoever. At the present time, one must admit that it is hardly the case, at least in Switzerland. Therefore, according to Mr Bigler, more emphasis should be put on the identification of the needs of society:

« The scientific community has experienced a tremendous criticism over the last years related to the GM technology. I wonder whether we have to rethink - I am considering myself as part of the scientific community - how to proceed. My question is: « Did we ask society or did we ask farmers what they need, what their problems are ? » If I look to what is on the market nowadays, it is neither solving the real problems for agriculture, nor for society. Of course, for fundamental research, we need the freedom to do what is driven by the interests of the scientific community and not only by what the society needs. On the other hand, we have to

look at the needs of society. If we come up with a plant which is ready to be experimented in the field and that no one can tell you what the profit is, I would not take the risk to put that plant in the field because I do not see any benefit. I think that it's a new way to proceed also between the scientific community and the society. We should try to improve this dialogue and really look at what is needed by society. »

For Mr Bigler, one way to achieve this goal would be to include all the stakholders in the development of a plant that is promising in terms of application:

« I wonder if a way to be more successful in the future is not to illustrate that plant biotechnology can be beneficial. We could try to form a kind of consortium with as many stakeholders as possible, going from the scientific community, the regulators to the private sector and then demonstrate with a case study that it can be done in a good way. We should take a plant which shows from the beginning - or has the potential to give - a benefit to society, the agricultural sector or to any of the stakeholders. That could bring us a step further because we are turning in a circle, and it's very difficult to find a way out of this circle. »

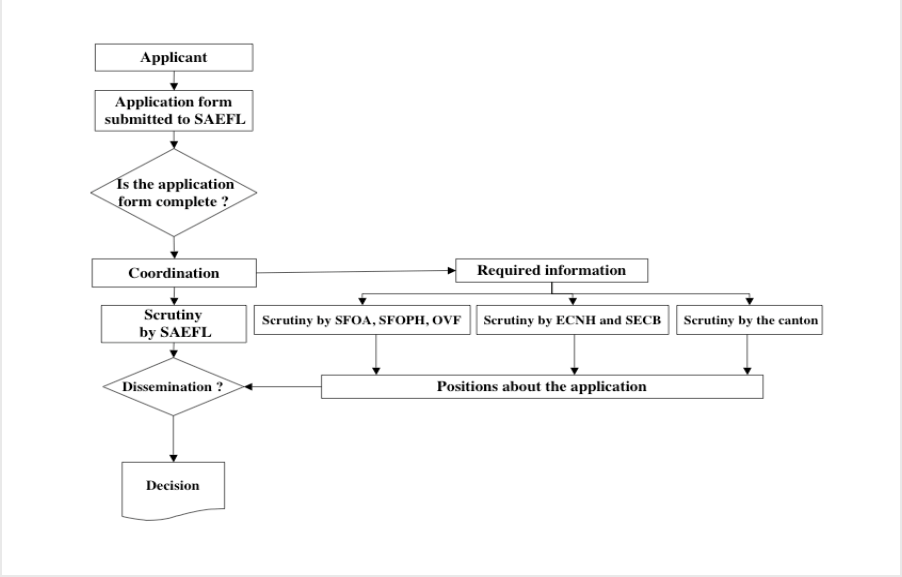
Mr Delabays exposed his experience at Changins in the field of consultation:

« In our institution we do have to set-up and prepare our research program every four years. Right now we are finishing a research program for 2004 up to 2007 and all the last months we had a lot of questions in Changins. For example : What do we do with GMOs? Do we go on or do we stop? We really asked these questions because funding is drying away now. When we prepare the next program, we have contacts with farmers, we do share what we want to do and what they think about what we do. We also have contacts with environmentalists and also with consumers. We have now three projects with GMOs. Except the organic farmer who said: « It's not our business because we have no opinion about what you do with that, we are against it, all the farmers - viticulture, orchards and potato growers and so on - say Go on, continue, we need some public research in this area. » Even the consumers, they tell us: « You have to go on, it's very important. » So I don't know where the public opinion is. […] In our specific situation, we have established a kind of consultation, discussion, in elaborating the planning. The different actors have been trusting us for a long time and it completely changed the way dialogue can be established. »

4. DECISION-MAKING PROCESS

4.1. DISTINCTION BETWEEN SCIENTIFIC AND POLITICAL CRITERIA

To begin with, it is important to remind how the decision-making process has been set up by the Release Ordinance of 1999. Here is the related decision-making flow chart:



Source: SAEFL

The distinction between scientific and political criteria was also an issue raised by the participants.

Mr Küenzi and Mrs Malnoë came back on the decision of the Swiss Agency for the Environment, Forests and Landscape (SAEFL) to refuse authorisations for experimental releases and its consequences.

For Mr Küenzi, a few members of the Swiss Expert Committee for Biosafety (SECB) resigned because the SAEFL used scientific arguments to justify the negative decision that were not considered as scientifically legitimate by these members:

« I'd like to come back to the reason why the members of the SECB resigned. It was clearly because scientific arguments where brought forward which were against the conviction of the people involved in the statement made by the committee. It was not because of political battles or divergences. The main problem was, as you know, antibiotic resistance. We could not accept this argument as the reason for not approving the experiments. »

Mrs Malnoë's point of view is that there were no scientific arguments to refuse the demand made by Changins in 1999. She assumes that authorities in charge of authorising field tests experiments may have been tempted to use scientific arguments instead of social, economical or ethical arguments to justify a negative decision, because scientific arguments have more legitimacy:

« I have been involved since 1991 with the field tests and I have to say that the problem is very complex. What you have to do is to distinguish between the different kinds of risk: environmental, social or ethical. Having been discussing with people, it seemed to me that the values of these different risks were not really well established. I have the impression that what happened to us was that there were no real scientific reasons to refuse our demand. There were maybe political, economical or ethical reasons for doing it. But these reasons were not expressed clearly enough and were not considered to be sufficient to refuse the trial. I think that it is something we should discuss and integrate into the discussion because otherwise it is very difficult as a scientist to have a clear dialogue with the public. »

Mr Sautter also denounced the risk of seing scientific arguments "instrumentalised" by political authorities in the decision-making process:

« The point is: is there a sound reason given for that decision? A political reason is supported by pseudo-scientific arguments and that's the difficulty for us. So we accept political decisions, no problem, but then you have to give also political reasons for that. »

This point of view was also expressed by Mr Delabays:

« […] When we decide, we have to make the effort to be very clear if we use a scientific argument as a political alibi. A scientist accepts a political, commercial, economical argument but it's very difficult for him to see that his work is used as an argument, a political argument, just like an alibi to take a decision. When a decision is made, we have to make this difference very clear. »

For Mr Roch, the matter is not to know whether it is a political or a scientific decision but rather to change scientists' attitudes when doing science. In this perspective, science should be more able to recognize the limits of its knowledge. This would surely be a way to improve society's confidence in science:

« I have the impression that as long as science is not able to really prove something or affirm something, scientists themselves call for a political appreciation. I was a scientist and I always tried to look at things with a scientific eye and I have to say that there is always a part of uncertainty and non-knowledge, especially in these biological sciences. I'm very admirative of what has been found until now, but there is still so much to be found. Nobody can be sure in an area where we do not really know what happens. The arrogant attitude of some scientists is very detrimental to the confidence of people in science. What if a scientist came, saying that he knows now this and this but that there is also an area where he doesn't really know and that he's wanting to make research in that area? I'm sure that with this kind of approach the population would be non-politic and would be much more ready to accept risks. Knowing that the person who is running the experiment knows that there are risks gives confidence to the people. »

According to Mr Hosbach, any decision in the field of risk mangement is somehow political, since a zero risk level is not achievable. Political decisions consist therefore in determining an acceptable level of risk:

« Any decision is in a way political because if you have for instance a scientific result that qualifies at 95 percent 200 meters, then the question is: « Do you accept it or not? » Whether you say "yes" or "no", you have a value on which you measure; and this value might have been different. So, in my view, any decision is not scientific in that way. It is in a way a political decision or a non-scientific one. »

For Mrs Willemsen, risk assessment cannot be seen as a purely rational process. It encompasses subjective elements. Indeed, the inherent uncertainty of science implies that one has to make choices, to set up priorities and thus integrate values:

« If you look at the decision with regard to the necessary distance to the next field, you see that recommendations vary from 20 meters to 50 meters or 400 meters etc. It's after all an evaluation and this is also a subjective procedure […]. »

« Even with regard to risk assessment in natural sciences, there are scientists who are using the same methods but come to different conclusions. Is one conclusion considered to be a political result and the other not? I just want to show that there are a lot of subjective aspects also in natural science and not only outside of sciences. »

While acknowledging that scientists have to interpret their results – making in that sense science a subjective process - Mr Sautter pointed out that it is essential for scientists to reach some kind of agreement, at least on the data:

« […] There is subjectivity also in science, of course. There is subjectivity in interpretation. But natural scientists should agree on the data, on the measurements. If you shift away from that, then we will also have a severe problem. […] »

End

APPENDIX I: POSITION PAPER

Since nearly the end of the 1980ies, the European public sphere is recording a growing number of public controversies concerning technological, industrial, environmental or food risks. These changes take place in the heart of the «risk society» and its paradoxes: indeed a very high level of security does exist simultaneously to a higher sensitivity in the public opinion to a certain kind of technological risks. Besides, some innovations raise new hypotheses of risk as well as questions of social, economical or ethical uncertainties. The relations between experts and social actors are in the process of being redefined in the context of (1) the insufficiency of classical political systems of representation in relation to scientific and technological choices, (2) the limits of scientific expertise as the unique authority in risk management. To meet these new situations and deal with these controversies, new forms of risk negotiation have emerged in Europe, introducing participation, counter-evaluation, plural expertise such as ethical commissions and technology assessment institutions. They all tend to achieve a better coordination and communication between politicians, experts, stakeholders, and citizens.

In Switzerland, the first open field test of a genetically modified organism (GMO) - a potato resistant to the PVY virus - took place in 1992 in the context of a legal loophole. Worried by the delay taken by authorities to legislate and introduce limits regarding innovations in biotechnology, a coalition of ecological movements decided to launch an *Initiative for Genetic Protection* aiming at introducing a very restrictive regulation. In parallel, the *Priority Programme Biotechnology* was adopted by the Parliament in 1991 in order to promote biotechnology as well as the competitiveness of Switzerland in a typical «technology push» model. Authorities launched in 1992 a legislative process whose goal was to frame biotechnological innovations resulting from genetic engineering. The package of laws, called *Gen-Lex*, though promised by the Federal Chambers for the next years, will eventually be adopted only ten years after, in 2003.

Since the mid-1990ies, the *Initiative for Genetic Protection* has propelled the controversy on genetic engineering and its promises, however still not very concrete at that time in terms of innovations. In this context, a certain number of interfaces have been set up, either by authorities or by academic actors or researchers, with the mandate, for most of them, to better communicate on biotechnological stakes. Authorities have speeded up discussions within Parliament and have set up interfaces oriented towards the public. In parallel to the creation of the *Swiss Expert Committee for Biosafety* (EFBS), the main body in the field of risk assessment, *the Swiss Ethics Committee on Non-Human Gene Technology* (ECNH) was created to provide a plural expertise and animate the public debate by encouraging participation. The *Technology Assessment* unit from the *Swiss Council of Science and Technology*, set up in 1991, was reinforced by its transformation into a *Centre for Technology Assessment* (TA-Swiss) in

1996. Other interfaces dedicated to the science-society dialogue were created by actors coming from research, such as the *Forum Genetic Research*, created by the *Swiss Academy of Natural Sciences* as well as the *Swiss Biotechnology Information and Communication* and the *«Biosicherheitsforschung und Abschätzung von Technikfolgen des Schwerpunktsprogramm Biotechnologie»* (BATS) which have accompanied the *Priority Programme Biotechnology*.

During the extremely sharp political campaign on the *Initiative for Genetic Protection*, positions polarised because of the severity of the prohibitive measures supported by the ecologists. Besides, many actors expressed their regrets that such a complex domain be reduced, by the interplay of the democratic rules, to put a «yes» or «no» in the ballot box on the issue of genetic engineering, vegetal, animal and biomedical fields as a whole. The development of the mad cow crisis in Switzerland as well as in Europe played a dramatising role, which tended to skew the debate on genetic engineering towards industrial and food risks. Misunderstandings and divergences were made public through the media, revealing what a great number of actors felt like a «gap between science and society». The thesis most frequently heard at that time, was that risk perception by the public is «irrational», since it is based on a reaction of fear in front of something new and unknown. This controversy has been the occasion to make an inventory of the concerned social actors and to make visible related stakes. Moreover, it has encouraged a large debate on technological choices.

The Initiative for Genetic Protection was rejected by 66,7 % of the voters in June 1998. After having aroused passions, on the proponents as well as the opponents' side, a time of appeasement in the public sphere followed the vote. A favourable phase for the activities of science-society interfacing came to be, which allowed for instance the organisation in 1999 of the second *Publiforum* in Switzerland on *Genetic Technology and Nutrition*. However, innovative initiatives oriented towards dialogue and participation remained seldom, since most of the interfaces limited themselves to informing or educating the public. At the time, the social degree of acceptability of biotechnological risks connected to the releases of GMOs in the environment was difficult to grasp. The Parliament was working towards the definition of legal requirements for this new type of technological innovation. In March 1999, two demands for authorising experimental releases were refused by the authority recently in charge of delivering the approvals for the deliberate release of GMOs into the environment, the Swiss Agency for the Environment, Forest and Landscape (SAFL). The first application came from the *Research Station of Changins* for a potato resistant to mildew, the second one from a private firm, *Plüss Staufer*, for a an herbicide resistant maize (T-25 maize). In autumn 2001, a third negative decision, concerning a research conducted at the ETH of Zürich on a wheat resistant to bunt (the KP4 wheat or Killer protein 4), started a crisis within the authorities in charge of expertise and decision. It must be underlined that in the two cases of public experimentation, the regulating authority (i.e. the SAFL) based its decisions on, among others, the precautionary principle, and the fact that potential

risks had not been sufficiently taken into account (risks of horizontal transfers of antibiotic resistant genes).

These decisions have been welcomed by ecologists but vehemently attacked by the ETHZ, industrialists and some members of Parliament. As a result, five members of the *Swiss Expert Committee for Biosafety* (EFBS) collectively resigned to express their dissatisfaction not to see their evaluation favourable to the experimentation taken into account4. The concerned researchers did not understand the impossibility to test their plants in open fields, while it is an essential phase in their research. Indeed, only field tests allow studying the behaviour of new organisms in real conditions, and not only in the confined environment of laboratories.

Contrary to known risks, such as the threat caused by CFC to the ozone layer or the use of pesticides in agriculture, biotechnological risks related to applications of genetic engineering are still largely hypothetical. They raise simultaneously scientific, technical, social and economical uncertainties. When one looks at the approval decisions from a geographical point of view, one notes that the territory of risk related to the releases of GMOs changes when it moves from the laboratory to the field for experimentation, and then from the R&D to the commercialisation scale. In other words, when they go out of the laboratories, GMOs go from the hands of molecular biologists to the ones of seed-bearers, ecologists and agronomists, each of them assessing the risks at his own level (for example, ecologists and agronomists evaluate the situation at the ecosystem level). Consequently, one observes that risk assessment criteria change when passing from one relevant territory of risk to another.

In the course of our research, we have reached the conclusion that the refusals in 1999 and 2001 by the Swiss Agency for the Environment, Forest and Landscape (SAFL), of the open field test conducted by public laboratories and financed by public research reflect a crisis which goes well beyond the people concerned by these decisions. As a result, the issue of the relevant political level for decision-making in the field of GMOs is raised. Several other issues in relation with these events can be raised:

1. the coherence or the coordination among public policies;
2. the inclusion of citizens' concerns in decision making;
3. the orientation of research policies;
4. the function of expertise and its role in the public sphere.

It is the reasons why, during the Forum organised by the RIBios and the Interface sciences-société, we would like to steer the debate concerning the

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[4] In 1999, political decisions against the release of GMOS in France have also resulted in the resignation of experts members of the *Commission of Biomolecular Engineering* in charge of biosafety.

meaning of this controversy for the future. With the adoption of the *Federal Law on Genetic Engineering in the Non-human Sector*, a new legal framework regulating biotechnological innovations is set. Consequently, it seems to us convenient to start a dialogue among the actors concerned by this change.

ISSUES FOR THE DISCUSSION

The Forum does not aim at resituating the official point of view of the participants' institutions. We assume that actors' positions evolve in the course of controversies, and that they take part in a collective learning process to which this Forum would like to contribute. The moderators will briefly introduce the issues for discussion. There will be no formal presentation by any of the participants but a free discussion.

1) Risk negotiation

The *Federal Law on Genetic Engineering* imposes that experimental releases into the environment must contribute to the study of biosafety. It must be pointed out however that this incentive to make research on risks related to GMOs runs up against obstacles: the lack of financial means at the researchers disposal on the one hand, and the fact that this kind of research lacks valorisation within the scientific community on the other hand. Besides, the question of risks related to GMOs has moved rapidly from laboratories to the public sphere where it has been seized by a lot of actors (media, NGOs, political parties, and s.o.). According to us, this phenomenon proves the necessity to explore ways that are likely to encourage assessment and debate about risks and their acceptability within society.

2) Coordination at the level of assessment and decision

In Switzerland as in the rest of Europe, new forms of risk negotiations as well as socio-technical change have been set up in the last years. New policies have emerged, opening room to participation, to counter-expertise, to plural expertise, and to science-society dialogue. In Switzerland, many interfaces have been set up, aiming at a coordination and a better communication between experts, authorities, stakeholders and citizens. Despite these initiatives, the first decisions taken by the authority in charge of delivering approvals have raised a controversy among experts, within the Parliament and between the executive, legislative and judicial powers. Since *Federal Law on Genetic Engineering* comes into force, we may ask if it is possible to achieve a better coordination between the authorities in charge of expertise, consultation and decision, and if it is the case, how to organise it.

3) Coherence between research and environmental policies

Two of the three refusals concerning open field experiments are connected to researches that have been financed during several years by the *Priority Programme Biotechnology*, which was approved at the beginning of the 1990ies by the Parliament. It is also within the Parliament that the legal requirements to authorise deliberate release into the environment have been recently negotiated in the *Federal Law on Genetic Engineering*. Consequently, we note a contradiction – which goes beyond actors of the administration or researchers – between two policies, the research policy on the one hand and the environment policy on the other. In this context, it seems interesting to explore procedures that are likely to make public policies more compatible.

4) «Socially robust» research policies

The controversy over GMOs in Switzerland as well as in Europe has shown the need to include upstream people and groups concerned by the applications of new technologies, if one wants to make their acceptation easier. In France, INRA has just completed a pilot-experience consisting in the co-construction of a research programme concerning transgenic vines resistant to the *«court noué»* disease, implying wine growers, researchers, citizens and sociologists5. Assuming that actors concerned by technological applications have to participate to their development, this experience tried to make the orientation of research on vines socially more robust. In this perspective, we may wonder whether such procedures are desirable in Switzerland and, if they are, which actors should be included.

5) Biotechnological research in Switzerland

The *Priority Programme Biotechnology* was aimed at promoting the so-called «applied research», but the interest was also important at the level of «fundamental research». Actually, these two facets of research are inseparable. But it seems to us that a third aspect of research has been neglected until then: public expertise. The industrial developments of plant biotechnology need to be balanced by the constitution of a solid public expertise, which is able to produce knowledge likely to frame the development of new technologies and their applications in accordance to the new law. Consequently, we may wonder if Switzerland is interested in maintaining and

[5] "Quand le vigneron, le profane et le chercheur délibèrent sur les orientations de recherche : une expérience pilote sur les vignes transgéniques" ; http://www.inra.fr/genomique/ogm-vigne-declaration-dg.html

developing this kind of knowledge and expertise in plant biotechnology, and in case, which kind of research is needed.

6) Deciding under uncertainty: the controversial implementation of precaution

Contrary to known risks which allow the adoption of preventive measures, the uncertainties surrounding biotechnological risks require new procedures of expertise and of public evaluation that are nowadays brought together under the controversial notion of precaution. Far from being confined to scientific knowledge, uncertainties do appear at the level of risk assessment as well as at the socio-economic level in relation with the multiple issues raised by the utilisation of biotechnology. Precaution can be interpreted more or less restrictively according to the fields and actors concerned on the basis of criteria such as the burden of proof, the cost/benefit outcome of the precautionary measures or the relation between the benefits and risks of the new technology. This diversity of interpretations and the lack of precise procedures of implementation open room for negotiation on the meaning that should be given to this principle in a given situation. Decision-makers have also to address the question of the link between the qualification of uncertainty and the implementation of precaution.

7) The implementation of precaution in international law

Precaution is interpreted differently in international law according to the forum in which it is formulated. For instance, the WTO *Agreement on Sanitary and Phytosanitary* (SPS) and the *Cartagena Protocol on Biosafety*, which is one of the protocols to the *Convention on Biodiversity*, tackle differently the issue of decision-making in a context of scientific uncertainty. The *Cartagena Protocol* gives the precautionary principle a greater importance than it has in the *SPS Agreement*. If both treaties allow the adoption of measures restricting international trade, those taken within the SPS Agreement (article 5.7) can only be provisional – they must be completed by additional information and reviewed within a reasonable period of time. This more or less restrictive implementation of precaution addresses the broader issue of the relations between environmental conventions and WTO agreements. Consequently, we may wonder how Switzerland, which has been active in the negotiation process of the Protocol, will interpret its obligations on the matter.

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