THE DEBATE ON THE RISK OF GENETICALLY MODIFIED (GM) FOOD: THE POLITICS OF SCIENCE

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ABSTRACT

Scientific research on the use of genetic engineering in the production of new food is facing a difficult situation. Further development in this field is being impacted more and more by the debate on the risk of GM food, where consumers' tools and the ability to influence decision-making are being enhanced. In Norway regulatory mechanisms have been introduced to address a wide range of GM-food risks, but at the same time have created certain obstacles for scientists and industry. Not yet using their most potent tool – the market - Norwegian consumers have succeeded in influencing the attitudes of industry and, to some extent, scientists with respect to GM food. Value commitment has been successfully mobilized by consumers and other stakeholders against the use of genetic engineering to solve some of society's problems. Scientists do not appear to possess adequate social resources to support their point of view. Their strategy in the generation of these resources is to participate in the control function together with the rule-enforcing agencies, and to propose projects on GM- food risks. The combination of democratic public participation and strong regulatory provisions may, however, have hidden drawbacks.

CONTENTS

1 INTRODUCTION. 1

2 THE OBJECT AND PURPOSE OF GENETIC MODIFICATION, AND THE CONSEQUENCES FOR ACCEPTANCE IN NORWAY. 3

3 WHAT SOCIAL RESOURCES CAN NORWEGIAN GENETICISTS USE? 7

4 CONSUMERS AND THEIR NEW POSSIBILITIES. 15

5 CONCLUSIONS 19

1 INTRODUCTION.

The process of social accommodation of modern biotechnology[1] has proved to be much more complicated than expected just few years ago. The spiral of development of this technology follows its own particular pattern in each country. After a moratorium proclaimed by scientists in the USA more than 20 years ago, another moratorium has been proposed in connection with the growing and commercialization of genetically modified (GM) plants and in connection with commercialization of the recombinant bovine growth hormone (reBGH) (Pure-Food-Action 2000; Min 2000; MHV 2000). The complicated political issues regarding genetically modified (GM) food can be seen as a prelude to these events. The idea of introducing a moratorium is again being aired and beginning to dominate public opinion in some European countries and, to a lesser degree, in the USA. In Norway, for example, an alliance of consumers, environmental and other organizations has demanded a 10-year moratorium on genetically modified food (MHV 2000).

As the study by Sheila Jasanoff has demonstrated, there are differing accounts of risks from genetic manipulation in the US, the UK and Germany (Jasanoff 1995). Cultural differences contributed to constructing biotechnology as a policy issue during the 1980s, but in the end the political framework in each of these countries managed to provide insurance against social and political unrest. However, new proposed moratoriums and their histories indicate that the situation is once again unbalanced. The absence of an international consensus on safety in connection with many GMO issues, which recently has become more evident, has made national governments to search for their own models to safeguard the public. Recent years bear witnesses to new developments in many countries, where approvals for commercialisation of genetically modified organisms (GMOs) were withdrawn, resistance campaigns against companies producing GMO were organized and so on. One of the reasons for this is that science could not play the role, which the public expected of it (especially when it comes to food safety expertise). At the same time consumers' awareness, activity and tools for participation in decision making have been developed. The objective of this work is to study the Norwegian situation, which represents an interesting example for understanding how the science-consumer relationship in this new reality functions, and what conditions have affected its development.

[1] **T**his term was used in the majority of the articles on the issue, but we shall use further more corresponding – "gene technology".

In section 2 we analyse the causes of the particular restrictive attitudes towards the use of gene technology in Norway. The object, purpose and the need for different types of genetic modifications, chosen by international research, appear to work against its acceptance in Norway. Another contributing factor is that scientists often cannot convince decision-makers to consider their point of view. Section 3 provides some clues to understanding the difficulties the geneticists are encountering, among these, the lack of social resources and strong formal rules. Section 4 discusses the strong and weak sides of consumer influence on GM- food policy. Some of the above mentioned issues have been considered on a more general level related to global mega trends in connection with interplay between technology and human values (Solem and Brattebø 1999).

2 THE OBJECT AND PURPOSE OF GENETIC MODIFICATION, AND THE CONSEQUENCES FOR ACCEPTANCE IN NORWAY.

Norway is one of the European countries, where the majority of people consider the use of genetic engineering in the production of new food to be risky (Nygard and Almås 1996). In 1997 Norway was the first European country**,** which demanded obligatory labelling of GM food (Jordfald 1999). Norway has the strictest laws regulating various applications of biotechnology in Europe (OECD 1998). The applications for commercialization of genetically modified organisms (GMO), which have been approved in the European Union, have generally been rejected in Norway (MD 1999). Norwegian food products, available on the market, appear to contain virtually no GM components (Genialt* 1999). There are of course a number of complex reasons for this situation, among them structural and cultural patterns characteristic of the Norwegian system. The Norwegian system of governance, for example, which is based on the parliamentary principle, has developed a culture determined by homogeneity, cooperation and low tension (Christensen and Peters 1999). Whereas the country, it seems, has reached a consensus about its attitude to GM food, the debate on risk issues is still going on.

The risk debate on the connection with the introduction of genetically modified food in Norway embraces a large range of issues. Among them are the risks represented by GMOs to the environment and biodiversity, possible risks of GMOs to human health, the benefit versus risk issue and the need for GM food in this country, as well as ethical issues.

The application of *Arena Theory* to understand the risk debate (Renn 1992) may provide a useful tool for analysing some aspects of the Norwegian situation. The social arena where the policy on all these items is decided is crowded by a plethora of stakeholder groups. The stakeholders include organizations opposed to Norwegian membership in the EU or opposed to the World Trade Organization, Norwegian Family and Women's associations, environmentalist associations, farmers' and consumers' organizations and many others; all of them with their own motives for providing social input in the policy process. However, the principal stakeholders are scientists, consumers, farmers and industry; for whom the stakes connected with the outcome of the decisions on the research and introduction of GM food can be high. For consumers globally this is determined by the important role played by the food industry in everyday life. Here they must take decisions much more often than in other areas. This

is also influenced by the fact that food safety evaluation procedures, based on the concept of substantial equivalence, do not cover many important issues of consumer protection (Gaivoronskaia and Solem 1999). The influence of consumers in the arena may depend on the particularity of the national situation. In Norway, for example the position of consumers and their ability to provide feedback on scientific projects is strengthened due to the inadequate involvement of industry in its role as a proponent of gene technology in the social arena (Gaivoronskaia and Solem 2000). Scientists can be affected by this situation, because the research in this field is guided to a considerable degree by the outcomes of the decisions already taken. This field of science in fact also needs a high degree of public acceptance to ensure its legitimacy (Hasse 1995). We shall look more closely at how much influence geneticists in Norway have on the decision-making procedure pertaining to the use of gene technology.

The objectives of the scientists working in genetics may be identified from the selection of interviews. Research should provide the possibility to find the solutions to society's problems with the help of genetic engineering and to carefully evaluate the risks involved. However, there is a problem present in view of the object and purpose of genetic modification of plants chosen by international research. If we consider GM plants, especially first generation ones, many of these are incompatible with the Norwegian climate and conditions. From 31 applications for the commercialization of GM products in the EU, 13 cases (for example tobacco, maize and cotton) represent cultures that cannot be grown in Norway or will have very limited cultivation areas (MD 1999). For example, the Monsanto application for the commercialization of glyphosate resistant GM maize was judged by the Norwegian Biotechnology Advisory Board to have no social usefulness due to the incompatibility of this culture with the Norwegian climate (BTN 1999).

Another aspect**,** which affects attitudes, is the purpose of modification. This is often viewed differently from one group of stakeholders to the next, and in the case of clear benefits to industry it is especially subjected to criticism. One example of this is the case of herbicide resistant crops, which corresponds to 21 of 31 GMOs applications in the EU according to data available in July 1999 (MD 1999). The majority of herbicide resistant plants are looked upon very sceptically both by the scientists themselves and by other Norwegian stakeholders. Tolerance with respect to the extreme climate conditions represents an especially interesting case. The argument that GMOs are incompatible with extreme climate is often used by Norwegian farmers. The representative of Norwegian Farmers' Association on the Biotechnology Advisory Board, B. Iversen noted: " The international research environment does not develop GMOs that are suited to our special climatic conditions" (Genialt 1999). But on other occasions, especially during discussions on some already developed cold-resistant species (plants or fish), various Norwegian stakeholders emphasize the menace of such GM

species for the environment (because of their higher survival capabilities) or potential health risk factors (Hindar 1999; Jordfald 1999). Thus, there seems to be no agreement among the various stakeholders when it comes to deciding whether cold resistance developed by means of genetic engineering: represents a benefit or a risk factor.

The examples of undeniable benefits of GMO application have not become issues of wide debate. Some of the GMOs internationally used in food production, such as chymosin produced with Aspergillus niger, genetically modified mould culture (Hansen 1998), may also be of interest to Norway as they give such benefits as less impact on the environment, better and new food qualities. Another example is the natural pigment astaxanthin**,** which controls the colour of fish and shrimps and is used as colouring agent in food. Fish cultivators normally use a chemically synthesized pigment to give fish the reddish colour appreciated by consumers (Vanda 1997). This pigment may be produced with the genetically modified red yeast (Xanthophyllomyces dendrorhous) developed by scientists at Wageningen Agronomy University (EC 1999), but this kind of application may not be possible in Norway.

However, Norway has its own serious food safety and agricultural problems, which could be resolved with the help of genetic engineering. The object and purpose of genetic modification, projected by scientists, may be in complete accordance with the needs of society. These cases demonstrate two types of development. Met with the criticism expressed by other stakeholders (such as environmentalists or some colleagues) at home, the initiators may try to establish international cooperation and succeed in getting support from, for example, the European Commission. One such example is the project aimed at controlling the grey mould that attacks of strawberries (Botrytis cinerea) and causes fruit rott disease (Iversen 2000). Scientists plan to use gene modification to create fungus-resistant strawberries that can be cultivated without the use of pesticides and under marginal climatic conditions.

In another case a solution to a problem that involved using gene engineering was rejected by the authorities. However, they received support from some scientists working in the same field, who might have been competing for funding (Odin 1998; Bergens Tidende 1999). This case involved the salmon parasite Gyrodactylus salaries**,** which was introduced in Norway in the 1970s. The parasite has now spread to 40 Norwegian rivers. It appears to have dramatic detrimental effects on the environment and on regional and national economic conditions. The strategy for tackling this problem is to treat on the treat rivers with plant toxin rotenone. Unfortunately, after some years the parasite returns in environment (Mo 1999). But there are many indications that certain species of salmon have an inherited resistance to Gyrodactylus. Some scientists have suggested finding the salmon gene responsible for the resistance to Gyrodactylus and using it to make all salmon resistant. This option was, however, rejected by the

authorities, environmental organizations and some scientists working with gene technology of fish (Bergens Tidende 1999).

In both the above-mentioned cases geneticists could not convince other Norwegian stakeholders (and the regulatory body in question) that the proposed solution to the problem would not present additional risk and would be optimal in terms of benefits for society.

In this context the objectives of Norwegian scientists may be seen to be to provide convincing evidence in the risk debates, which gradually could change the restrictive attitudes of consumers and of the other stakeholders towards the use of genetic engineering. Improved communication with the public is another important objective.

The creation of a favourable framework for research with interdependent links is also important. Scientists have an objective to obtain more funding for basic research, so as this will help provide better knowledge about risk assessment. It would be beneficial to change the balance between resources put into new and traditional fields, stimulating the research that can produce innovation. Restructuring of the university system in such a way that it will adapt faster to the changes in science could also be a significant contribution in this direction. Another obstacle to overcome is the time factor, where delays in the funding of scientifically innovative projects may be catastrophic. Molecular genetics for example, has become the fastest developing field of science, and funding delays may cost some scientific groups their leading position.

3 WHAT SOCIAL RESOURCES CAN NORWEGIAN GENETICISTS USE?

To reach its aim, each of the stakeholder groups present in the arena must mobilize the social resources available - money; power; social influence; value commitment and evidence (Renn 1992). The chances of having points of view considered in the final decision **may** depend on having a sufficient amount of these resources. Stakeholders must act according to the two sets of rules: *formal* rules that are determined by the rule-enforcing agency, and *informal* rules that are created in the process of interaction between actors.

The formal rules, which include laws, acts and mandated procedures concerning gene technology, represent - in the Norwegian case - the strictest rules in Europe. The Gene Technology Act stipulates that manufactured GMOs must be safe for health and the environment, produced according to the principle of sustainable development, and in a way that is ethical and useful for society (OECD 1999). These stipulations serve as a filter for scientific projects and undoubtedly are also reflected in debates on gene technology. The somewhat vague formulation of the concept of ”sustainable development”, however, is open to political manoeuvring or may be used by more influential groups.

There are two mechanisms in Norway for the granting of approval for GM food. The ”Gene Technology Act”, which regulates living GMOs (also used as food), is enforced by the Directorate for Nature Management in cooperation with the Ministry of the Environment. The processing of GMO applications is a long procedure involving several organizations, agencies and ministries. The Ministry of the Environment is a decision-maker in this context, and its role coincides with the mandate of the rule-enforcing agency (MD* 2000). Food produced from GMOs is regulated by food acts that are enforced by the Norwegian Food Control Authority (Jordfald 1999). The rule-enforcing agency as a decision-maker occupies a central place in the arena, and all stakeholders communicate with it to voice their claims.

In 1991 Norway created a special body, the “Biotechnology Advisory Board” which advises on the application of the laws in force. It is an independent advisory body, nominated by the government (Appolon 1996). Scientists, consumers, representatives from professional organizations and some associations sit on this board**,** which helps to balance interests in connection with GMO issues. The main functions of the board are the assessment of principal or general questions of biotechnological reality, the ratification of proposed changes to the laws and the approval of application under the Gene Technology Act, as well as the acts and regulations on the use of gene technology in medicine. The board is also responsible for

informing the public and acting as a liaison between the various stakeholders.

Social influence. Among the resources available to scientists, social influence may prove one of the most important for their purposes. Social influence operates through the media of *reputation* and *rewards*, which can correspondingly generate trust and prestige. Some components in this formula to produce social influence are, however, lacking. One of them is trust in science.

The Norwegian scientists interviewed realize that the lack of trust the public has in science represents a problem whenever the debate about GM food takes place. This problem is hardly new in Norway and other European countries. In 1996 the Norwegian Euro-Barometer showed that only 13% of the participants had trust in university/school sources when asked for their opinion about the most reliable source of information on biotechnology (Nygård and Heggem 1996). The public authorities were considered the trustworthiest sources in Norway, followed by consumer organizations and environmentalists, and only then came the authority of science. This does not appear unique to Europe, with the exception of the very high level of trust placed in the public authorities, which is special and attracts attention.

The reasons for the lack of trust in scientists, especially in connection with food safety, are evident and have been widely discussed on several occasions. The situation in Norway reveals some general and particular features. The country's history and socio-economic development is different from the rest of Europe. The long, virtually hegemonic era of social democracy, in particular during the reign of Einar Gerhardsen (Norway's longest serving Prime Minister) following the German occupation of the country (April 1940-May 1945) has set its mark on Norway. The Labour Party's "common man ideology", was no doubt a principle**,** which may have undermined the role of the scientists as principal advisers (Walla 2000). The fact that many (or most) scientists were recruited from the predominantly "upper classes" may (or may not) have created an additional barrier to full political acceptance by the Labourites.

Moreover, some of the scientists whom we interviewed feel that the low level of trust and scepticism shown to scientific innovation are due to environmental problems stemming from industrial pollution. Scepticism to scientific innovation also disrupts the balance between resources put into new and traditional scientific fields, and may have consequences not only for science, but also for society as a whole. The development of new ideas also appears to be threatened by the natural richness of Norway and the many possibilities of exploiting it. In other countries, for example in Germany, public opinion made it necessary to downplay the extent of scientific innovation represented by gene technology (Hasse 1995).

The relatively low profile of the scientists' reputation may be one of the reasons for the lack of trust shown in them. Their reputation could perhaps be improved if, for example, science along with technology could be

considered at some stage as a means of solving serious national economic problems, in much the same way biotechnology was seen as a tool for increasing the productivity in, for example, Australian agriculture in the critical situation in the 90s (Lawrence and Vanclay 1993). Under such circumstances, additional public funding would be appropriated to solve this special problem, or incentives would be created to encourage industry to finance relevant field. Some of the biotechnological applications were viewed in Norway as providing the answers to agricultural problems with respect to enhancing quality and production in farming (Almås 1994). However, in the common opinion of scientists and Norwegian farmers**,** such applications did not offer substantial benefits to farming because of the special environmental factors and the small scale of agriculture units in Norway.

The credibility of scientists generally, and of those geneticists engaged in the creation of useful GM plants and microorganisms in particular could be improved if some other group with recognized influence in society formed a pressure group to advocate the benefits of research. It is argued that the influence of such a hypothetical group could generate trust in the specific actor (Renn 1992). However, this group (or person) should have the characteristics which would make people see them as a kind of authoritative model. If, for example, a person such as Tor Heyerdal would defend the benefits of genetic engineering in Norway, this could in time perhaps change public opinion. Politicians could possibly represent such group in Norway; however a major obstacle here appears to be their lack of knowledge when it comes to scientific issues in this special field. Bearing this in mind**, a** few years ago a group of geneticists proposed a dialogue and exchange of information to politicians, but this opportunity was not grasped.

The reputation of scientists also suffers from the negative symbolism surrounding some fields of science, especially genetics. The origins of this symbolism are to be found in science fiction literature and came to Norway from countries where the debate on the risk of genetic engineering and undesirable consequences of research was initiated earlier. Typical responses from the public in Norway in connection GM food are ”we don’t want to be guinea pigs” or ”we don’t want the human body to be a laboratory” (SV 2000). On another occasion, gene research was compared to “hanging a time bomb around consumers’ necks” (Schrødingers katt 1999).

All the above-mentioned facts have tainted the image of scientists as a stakeholder group when they try to mobilize social influence as an input tool for into decision- making process.

Another type of social resource useful in the arena is ***value commitment***, which is very powerful if a stakeholder has the possibility to use it effectively for his or her policy purposes. However, the field of genetics (engaged with the creation of GMOs) appears to provide different options. The concern of the Norwegian Parliament at a very early stage was that biotechnology might develop in an undesired or unintended way, and it

requested a ”White Paper concerning the ethical guidelines for research and development of biotechnology and genetic engineering” (Nielsen 1997).

Value commitment caused Norway to take very cautious decisions regulating GM organisms and food, which - in turn– put constraints on scientists. Arguments in risk debates have been linked to the belief that one should not intervene with nature and that sustainable development and ethical principles should be safeguarded (Alms 1999; AI-1, 1998; Forum* 1999). Terminator technology, for example, was heavily criticised, as it made farmers far more dependent on the companies producing seeds and because of possible negative consequences for third world countries. The agendas groups champion the cause of animal rights and these groups are often provoked by the use of animals for human purposes, or condemn the application of genetic modification to create animals with an ”unnatural state”. Consumer organizations underscore that the attitude to GM food is actually the consumers’ value choice (MHV 2000).

No less important is the fact that omnipotent multinationals (viewed rather negatively) were engaged in research, development and commercialization of GM plants and food. The introduction of GM food was closely connected in the Norwegian debate with the investment by multinational companies of billions of dollar in research (MHV 2000; Forum* 1999). The dominant opinion in this connection is against funding of research by industry and against scientists earning money from research. The impression one gets from some publications is that scientists working in the field of gene technology put profits before human life. Newspapers' headlines have been rather dramatic at times, for example: ”Gene experiments take life, but earn money!” (AI-2 1999).

During the debate in Germany it was noted that this shift of focus to ethical and social impacts has undermined the authority of scientific experts (Hasse 1995).

Only few hazards due to inadequate food safety that have occurred in Norway are suspected of originating from imported food: Shigella epidemia or Salmonella occurrence (St. meld 40, 1996). The groups actively opposed to EU membership never miss the chance to raise the issue of food safety problems in Europe, and the fact that a number of applications for commercialization of GM food have already been approved in some European countries (NEU 1996).

In this way they link the issue of the lack of food safety with food produced abroad (Storstadt 1999), which may in turn escalate the negative attitudes some consumers have with respect to such food. This may then lead people to believe that the more open society becomes and the more consumption is internationalized, the greater food safety risk will be.

Risk debates on GM food also appear to lend support to the idea of safe isolation from other countries, something that science, seen rather like ”an international cultural activity”, contradicts. In the opinion of the interviewed scientists, being a small country, Norway has a lot to gain from increasing its

contact with the rest of the world. However, the respondents do not think that this excludes the necessity for stringent controls on imported food by the authorities.

Evidence, as a resource, could have logically provided scientists with the possibility of shaping policies and changing attitudes on GM food. What do we mean by evidence? In the field in question we mean proof (connected with each particular case) showing that a particular GMO does not represent an environment or health risk. The bulk of such evidence in Norway and other countries is presented by the companies, applying for commercialisation of their products. Such evidence is perhaps more easily understood as "the claim of truth that a social group makes, based on methodological rules and accepted theoretical knowledge" (Renn 1992). It is easy to see that an element of scepticism will enter into the public evaluation of such evidence from the companies aiming for commercialization.

Previous experience from Europe and the USA has shown that only evidence provided by *independent science* that is really influential and the new European Food and Public Health Authority is seen to be independent of industrial and political interests (EC* 1999). This opinion was shared by the scientists who were interviewed in our study and participating in debates in Norway. However, public funding for research in Norway has also limited the possibility of providing independent evidence. Two circumstances, in the opinion of scientists, contribute to this situation. One is the availability of enormous natural resources which permits the country to sustain a high standard of living; the second are the chosen political decisions.

The actual situation, or reality, will eventually correct evidence and fuel further development. Evidence about GM food can be accumulated over time in labs, but should consumer and environmental organizations, in agreement with some scientists in Norway, succeed in establishing a moratorium on this technology (MHV 2000; AI-1 1998), what we can learn from actually using such goods will only become available after a considerable delay.

A moratorium in only one country such as Norway may have various consequences. Failing to consider such consequences usually provides the opponents of gene technology with an important argument. But those who propose a moratorium appear to have a similar problem. It is difficult to imagine now, that all GM food will be taken off the shelves and that the research in this field will be slowed in the USA. This**,** therefore**,** means that evidence can be tested against reality in the US and Japan, where science has more social resources and the public is more benevolent towards gene technology. Another possibility may be that the "guinea pigs" will be found in a Third World country. In both cases such a course of events does not agree with the international role Norway prefers to play, i.e. one with a high profile on moral issues in connection with gene technology.

Should the results of actually using GM food confirm the available evidence as to the safety of employing gene technology in food production and fields related to it, the question that then needs to be asked is: what is the cost of this "wait- and- see" position, both for society and the scientific community in Norway? If we take, for example, the sensible and - for Norwegian society - very important field of aquaculture, what consequences will Norway face, if decision to apply gene technology to solve such problem as fish diseases is delayed? Among other things, it could cost Norway the world leadership in this field.

But looking from the opposite angle, it is hard to find a winner. Let us imagine the worst- case scenario: some European countries have used gene engineering to develop disease- resistant fish and released them into the environment, but the consequences are devastating. The shift of balance in the environment originating in these countries will quickly spread to Norway. As numerous other examples have taught us**,** the environment has very fluid borders and if the deliberate release of some GMO has unfortunate consequences the effects will in fact be less controllable than acid rain.

Thus, scientists in this particular field do not seem to have adequate social resources to exert influence on GM-food policy. The image of science, which possesses powerful resources to make an imprint on society's decision making, is present, however in many interviews. Respondents make frequent references to the possibilities in their field of science in Denmark or in the USA, associating it in a way with an imaginable future for Norway.

A special characteristic of the Norwegian scientists is their conviction that controlling food for the presence of GM components is a vital necessity and their willingness to be involved in GM-food risk research. The rule-enforcing agency is an important point of reference for the respondents. The function of safeguarding the public with respect to GM food has been given to the Norwegian Food Control Authority (NFCA), which the scientists feels is a very competent and efficient body. For example, some scientists from the Veterinary Institute and Food Research Institute have recently participated in a joint project with NFCA on the detection of GM components in food (Genialt* 1999). Researchers working in this field consider that food controls should be performed at the national or local level, but others point to the need for international cooperation. Many feel that the rule-enforcing agency must be strengthened to better cope with its future tasks. In this connection, some scientists have suggested that an independent Norwegian laboratory be organized, whose function would be to analyse products and plants for the GM components (AI-3, 1999). The thinking here is that in the future society may be confronted with "genetic crimes", where scientists themselves are breaking regulations and laws. Hence, there is a need to create *a special body*, prepared to investigate such cases. The prototype for this may be the investigative body established to enforce economic law (in Norway – Økokrim).

Some research groups suggest becoming involved in risk research on GM food (Kroghdal 2000). The group of researchers from NINA (Norwegian Institute for Nature Research) has shown that herbicide tolerant soya sprayed with glyphosate produces more of the plant estrogen than normal soya (Kvaløy et al. 1998). All the above show that scientists have a high degree of trust in the authorities and thus do not differ in this respect from the rest of the Norwegian population. Cooperating with the authorities for the common good may in part be explained by their willingness to generate social prestige.

It is also evident that scientists are very attentive in their declarations, or while explaining the content of their research project, to avoid making a negative impression on consumers. They strive to use the same arguments as those used during public discussions on the risks of GMOs, for example ”it is wrong to introduce non - natural animals into nature” (Apollon* 1996) or ”it is wrong to change the metabolism of salmon”.

Hence, the situation in the social arena where the debate on GM food is taking place is characterized by the lack of some vital social resources by scientists who work in the field of genetics. The lack of social influence is connected with external (international) and internal causes. Among the former we can mention the general direction of the international research on GMOs, which in recent years has been centred on creating plants useful for industrial agriculture and large companies producing chemicals for agriculture. Another may be connected with the poor adaptability of many GMOs with respect to the Norwegian climate. Internal causes include a lack of trust and the limited possibilities for scientists to enhance their reputation. The latter can in part be explained by the strict formal rules the country has.

Value commitment has been mobilized by the stakeholders – opponents of gene technology and was used by them rather successfully to enforce rules and to lower the public acceptance level of risk. Negative symbolism especially when it comes to the application of gene technology to create new foods, has also contributed to this.

The evidence could not provide the scientists with the necessary resource. A number of questions about GM-food risks remain unanswered. The evidence originating from safety studies carried out by multinational companies was devalued in the discussion due to their vested interests. Testing of evidence against reality seems to be a problem, which as yet has not been confronted constructively in Norway.

Scientists are trying to win over to their side other stakeholders who could help them generate social resources. In many other countries such stakeholders are represented by industry (Hansen 1999). However, in Norway formal rules appear to be one of the limitations preventing industry from cooperating with science.

4 CONSUMERS AND THEIR NEW POSSIBILITIES.

Discussions in connection with gene technology and GM food have raised awareness and encouraged the activity of the various stakeholders. For consumers, the use of genetic engineering in food production has become a major problem, and due to this their interest in such issues as environmental and food safety, has reached a new level.

'Consumer' as a term has become a positive antithesis to 'consumerist', which seems lately to be a concept with more negatively psycholinguistic connotations. The consumer's image is now linked to our democracy research, associated with a search for deeper knowledge about new technologies as well as posing ethical questions about future generations. It has gained a new status as the *object of research*, especially noticeable in connection with consumers' active involvement in the problems of gene technology.

A number of important European and US research projects have been dedicated to the study of consumers' knowledge, attitudes and expectations with respect to different applications of modern biotechnology (Nygård and Heggem 1996; Fjæstad 1997; Iversen 2000). Multinationals are investing large sums of money in order to understand how to change the negative attitudes of European consumers to GM food.

Together with the other groups (including environmentalists and public interest groups) consumer organizations in various countries have filed lawsuits in connection with GM- food issues. Some of these are the commercialization of BT-crops, of crops with antibiotic resistance gene and reBGH safety concerns. Consumers have organized various alliances with other groups, for example environmentalists, in order to develop common strategies. They have tried, with some success, to influence the European market for GM food, and have convinced supermarket chains to join their side. In the UK they have also managed to change the course of development initially planned by government and insisted on a moratorium on the commercialization of GM crops.

The consumers' willingness to participate in decision-making about complex problems linked to GM food has stimulated the development of consensus conferences in a number of countries. Successful examples of this are the Danish and Norwegian cases (Fixdal 1997; Sluttrapport LFK 1996); the European example may have also influenced the organization of the discussion meetings on GM food in the USA, where this tradition was not present before (Purefood News 2000).

In Norway consumers appear to have a rather strong social influence on GM-food policy. The Advisory Board on Biotechnology, dealing with the

issues related to the interpretation of the law on gene technology, includes a representative from the Norwegian Consumer Union. In 1996 Norway organized a consensus conference with 16 lay people and 15 experts who discussed questions on the risks of GM food to health and the environment, the labelling of such food and consequences of scientific uncertainty (Sluttrapport LFK 1996). The conclusion of the panel was that it is premature to introduce GM food in Norway due to the uncertain consequences for health and the environment, and to the fact that currently there is no need for such food in the country. The panel advised the scientists to concentrate on health risks and long-term effects of the technique on gene structures. The time factor must be important for obtaining more scientific evidence.

The food producing industry is strongly influenced by consumers' attitudes and has chosen not to be engaged actively in communicating the benefits of possible application of technology. Neither is this industry inclined to use this technology at present, demonstrating a considerable risk aversion in this connection. During a recent campaign on the testing of food products with the purpose of identifying GM components, it was found that Norwegian food contained only small traces of GM components, while about one third of an imported food contained more than the amount permitted by law - 2% (Genialt* 1999). Another case is connected with the salmon feed "Ecolife", which the producers have chosen to label: " 2% of the raw material may be gene modified", because they were not entirely sure of the measurement methods employed (Gennytt 2000). This move was a result of the sensitivity to consumer opinion; actual inspection of the content of fish feed has not been undertaken by authorities since the introduction of the law. In this connection the consumers' groups have raised the question that the approval procedure for fish and animal feed with GM components must be adopted.

Recently 15 organizations have joined the campaign "Gene food – No, thank you" (MHV 2000). This campaign supports the position of supermarkets and the food industry sceptical to the production and sale of GM food. An important part of the campaign is the demand to declare a 10-years moratorium on GM food in Norway. The declaration, however, contained some contradicting elements. It is stated that "we refuse as consumers to be guinea pigs for scientists and the food industry", but at the same time "we need this moratorium to gain more knowledge about long-term effects on men, animals and the environment". How then, should this knowledge to be obtained? The two statements demonstrate the rather confusing consumer position, especially when moral claims are also being made.

According to the prognosis of Norwegian scientists, consumers will not accept GM food in the foreseeable future. The scientists take the consumer attitude to GM food very seriously, believing that it should be one of the main factors determining the development of products. But the scientists find

that consumer attitudes, indeed also the attitudes of politicians in Norway, are not based on a large degree of knowledge and facts. There are many general reasons why consumers have insufficient information about food and possible risks. For example, inadequate transparency of the entire food system (also in Norway), the consumers' lack of a technical understanding of food processing and (or) the wrongly held conviction that scientists are making an insufficient effort.

We can look at two cases to exemplify this situation. The first case is the revelation in 1998 that some cheese producers in Norway were treating their cheese with antibiotics to prolong shelf life. This is especially controversial, as Norway was among the first countries to tackle the antibiotic resistance problem, and as a result has reduced antibiotic use in animal and fish feeds, and banned all GMOs with antibiotic resistant genes. A perfect example of the usefulness of gene technology in this connection is the application of GM Streptococcus termophilus T102 for the detection of antibiotic traces in milk, proposed by Valio, Finland (Sluttrapport LFK 1996). Coming back to the risk from consuming antibiotics, does the above-mentioned mean that we are once again confronted with the same situation, that is: while preoccupied with some uncertain and unknown risks from GMO, we are actually being affected by risks from conventional food, but are unaware of this fact?

The second case involves the lack of knowledge consumers have as to the possible risks of contracting BSE from consuming jelly, prepared with imported collagen (again associated with the Norwegian situation). Consumers are simply unaware of this fact.

Value commitment has become an important part of the consumers' strategy. The scepticism Norwegian consumers have when it comes to GM food is certainly based on their previous attitudes, especially attitudes about nature. Expressions such as "the food must be clean, not manipulated..." or "it is not right to change the metabolism of salmon..." exemplify this attitude. It is interesting to note that salmon in a way has become the symbol of virgin nature**,** which should not be touched by human hand. The idea of creating of "super-salmon" by introducing genes coding for the growth hormone has always been met with strong opposition from consumers and other stakeholders (BTN* 1995; Schrødinger**'s** katt 1999). The suggestion of other types of genetic manipulation in connection with salmon has also not met with success.

Another important factor under value commitment is the negative consequence of introducing of GMOs in the Third World. This is an important argument in the present discussion in Norway on the adoption of the biopatenting. Recently this argument has been the theme of the public meeting organized by the Biotechnology Advisory Board (Genialt** 1999).

The results of our interviews show that there are indications that more understanding exists in Norway among scientists and consumers in relation to GM food issues than in many other European countries. This understanding is expressed in the views of scientists about the need for

extensive risk analyses of GM food, their recognition of the importance of the consumers' participation in decision-making, and scientists identifying with the role of the consumer (Gaivoronskaia and Solem 2000). However, the consumers' involvement is viewed more as a necessary attribute of the democratic system than some objective value that can be added as a result. A similar observation about the willingness of the scientific community in Norway to view the problems from society's angle has been made by Almås (Almås 1994).

Hence, consumers in Norway are provided with mechanisms for influencing GM food policy. Social influence and value commitment are important in this respect. They have influence on the food industry choices and easily can create alliances with other stakeholders who have similar interests. However, their platform is sometimes weakened by the absence of knowledge, contradictory statements and a certain negative approach to science, which as was stated above, is based on the negative symbolism surrounding it. Norwegian consumers manage to exert their influence on society's choice without directly using the "market" tool.

5 CONCLUSIONS

Norway is a country where with the active participation of consumers various stakeholders have created **a** powerful platform opposed to the introduction of GM food. Regulatory mechanisms cover a wide range of risk**s** in connection with GM food. Together with other factors these strong regulatory rules, have created a difficult situation for scientists and industry. Scientists find themselves in a position where they encounter difficulties mobilizing social resources and influencing the debate and decisions taken on GM food.

Various reasons may explain the insufficient social influence of science in Norway. The direction chosen by international research on GMOs has favoured the creation of GM cultures, growing them in vast areas with a moderate climate; hence many of them were not suitable for Norway. This is then one of the issues impeding the influence of science and reputation of science. Consumers associate the work of scientists with profits from research for multinational corporations, something that is considered to be negatively. The low degree of trust the public had in science and the absence of the possibilities to build reputation has contributed to this situation. Nor do evidence and value commitment provide the scientists with the necessary resources. These circumstances affect the strategies scientists opt for with respect to regulatory agency and consumers, both of which have more influence in society. By becoming involved in the control functions together with the authorities, the scientists may in fact be generating their own lack of resources.

The system described has many positive consequences in terms of better understanding among the groups of scientists, consumers and authorities, and producing more democratic mechanisms for public participation and offered society better protection. However, there are hidden shortcomings. It is not difficult to imagine that a better framework (and public opinion) favouring the development of science in other countries will a) cause some scientists look for opportunities abroad; b) leave industry at a distinct disadvantage compared to its foreign competitors; c) provide a better level of protection for consumers against various risks, also those connected with food in these, more science- oriented countries.

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