Siemen van Berkum
Jos Bijman
Marshall Martin
Berit Nygård

Mededeling 565

THE FUTURE OF BOVINE SOMATOTROPIN IN THE EUROPEAN UNION

A STUDY ON PUBLIC ATTITUDE, DAIRY POLICIES AND COMPETITIVENESS OF THE EU DAIRY SECTOR

June 1996

Agricultural Economics Research Institute (LEI-DLO)

Purdue University
Department of Agricultural Economics

University of Trondheim
Centre for Rural Research

REFERAAT

THE FUTURE OF BOVINE SOMATOTROPIN IN THE EUROPEAN UNION; A STUDY ON PUBLIC ATTITUDE, DAIRY POLICIES AND COMPETITIVENESS OF THE EU DAIRY SECTOR
Berkum, Siemen van, Jos Bijman, Marshall Martin, and Berit Nygård
The Hague, Agricultural Economics Research Institute (LEI-DLO), 1996
Mededeling 565
ISBN 90-5242-355-5
111 p., tab., fig., appendices

Within the European Union (EU) the use and sale of recombinant bovine somatotropin (rBST) has been banned until December 31, 1999. Within a few years, a new decision must be made on the future of rBST use in the EU. Two issues will be, in our opinion, decisive in the political process: a) the public attitude in the EU towards rBST, and b) the socio-economic impact of using/not using rBST in EU dairy farming. These two issues are the main elements of the analysis in this report.

From studies of public attitude towards biotechnology one may expect that the current negative attitude towards rBST will not easily change. Especially where this attitude is based on fundamental values and beliefs, for instance on the treatment of animals, no quick change can be expected. However, experiences in the USA show that consumer concern *ex ante* does not necessarily lead to adverse consumer behaviour once rBST is introduced. Adoption of rBST by American dairy farmers is mostly in line with *ex ante* adoption studies, with some differences in different states due to variation in the structure of the dairy industry.

For the EU, the most decisive element in the decision making on the future of rBST use is the continuation or abolishment of the milk production quota system. Under four different scenarios we have studied the potential socio-economic impact of rBST use. The distinguishing element in the scenarios are yes/no quota system and yes/no rBST. Only when the production limitations are lifted, the use of rBST may become economically desirable, as it may help strengthen the competitiveness of the EU dairy industry. Not only the reaction of EU consumers, but the reaction of consumers in the major EU export markets is important.

Dairy Farming/Biotechnology/USA/European Union/Dairy Policies/Adoption/Economics/Structure/Public Attitude

---

CONTENTS

Page

Page

PREFACE

The development of biotechnology and its applications raises a number of important questions concerning its impact on people, society, and markets. The European Commission sponsors activities to study those impacts in its RTD programmes in the field of biotechnology, in particular its socio-economic impact and public attitudes to biotechnology. The Commission services have participated in the public debate through a number of *ad hoc* activities, like support to meetings and studies.

The Commission's White Paper on 'Growth, Competitiveness, Employment' confirmed the importance of such activities and stressed that they should be continued and logically further developed.

The debate on biotechnology often involves sophisticated argument. Differences in knowledge and perception of facts and data lead to misunderstandings and lead to deadlocks in the debate. Therefore provision of accurate information and access to it are of primary importance. In this realm the Biotechnology programme launched a call for proposals for studies, to support experts working on specific subjects. Grants have been attributed to a wide range of subjects (risk analysis, education in biotechnology, public perception, industrial strategies, employment aspects, etc.). Their selection took place on the basis of a peer review evaluation. The studies collect relevant facts, discuss and explain them, and thereby generate information useful to the general public or for public policies.

This particular study here deals with the future of recombinant bovine somatotropin (rBST) in Europe. It analyses present-day differences in public attitudes to rBST, the state of regulatory policies, and evaluates a number of scenario's for the EU dairy sector under different policy alternatives.

This report represents the studied opinion of experts working on the subject. It is published as a contribution to the debate on biotechnology. Thus, this study is meant to be a valuable contribution to this debate, but does not reflect otherwise the position of the Commission. There might also be publications in this series in which other experts draw different conclusions about the same subject, and their comparison will only complete the picture of promises versus realities in the biotechnology field.

This study has been carried out by the following experts:

- Berit Nygård, of the Centre for Rural Research, University of Trondheim, Norway;
- Siemen van Berkum and Jos Bijman, of the Agricultural Economics Research Institute (LEI-DLO), The Hague, the Netherlands;
- Marshall Martin, of the Department of Agricultural Economics, Purdue University, West Lafayette, IN, USA.

Although the study has been a collaborative effort, some division of labour was agreed upon. Berit Nygård has mainly been working on the issue of public attitudes, while Jos Bijman and Siemen van Berkum have studied the economic and regulatory aspects. Marshall Martin has provided the information about rBST use in the USA. Together the researchers are responsible for the conclusions and the report as a whole.

Integral to the project was a workshop held, on January 30, 1996, to discuss preliminary findings of the study with various stakeholders. At the workshop a good discussion took place about these findings as well as about broader socio-economic issues of agrobiotechnology. Wherever possible, the comments of the workshop participants have been incorporated into the main report. Appendix 1 gives a brief report of the workshop.

The final text of this report has been written in February 1996. Therefore, changes in US farm commodity programs, as part of the 1996 Federal Agricultural Improvement and Reform Act, have not been incorporated in the analysis.

The researchers would like to thank all those who have directly or indirectly contributed to this project. In particular, we are grateful to the workshop participants for their very constructive comments and suggestions.

Agricultural Economics Research
Institute (LEI-DLO)

Director, L.C. Zachariasse

European Commission
Directorate General XII
Biotechnologies

R. van Vliet and A. Klepsch

The Hague/Brussels, June 1996

SUMMARY AND CONCLUSIONS

Within the European Union (EU) the use and sale of recombinant bovine somatotropin (rBST) has been banned until 31 December 1999. The December 1994 Council decision was based on two considerations. First, the introduction of rBST would not be in line with reform of the Common Agricultural Policy (CAP), as it would negatively effect dairy and beef markets. Second, a strong aversion against the use of rBST existed among consumers. The Council feared, together with the European Commission and the European Parliament, that the consumption of dairy products and beef would decrease considerably and that the image of dairy products would be negatively affected. Another issue supporting an extension of the existing ban was the ongoing uncertainty about the impact of rBST use on the health of the cow.

Within a few years, a new decision must be made on the future of rBST use in the EU. Two issues will be, in our opinion, decisive in the political process: a) the public attitude in the EU towards rBST and b) the socio-economic impact of using/not using rBST on EU dairy farming. These two issues are the main elements of the analysis in this report.

Besides the socio-economic impacts, other issues play a role in the societal debate about rBST, and about agricultural biotechnology in general. Although these other issues only receive minor attention in this report, it is useful to list them because they influence public attitude towards biotechnology. Discussions on the merits of agricultural biotechnology usually deal with a) the safety of biotechnology products for human consumption; b) the short term and long term impact on the environment; c) the socio-economic impact on farming, particularly the changing structure of agriculture and the expected domination over agriculture by large agrochemical and pharmaceutical companies; d) the impact on health and welfare of animals; and e) ethical aspects.

Regulation of rBST

Historically there is probably no other agricultural technology that has aroused such large and broad social and political debate even before its introduction as the case of rBST. Because biotechnology is a new technology, there has been uncertainty as to how this technology should be regulated. Should biotechnology products be assessed and approved under existing regulation, or is there a need for new legislation?

The regulation that eventually resulted from the social and political debate over rBST is a reflection of the influence of different interest groups, of the political sensitivity of the issue, of the latitude regulators have and of the decision making process itself. As these are country specific issues, different countries have come up with different regulation on rBST. While the USA and approximately twenty other countries have approved the use of rBST, the EU has placed a ban on its sale and use, and others, like Canada, have yet to make a decision. But even within countries, regional governments may implement additional regulations, as such labelling requirements in some states in the USA.

Consumer acceptance and public attitude

Consumers are increasingly critical about the quality of food products. Quality includes traditional characteristics like taste, appearance and price, but increasingly also encompasses the production methods used on the farm. Thus, in the case of milk derived from rBST treated cows, consumers not only are concerned about the food safety, but also about the impact of rBST use on the environment, on the health and welfare of the cow, and on the structure of European dairy farming. The quality concept also has an ethical dimension, in the sense that consumers prefer ethically justifiable production processes.

No international comparative studies exist on how European consumers would react to rBST-derived dairy products. What is available, are the EU-12 Eurobarometer studies on public attitude towards biotechnology. In the 1991 and 1993 editions of the Eurobarometer, questions were asked about the knowledge and risk perception of biotechnology and genetic engineering. Although the Eurobarometer does not contain any specific questions on consumer acceptance, the conclusions can provide some indication of the future acceptance of biotechnology products like rBST.

From the Eurobarometer study it appears that the public is more likely to accept genetic engineering of plants and micro-organisms than genetic engineering of animals. Although rBST has nothing to do with genetic engineering of animals, the combination of biotechnology and animals makes the average consumer wary. The Eurobarometer focused on knowledge of biotechnology and sources of information on biotechnology. There is a large variation as to the trust people put in different sources of information on biotechnology. Consumer and environmental organizations receive the most trust, and they have been very critical about rBST. The biotechnology industry, such as producers of rBST, was not considered very trustworthy.

Besides the general knowledge base of individuals, the public attitude is also influenced by the public discourse on biotechnology. The intensity of the discourse as well as the articulation of the different interests effect the national opinion on new biotechnology. While in Great Britain and the Netherlands the concern for animal health is especially mentioned as a reason to reject rBST, in Germany the expected negative consumer reaction is also a major reason for rejection. In Norway, Sweden and Finland, the farming community is strongly opposed to using rBST, as it conflicts with the current practices of small scale farming, strict disease control, restrictive use of antibiotics and no illegal use of hormones. The productivity enhancing effect of rBST is not considered very important in the Scandinavian countries, due to the relatively large government protection of the dairy sector.

A large part of the differences in public attitude towards biotechnology can be attributed to cultural differences and variation in fundamental values. Recent studies indicate that people's attitudes towards modern biotechnology are based on fundamental values. In contrast to (scientific) knowledge, fundamental values remain relatively stable over time.

Farm structure and adoption

The structural features of dairy farming differ considerably in Europe. The average EU dairy farm has 19 cows. While Norwegian and Finnish dairy farms are much smaller, with 12 and 13 cows respectively, the average dairy farm in the Netherlands is much larger with 40 cows. The Netherlands, Germany, France and Denmark are the most important exporters of dairy products in the EU. However, farm structure is quite different in those countries. In Germany and France, more than 50% of the dairy farms also have other farming activities. In the Netherlands and Denmark most (about 70%) of the dairy farms are specialized dairy farms. In all European countries, dairy farms are becoming larger, while the number of farms is declining.

The literature on adoption of new technologies suggests that larger and more productive farms, with younger operators and newer technologies in use are more likely to adopt rBST than smaller farms, with less productive cows and older farmers. The US experience with rBST so far seems to support this hypothesis, but with two exceptions. First, adoption of rBST has lagged somewhat in California compared to the national average. This is due to the very large herds and the tendency to manage the herd rather than individual cows. Second, the experience in Wisconsin, the second largest dairy state, has been somewhat different than in other states. By November 1994, only 5.5% of Wisconsin dairy farmers were using rBST compared to 11% nationwide. This relatively low level of adoption could be the result of the high level of politicization surrounding rBST in Wisconsin. Consumer concerns about the safety of rBST in milk, along with concern about the economic pressures for structural change in Wisconsin's dairy industry, has resulted in strong resistance to rBST adoption by Wisconsin's dairy farmers. The politicization of rBST in Wisconsin appears to demonstrate that economic as well as social forces can play a role in farmer adoption decisions concerning emerging agricultural technologies.

Dairy policies

Dairy policies in the EU, the USA and Scandinavian countries used to have a lot in common, but also had major differences. On average, dairy farms in the EU receive substantially more support than dairy farms in the USA. Another difference is that in the EU and Norway milk production is restrained by a quota system, while such a system does not exist in the USA. If US dairy production exceeds a certain level of surplus production, support prices are reduced and this would bring down production. In the EU, where price guarantees exist and production is higher than consumption, 'excess' production is sold with (export) subsidies.

EU dairy export

The use of rBST may affect trade patterns and trade volumes. With a quarter of total world production, the EU is the most important milk producing region. The EU is by far the largest supplier of dairy products on the international market, supplying almost half of all internationally traded dairy products. Still, the EU only sells about 11% of its milk production to third countries. New Zealand, the second largest dairy exporter, sells 70% of its production on the world market. Major export markets for EU dairy produce are Saudi Arabia and other Middle East countries, USA, Switzerland, and Japan.

The future of EU dairy export is determined by internal and external factors. The main internal factors are the developments in consumption and the future of the quota system. The external factors are international trade agreements, the enlargement of the EU with Central and Eastern European countries, and production and consumption patterns in third countries. The OECD expects that world prices for dairy products will increase, due to diminishing of subsidized exports (as result of the GATT/WTO agreements), to falling surplus stocks and to growing demand in non-OECD area, notably Asia. Despite these positive market developments, it is not expected that the EU will maintain its current share of the world market, mainly because it has to reduce its subsidized exports.

EU dairy sector under four scenarios

Whether rBST will be used in the EU in the next century is strongly related to the quota system, which also expires at the end of 1999. We have designed four scenarios for the dairy sector in the early years of the 21st century, with yes/no for the quota system and yes/no for rBST use as distinguishing elements. Scenario 1 is a continuation of the current situation, with a quota system and without rBST. This scenario is the baseline, used as point of reference for the other scenarios. Under scenario 1, production will remain unchanged, consumption will increase slightly, new exports will decline due to GATT/WTO commitments, internal real prices will be lower, the number of dairy farms will decline and the number of cows per farm will increase following the current trend in concentration among dairy farms, while regional distribution of dairy production will not change.

Scenario 2 combines a continuation of the quota system with the use of rBST. There will be no change, compared to the baseline, in production, consumption, net exports and internal milk prices. The trend towards a larger number of cows per farm continues, but at a lower rate, because of the combined effect of long term structural growth in the number of cows per farm and a decrease in the number of cows due to the productivity enhancing effect of rBST. There will be some regional concentration of production within EU countries.

Under scenario 3 the quota system is abolished, while rBST is still banned from the EU market. The unrestricted production opportunities result in larger production, lower prices and thus a slightly higher consumption in the EU.

Lower prices will also enhance the EU export performance. The structural adjustment of the dairy industry will be reinforced, with fewer dairy farms, more cows per farm, and regional concentration of milk production in regions with the lowest production costs, like Niedersachsen (G), Bretagne (F), Lombardia (I), West England (UK), the Netherlands and Denmark.

Scenario 4 represents the elimination of both the quota system and the ban on rBST. This scenario can be seen as a reinforcement of scenario 3, as rBST use gives a push to milk production. Internal prices will be lower, net exports will be higher. Internal consumption will only be slightly higher, due to low price elasticity of demand. Structural change will accelerate: more concentration of production on a farm as well as on a regional level.

The abolishment of the quota system is expected to result in increased production and net exports, plus an accelerating of structural change in the dairy sector towards more concentration of production, on a farm as well as on a regional level. The adoption of rBST reinforces these effects: more production and exports, lower internal prices, fewer but bigger dairy holdings, and more regional concentration of production. Those effects may be socially negative if the pace and extent of structural change exceeds certain limits, i.e., if many farmers have to leave the sector.

On the other hand, a scenario without a quota system and with rBST may contribute to improving the international competitiveness of the EU dairy industry, as it creates opportunities for profiting from economies of scale in milk production. Such a structural development may be necessary if the EU wants to maintain its level of production, but has to lower export subsidies.

However, the competitiveness of EU dairy products also depends on quality aspects like food safety and animal welfare. In high income markets like Japan and Switzerland, consumers may not be willing to accept dairy products from rBST treated cows. It is expected that these high income export markets will become more important as export subsidies are reduced. Currently, there is little information on consumer attitude towards rBST in the major export markets for EU dairy products. Consumer research in these countries may provide that valuable information.

1. INTRODUCTION

1.1 Introduction

Bovine Somatotropin produced with the help of recombinant-DNA technology (in this report referred to as rBST), has been one of the main issues in the pubic debate on the merits of modern biotechnology. It is one of the first agricultural technologies to result from recombinant-DNA technology and, partly therefore, one the most controversial. Like all previous new technologies used in agriculture, rBST promised desirable, primary consequences as well as some unwanted, secondary impacts. But unlike other agricultural technologies, rBST has been a focal point in a much larger debate about the benefits and costs of using modern biotechnology in agriculture and food production.

The debate on agricultural biotechnology has focused on many issues that surround biotechnology, but are not limited to agriculture and food. Because biotechnology deals with living organisms, broader issues on ethics, safety and environmental impacts have raised much controversy, especially in the early years of its development. Still, agricultural biotechnology has received more public attention than one would expect on the basis of the position of agriculture in modern society (§ 1.2).

The development and introduction of agricultural biotechnology has raised questions about the safety for humans, animals and the environment; about socio-economic impacts; about how to regulate this new technology; about ethical issues; about intellectual property rights; and public perceptions (Baumgardt and Martin 1991). Most of these issues also are present in the societal debate on rBST (§ 1.3).

The importance of rBST as one of the first products of agricultural biotechnology, together with the continuing uncertainties as to the impact of rBST use, resulted in a politicization of the rBST debate. While scientists continued to disagree on the exact impacts, interest groups differed considerably in their valuation of the expected impacts. Still, governments had to come up with regulations that could meet both social and economic interests and be science-based wherever possible (§ 1.4).

The expected adverse socio-economic impact on European dairy farming, together with the fear that consumers would buy less milk and dairy products if cows are treated with rBST, was reason for the Council of Ministers of the European Union (EU) to ban the sale and use of rBST. This ban is valid until December 31, 1999. Whether, and on what conditions, rBST will be approved after that date depends on what happens with (1) public attitude towards agricultural biotechnology in the EU, (2) the EU dairy policy, particularly with the production quota system, and (3) the international competitiveness of the European dairy industry, especially now that American dairy farmers are using rBST (§ 1.5).

1.2 The debate over agricultural biotechnology

Although the public debate about biotechnology is not only about agricultural biotechnology, the latter has been disproportionately important, relative to its role in the world biotechnology industry, in stimulating and shaping that debate. The relative importance of agricultural biotechnology can be shown by some figures: in 1993 agbiotech companies invested about $85 million in R&D, while biopharmaceutical firms invested more than $3 billion in R&D 1) (Bio/Technology, July and August 1994). Yet, many of the most controversial aspects of biotechnology pertain primarily, if not exclusively, to agriculture and food. These aspects include environmental implications of the release of genetically modified organisms, the awarding of intellectual property rights to life forms, food safety and regulatory concerns, ethical considerations and industrial concentration issues.

This relatively large emphasis on agricultural biotechnology applications is caused by the sensitivity of agriculture and food matters. Consumers are increasingly critical about both the quality of food products and the way they are being produced. First, with abundant food supplies and rising income in the industrialized countries, consumers are putting more emphasis on the quality and less on the price of food items. It is expected that quality issues will increase in importance (Senauer et al., 1991; Steenkamp, 1992). It is difficult, though, to point out exactly what this means for individual products and markets, as food quality is a broad concept. The various dimensions of food quality can be categorized as follows: (1) physical characteristics like taste, appearance and freshness, (2) food safety, e.g., the absence of toxic substances, and (3) characteristics of the production process, particularly farming practices. Consumers tend to favour animal production systems that take into account animal welfare aspects, and plant production methods that are less polluting. In food marketing, more and more attention is being given to the sustainability of farming methods.

Second, in the perception of many, the (small) family farm structure of agriculture is the ideal structure for the well being of the farmer, who lives in harmony with the natural environment, and for producing good food products. Any new technology that may change the structure of agriculture is seen as a threat.

A third reason for the sensitivity of agriculture and food is the cultural dimension of food consumption. Particularly in Europe, what you eat and how and where you eat are still important cultural phenomena and vary from region to region and from country to country. Any real or perceived threat to

---

1) Both figures exclude R&D spending by large, established pharmaceutical and agrochemical companies.

current food consumption patterns is looked at suspiciously. Early stories about the revolutionary impact of biotechnology on food production and consumption have caused much anxiety 1).

1.3 The issues in the debate on rBST

A large part of the public debate about agricultural biotechnology has focussed on rBST. Not only because rBST is one of first commercial agbiotech products, but also because it combined many of the issues that were of importance in the larger debate. The following were/are the main issues in the rBST discussion (see e.g., Hallberg, 1992): health and welfare of the cow, safety of milk and dairy products, structure of dairy farming, environmental impacts, domination over agriculture by large agrochemical and pharmacentical companies, and ethical aspects.

The perceived impact on the *health and welfare of the cow* has led to heated discussions. Hundreds of studies have been conducted. The majority of these studies indicate that no adverse health effects are to be expected. For this reason veterinary advisory boards in both the USA and the EU have approved the use of rBST. However, a few studies do indicate that there may be a negative impact on the health and welfare of the cow. Thus, the debate lingers on and a definite answer cannot be given. Part of the uncertainty results from the health effects that coincide with higher milk production itself, like a higher incidence of mastitis. One of the welfare (and ethical) issues in this debate is about the way rBST is administered to the cows: a fortnightly injection.

As consumers have become more and more concerned about the safety of food, uncertainty about the *safety of milk and dairy products* from cows treated with rBST has long been a major concern. Now, most scientists and other observers agree that the use of rBST does not pose any threat to human health. Still, some scholars disagree on this conclusion. Particularly the higher concentration of insulin-like growth factor-1 (IGF-1) has worried some health scientists. The fact that rBST is a hormone caused additional health worries in Europe, even though BST naturally occurs in the milk. The existing ban on the use of any hormone in animal production, and incidents of illegal use of hormones that are a health threat, has made European consumers very sensitive to the word 'hormone' itself; even though BST is a protein hormone and not a steroid hormone that has been a concern in meat production and consumption.

---

1) This is not to say that food consumption patterns do not change. Indeed they do change rapidly, particularly in Europe. But a change in consumption habits is an individual choice, while a change in production technology lies outside the scope of the individual consumer.

Another major concern is the impact on the *structure of dairy farming* and on rural communities. It was expected that the increase in milk production per cow of 10 to 15% would benefit large farms more than small farms. Since rBST is administered to a cow individually, its application is scale neutral. However, realization of the production increasing potential will require rather intensive monitoring and management of feed rations, milk production, animal health, breeding programmes, and overall system coordination. These monitoring and management activities and the equipment needed are not scale neutral. Larger farms tend to have better management and are more likely to have computers for monitoring feed intake, health and production per cow. Many believe that rBST will increase the size and reduce the number of dairy farms. Since many small farms would go out of business, this process would also negatively affect the viability of rural communities. Thus, a shift in production may occur from regions where production is more extensive to regions where production is more intensive. In the European context, of course, the potential for such a shift is limited by the system of national production quota, but within countries a regional shift may occur.

Although many *ex ante* studies have been carried out on the potential effect of rBST use on the structure of dairy farming, it is extremely difficult to arrive at definite answers. Most observers agree on the conclusion that rBST will intensify past trends in agriculture, like fewer and larger farms (Hallberg, 1992: 298), but the exact figures depend on many social and economic factors, the management profile of the farmer, the size of the farm, the price of milk and the existence of a quota system. In the EU, with its quota system for milk production and its large surplus of dairy products in the late 1980s and early 1990s, many people in the dairy industry have their doubts about the desirability of a productivity enhancing technique like rBST, even if it reduces per kilogramme production costs.

Some people have also been concerned about the *environmental impacts* of rBST use (this issue is related to the structure of agriculture issue). Because large farms, with intensive production methods, are more likely to adopt rBST and thus benefit from it, smaller farms, often with extensive production methods, would go out of business. Thus, the intensification of dairy production could lead to more concentrated emission of minerals and ammonia, and thus environmental pollution. It may also have a negative impact on the attractiveness of the landscape, an issue that is related to the growing importance of tourism.

A further item in the discussion about agricultural biotechnology in general was the fear for increasing *domination over agriculture by large agrochemical and pharmaceutical companies*. Although this domination is more an issue in the debate over plant biotechnology (e.g., the fear of package sale of seeds and agrochemicals), the development of rBST by a few large agrochemical and pharmaceutical companies was looked upon with suspicion. This feeling may have been even stronger in Europe, since the companies developing rBST have been mainly American.

In addition to the debate about the factual impact of rBST, there is also the issue of how to value these facts. This is basically an *ethical discussion*, where values and beliefs are important. According to Thompson (1992), the ethical aspects of rBST fall into three categories. The first group of ethical questions concern the impact felt by dairy farmers, particularly those farmers who are adversely affected. Will the costs and benefits of using rBST be fairly distributed? The second group includes the impact on dairy cows. If rBST is to have certain negative animal welfare implications, are we willing to accept those? The third group of ethical questions include environmental impacts of the intensification of the dairy industry. Will the adoption of rBST lead to new or exacerbate existing environmental problems? And how does this combine with the need to move towards a more sustainable agriculture?

1.4 Politicization and regulation of rBST

Historically there is probably no other agricultural technology that has aroused such large and broad social and political debate even before its introduction as the case of rBST. Given the broad diversity of societal issues that were at stake in this debate, a wide range of interest groups entered into the discussion, at one time or another. Consumer organizations, church organizations, animal welfare organizations, trade organizations, various farmer groups and scientific societies all voiced their opinion on this new agricultural technology.

Proponents and critics not only fought each other, they also put pressure on government authorities. Because biotechnology, and therefore rBST, is a new technology, there was uncertainty as to how this technology should be regulated. One of the main issues in this political debate was whether biotechnology products could be approved under existing legislation, or that new legislation should be implemented, with both more strict and new criteria concerning the impacts. Both proponents and critics saw rBST as a test case for regulation of agricultural biotechnology in general. Because of this, the introduction of rBST became a very politicized issue.

According to Barham et al. (1995) the debate on rBST has ushered in a new era of politicization of agricultural technologies. The introduction and adoption of many (but certainly not all) new agricultural technologies may be accompanied by broad societal and political debate. Barham et al. give several reasons for this process of politicization. First, there is an increasing number of societal organizations that closely watch the introduction of new agricultural techniques and voice their concern if there are any potential negative socioeconomic, ethical, environmental, health or animal welfare impacts. Second, as retailers are increasingly sensitive to consumer reactions to new agricultural techniques, they are more strongly voicing their opinion on the direction of technical change in agriculture.

Because of the politicization of agricultural biotechnology, and the differences of opinion even among scientists, regulating rBST has not been a straightforward issue. Government authorities had to account for the reserved public attitude towards agricultural biotechnology in general, for targeted critique by special interest groups, and for uncertainty over consumer reaction to the introduction of milk from cows treated with rBST. All the above listed issues in the rBST discussion had to be reckoned with. At the same time, government agencies dealing with the promotion of science and technology, seconded by private biotech industry, did not want the development of biotechnology to be hampered by too strict regulation.

The regulations that are resulting from the social and political debate over rBST are a reflexion of the respective influence of different interest groups, of the political sensitivity of the issue, of the latitude regulators have and of the decision making process itself. As these are country specific issues, different countries have come up with different regulation on rBST. While the USA and Mexico have approved the use of rBST, the EU has placed a ban on its sale and use, and others, like Canada, have yet to make a decision. But even within countries, regional governments can demand additional regulation, as the different labelling requirements in individual states of the USA show.

The differences in national regulation of rBST, reflecting the cultural differences between countries, may not be desirable from an economic perspective. Because dairy products are traded in an international market, country specific regulations can influence the competitiveness of the domestic dairy industry. Of course, this influence can be negative or positive, depending on the actual regulations compared to those of competing countries. The effect on competitiveness is reason enough for governments to closely watch foreign regulations and strive for harmonization.

1.5 The future of rBST regulation in the EU

In the EU, the sale and use of rBST has been banned until December 31, 1999. Although there was broad political support for this decision by the Council of Ministers, an interesting question is whether changing viewpoints by stakeholders in the EU, combined with positive experiences in the USA, may lead to pressure on the EU authorities to not extend the ban after the year 2000. Two developments, in our opinion, may be instrumental to such pressure: (1) a gradual, but continuous change in European public attitude towards agricultural biotechnology, towards a higher rate of acceptance, and (2) a deterioration in the competitive position of the EU dairy industry, due to market liberalisation (under the GATT/WTO agreement) and to use of rBST in the USA (and other countries). Whether these changes may take place in the near future and under what conditions, is the main focus of this report.

Studies on public attitude towards (agricultural) biotechnology in the EU generally show low rates of acceptance. Low acceptance can have several reasons, among which low knowledge and high risk perception are the most important. Studies on public attitudes have been conducted in the EU as a whole, as well as in individual European countries. Even though most of these studies focused on biotechnology in general, often special reference was made to applications of biotechnology in agriculture and food production. Comparative studies on attitudes in different countries of the EU, notably the Eurobarometer surveys (Marlier, 1992; INRA, 1993), showed that there are large differences in the knowledge of and opinion on biotechnology applications among inhabitants of the various EU member states.

A change in European public opinion on agricultural biotechnology could result from several developments. First, more knowledge of biotechnology could result in higher acceptance of specific applications of biotechnology. It should be emphasized, however, that more knowledge does not automatically lead to higher acceptance of biotechnology products. It all depends on the specific application and product. Second, introduction of agricultural biotechnology products in the coming years may make people more familiar or even enthusiastic about this new technology. Third, the commercial introduction of rBST, particularly in the United States, has created a new situation. Now, the adoption of rBST by farmers and the real impact on milk production and changes in the structure of the dairy industry can be monitored. Results of these studies can be compared with *ex ante* impact assessments.

The other main question in this report focuses on the potential changes in competitiveness of the EU dairy industry. If the use of rBST really leads to lower production costs, farmers using rBST will improve their competitiveness compared to those that do not use it, both domestically and in third countries. Eventually, this may lead to changes in the competitive position of the various dairy exporting countries on the world market. For the European Union, as one of the main exporters of dairy products in the world, changes in the supply and/or the prices of competitors are important to monitor.

Because rBST has only been marketed for a short period of time, there has been limited time for it to have had any significant impact on the (world) dairy market. Therefore, this study will look at expected changes under several scenarios. The United States have been using rBST since February 1994. Real changes in the dairy market are now beginning to emerge. Changes in the competitiveness will only result if prices of American dairy products are decreased, nationally and internationally. This study looks at expected, and not at observed changes, under several scenarios for the EU dairy industry.

1.6 Outline of the report

The report continues, in chapter 2, with a description of the regulatory background for the decision by the Council of Ministers to ban the sale and use of rBST until the end of 1999. One of the regulatory issues that may become important in the future is labelling: can one or should one label rBST-milk or rBST-free milk? As there does not exist a method to distinguish natural BST from rBST, labelling does not seem very useful (because the claim on the label cannot by controlled); still there are options for labelling rBST-free milk.

In chapter 3 the current and future public attitude towards biotechnology in general and rBST in particular is discussed. The discourse on biotechnology in five EU member states (UK, Netherlands, Germany, Sweden en Finland) is presented, along with the discourse on biotechnology in Norway.

Chapter 4 discusses dairy farm structure in the EU, Norway and the USA. Rather large differences appear in the size of dairy holdings, in the productivity of the cow and in the rate of specialization of dairy farmers. These structural characteristics may give an indication of the rate of adoption and diffusion of rBST among dairy farmers. There are, however, factors indicating that traditional adoption patterns of agricultural technology may not be valid in the case of rBST, as European consumers have expressed their doubts about the desirability of milk from cows treated with rBST.

The dairy policies in the EU, Norway and the USA are described in chapter 5. Particularly the future of the EU quota system for milk production is important for this study. The profitability, and thus the adoption, of rBST is quite different under a quota system than without such a system. The future of rBST in the EU, therefore, depends very much on the future of EU dairy policy.

In chapter 6 the current EU external trade in dairy products is described. The EU is the main player on the world dairy market. Changes in dairy policies, in production costs, in the availability and amount of export subsidies, all influence the competitiveness of EU dairy products. The perspectives for EU dairy exports are discussed, given several regional and global developments influencing the competitive position.

Last but not least, chapter 7 presents several scenarios on the future of the EU dairy sector. The discriminating elements in the scenarios are yes/no rBST and yes/no quota system. These scenarios make clear what changes the EU dairy sector encounters under the assumptions of abolishing or extending the quota system and allowing or not allowing rBST. For each of the four scenarios the expected developments in production, consumption, price level, export level, farm structure and regional concentration of production are discussed.

2. REGULATION OF rBST

2.1 Introduction

The 1994 decision to ban the use of rBST in the European Union until the end of 1999 was preceded by several short term bans. For most stakeholders the decision making process has been rather obscure, with many issues simultaneously at stake. The discussions within the European Commission, the European Parliament and the Council of Ministers have been very politicized, with interests from various countries often conflicting. Even the regulatory path that a product like rBST has to follow before approval is not always very clear. Some observers (e.g., Bent, 1993a) even claim that the EU approval procedures for livestock productivity enhancers (including rBST) are extremely confusing and even contradictory. There seems to be no published comprehensive review of approval procedures. Several European institutions are involved, each representing different interests and with different powers. Some aspects of approval and control are executed at a Union level, others at a national level. Even if the procedures are clear for the moment, there is change over time 'as the European Community endeavours to balance political expediency with moves towards rationalization and harmonization' (Bent, 1993b: 25).

In the following, some key elements of the regulatory context of rBST approval in the EU will be presented. It is not the aim of this chapter or report to provide the comprehensive review on approval procedures. By presenting the key elements, the reader will hopefully get sufficient insights into the regulatory background to the (dis)approval of rBST use in the European Union. In the second part of this chapter the state of regulation in several other countries is briefly described.

2.2 European Union

2.2.1 Regulatory background

Within the EU, productivity enhancers that are injectable and implantable substances with a hormonal activity are considered veterinary medical products, and thus fall under the supervision of DG-III-C (Internal Market and Industrial Affairs). The basic rules governing approval for marketing of veterinary products are contained in Directives 81/851/EEC and 81/852/EEC. These specify that the main criteria which should be taken into account by Member States are quality, safety and efficacy, and that tests conducted in compliance with Community requirements in order to obtain national approval need not be repeated at the Community level. Directive 81/851/EEC (with updates 87/20/EEC and 92/18/EEC) set out the procedures to be adopted with respect to applications for authorization, renewal of authorization, manufacture of veterinary products and imports from non-EU countries, supervision and inspection of manufacturing and trading, and of labelling. The Directive also instigated the Committee for Veterinary Medicinal Products (CVMP), composed of representatives of the Member States and the Commission. Directive 81/852/EEC (with updates 90/676/EEC and 90/677EEC) legislated for the approximation of Member State laws relating to analytical, pharma-toxicological and clinical standards and protocols for the testing of these products. By implementing these two Directives, approval in a number of member states was facilitated, and procedures for national approval were standardized.

In order to approximate national measures for market introduction of medicinal products derived from biotechnology, a special Community procedure was adopted in December 1986 (Directive 87/22/EEC). This procedure enables questions relating to quality, safety and efficacy for these substances to be resolved at Community level within the CMVP before a national decision is reached. This Directive did not in itself introduce new criteria for the approval of substances.

2.2.2 The decision by the Council of Ministers

The Council of Ministers of the European Community (now European Union) decided, on December 19, 1994, to ban the sale and use of rBST until December 31, 1999 (Decision 94/936/EC). This decision is basically an extension of Decision 90/218/EEC (revised with Decisions 92/98/EEC and 93/218/EEC) that prohibited the sale and use of rBST in the Community.

The decision was made on a proposal by the Commission (COM(93) 605). The Commission had chosen December 31, 1999, as the expiration date, because that is also the date on which the current milk quota system ends (Regulation 3950/92/EEC). The Commission has given two reasons for the extension of the ban on rBST (COM(93) 331). This reasoning has been accepted by the European Parliament in their Advise on the proposal by the Commission (Bull. EC 12-1993, 1.2.21) and by the Council of Ministers, in their final decision. First, the introduction of rBST would not be in line with reform of the CAP, as it would lead to an uneven situation in the milk and beef sector. Because application of rBST would lead to higher productivity, holdings with a large quota would benefit more than holdings with a small quota, and thus milk production would concentrate in regions with intensive milk production at the expense of regions with extensive production. As more dairy cows would be slaughtered, the beef market would become disrupted. It would also lead to problems on export markets as most third countries prohibit the use of rBST. Second, a strong aversion against the use of rBST exists among consumers. If the use of rBST would be allowed, the consumption of dairy products and beef would decrease considerably and the image of dairy products would be affected. The markets for dairy and beef products would be further disrupted, as no labelling system can repair consumer trust. Moreover, control and surveillance of the use of rBST is very problematic. Thus, socio-economic issues have been the main consideration behind the Council decision. Another issue that has favoured the current decision is the ongoing uncertainty about the impact of rBST use on the health of the cow. This issue particularly has been brought forward by several interests groups in the EC.

Effects on human health have not been an issue in the discussions leading to the Council Decision. The Committee for Veterinary Medicinal Products (CVMP) of the EC has declared, in its advice of January 29, 1993, that rBST is safe for humans and animals. The assumed higher concentration of insulin-like growth factor-1 (IGF-1) was taken into account by the CVMP.

It must be emphasized that the ban on the sale and use of rBST in the EU does not preclude the import of dairy products from countries that have approved rBST. Thus, the import of dairy products that are made with milk from cows treated with rBST is possible under the current regulation. Chances that European consumers actually buy dairy products made from rBST milk are currently not very large, as there is hardly any import of dairy products from the USA and other countries that have approved rBST, but could increase in the future as more countries around the world approve rBST use.

2.2.3 The issue of labelling

Labelling of products made with the help of genetically modified organisms (GMOs) is one of the main demands from consumer organizations in Europe. So far, no EU regulation on labelling of GMO-derived food products has been decided. Thus, there is no labelling requirement for imported dairy and meat products from cows treated with rBST. Such products can be imported and sold in the EU without anyone knowing it. Labelling of imported dairy products from cows treated with rBST is not allowed under GATT/WTO rules. These rules state that countries are not allowed to require labelling if there is no scientifically substantiated reason to do so. The decision on scientific substance lies with the Codex Alimentarius. This body of experts has declared that both milk and meat from cows treated with rBST are safe for human consumption.

Labelling GMO-derived food products has been under discussion in the EU for several years now. Differences in opinion on labelling have been a major hurdle in making a final decision on the Novel Foods Regulation, of which draft versions have been debated several times. The final draft regulation of the Council of Ministers was sent to the European Parliament in October 1995 (Bull. EC, No. C320 of 30/11/95). According to this proposal, labelling of GMO-derived food products will be required:

- if such products are substantially different from equivalent traditional products, in composition, in nutrional value or in intended use;
- if such products contain new compounds that are not present in equivalent products and pose health risks for certain groups of consumers (e.g. in the case of allergenic compounds);
- if such products contain new compounds that are not present in equivalent products and that may lead to ethical objections;

- if such products contain genetically modified organisms, other than for modifying agronomic traits.

Although some countries in the EU would have liked to see more strict labelling requirements, notably Germany and Austria, the Council of Ministers has agreed on this final draft, in order to establish the much needed EU wide legislation on the introduction of GMO-derived food products. As of January 1996, the European Parliament still had not acted on this proposal.

If this proposal for a Novel Food Regulation is accepted - and that is expected - the labelling requirement does not cover dairy products from cows that have been treated with rBST, both domestically as well as in third countries. Milk from rBST treated cows would be considered substantially equivalent to milk from cows that have not been treated. Thus, there is no legal basis for labelling milk from cows that have been treated with rBST. This still leaves room for some kind of labelling of milk from untreated cows.

Even if there was a legal basis, labelling dairy products from cows that have been treated with rBST would be troublesome. As all cow milk contains BST (in variable quantities), and rBST is equivalent to naturally occurring BST, there is no way to detect in the milk or derived dairy products whether cows have been treated with rBST or not. Thus, there is no control device for differentiating between milk with natural BST and with rBST.

2.3 United States

In the United States, new drug products (human pharmaceuticals and veterinary products) have to be approved by the Food and Drug Administration (FDA). Already in 1986 the FDA determined that milk and meat from rBST-treated cows presented no increased health risk to consumers. The human food safety evaluation was based on several factors: BST is biologically inactive in humans, rBST is orally inactive, and rBST and BST are biologically indistinguishable (for details on safety assessment: Juskevich and Guyer, 1990). After this general safety evaluation, the FDA reviewed company requests for approval for commercial sale of rBST. Of the four major pharmaceutical companies working on rBST, to date only Monsanto has received FDA approval. This occurred on November 4, 1993. Due to Federal legislation that required a 90-day moratorium on rBST use following FDA approval, Monsanto could not begin sales to dairy farmers until February 4, 1994. This version of rBST is sold by Monsanto under the brand name Posilac™. The rBST version developed by Elanco (a division of Eli Lilly) is still under evaluation by the FDA.

Also in the USA the issue of labelling has been discussed extensively. The FDA has determined there is no legal basis to label milk products from cows treated with rBST, as there is no distinction between this milk and milk from untreated cows. A label saying that the milk is 'from cows not treated with rBST' is allowed, only if it is combined with the statement that 'no significant difference has been shown between milk from rBST treated and non-treated cows'. No safety or health claims are allowed.

Individual states in the USA have their own authority in regulating the marketing of food products, as long as they remain within the framework of federal regulations. Thus, individual states may allow the use of labels saying the milk is 'from cows not treated with rBST'. If states do so, they should evaluate these rBST labelling statements. FDA recommends that companies making rBST claims be able to demonstrate that milk and all milk-derived ingredients are from cows not treated with rBST. This may include establishment of a third-party certification programme to assure accuracy of the claims. If rBST claims are made, milk from non-rBST herds must be kept separate at every stage from other milk, as verified by a valid paper trail (FDA Notice on BST labelling, February 1994).

Only a small number of states, notably Vermont, New Hampshire and Wisconsin, have implemented regulation on BST labelling. Vermont has actually demanded that all milk from cows treated with rBST be labelled as such. As this state regulation seems to be in conflict with FDA regulation, complaints have been brought forward by certain companies and organizations. In the state of Wisconsin, a voluntary labelling measure has been adopted by the state legislature (Barham et al., 1995). This measure allows processors to indicate on the package that their milk products came from herds which had not been treated with rBST (in combination with the above mentioned FDA required disclaimer).

2.4 Other countries

Several countries around the world in recent years have approved the sale and use of rBST. Most of the these countries are developing countries and/or Eastern European countries. None of them are major milk producing countries. Of the main dairy producing countries, only the United States has licensed the sale of rBST.

The following countries have approved the use of rBST: Algeria, Brazil, Bulgaria, Costa Rica, Czech Republic, Honduras, Jamaica, Malaysia, Mexico, Namibia, Pakistan, Romania, Russia (and other republics of the former Soviet Union), Slovakia, South Africa, South Korea, United States, Venezuela and Zimbabwe.

Posilac™, Monsanto's trade name for rBST, is being sold in Brazil, Czech Republic, Malaysia, Mexico, Russia, South Africa, United States and Zimbabwe.

Besides the 15 member countries of the EU, the use of rBST is also not allowed in Australia, Canada, New Zealand and Norway. Australia and New Zealand have not approved rBST because its use is not considered to be very profitable under the production method of year round grazing on grassland

1). Moreover, these countries fear adverse consumer reactions in Japan if their dairy farmers start using rBST. In Canada, a moratorium on the sale of rBST expired in July 1995. Still, Health Canada (i.e. the ministry of health) has not approved the product. The delay is due to Health Canada's requests for more animal health data from the manufacturer Monsanto (The AgBiotech Bulletin, November 1995). In Norway, the use of rBST has not been approved, and it is not expected that it will be approved in the near future (see also chapter 3).

---

1) The effect of rBST is largely dependent on the kind and quality of the feed; the better the feed, the larger the effect. rBST has the most effect when the cows are fed concentrated feed, and the least effect for grazing cattle that do not get concentrated feed (Sejrsen 1992:25).

3. PUBLIC ATTITUDES TO rBST

3.1 Introduction

If enhancing production is the main goal of innovation in the dairy industry, then rBST could be expected to be of great importance as it can make milk production more efficient. However, in a time when the focus in agricultural production is shifting from quantity to quality, rBST is a controversial product. It must not only be evaluated from a technological and economic point of view, but also with reference to the social consequences of its use. Ultimately, the socio-economic impact of rBST depends on the farmers' willingness of use it, on the consumers' willingness to buy milk produced by cows treated with rBST, and on the regulation of rBST on a national and international level. The discussion of the public perceptions of rBST in this chapter will be linked to the broader debate on the use of biotechnology in food production.

In the first part of this chapter, the importance of taking the consumers' attitudes into consideration when introducing a new product on the market is emphasized. In the second part, we present results from the Eurobarometer 39.1 study, conducted in 1993, in which the public perceptions to different forms of biotechnology are investigated in several European countries. We assume that there is a connection between attitudes towards new biotechnology in general and public perception of rBST in particular. In the third part of the chapter, we study how this could mirror the public discourse on biotechnology in some selected European countries 1).

3.2 Method

To get information about the public perception of biotechnology, we have used data from Eurobarometer 39.1 2), carried out during the spring of 1993. Unfortunately the Eurobarometer studies have no questions directly concerning rBST, but these studies offer comparable data from all EU countries about public opinion on biotechnology in general. Comparable data from two of the Nordic countries selected for this study are also available. Norway partici-

---

1) The countries discussed in this chapter are the UK, Germany, the Netherlands, Norway, Sweden and Finland.

2) The Eurobarometer studies, conducted on behalf of the European Commission, are surveys of the opinions and knowledge of Europeans on a broad range of issues. They are carried out in all countries of the European Union. Several editions of the Eurobarometer, notably 35.1 (1989) and 39.1 (1993), have included questions on biotechnology and genetic engineering.

pated in the Eurobarometer 39.1 as the only country outside the EU, and seven of the fifteen biotechnology questions from the same study were asked in a national study in Finland (von Troil, 1994a).

In Eurobarometer 39.1 there was a total of 14,000 respondents; 1,000 from each country 1). The data are drawn from personal interviews carried out by national opinion polling organizations in each country. The Eurobarometer gives us extensive and comparative data about public opinion towards modern biotechnology. However, large quantitative interview studies of this type also have their limitations. In surveys where the respondents are asked to choose between different alternatives, the answers do not always measure the proper attitudes. Another problem one should be aware of is that the relationship between what people answer in a survey, and their actual behaviour, for example when choosing between different products in a shop, do not always correspond. The Eurobarometer is dealing with attitudes towards modern biotechnology in general, and does not have any questions about specific food products produced with or containing genetically modified organisms. This makes it difficult to predict how these attitudes will influence consumer behaviour in the future.

A problem with surveys conducted to determine public attitudes towards specific agricultural biotechnology products could be the information given to respondents (Smith and Warland, 1992). Responses can easily be biased by the use of value-laden language, by the information provided and the way questions are asked (Caswell et al., 1994). In the Eurobarometer, the various statements about biotechnology are worded in a rather positive way. The main focus is on the potential and the positive aspects of the use of new biotechnological methods in various areas. The immediate reaction is to agree that such research is worthwhile and should be encouraged. In order to have any objections, one would need to have thought about the questions in advance. This high level of awareness is found only in the countries of Northwestern Europe. In addition, comparative studies are problematic because of the contextual differences, which can lead to different understanding of the same question, depending on the association it gives. In spite of this, and the absence of specific rBST questions, the Eurobarometer study gives useful information on how the support for and the evaluation of risk of various forms of biotechnology vary among countries in Europe.

In addition to the Eurobarometer studies, we have also used other sources to get more specific information about the attitudes to rBST. We have investigated whether the public attitudes could be mirrored from discussions at organizational level and from the media coverage of questions concerning new agricultural biotechnology in general, and rBST in special. In order to get information about the national regulation and official view on rBST in the different countries, we have been in contact with a number of key persons in

---

1) Because of the great differences between Northern Ireland and the rest of the UK, and the former East and West Germany, these regions are treated individually in the analysis.

farmer organizations, government agencies, the dairy industry, etc. Due to their position, these people are valuable resource persons.

3.3 Consumer attitude

With consumers becoming more critical towards the quality of food products, the introduction of a new product requires that consumer attitudes are taken into consideration. Several studies have examined consumer acceptance of food-related biotechnology (Berrier, 1987, Hoban, 1989; Hoban et al., 1992; Hamstra, 1991; Hamstra, 1992; Hamstra, 1993). Among the consumer interests regarding food are food availability, food quality and acceptable prices. Moreover, the way food is being produced becomes increasingly important, as is shown by consumer interest in environmentally sound and animal friendly farm practices. If biotechnology can contribute to this, consumers are likely to accept it. With regard to biotechnology in food, consumers appear to be very sensitive to any possible safety risk. It is expected that consumers will only accept biotechnological foodstuffs, if there is a clear consumer benefit and if it is safe for human health and the environment (Hamstra, 1991). In her studies, Hamstra also found that consumers expressed their doubts about the distribution of benefits and the prevention and control of possible adverse effects for human health or the environment. When it comes to food, consumers often are concerned about different issues than those the experts are concerned about (Sjødèn, 1990).

Knowledge, risk perception and ethical views all influence the degree of acceptability of biotechnology (Zechendorf, 1994). The knowledge base of an individual and his or her source of knowledge or information will help form public attitudes towards agricultural biotechnology and its products. The attitudes among consumers depend on the kind of information provided, and are also related to basic values (Almås and Nygård, 1994). Consumers may reject biotechnology-derived products if they feel that they are being denied the information needed to control their own food choices (Thompson, 1992). But the freedom of choice has two aspects. One is to have many possibilities, many alternatives to choose from. The other is the ability to make a choice among the alternatives (Kuitert, 1985). The more alternatives, the more difficult the choice, especially when the consumer lacks the capability to choose.

The complexity of society is one of the most characteristic marks of our time (Beck, 1992). It is not easy for people to have their own opinions about everything. In many cases, people are dependent upon trusting experts for their opinions on what is new or unknown. In this way, people's attitudes are no longer only a question of their own knowledge, but to a great degree also a question of trust in those who are experts in the field (Beck, 1992). And experts do not always agree. The experts' opinions are divided on public health issues, animal welfare issues and the structural consequences of adopting the use of rBST. When experts disagree, non-experts are faced with uncertainty about whom to believe (Thompson, 1992:40). According to Thompson (1992:45), the matter of trust is the greatest and most serious ethical issue associated with rBST. The reality of disagreement among alleged experts creates a situation in which a member of the lay public, lacking even the evidence to make informed judgments about whom to believe, quite reasonably comes to regard all claims about the likely consequences of technical change with justifiable scepticism. Since it is logically impossible for all the experts who expose contradictory views to be speaking the whole truth, it is very reasonable to question the validity of claims that any expert makes about the true risk of a technology.

In spite of the fact that several governmental agencies and advisory bodies in the USA (e.g. NIH and FDA) and the EU (CVMP) have stated that milk from cows treated with rBST is safe for human consumption, there has long been and still may be uncertainty among consumers about food-safety issues. This uncertainty is evidence of a lack of confidence in science and in its institutions. This development should be taken seriously, not only for science, but for the foundations of democratic institutions. Both commercial undertakings and political decision-making require a certain amount of trust. Trust must of course be won, and once won must be preserved. Whatever the causes, and however just or unjust the suspicion of science might be, the difficult discussion on the merits of rBST has probably not promoted trust in regulatory bodies. According to Thompson (1992: 45) this was the largest and most serious ethical issue associated with rBST in the USA.

Consumer groups who are reacting to the food-safety issue are not reacting to a health risk per se, according to Thompson (1992). He states that consumer groups were reacting to uncertainty, to a problem in deciding whom to believe about rBST and milk. While the fact that an overwhelming majority of credentialed scientists see no health risk associated with rBST milk should count heavily in favour of rBST, the fact that some scientists are linked with private corporations and research institutions that stand to gain from sales of rBST weighs against it. The layman does not evaluate the risk of rBST as such. The layman must evaluate the risk of choosing the wrong expert (Thompson, 1992:41).

3.4 Results from the Eurobarometer studies

If we follow Beck's argumentation, people's attitudes towards modern biotechnology are no longer only a question of their own knowledge about the subject, but also to a great degree a question of their confidence in those who are the experts in the field. Results from the Eurobarometer studies indicate that there is a definite variation between the sources of information and people's confidence in the various countries. Results from the Eurobarometer studies also show how support and risk perception of biotechnological research in different areas vary between various countries. We will now give a brief summary of the main findings of relevance to this study (for a more detailed description see Almås and Nygård, 1995).

3.4.1 Whom to believe?

Results from the Eurobarometer studies indicate that there is a large variation as to the trust people put in different sources of information. If we look at the average for all of the countries included in the study, we find that respondents have the greatest confidence in environmental organizations (26%) (see appendix 2). While confidence in environmental organizations is rather high in countries such as West Germany (39%), and East Germany (31%), the comparable numbers for Norway are only 14%. In Norway, this may be because there are other actors, such as several of the political parties and the ministry of environment, that also have significant legitimacy in the environmental political discourse.

Very few name industry as a source of most confidence in telling the truth about modern biotechnology. None of the EU countries reports more than 2%, and in most of the countries, less than 1% of respondents named industry as the source that they have most confidence in to tell the truth about biotechnology and genetic engineering.

Norway differs the most from the EU countries in that the amount of confidence in public authorities is rather large (21% in Norway, against 7% in the EU). The confidence in public authorities is also great in Denmark (18%), and probably we would have found the same in Sweden and Finland, as the Scandinavian countries are rather culturally homogenous. In comparison, only 2% in Italy, and 3% in Belgium respond that public authorities are the source in which they have most confidence regarding information about biotechnology and genetic engineering. The great amount of confidence in public authorities in the Nordic countries reflects the fact that they have a reputation for being relatively impartial and objective in difficult questions regarding regulation.

3.4.2 Support for biotechnology research

In the following we shall look at how support for biotechnological research varies among different areas. From the Eurobarometer we have taken examples ranging from breeding plants, animals and micro-organisms, production of food, to biotechnological research to develop new medicines and vaccines and to detect hereditary diseases in human beings. Each question has a short introduction that explains the field of application (see appendix 3). The respondents were asked whether they agree or disagree that 'such research is worthwhile and should be encouraged'.

Biotechnological research for developing new medicines and vaccines has the greatest support in a majority of the countries (see appendix 4). In the Netherlands and West and East Germany, the greatest support is for research on the use of genetically altered micro-organisms for the breakdown of sewage and other waste products, together with the clean up of oil slicks. It seems reasonable to view this in the context of the strong environmental actors in the national discourse. West Germany distinguishes itself by having the least support for the statements supporting genetic engineering in all areas, except when it comes to farm animals, where the Netherlands gave the lowest support. The historical background with racial experiments during World War II, together with the existence of strong environmental political actors helps to explain why this scepticism towards biotechnology is most strongly articulated in Germany.

In the Netherlands, there has been a thorough discourse concerning genetically altered farm animals. This could be partly explained by the strong environmental movement. While the Netherlands is the country which gives the least support to biotechnological research in farm animal breeding, they are the leading supporter when genetically altered micro-organisms to clean up oil slicks or other contaminants in the environment are in question. A great amount of knowledge is required to be able to differentiate about 'bad' and 'good' use of the modern biotechnology. In Denmark, it was found that increased knowledge about biotechnology resulted in a polarization between the sceptics and the supporters. The differentiation we find in the Netherlands might be a result of the same, indicating a relatively high information level concerning biotechnology and genetic engineering.

On the whole, Belgium is the country with the highest support for biotechnology research. Except when it comes to farm animals, foods, and human beings, Belgium is the leading or second leading supporter. It has previously been suggested that there is a north/south division in attitudes; the opinion in northern Europe appears to be more sceptical, while the southern European countries have a more positive attitude towards biotechnology (Zechendorf, 1994). According to our data, this pattern is not unambiguous, but seems to be correct when it comes to farm animals, foods and human beings, with Spain and Portugal among the leading supporters.

The use of new biotechnology methods in the breeding of farm animals as a goal of biotech research receives the lowest support in all countries. Paradoxically, in all countries, there is greater support for research in genetic engineering for human health purposes than for animals. This may perhaps be explained by the difference in the purpose. In the case of human beings and genetically engineered production of medicine, the purpose is to save human lives. In developing transgenic animals, the commercial interests are more in the fore. As such, the motivation for this type of research is not primarily saving lives or improving the welfare of animals, but rather to increase productivity and profitability.

3.4.3 Risk perceptions

The respondents to the Eurobarometer studies were also asked to indicate whether they agree or disagree that biotechnological research in the different areas could pose a risk to human health or to the environment. The concern about risk varies a good deal between the different technologies (see appendix 5). The concern about risk is greatest for those technologies that received the least support: biotechnology used on farm animals, food, and human beings. If we look at the variation between the different countries, we find that the concern about risk for all the technologies is consistently greatest in Denmark (together with West Germany). This is interesting considering that Denmark is the country with the longest tradition of popular discourse on modern biotechnology, and that the Danes are probably the most knowledgable about modern biotechnology. Spain and Italy are the countries where the concern about risks is consistently low for all technologies.

3.5 Country studies

The degree of knowledge about biotechnology as well as the ability to influence its development correlate with the degree to which biotechnology has been the object of public discourse in the various countries. We assume that the strength of the various actors in the discourse will vary from country to country, depending on the strength of the hegemony of the technical-industrial actors. In addition, cultural differences and variation in fundamental values will contribute to form people's attitudes towards modern biotechnology in various European countries. Recent studies indicate that people's attitudes towards modern biotechnology are based on fundamental values (Almås and Nygård, 1994). In contrast to (scientific) knowledge, fundamental values remain relatively stable over time.

3.5.1 The discourse on biotechnology in the UK

In the UK there has been a quiet, limited discourse about genetic engineering and biotechnology (Husted, 1992). In the same manner as in the USA, but far less dramatic, various interest groups have attempted to influence the federal regulation of new biotechnological methods. On the one side we find the associations for animal protection, environmental organizations, trade unions, religious and ethical movements and representatives from small-scale farms. On the other side are the pharmaceutical companies, the agro-chemical industry and the food industry. These two parts present opposing views of the regulation and control of genetic engineering. The former pressure group wants governmental regulations that will slow down, limit, or prevent certain developments, while the latter, even if they see the need for some regulation, often take a stand for less regulation and for a relatively free market for the new biotechnological products and processes.

British working groups that function as advisory and controlling organs on issues concerning genetic engineering are bound by secrecy. While in the USA the 'Freedom of Information Act' is discussed, it differs from the situation in Great Britain under the 'Official Secrets Act'. This is one of the reasons for difficulties that the sceptical groups have had in getting access to qualified information and opinions (Husted, 1992).

In spite of this, there are several groups campaigning against rBST in Great Britain. The animal welfare organization Compassion in World Farming (CIWF) has campaigned long and hard against the use of rBST, believing it has a negative impact on animal health and welfare (D'Silva, 1994). Likewise The Farm Animal Welfare Council supported the continuation of the EU-moratorium, with the following observation: rBST used at low levels in low yielding dairy cows may not have any adverse effects on cow welfare, but when used to induce high levels of milk production, rBST can have severe effects on welfare, particularly in relation to the occurrence of mastitis and other diseases (The Veterinary Record, July 23, 1994). The evidence of mastitis in rBST-treated cows was the reason why the UK Veterinary Products Committee refused licences for rBST from Monsanto and from Elanco (Dixon, 1991). The National Farmers Union (representing farmers and growers) also supports the EU-moratorium on the marketing of rBST. The British Ministry of Agriculture has supported findings demonstrating that rBST use is effective and poses no risk to human health or to the environment, but withheld approval because of insufficient data on animal health.

3.5.2 The discourse on biotechnology in Germany

From the Eurobarometer study, it appears that Germany (especially the former West Germany) distinguishes itself in comparison to the other EU countries in that it has the lowest support for the use of biotechnology in practically all the various contexts that were treated in the Eurobarometer (Almås and Nygård, 1995). This makes it especially interesting to study what characterizes the discourse concerning biotechnology in Germany. According to Andersen (1992), the German discourse is marked by certain types of participants that are not found to the same degree in other countries. Well known actors are the 'old' political parties, the representatives of industry and the representatives for research who also take part in the German discourse. In addition, are the many other important actors who have in some special manner contributed towards the characteristics of the German discourse. The political party 'Die Grünen' has made biotechnology a leading issue. There is a strong, organized and well founded critical expertise in Germany. Several independent institutions outside the established research environment, for example 'Öko-Institut' and 'Forschungsstätte der Evangelishen Studiengemeinschaft' (FEST) have also participated in the discourse. In addition, the church, more specifically the Evangelical Lutheran Church, takes a much more active part in the discourse than it does in other countries. The German Organization of Veterinarians (Tierärztliche Vereinigung für Tierschutz) has stated its opposition against rBST, as there are still many animal health questions unresolved (Welt der Milch, 48, 1994/3).

3.5.3 The discourse on biotechnology in the Netherlands

As already mentioned, the Eurobarometer shows that the Dutch have a differentiated view on various forms of biotechnology, indicating a relatively high information level concerning biotechnology and genetic engineering. There has been a thorough discourse concerning genetically altered farm animals, and the Netherlands give the least support of all countries on the statement that such research is worthwhile and should be encouraged. Several studies on public opinion and consumer acceptance of food biotechnology were also carried out in the Netherlands (Hamstra, 1991, 1992, 1993).

Since 1986, farmers, consumers, animal welfare and environment organizations in the EU have been demanding a ban on rBST and products derived via its use. The Dutch animal protection organization 'Nederlandse Vereniging tot Bescherming van Dieren' has had a central role in the campaign, as one of the member organizations of the 'Eurogroup for Animal Welfare - A united voice for animal welfare in the European Union'. A statement against rBST, signed by more than 300 European organizations, was sent to the European Council in 1994.

In the Netherlands, the expected negative consumer reaction is the main reason why the dairy industry has taken a clear stand against the use of rBST. They have done so even though the use of rBST would clearly contribute to the reduction of costs in the production of milk, thereby increasing the ability of the Dutch producers to compete in the international market. Milk is regarded as a natural product, and this is the way the producers would like it to continue to be considered. The market for dairy products is a very international one. Thus, the main clients of the Dutch dairy industry are the Germans. German consumers are very sensitive about their food; it must be 'natural' and not produced with the aid of additives (Lager, 1994).

3.5.4 The discourse on biotechnology in Norway

From the Eurobarometer studies, we can see that the Norwegians are among the most sceptical. This is further illustrated by the Norwegian Gene Technology Act that was passed on April 2, 1993, which has been called 'the world's strictest law concerning genetic engineering' (White paper No. 8, 1992-93). When deciding whether or not to grant an application of genetically modified organisms (GMOs), the Norwegian Gene Technology Act not only demands that GMOs should be safe to humans and to the environment (as is the internationally dominant approach to regulation of GMOs), it also includes that significant emphasis shall be placed on whether the deliberate release represents a benefit to the community and a contribution to a sustainable development (White Paper No. 8, 1992-93, §1). The proposal for the Gene Technology Act, together with a White Paper on human biotechnology, were instrumental in encouraging a great media interest in biotechnology and genetic engineering in Norway in 1993 (Kraft, 1994). New biotechnology changed from being a special area of interest for very few, to be a topic that 'everybody' was to have an opinion on.

Studies from 1988 and 1990 show that Norwegian farmers strongly opposed the use of productivity enhancing hormones in meat and milk production, even if it were to become available (Almås, 1991) 1). In the first part of the 1988 study, 80% of the Norwegian farmers interviewed said that they would not use such hormones if they were available. In the same study, it is also shown that there is a strong consensus for considering the social and economic consequences that biotechnological research might have on agriculture. At the same time, as many as 66% state that they have poor knowledge about the new technologies that might be considered for agricultural use.

Lack of knowledge is often used as an explanation for why people are sceptical about various forms of biotechnology. It is very interesting then, to look at the results from the second part of the study, done in 1990. During the winter of 1988/89 an educational campaign called 'Ethics in the barn' was organized by three of the strongest national agricultural organizations. The educational campaign gathered exceptionally large nationwide participation (13,855 participants divided into 1908 study groups). Approximately one third of the textbooks for the course were about general issues in biotechnology, so it could be expected that the level of knowledge about biotechnology would increase. One would also assume that the scepticism would decrease, since several biotechnology products approached the final stage of development during the period of this campaign. For example, transfer of embryos to cows was being done on a research basis during this period. The results of the study in 1990 show, to the contrary, that opposition to growth hormones became stronger during the two years (Almås, 1991). In 1990, as many as 88% responded that they would not use growth hormones in meat and milk production even if they were to become available. These results show that there are other factors in addition to the level of knowledge about biotechnology that form people's attitudes towards modern biotechnology.

One of the main issues in the Norwegian rBST-debate, has been whether or not it will be possible to maintain the ban against rBST in Norway if rBST is approved in the EU. Under the European Economic Space (EES) agreement, it could be difficult to prevent rBST from being marketed in Norway if it is permitted in the EU, even though Norway is not among the EU member states. Several animal welfare organizations, environmental organizations, and agricultural organizations have signed an appeal against rBST. These organizations support the international campaign against allowing the use of rBST.

3.5.5 The discourse on biotechnology in Sweden

The discussion of gene ethics at the official level in Sweden can be illustrated by the activities in the parliamentary committee, which was initiated during the spring of 1990 (Nilsson, 1994). The committee presented its 'Gene technology - a challenge' in the autumn of 1992, and in 1993 there was a hear-

---

1) It should be noted that those studies were concerned about hormones in general, not rBST specifically. At the same time, there is no reason to believe that the attitude towards rBST is more positive than the attitude towards other growth hormones.

ing on this report. The committee on gene technology's major concerns are the issues of patent rights and questions of ecological risks regarding genetically modified organisms (GMO). Nilsson (1994) writes that the reactions to the report in many ways reflect the lack of confidence that is found among the various groups in the gene-ethic discussion. The motive for a comprehensive law for gene technology is to gain political influence in 'expert questions' that would otherwise be relegated to departments and professional authorities.

Jonas Josefsson, philosopher at the University of Lund, and secretary for the Nordic committee for ethics in biotechnology (Nordic Council), informs us that in spite of his special interest in ethics, he cannot remember having observed any discussion about rBST in the press or in any other area of the media in Sweden. It is possible that the question has been raised in special interest periodicals for agriculture and animal protection, but it cannot be said that there has been any general debate on the subject of rBST. In Sweden, the public debate about modern biotechnology has concentrated mainly on the medical aspects, related to human health and reproduction. For example, a discussion like the one in Norway about transferring genes from flounder to aspen trees has not taken place in Sweden. Nor has there been any discussion about Novel Foods (defined as food produced with the aid of, or containing, GMOs) in Sweden.

The Federation of Swedish Farmers (LFR) took a stand in opposition to the use of rBST as early as 1988. Gunnela Ståhle, from the LFR, points out that their rejection of rBST is based on several factors. It is assumed that the use of rBST will have a negative influence on animal health, since increased production leads to an increased risk of production diseases. The use of antibiotics will thus increase. The structural consequences of using rBST, leaving room for fewer cows, and the risk that farmers with small herds will be unable to compete, is another reason for LFR's rejection of rBST. The aspect of public health is also mentioned by LFR as an area they believe has not been given adequate attention.

3.5.6 The discourse on biotechnology in Finland

In August 1993, a small study about the public opinion on biotechnology was carried out in Finland. The seven questions that were posed were taken from the Eurobarometer 39.1. A selection of 972 Finnish citizens ranging from 15 to 69 years of age were interviewed. The results basically indicate that there is a relatively high support of, and low concern for risk regarding biotechnology and gene technology in Finland (von Troil, 1994b). As in Norway, the most scepticism is connected with the fields of genetic engineering in regard to farm animals, food, and human beings. The field of genetic engineering that has the greatest support in Finland is the production of medicine and vaccines, and genetically modified microorganisms in connection with the environment. While gene technology applied in these areas is regarded as valuable, there is strong support for the idea that this must be regulated. As in the other Scandinavian countries, there is great confidence in public authorities in Finland (von Troil, personal communication).

Like in Norway and Sweden, rBST is not a well-known topic for the layman in Finland, and it has therefore mainly been discussed by those who are confronted with it by virtue of their jobs. Both the farm organizations and farm authorities have made it clear that rBST is an undesirable, unwanted product. Banning such hormones is seen as responsible policy, and because of the strong agreement on this, the debate surrounding rBST has calmed down during recent years. No pressure groups wanting rBST to be allowed have let themselves be heard, and the fact that rBST is forbidden, contributes to keep the opponents relatively calm.

Like in Sweden, most of the debate on bio-ethics in Finland has been about the application of biotechnology related to human health, medicine and reproduction technology (von Troil, 1994b). In the Finnish press new results about the medical accommodation of genetic engineering are reported without actually being questioned. One of the reasons for this lack of public debate could be the deep economic crisis in Finland, as the problems brought on by this crisis have overshadowed all other debates.

Olli-Pekka Väänänen of the Finnish agricultural organization 'Central Union of Agricultural Producers and Forest Owners' (MTK) states that they have taken a restrictive stand against rBST (Väänänen, personal communication). The same position has been taken by the Finnish organization for the protection of animals.

3.5.7 Summary of country studies

We have shown how national opinions about biotechnology in Western Europe are influenced by the manner in which its various elements have been articulated in the national discourse. The strength of the various actors in the biotechnology discourse vary from country to country. In all the countries selected for our study, there are organizations opposing the introduction of rBST. The Eurodeclaration on rBST summarizes the arguments to continue the ban on rBST in six points: 1) Violation of Consumer Rights; 2) Harm to Dairy Farmers; 3) Detrimental to the Health and Welfare of the Cow; 4) Not proven safe for Humans; 5) Increased Environmental Problems; 6) Opening the Door to Growth Hormones.

While in Great Britain the concern for animal health especially is mentioned as a reason to reject rBST, in Germany and the Netherlands the apparent negative consumer reactions also are major reasons to reject rBST. German consumers are regarded being especially sensitive about their food.

In Norway, Sweden and Finland there is also a strong support for the idea that rBST is an undesirable product. This is confirmed by information from central sources in agricultural organizations and administrations. In Norway and Sweden, the farmers' organizations took a stand against rBST as early as 1986 and 1988. The interest in rBST has decreased during the 1990's. The reason for this is apparently the regulation forbidding the use of hormones, and the strong agreement that this is an unwanted product. The negative attitude towards rBST is not unexpected, due to the small-scale farming, strict disease control, restrictive use of antibiotics and no illegal use of hormones that has characterized farming in the Nordic countries until now. The exceptional good health of farm animals in all the Nordic countries is among other factors a result of cold climate, a relatively small number of animals in each herd, organized fight against diseases and effective control programmes. Farm animals are kept according to sound ethical principles, where the welfare of the animals is given high priority. Some of the reasons for this are the stringent control routines together with an official policy that have made it possible to carry on with small-scale farming. The fact that agricultural production in Norway, Sweden and Finland has been strictly controlled by federal regulations might possibly have brought the profitability aspect more in the shadow. There is a common belief that the general agricultural policy (and the quota system) will be more decisive for the possibility to continuing farming in the future, than an eventual increase in profitability by taking production enhancers like rBST into use.

3.6 Discussion and concluding remarks

New technology that increases productivity does not receive immediate acceptance on the part of the producers or the consumers in the selected European countries. For dairy farmers, it is important that milk production is profitable. One key question is whether the negative opinions about rBST held by farmers and consumers will lead to a definite ban of rBST in Europe. This will to a great extent depend on agricultural policy at the national and supranational level. If the conditions make it impossible to carry on with dairy production in an economically feasible manner without using productivity enhancers like rBST, farmers' scepticism and expected negative consumer acceptance may not stop the introduction of rBST in the long run. On the other hand, it may appear to be a competitive advantage to be able to offer the consumer both meat and milk that have been produced without the use of any hormone, as consumers are exceedingly sceptical towards products that are produced with the aid of hormone supplements.

A reduction in the price of dairy products may be of importance for the consumer. The effect is not unambiguous, however. In general the price elasticity of demand for staple consumer products like milk is low. But it is higher than average for low income groups. For other socio-economic groups other aspects may be more important. Some segments of the public are placing greater weight on quality and safety than they did in the past. According to Caswell et al. (1994:20), a new ecological, environmental 'green' direction is growing among the consumers. Consumers are willing to pay higher prices for foods that offer enhanced qualities, such as improved nutrition, safety, flavour, and appearance. The quality concept also has an ethical dimension which includes that the production process has been worked out in an ethically justifiable manner (Lassen, 1993). The ethical questions have been a major issue in the discussion of organic products. Producers will respond to the changing consumer preferences, and put more emphasis on these quality aspects.

The claim that milk from cows treated with rBST is safe for human consumption may not be sufficient for consumers to accept, i.e., buy this milk. The strong emphasis that the product is no different from regular milk also tells the consumer that rBST does not provide the consumer with a product of higher quality. If rBST does not have any benefits, either quality-enhancing or price-reducing (depending on the future dairy policy, see chapter 7), there is not much reason for the consumer to accept it. Even if the risk is very small, why expose people to the risk, when there is no short supply of milk? There is still some disagreement whether an increased level of IGF-1 in the milk poses a risk. As long as this uncertainty exists, the health issue remains relevant. Consumers may rationally see little risk in being deceived by rBST's opponents, and may be comparing this risk to a low-probability/high-consequence risk of being deceived by the majority of voices speaking in favour of rBST (Thompson, 1992:41-42). As a result of the disagreement among the experts, science is put in a position of being both a threat and a guarantor against threats.

From the Eurobarometer study it appears that consumers are more likely to accept genetic engineering of plants and micro-organisms than genetic engineering of animals or humans (Almås and Nygård, 1995). The opposition towards rBST does not stem from the way it is produced, but rather from the consequences of its use. rBST is a product that has many controversial aspects reaching beyond the fact that it is produced by genetically modified organisms. For the biotechnology industry the rBST case is a difficult one. The low acceptance may do harm to the introduction of other biotechnology products. If rBST is going to stand as the first example of what products the new agricultural biotechnology is going to introduce in the EU, the biotechnology industry could be exposed to the very difficult task of convincing the public about the necessity of their activities. As such, many scientists think the rBST is a bad case to push and may harm the relations between the research community and the public.

An important conclusion we can draw on the basis of the Eurobarometer is that people's confidence in representatives from industry is minimal. There is little enthusiasm for leaving the development of technology to commercial powers. This is a challenge to industry, but also to the EU Commission that has defined biotechnology and genetic engineering as a key technology for ensuring the competitive ability of the EU. At the same time, there is reason to believe that environmental and consumer organizations, together with representatives for education and research will greatly influence the biotechnological discourse in Europe in the years to come. Religious groups and societies may start defining their profiles, especially regarding the patenting of life and genetic engineering of human cells. This will ripen the biotechnological discourse in southern and central Europe and may alter the balance of power between the supporters and the opponents of new biotechnology.

It remains to be seen how public attitudes towards biotechnology in general, and to rBST in particular will develop in the near future. Given that people's attitudes towards modern biotechnology are based on fundamental values, there is not much reason to expect any rapid change, as fundamental values, in contrast to (scientific) knowledge, remain relatively stable over time. On the other hand, pressure from European producers to suspend the ban on rBST in the EU before the end of 1999, so that they can be more productive, could be seen as another scenario. We may have a situation that resembles the one described by Kvistgaard and Neimann-Sørensen (1992): the individual farmer feels pressured to use rBST, because he expects that all his colleagues will use it. This may happen in spite of objections from consumers, and in spite of the fact that it is in conflict with the individual's own values and norms (Kvistgaard and Neimann-Sørensen, 1992:98). Here lies a challenge to the policy makers to make it possible to keep on with profitable dairy production without adopting the use of rBST. This shows that the discourse about new agricultural biotechnology in general, and rBST in particular, is just as much a social and political question as a technological question.

4. FARM STRUCTURE AND ADOPTION

4.1 Introduction

This chapter focuses on a description of the structural features of the dairy sector in the countries under consideration. Farm characteristics are of major importance in assessing the potential adoption of new technologies, like the use of rBST (e.g. Caswell et al., 1994). The relation between farm structure and adoption is however not unambiguous, as other factors also play a role (see figure 4.1 on page 50). One of those other factors is the profitability or competitiveness of the farm, which is linked with the structure of agriculture. Attention will be paid to the economics of dairy farming in the EU and its relation to structural features in section 4.3. The chapter will close with the confrontation of farm structure and profitability on the one hand and potential adoption of rBST on the other.

4.2 Structural features of the dairy sector

In 1995 there are almost 21 million dairy cows in the EU-12 (see table 4.1). About 70% of the herd is in Germany, France, United Kingdom and Italy. The total number of dairy cows has fallen drastically in recent years: compared to the herd of 1988 the number of dairy cows in 1995 is 20% less. The trend observed in these figures did not start with the introduction of the quota system in 1984. Since 1968, when the common dairy policy was fully established, the number of dairy cows has decreased in all EU member states, except in the Netherlands and Ireland where in the period between 1968 and 1983 the dairy herd increased on average 2% per year. Since 1984, the number of dairy cows has fallen in all member states, most drastically in France and the Netherlands (CEC, Agricultural Situation Report, various years). The total number of dairy cows in the EU showed a substantial increase every time a new member state joined the Community. The 1995 enlargement of the EU with Sweden, Finland and Austria, has expanded the EU dairy herd with 1.7 million dairy cows. With this enlargment, the EU dairy herd counted 22.5 million cows.

The United States (US) dairy herd is almost half the size of the herd of the EU-12. Compared to the reduction of the number of dairy cows in the EU in recent years, the decline in the US is less significant. In the period between 1988 and 1995, the reduction of the number of dairy cows was only 6.7%, or on average less than 1% per year (over a longer period of time the decline in the US is also considerable). The decline in the Norwegian dairy herd has been 7.6% in the period observed, also much less than in the EU. More significant is the decline of the dairy herd in Finland (-26%) and Sweden (-17%) in the period being considered.

Production per cow has been increasing year by year in the EU, USA and Sweden, while the yield per cow is rather stable in Norway and Finland. The level of productivity is highest in the USA. The production per cow in the EU is less than in the USA and in the Scandinavian countries. There are, however, big differences in productivity per cow between EU member states, in the range of 3.6 t/cow/year for Greece to 6.5 t/cow/year for Denmark, in 1993 (CEC, 1995).

Table 4.1 Selected basic indicators of the dairy sector in the EU, USA and Scandinavian countries

		1988	1990	1992	1994p	1995e
EU-12	Dairy cows ('000)	25,995	24,507	21,686	20,959	20,800
	Yield (t/cow/year)	4.6	4.8	5.2	5.3	5.3
USA	Dairy cows('000)	10,212	10,015	9,728	9,528	9,532
	Yield (t/cow/year)	6.4	6.7	7.1	7.5	7.5
Norway	Dairy cows('000)	354	355	342	331	327
	Yield (t/cow/year)	5.6	5.7	5.7	5.8	5.4
Sweden	Dairy cows('000)	621	576	526	517	n.a
	Yield (t/cow/year)	5.5	6.1	6.1	6.5	n.a
Finland	Dairy cows ('000)	551	490	427	408	n.a
	Yield (t/cow/year)	5.0	5.7	5.8	5.7	n.a

Source: OECD, Current situation, short term outlook and recent policy changes in the dairy markets of OECD and observed countries. AGR/CA/APM/MD(94)6, August 1994 and (95)5, October 1995.

Trends in the yield per cow differ between the EU and the USA. Since 1992 a slowdown of the yield increase in the EU can be observed. In 1988-1990, production per cow went up 2.1% per annum on average. Yield increase per year reached 4.2% in the 1990-1992 period, but the growth rate dropped in 1993 and 1994 to somewhat less than 1.0% per annum. The yield per cow in the USA shows a more steady path with rather high growth rates of 2.3% per annum in the period 1988-1990, 3.0% for 1990-92 and 2.9% in 1993 and 1994. According to OECD estimates the yield per cow in the US will stabilize in 1995. Such a projection may be too conservative if the impact of the use of rBST is fully taken into account.

The Netherlands, Germany, France and Denmark are the most important EU exporters of dairy products (see also chapter 6). Therefore, these countries are selected to look at more closely.

In 1991, there were 1.2 million dairy farms in the EU (table 4.2). Out of these 1.2 million farms, about 40% are in Germany and France. In these two countries, 50% or more of the farmers with dairy cows also have other farming activities (other animals, crops); in Germany only 43% of the farms with dairy cows can be categorized as specialized dairy farms, while in France it is 52%. In the Netherlands and Denmark, the specialization rate is much higher (around 70%, almost the same as in the USA). Compared to those in the Netherlands and Denmark, the dairy farms in Germany and France fewer cows and about the same land area. So, dairy farming is less intensive in Germany and France than in the Netherlands and Denmark. The number of cows per dairy farm is increasing over time at the EU level as well as in all member states shown in table 4.2. As the smallest dairy farms leave the sector, this increases the average farm size in terms of number of dairy cows per farm.

Table 4.2 Features of dairy sector in selected countries

	EU	NL	G	F	DK	USA	N	S	F
Number of dairy farms ('000)	1,202	48	275	199	21	182	29	23	47 a)
Specialized farms (%)	57	69	43	52	67	68			
Farm area (ha)		29.0	29.4	38.4	36.0	158			
Cows per farm 1991	18.4	40.1	17.3	25.0	35.8	54.0	11.6	22.0	10.5 a)
Cows per farm 1987	15.7	37.6	16.0	20.0	30.4	44.0	11.2	18.0	8.6 b)

Note: 1991 data; a) data 1990; b) data 1983.
Sources: CEC, Agricultural situation report 1994, 1995; Rabobank, 1995:10; Agricultural Statistics of Norway, Sweden, Finland.

Compared to European dairy farms, US farms are large, both in terms of number of cows and hectares, and specialization. However, these data are all averages. There are significant differences between individual farms. Around 14% of all US farms with milk cows are large dairy farms with 100 or more dairy cows. The largest farms are concentrated in the West and Southwest. Very large dairy herds of 700 to 1,500 cows are common in Southern and Central California, Arizona, New Mexico, Texas and Florida, but are rare elsewhere.

Table 4.3 Farm structure of the dairy sector in selected countries (% of total number of farms)

	EU	NL	G	F	DK	USA	N	S	F
Farms <10 cows '92	46.7	13.3	35.0	17.5	10.2	38 a)	40.1	18.4	49.0 b)
Farms <10 cows '87	53.3	16.6	40.3	28.6	16.3	46 a)	44.0	26.5	64.1 c)
farms >50 cows '92	7.8	31	3.5	8.0	22.9	39	0.2	7.5	0.1 b)
farms >50 cows '87	5.8	28.9	3.3	4.9	16.8	30	0.2	3.4	0.1 c)

a) % farms <29 cows; b) data 1990; c) data 1983.
Source: CEC, Agricultural situation report 1994, 1995; Rabobank, 1995, p.10.

The trend of increasing concentration of dairy farming is confirmed by data on small and large farms (see table 4.3). In 1987, more than 53% of EU dairy farms had less than 10 milking cows and only 5.8% of the farms had more than 50 cows. In 1992, these percentages changed so that the percentage of smaller farms declined and the number of larger dairy farms had increased. These changes appear to be the general trend in the EU member states and in the USA (and in the Scandinavian countries too; see Nord, 1995). But the smaller dairy farms are still dominating the scene in the EU, contrary to the situation in the USA. Only 38% of US dairy farmers have less than 29 cows, but in the EU almost 80% of dairy farms are within this category. Also in this respect there are big differences between EU member states and between regions within member states (e.g. Habraken, 1994).

Together with the increasing concentration in milk production at farm level, the number of processing plants has declined and the scale has expanded. Since the introduction of the quota system in the EU in 1984, the structural change of the dairy processing industry, which had already started during the mid-sixties, has undergone an impressive acceleration. The number of businesses in the milk collecting and processing industry dropped from over 9,000 in 1973 to less than 4,000 in 1993 (Rama and Pieri, 1995). This concentration trend has favoured the biggest companies whose position has been strengthened further. More than 60% of EU milk production is delivered to approximately 70 companies which make up less than 2% of the total number. The (three) biggest dairy processors are private companies while in most EU countries dairy cooperatives play a significant role too

4.3 Economics of dairy farming in the EU

The economics of milk production is difficult to analyse. On most dairy farms, except the specialized ones, milk production is mixed with other animal and/or crop production, with which it constitutes an integrated farming system. Milk production is inextricably bound up with beef production, as beef production accounts for a substantial contribution to total gross production value, even on the highly specialized farms in milk production. Therefore, allocation of costs on an output basis is complex and mainly done by using standard norms based on averages. Actual allocation of costs on a farm may differ from the averages used in the calculations. Moreover, there is a wide spectrum of methods in valuing unpaid cost items like owned land, family labour and owned capital. All this makes the specific consideration of milk production somewhat arbitrary. However, despite the methodological complexities, estimates of production costs have been made and used by economists and policy makers for different purposes, like measures of productivity, to provide guidelines for farm operators and in setting target prices. Moreover, cost price comparisons between countries can play a role in the analysis of international competitiveness of a sector.

In the work of Rama and Keane (1993), production costs for milk in nine EU countries (and Poland) are estimated. Because of the methodological problems mentioned above, a ranking of countries by costs can not be found in this study. Instead, emphasis is put on the links between farm structure, milk utilization and production costs. It appears that a fairly clear relationship emerges between size of the herd and the total unit costs. Costs per unit tend to fall with increasing herd size, but flatten out after a certain point. The main reason for the size economies is related to the high level of family labour resources on smaller dairy farms. Omitting family labour from the cost estimates leaves a less strong relationship between scale and unit costs. As the size increases, labour (and land) requirements per kilo diminish to a very great extent, because of greater mechanisation and computerisation possibilities. After reaching a certain level (in terms of number of cows), production costs per unit are increasing as total required capital (including land) goes up and additional labour has to be hired. Differences in costs between large and small farms are highly attributable to family-provided inputs, like land, labour and capital.

Production costs and profitability of dairy farming are affected by various interrelated factors, of which the size of the farm is but one. Other key factors affecting profitability of milk production are the breed of the cows (affecting yield per cow, nutritional content of milk, production costs, and revenues), and the level of intensification (Rama and Keane, 1993:119-121). A crucial factor is the management of the farm. These factors are farm specific, and therefore costs of production and profitability may differ considerably between farms even if they have a similar size.

Using farm accountancy data from the EU FADN database, Habraken (1994) analyses the trends in farm size, net return, cost of production and family income of highly specialized dairy farms in the EU member states. Apparently, there are huge regional differences in costs and returns. Based on the assessment of cost of production and family income per farm, the six best performing regions are Niedersachsen (G), Bretagne (F), Lombardia (I), West England (UK), the Netherlands and Denmark. Compared to EU and country averages, the dairy farms in these regions have more cows and a higher livestock density (and milk production per hectare).

4.4 Adoption and diffusion of rBST

The socio-economic impact of the use of rBST on the dairy sector depends on the adoption and diffusion of this new technology. *Adoption* refers to the decisions of individual producers whether or not to use a technology, whereas *diffusion* is the rate and extent of technology adoption over time (Rogers, 1992). Studies on adoption and diffusion are carried out before (*ex-ante*) and after (*ex post*) the new technology has been introduced. Studies on diffusion of technology provide important information for public policy makers, because after a minimum number of farmers have adopted the new technology starts to have industry-wide or even nation-wide (socio-economic) effects.

The decision by farmers to adopt rBST is influenced by many factors. Since farming is an economic activity, the expectation that profits from adoption will be larger than profits that would be earned without adoption is an important driver behind adopting rBST. The profitability of rBST use is influenced by internal factors, i.e. farm and farmer characteristics, but also by factors that lie outside the direct influence of farmers. For instance, public policies and regulations often change the relative costs for inputs or the revenues that can be earned by farming. And ultimately it is consumer demand for food produced with the use of biotechnology, that will determine whether the adoption of rBST will be profitable.

In the USA, many ex-ante studies have been conducted on the adoption and diffusion of rBST (see Caswell et al., 1994, for an evaluation of 15 such studies). Three types of predictive approaches have been used: profit function models, which compare the costs and benefits of adoption for farms with different production conditions and management techniques; historical trend analyses, which examine previous agricultural technology adoption experiences and compare them with the current technology; and farm operator surveys, which ask farmers their use intentions, sometimes in several different ways to test the sensitivity of their responses to the information they have at hand (Barham et al., 1995). In the USA, at least a dozen producer surveys were undertaken between 1986 and 1993, especially in the major dairy production states of California, New York, Texas, and Wisconsin, to elicit responses from producers on their intentions to use rBST.

Caswell et al. (1994) summarized the results and methods of many of the American studies on the adoption and diffusion of rBST. They conclude that there is a wide range in the forecasts of adoption and diffusion rates. Estimates of adoption of rBST after the first year of commercialization ranged from 6% to 77% of either total farms or cows. No study predicted complete adoption by the entire dairy sector, even after ten years of availability. Most studies estimated that the extent of final adoption would fall between 30 and 75%. There were no significant differences in ranges of estimates for different regions of the USA. An important reason for the wide range of forecasts is the uncertainty about the acceptability of the biotechnology-derived product among producers, dairy processing firms, and consumers. But also uncertainty about the level of production efficiency that can be achieved when the technology is applied under actual farm conditions, and about possible changes or adjustments in government dairy policy can lead to the large variation in estimates of the adoption of rBST.

In analysing potential rBST use, most of the ex ante adoption studies look at farm-level determinants. This focus on the farm and farmer characteristics, with its implicit assumption that farmer decisions will be independent of overall industry conditions, is not uncommon in research on the adoption and diffusion of new technology in agriculture. Barham et al. (1995) have compiled a list of explanatory factors used in ex ante rBST adoption analyses and the typical direction of their effect (see figure 4.1).

The effects of the various farm and farmer characteristics on rBST adoption, as listed above, can be explained as follows. Larger and wealthier farms are more likely adopters because of information economies associated with the adoption of new technologies, their lower aversion to risk, and/or their better ability to finance associated investments. Herd productivity and more 'skilled' farm management practices are seen as being positively correlated with adoption. Also, human capital attributes of farm operators are seen to be positively related to adoption of new technology, in that they will contribute to the operator's capacity to make use of innovations profitably. Age is negatively related, because younger farms are often viewed as having a longer time-horizon with respect to the farm enterprise, and thus to the gains from adopting new technologies. In the miscellaneous category, the adoption outcome associated with group membership or industry-level type concerns can be either positively or negatively related to adoption, depending on whether farmers view themselves as unable to affect the outcome through individual decisions or as part of a larger group acting collectively or jointly.

This focus on farm and farmer characteristics presents an incomplete picture of factors that influence adoption and diffusion. According to Barham et al. (1995), the American ex ante adoption studies do not account for the potentially negative effect of consumer response on adoption outcomes. If ex ante studies of consumer attitudes showed significant reduction of milk consumption as rBST was introduced, more complete producer surveys should include questions about how producers might adjust their adoption decisions to different scenarios of consumer response. However, such comprehensive studies are rare.

Explanatory Factors	Predicted Effect (+ = adoption, - = non-adoption)
1. *Farm Structure*	
Herd size	Bigger herd (+)
Diversity of income sources	More diverse (-)
Wealth	More wealth (+)
2. *Farm Management Practices*	
Herd productivity	
Higher productivity (+)	
Dairy herd improvement association	Participation (+)
Use computers on farm	Computer use (+)
Artificial Insemination	AI use (+)
Milking facilities	Parlour (+)
3. *Human Capital Attributes*	
Age	Younger farmers (+)
Years of formal education	More education (+)
Dairy farm experience	More experience (+)
4. *Miscellaneous Factors*	
Membership in farm groups	Information (+)
	Group pressure (-)
Concern about price impacts	Treadmill concern (+)
	Surplus (-)

Figure 4.1 Predicting rBST use in ex ante adoption models
Source: Barham et al., 1995.

To our knowledge, no detailed *ex ante* studies of adoption and diffusion of rBST use have been conducted in the EU. Given the quite different dairy farm structure in the EU compared with the structure in the USA, and even the large differences within the EU, adoption and diffusion of rBST might follow a rather different course than in the USA. It may be useful to conduct such studies in order to be prepared for expected changes in production and industry structure. Such studies should also include, as above suggested, potential consumer response. As the attitude of consumers in Europe is expected to be negative (although with differences among EU countries), adoption and diffusion studies will not be complete without the incorporation of the impact consumer response may have on farmer behaviour.

4.5 US farmers' experience

Studies in the late 1980s (Fallert et al., 1987, Blayney and Fallert, 1990) suggested that, depending on the government milk price support levels, over a 7-year period from 45 to 70% of US dairy farmers would adopt rBST. They estimated a 10% adoption rate in the first year and from 20 to 33% adoption by the end of the second year. Current actual adoption rates for Posilac™ seem to be following the trend projected in these studies by the US Department of Agriculture (USDA).

Previous studies expected milk prices to remain at government price support levels. However, in the 1990s annual average farm-level milk prices have been 20 to 30% above the government support price. Consequently, cow numbers have remained stable around 9.5 million head. Growth in domestic and export demand for dairy products, along with occasional weather related problems with the quantity and quality of forages, have contributed to profitable milk production. Except under a very high-price support, with rBST adoption, the USDA studies had expected herd size to decline over a 7-year period from about 10.4 to 9.4 million cows.

The USDA studies had forecast that with rBST adoption, average milk production would increase about 3,000 pounds per cow over a 7-year adoption period, or about 430 pounds per year on average. USDA data for the 2-year period 1994-1995 suggest that milk production has actually increased about 725 pounds per cow, or on average 363 pounds per year. It should be noted that Posilac™ was available for 23 months of this recent 24-month period, beginning in February, 1994.

Monsanto officials indicate that the most rapid adoption of their product has been in New York, Pennsylvania, California, New Mexico, and Idaho. Monsanto has not yet released any data for their second year of sales nor are there any national studies available on rBST use for the entire 2-year adoption period. However, economic studies have been published for two of the key dairy states, New York and Wisconsin.

Three states, California, Wisconsin, and New York, represent about 36% of the dairy cows and 38% of the milk production in the United States. California is the leading dairy state with 12% of the cows and 16% of the production.

Wisconsin is the second leading state with 17% of the cows and 15% of the production. New York is the third leading state with about 8% of the cows and production.

Adoption of rBST has lagged some in California because of the large herd size, the corporate style operations, and a tendency to manage the herd rather than individual cows. The average herd in California is 305 head with several farms having more than 1,000 head. In California, slightly more than 50% of the dairy farms report 100 or more cows. Hence, some California dairy farmers have been slow to adopt rBST since their employees have to milk large numbers of cows each day and can not easily monitor the performance of each cow as is done more easily on family farms with smaller herds. Also with the large volume of milk production per farm, and often long hauling distances to the limited number of processing plants, there has been a concern by some California dairy farmers that if they used rBST and their processors did not accept milk from rBST-treated cows, they might have some difficulty finding an alternative buyer.

In contrast to California, adoption has been relatively rapid in New York for several reasons. In New York there are about 11,000 dairy farms averaging 66 cows per farm with 55% of the farms reporting more than 50 cows and 17% reporting more than 100 cows. With moderate size herds, and mostly family farm operations, it is easier to administer rBST and monitor cow performance.

Cornell University scientists have conducted extensive studies of rBST. Consequently, New York dairy farmers have confidence in the university staff. This has helped encourage rBST adoption. Also many dairy processing plants are available to process milk within relatively short hauling distances. If a few processors refuse to accept milk from rBST-treated cows, there are other processing plants nearby that will accept milk from rBST-treated cows. This reduces the marketing risk for New York farmers who wish to adopt rBST.

Knoblauch et al. (1995) studied 400 dairy farms in New York for the years 1993 and 1994 (for details see appendix 6). Recall that Posilac™ first became available in February 1994. They divided the sample into four groups. The first group (137 farms with an average of 89 cows in 1993) included cows that were not treated with rBST. The second group (24 farms with an average of 100 cows in 1993) used rBST on less than 25% of the cows during the period February through December 1994. The third group (85 farms with an average of 237 cows in 1993) used rBST on 25% or more of the cows during the same period. The fourth group (13 farms with an average of 135 cows in 1993) started and ceased the use of rBST. They made a comparison between the year before adoption and the year of adoption for farms using rBST. They also compared farms using rBST to the farms that did not use rBST in each of the two years.

A summary of the results of the Knoblauch et al. study follows:

- for the herd not using rBST, the herd size grew by four cows, milk sold per cow remained unchanged, cost of production increased 0.17 cents per pound, and net farm increased by $2,789;

- for the herd where less than 25% of the cows were treated with rBST, milk sold per cow increased by 689 pounds, cost of production increased by 0.42 cents per pound, and net farm income increased by $540;
- farmers who used rBST on 25% or more of their cows increased the herd size by 21 cows, increased milk sold per cow by 1,752 pounds, cost of production increased by 0.22 cents per pound, and net farm income increased by $20,568. In the period 1992 to 1993 these same farmers without rBST use increased milk sold per cow by only 122 pounds, substantially less than the following year when they used of rBST;
- for those farmers who tried rBST but did not continue its use, herd size increased by only three cows, milk sold per cow increased by only 106 pounds, cost of production increased 0.60 cents per pound, and net farm income decreased by $6,987.

From this economic analysis of a relatively large sample of representative New York dairy farms, it is clear that farmers who adopted rBST had, on average, large herds and were more profitable than other farmers. With the adoption of rBST they increased productivity per cow and net farm income. Feed cost per pound of milk sold decreased for farmers using rBST, while it increased for non-adopters. Adopting rBST use is relatively easy, but changes in feeding programmes and selection of animals to be treated with rBST requires additional management time.

Dairy farmer experience in Wisconsin, the second largest dairy state, has been somewhat different than in California and New York. Herd size is much smaller in Wisconsin and farmers tend to be slower to adopt new technology. Many Wisconsin dairy farmers still are not members of the Dairy Herd Improvement Association (DHIA) and many have not yet adopted the use of Total Managed Rations (TMR) to improve herd nutrition and performance.

Results of a survey of dairy farmers conducted by researchers at the University of Wisconsin was released in May 1995. The researchers document the attitudes and rBST adoption rates of Wisconsin dairy farmers (Barham et al., 1995). According to this survey, by November-December 1994, about 10 months after the initial commercial sale of Posilac™ by Monsanto, only 5.5% of Wisconsin dairy farmers were using rBST compared to about 11% nationwide as reported by Monsanto on January 31, 1995. About 1% of the Wisconsin farmers indicated that they anticipated using rBST within six months, while 3.6% said they would wait at least six months before making a decision. Of the remaining 90% of the survey respondents, many (36%) said that they were unlikely to use rBST and a majority (54%) said that they would not use it under any circumstances.

For the Wisconsin dairy industry, a growing gap in adoption rates between Wisconsin and the rest of the United States could hamper the long-run competitiveness of the state's dairy industry. However, anecdotal evidence suggests that the Wisconsin dairy industry may undergo a substantial structural transformation over the next few years with the smaller and less competitive dairy farmers leaving the sector, while larger and more competitive farmers expand the scale of their operations. Based on the New York study, and other studies of technology adoption, these large farmers with improved management skills would be more likely to adopt the use of rBST.

The authors of the Wisconsin study conclude that the relatively low level of adoption of rBST in Wisconsin is a result of the high level of politicization surrounding rBST in Wisconsin. Furthermore, this politicization process has been intertwined with underlying structural and organizational issues in Wisconsin. Thus, consumer concerns about the safety of rBST in milk that was fed by the news media, along with concern about the economic pressures for structural change in Wisconsin's dairy industry due to expansion of the dairy industry in other regions of the United States, has resulted in strong resistance to rBST adoption by Wisconsin's dairy farmers. The politicization of rBST in Wisconsin - and perhaps in Vermont, Maine, Rhode Island, and California, all of which have experienced some organized resistance to the introduction of rBST - appears to demonstrate that social forces can play a role in farmer adoption decisions concerning emerging agricultural technologies.

Wisconsin dairy farmers, and non-adopters in other states, face a serious challenge as the more progressive operators, who generally manage larger herds, adopt rBST and expand milk production, and probably herd size. Under such competitive pressures, the non-adopters' strategies might include: increase the scale and technical efficiencies of existing dairy farms, develop alternative low-cost ways to compete in a market with declining milk prices, develop new markets for rBST-free products, and prepare to consider some changes in marketing and processing as the adoption of rBST increases.

MONSANTO'S EXPERIENCE

While Monsanto was awaiting FDA approval, it developed an extensive database on approximately 100,000 US dairy farmers. This database serves as a basis for its direct marketing programme. To order Posilac™, each dairy farmer must call a toll-free 800 number. The product is manufactured in Austria and air freighted to Memphis, Tennessee, the national transportation hub for Federal Express. Once the farmer has placed an order, Federal Express delivers the product to the farmer. The farmer then receives from Protiva, a division of Monsanto, a bill for the product plus shipping and handling. Monsanto currently has about 75 field representatives who work with farmers to answer questions and help them use rBST. Protiva also maintains a 24-hour hotline for farmers to call for technical information. Consumers also can call a toll-free 800 number if they have questions.

Posilac™ is shipped in boxes of 25 single-dose syringes, each containing 500 mg, as a prolonged release product. The farmer should administer the product every two weeks beginning during the ninth week of lactation. Assuming a 310-315 day lactation, this implies 18 injections per cow over a 252 day period. Farmers can expect a five to 15-pound increase in daily milk production. The average experience has been about 10 pounds per cow per day. After injecting the cows, the used syringes are mailed back to Monsanto in a special container provided by Monsanto.

Response to the injection is fairly immediate. Increases in milk production usually are noted within two or three days of the injection. Data provided by Monsanto indicate that the response to Posilac™ increases after each administration, then plateaus at a sustained higher level as compared to the normal lactation curve.

Initially, Posilac™ was sold to the producer at $5.00 per unit (36 cents per cow per day). The current price is $6.60 per unit (47 cents per cow per day). The minimum order is 50 units. Each order, regardless of the order size, has a handling and shipping charge of $8.50. The bill must be paid by the 20th day of the month following the month in which the order was placed. Since dairy farmers receive a monthly milk check, this method of payment usually does not cause any cash flow problems for the farmer.

Since cows will produce more milk, they must consume more feed. Monsanto estimates that to produce 10 pounds more milk per day, the cow requires an additional 3.1 Mcal of energy. Feeding 4 pounds (dry matter) of a ration with 0.78 Mcal per pound of dry feed could meet this requirement. If the ration cost is seven cents per pound, the feed cost would equal 2.8 cents per pound of milk response. Monsanto estimates administration costs at one cent per cow per day. This is based on 50 cows injected once every two weeks with labour at $14.00 per hour. Monsanto estimates that with the milk price at $1.25 per pound, farmers should receive $0.51 profit per day per cow producing an additional 10 pounds of milk as a result of the injection of rBST with a daily cost of 36 cents per cow ($5.00 per unit). On a 50-cow farm, injecting rBST for 252 days of each cow's lactation would generate $6,426.00 in additional profit per farm.

After six months, on September 14, 1994, Monsanto had received more than 78,000 telephone calls from consumers and other interested parties. They also reported that more than 10,000 producers had treated 800,000 cows with 6.8 million doses of Posilac™. Of 95 reports of concern from producers, only 14 had concerns about mastitis, a common udder inflammation that normally clears up in four to five days.

After one year of experience with Posilac™, Monsanto reported sales of 14.5 million units to about 13,000 dairy producers, approximately 11% of all U.S. dairy producers. As of February 1995 Posilac™ had been administered to approximately 2.7 million dairy cows. Monsanto estimates that those farmers who purchased Posilac™ during the first year of sales managed approximately 30% of the U.S. dairy herd. According to Monsanto, more than 99% of their customers reported increases in milk production. The average reported increase per cow was about 10 pounds per day.

Monsanto's data suggest that the size of herds supplemented with Posilac™ closely resembles the distribution of herd sizes in the United States. Herds more than 100 cows are slightly more likely to be using Posilac™. However, according to Monsanto, 55% of the farmers using Posilac™ manage herds of 100 or fewer cows. The usage rate on farms varies from five to 70% depending on individual herd management and stage of adoption.

To help monitor any potential herd health problems, Monsanto has an active outreach programme. During the first year of sales there were more than 110,000 telephone inquiries from customers. Also, Monsanto works with a network of more than 120 veterinarians and animal nutritionists.

During the first year of sale of Posilac™, from the estimated 2.7 million cows treated, there were only 806 reports of adverse effects. Follow up by the FDA found that there were 121 reports of mastitis, 105 reports of increased somatic cell counts, 73 reports of udder swelling or abnormal milk, and 89 reports of reproductive disorders. Of the 806 reports, 496 were possibly related to product use and 310 were unrelated. After careful review, the FDA did not find any cause for concern. The agency validated Monsanto's adverse drug reaction reporting system and investigated some reports with on-farm inspections. The FDA plans to continue to monitor Posilac™ use including an ongoing, two-year study of 24 dairy farms of various sizes in different regions of the United States. They will release the results from this study in 1996.

Monsanto has plans to soon release an updated progress report on Posilac™ use after two years' experience with the product. In November 1995, officials in the Protiva division of Monsanto estimated that during 1995, depending on the season, from 15 to 25% of US dairy farmers had used Posilac™. These farmers manage between one-fourth and one-third of the total US dairy herd.

5. DAIRY POLICY IN THE EU, NORWAY AND USA

5.1 Introduction

In this chapter the focus is on dairy policies in the EU, Norway and the USA. First, EU dairy policy is characterized by describing the instruments used within the market organization for dairy products. As the milk quota system is an instrument of crucial importance for this market organization, attention will be paid to the impact of this system on the sector and to the discussion on the future continuation of this instrument in EU dairy policy. Then, Norwegian dairy policy is described. No attention is paid to dairy policies in Sweden and Finland as both countries are new EU member states; dairy policy in both Scandinavian countries is comparable to EU dairy policy. The US dairy policy is characterized by the dairy price support programme and the milk marketing order programme. This chapter ends up with some concluding remarks on differences and similarities between dairy policies in all countries under consideration.

5.2 EU market organization for dairy products

The basic management of the dairy products market was instituted in 1964 by the first EEC dairy regulation. This involved the annual fixing of a target price for milk in each member state and, on the basis of this price, an intervention price for butter (for skimmed milk powder an intervention price was established in 1968) and threshold prices for a list of twelve pilot products. Originally prices were not common between the six member states during the period up to 1968, but these differences were gradually phased out. Since July 1968, a single-price market has existed (Tracy, 1989).

The methods by which the appropriate price levels are secured are:

- the imposition of variable levels on imports of dairy products to prevent internal price levels being reduced below the threshold or minimum import prices;
- the payment of subsidies on exports in order to bring prices of EU products down to the generally lower-priced international market level. Export levies may be applied in times of shortage, when world market prices are above EU prices;
- the protection of the domestic market against disruptions caused by seasonal and structural surpluses through the guaranteed purchase and storage of butter and skimmed milk powder;
- the payment of a subsidy on skim milk used for the manufacture of casein and caseinates and on skim milk and skim milk powder fed to livestock.

5.2.1 EU quota system

In the early 1980s, a target for milk deliveries was set, which, if exceeded, would lead to a modest reduction in the price received by farmers for their milk. This did little to halt the expansion of milk production and budgetary costs of the milk sector, and so, in April 1984, the milk quota system was established. Originally, the quota system was authorized for five years, but in 1988 it was extended for another five year period. As part of the CAP reform, it was further extended from 1992 until the year 2000, with the quantity to be specified year by year.

Originally, quotas were set for each member state at the level of 1981 deliveries plus 1%, with 1984/85 a transitional year with an extra 1% added. In addition, a Community Reserve was established to supplement the quota in particular areas of difficulty. Overproduction of butterfat led to the system being tightened in October, 1986 by penalizing any increase in fat content above the 1985/86 level. This was not enough to prevent budgetary problems and quotas were reduced by 6% in 1987/88 and an additional 2.5% in 1988/89. Quotas were further reduced in 1991/92 by 2% as a result of a deteriorating market situation. On April 1, 1993, quotas were increased overall by 0.6%, while additional quota was given to Italy, Greece and Spain to ensure a proper application of quota in these countries following the revision of quota estimates.

Table 5.1 Total milk quotas, by member state and EU-12 level

	1986/87	1988/89	1993/95
Belgium	3,611	3,326	3,310
Denmark	4,883	4,468	4,455
Germany (West)	23,553	21,558	21,621
Greece	583	536	631
France	26,508	24,303	24,236
Ireland	5,599	5,150	5,246
Italy	9,914	9,133	9,930
Luxembourg	291	268	269
Netherlands	12,074	11,053	11,074
UK	15,790	14,475	14,590
Total EU-10	102,806	94,270	95,362
Former GDR	-	-	6,244
Spain	5,400	5,032	5,567
Portugal	-	-	1,873
Total	108,206	99,302	109,046

Source: CAP Monitor, appendix 7 and 8.

The system has been continually refined and altered to fit changing circumstances. The most essential elements of the current system are (CAP Monitor, 28.2.95):

- a guaranteed total quantity (quota) specified for each member state (table 5.1). No transfers of quota can take place across national borders;
- if this total quantity is exceeded, a levy is payable by individual milk producers. The level is currently fixed at 115% of the target price;
- a member state can choose whether to collect the levy directly from producers (farm level), or from the purchasers of milk (dairy processors), who will deduct any amount owed from individual producers through the price of milk or by other appropriate means;
- the levy is only payable to the Community if the total guaranteed quantity for the member state is exceeded. Individual producers who exceed their quota are subject to the levy once allowance has been made for producers who have marketed less than their quota;
- individual reference quantities are allocated to each holding. If the fat content of a producer's milk varies from the base level (usually the level in 1985/86), the amount of milk delivered is multiplied by 0.18% per 0.1 gram of fat per kilogramme of milk. This effectively means that quotas are fixed in terms of fat rather than in quantity of milk.

Although quotas are linked to a producer's holding, they can be transferred from one farm to another through the sale, lease or inheritance of the farm, the lease of the quota itself, the purchase of quota by the governmental authorities of a member state, or the allocation of quota from a national reserve. Arrangements and rules for quota transfer vary considerably from one member state to another. To restructure milk production, governmental authorities of member states can purchase quota from producers and reallocate it to other producers.

5.2.2 1992 CAP reform and GATT agreement

The 1992 CAP reform and the implementation of the GATT agreement have only limited implications for the EU dairy market organization. As part of the CAP reform package it was decided to reduce the target price for milk and to reduce milk quotas. The price cut was justified by the decline in feed prices as a result of a fall in cereal prices. Such a price reduction was achieved by the lowering of butter intervention prices in 1993/94 and also in 1994/95. The quota and price decisions have been subject to review. Sofar, no quota cut has taken place, but the butter intervention price was reduced more than originally foreseen in the Mac Sharry reform package.

Under the GATT Uruguay Round, the EU has entered into commitments governing market access, export competition, and internal agricultural support. The commitments began on 1 July 1995 and will be implemented fully over a six year period. The market access provisions relating to dairy products are a reduction of tariffs by 36% (20% for skimmed milk powder (SMP)) compared to the average level of 1986-88, and creation of import opportunities representing 3% of domestic consumption, rising to 5% by 2001. Provision will have to be made to enable the import of around 105,000 tonnes of cheese and some SMP and butter. The export competition commitments entail a reduction of 36% in expenditures on export support and 21% in the volume of subsidized exports, compared to the average level of 1986-90. The principal effects will be to reduce subsidised cheese exports (Van Berkum, 1994, see also section 6.4). Rules governing imports and exports had to be adjusted. EU variable import levies are replaced by ad valorem tariffs. Furthermore, a system of import and export licenses had to be implemented in order to monitor trade according to the commitments made in the GATT agreement.

5.2.3 Alternatives for present policy

The most crucial question for the EU dairy sector in coming years will be whether the quota system will be maintained after the year 2000. Abolishing the system of production rights may have large economic and structural consequences for the EU dairy sector (see chapters 6 and 8). Here we focus on some effects of the quota system on the sector and discuss alternatives to the present policy.

The impact of the introduction of the system of production management on market developments has been multifarious. Less production led to less excess supply and so to lower export and intervention stocks. The forced production limitation resulted in higher farm level milk prices. Estimates indicate that - assuming unchanged budgetary outlays - without the quota system, the milk prices would have been 20% less. Milk prices have remained higher since 1984 compared to average agricultural prices (which are declining). Partly this can be attributed to the quota system. Also, the quota system has had consequences for feed prices. Because of the shrinking of the dairy herd, more green fodder per animal is available. Subsequently, demand for compound feed decreased and prices declined. In general, dairy farmers have benefitted from lower feed prices. Lower cereal prices in the EU resulting from the 1992 CAP reform also have affected favourably the feed costs for dairy farmers.

Although the economic results for the primary dairy sector are relatively positive and will not be affected negatively by the 1992 CAP reform, discussions to change the dairy policy occur from time to time. In the discussion of policy alternatives, the unfavourable aspects of the present quota systems are highlighted. The processing companies are especially against limitations on production. In countries where the production rights are tradeable (like the Netherlands and UK), the system is cost increasing. Advocates for an alternative dairy policy indicate that the quota system slows structural adjustment in the sector. In the following three alternatives are sketched.

A. A two-price system is mentioned regularly as an alternative for the quota system presently in force (e.g. Hubbard, 1992). In such a system the maximum amount of milk is allocated to each dairy farmer. That amount (quota) can be delivered against a guaranteed price, which is above the world market price level. For milk production exceeding the quota, the farmer would only receive the world market price. A disadvantage of this approach is that the quota with the guarantee price will have to be about same as the internal sales on the EU-market which means that the present EU production will be cut by about 12-15%.

B. Another approach is radical price liberalization. According to this idea, price supports and the quota system would be abolished and farmers would be supported only by direct income payments. This income support could be production-tied or de-coupled from production levels or animal numbers. Internal prices would have to be on the same level as those on the international markets and no production management would be endeavoured any more. Proposals in this direction are not welcomed enthusiastically sofar. For most farmers, the economic advantages of the quota system (assuring production and sales support) are considered to be larger than those of liberalization where the market mechanism would cause more price uncertainty.

C. As a third alternative, a direct payment could be introduced together with price reductions and maintenance of the quota system. Such an alternative could fit well within the GATT commitments. It would help to realize the export reduction requirements relatively easily. In fact, this approach was under discussion in the 1992 CAP reform package through the proposal of the dairy cows premiums. However, the proposal was rejected because it would mean a steep rise in the budgetary costs of the dairy policy.

For the time being there is no support for dismantling the quota system. EU countries are, however, split in their views on how to solve a decline in milk prices. The Netherlands and UK are at the forefront of those who believe that there should be continuing support price cuts, while Germany favours quota cuts and unchanged prices. In Germany, milk prices paid to dairy farmers have declined around 20% since 1990, due to overproduction and a strong D-mark affecting exports negatively. Price reductions would be supported by budget controllers within the Commission, who are alarmed at the failure of the quota system to curb over- production and reduce subsidy payments (Agra Europe, London, April 29, 1994:E/7). The EU member states have not taken any position yet in discussions whether the quota system should be extended after the year 2000, and, if not, which alternative dairy policy should be pursued. Only the Dutch Minister of Agriculture has given his opinion by stating that the quota system is 'artificial' and therefore it should be abolished 'in the longer term' (LNV, 1995).

5.3 Dairy policy in Norway

In Norway, a quota system was introduced in 1983. The quotas are allocated to individual farms and are firmly fixed to the land. Transfer of quota from one farm to another is not allowed. The quota system is continued for one year at the time. In 1983, each farm was given a 'basis quota' based on the average production over the previous three years. Every year the quotas are adjusted to the market forecasts by multiplying the individual quota basis by a given factor. A dairy farmer may opt for a qualification as a special case and apply for extra quota. He will only be successful when his farm development is in accordance with the official guidelines. These guidelines for farm development refer to investments in expansion of farm buildings, expansion of area, and labour available on the holding. Since 1983 the rules of quota distribution and the related subsidies have contributed to levelling the production structure. Less milk is produced on large farms while many farms that had a limited production in the early 1980s have expanded. An increasing share of total milk production is produced at semi-large farms (60-100 thousand litres; Jervell, 1993). The distribution of the quota shows the general principle of Norwegian agricultural policy, which is more to keep rural areas economically viable and occupied than to pursue the cheapest possible production.

Ever since 1982 the national target quantity has been 1.8 million tonnes annually. Since 1992 the quantity target has been reduced several times to 1.74 million tonnes in 1994. A buy-out scheme was introduced in 1991 in order to minimise the consequences of the quantity reductions for the remaining milk producers. The buy-out quota was not redistributed to other farmers. A farmer participating in the buy-out scheme pledges not to produce milk on the farm for a period of seven years. A compensation is paid for income losses. The dairy farmers themselves finance the scheme by a lower average milk price. Due to limited producer response, the scheme ceased operation at the end of 1994.

Norwegian dairy farmers receive relatively high price supports. Producer prices are about 60% higher than in the EU. For deliveries beyond the quota limit, very low prices are given (around 5% of the target price). Market price support is supplemented by direct income payments, which are differentiated according to region and farm size. Basically, farmers in the more disadvantaged areas with the smallest farms are most favoured by the system. Norway has an extensive system of deficiency payments and other forms of direct payments. In 1992, a complete list of these payments included more than 40 separate schemes, some of which are targeted to meet regional, environmental and rural development objectives (OECD, 1993:144). A dairy farmer could receive payments from several schemes. The new agricultural policy approved in February 1993 is aimed at establishing a less complex support system with fewer policy instruments. For the 1993/94 and 1994/95 production years administered prices were reduced for all products (OECD, 1995a). Spending on deficiency payments was further reduced, especially for milk. Other forms of direct payments with weaker links to production have also been reduced.

5.4 Dairy policy in the USA

Most of the current major public dairy policies in the USA stem from the legislation enacted in the thirties and the forties (Weimar and Blayney, 1994).

Many of the major public policies are directed towards milk pricing, but milk quality and safety also have been important public policy targets. The two main vehicles of US dairy policy are the price support programme and the federal milk marketing order programme. Through the price support programme the US government stabilises dairy farm incomes while reducing seasonal instability in milk prices by purchasing unlimited quantities of manufactured dairy products at established support prices. Until July 1995 import quotas were imposed to keep imports of dairy products from overwhelming the dairy price support programmes. Since that date import quotas have been changed into a system of tariffs according to the rules defined in the GATT Uruguay Round agreement. Since 1985 export support through the Dairy Export Incentive Programme assist US exporters of dairy products to enter foreign markets. Federal and State milk marketing orders provide additional pricing mechanisms for the price support programme and cover nearly all fluid-grade milk produced in the US. Federal orders set minimum prices for raw-grade milk according to its use that processors must pay to dairy farmers or their cooperative. Federal orders do not determine how the milk may be used or how much milk is produced or marketed (Manchester, Weimar and Fallert, 1994).

The dairy price support programmes supports the milk prices received by the farmer through the purchase of butter, nonfat dry milk, and Cheddar cheese. These purchases are made by the USDA through the Commodity Credit Corporation (CCC). Processors offer butter, nonfat dry milk and cheese at announced prices. These prices are designed to return the support price to the farmer. The farm bill of 1990 sets an annual milk surplus target of 3.5 billion pounds of milk (1.6 billion tonnes), which provides a supply for government programmes and a cushion in case supplies are smaller or demand greater than expected. If USDA estimates a smaller surplus, price supports are raised. If annual purchases of dairy products are anticipated to be greater than 5 billion pounds of milk equivalents, the price support will be reduced, while if they are between 3.5 and 5 billion pounds, no price support adjustment is made.

Since the CCC purchases the final manufactured products in the market at the support price level, the prices actually paid by milk processors to the dairy farmer are not directly regulated by the programme. Price linkages between the price support programme and the Federal order system are shown in figure 5.1. Prices received by the individual dairy farmers depend upon many factors other than the support level, including plant location, product manufactured, quantity of milk delivered, local competition, and plant operating efficiency. The Federal order system sets minimum prices processors must pay dairy producers for Grade A (fluid-grade) milk. Milk is categorized into two groups and priced according to its use. Only Grade A milk can be used for beverage production, while Grade B milk can be used to produce only hard-manufactured dairy products. The price paid to farmers for manufacturing-grade milk is competitively determined. A commonly used measure for manufacturing-grade milk prices is the Minnesota-Wisconsin (M-W) price series. The M-W manufacturing price is used as a base formula by all orders and is the minimum Class III price. Minimum Class II prices are calculated by adding a small differential to the M-W price. The minimum Class I price is the M-W price plus any differential based on sanitation costs, transportation costs, and supply and demand conditions for milk.

The Agricultural Act of 1949 incorporated the parity price guideline which provided for minimum and maximum levels at which farm milk prices were to be supported. From 1949 to 1981 the minimum support price was 75% and the maximum was 90% of parity. Since the Agricultural and Food Act of 1981 minimum support prices are legislatively set in dollars per hundredweight (Weimar and Blayney, 1994).

Support prices may be adjusted from year to year depending on market developments. Since 1981 the support price for milk has declined in nominal terms several times as CCC projected removals exceeded 5 billion pounds milk equivalents (Manchester, Weimar and Fallert, 1994). Several programmes have attempted to reduce surplus production. For this purpose, the Food Security Act of 1985 established a whole herd buy-out programme for dairy farmers (Dairy Termination Programme). Cows and heifers exiting dairying under this programme were exported or slaughtered. This measure to manage excess dairy production was later considered to be unnecessary and was abolished in 1988. Since the late 1980s, growth of demand for US dairy products - domestically and internationally - has reduced excess supply. As a result, market prices for dairy products rose to a level above the support price. Since 1989 the farm level US support price has been US$ 0.101/pound and market prices has been US$ 0.11 to US$ 0.13 per pound to US farmers, what means that the price supporting programme has not effectively supported the farm level price since the late 1980s.

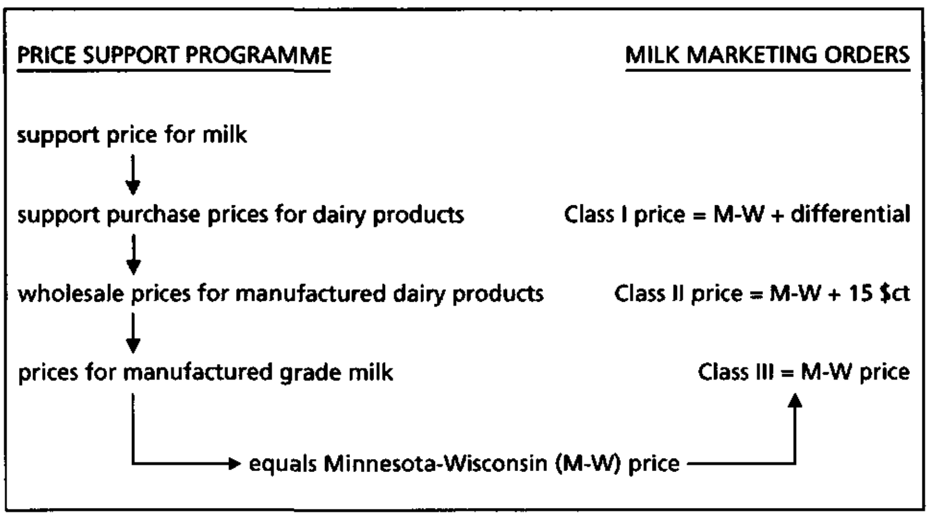

Figure 5.1 Federal milk marketing orders' link with Federal price support programme
Source: Manchester, Weimar and Fallert, 1994:5.

5.5 Concluding remarks

Dairy policy in the EU, USA and Scandinavian countries has a lot in common. The most significant similarity is the high level of protection all countries offer to their dairy sector (see table 5.2). The Producer Subsidy Equivalent (PSE) - an indicator for protection developed at and widely used by OECD - measures the value of the monetary transfers to producers from consumers of agricultural products and from taxpayers resulting from a given set of agricultural policies. As a rule, the PSE is expressed as the total value of transfers as a percentage of total value of production (valued at domestic prices). It appears that on average dairy farmers in OECD countries receive more than 60% of the production value through all support measures considered. The EU support level is equal to the OECD average, while the indicator for the US dairy farmer has declined and is now substantially below the average OECD level. According to the PSE-indicator, Norwegian dairy farmers are receiving substantially more support than the average OECD level. The Nominal Assistance Coefficient (NAC) on production - also an OECD concept - is the ratio of the border price plus the unit PSE to the border price. This coefficient gives an indication of the ratio between internal and world market prices. The NAC is highest for Norway, least for USA, and the EU-12 equals the OECD average. All countries use price supports as a policy instrument, resulting in internal prices significantly above the international level, especially in Europe. In the USA, farm prices in the market place are now well above government support prices and are determined by market supply and demand forces. To prevent an inflow of cheap(er) dairy products from other countries, the price support is linked to border measures. While EU and Norway rely on import tariffs, US dairy imports were restricted by import quotas. These US import quotas were abolished in July 1995, when they were changed into tariffs as agreed in the GATT Uruguay Round, and are gradually being relaxed.

Table 5.2 Overview of support to milk producers

		1986-88	1989-91	1992	1993(e)	1994(p)
EU-12	PSE %	64	63	65	62	63
	Producer NAC	2.70	2.55	2.62	2.48	2.51
USA	PSE %	64	57	54	55	54
	Producer NAC	2.55	2.17	2.06	2.10	2.04
Norway	PSE %	79	80	83	81	81
	Producer NAC	6.28	6.26	7.07	6.04	5.75
OECD	PSE %	66	63	63	63	62
	Producer NAC	2.9	2.6	2.6	2.5	2.5

Note: (e) estimate, (p) provision.
Source: OECD, Monitoring and Outlook report 1995.

Despite the similarities in policies, there are also striking differences. The main difference is that in the EU and Norway milk production is restrained by a quota system, while such a system is not in force in the USA. If US dairy production exceeds a certain level of surplus production, support prices are reduced, and this would bring down production again. Therefore, while in Europe production is bound to quota, production management in the USA seems to be strongly linked to price support levels. Futhermore, in recent years, US government owned stocks of dairy products are much lower than in the early 1980s, and milk price supports have had little impact on prices farmers receive and consumers pay.

6. EU INTERNATIONAL TRADE POSITION AND PERSPECTIVES

6.1 Introduction

The use of rBST may affect trade volumes and patterns. Widespread use of rBST by milk producers could stimulate dairy production. This could lead to increased surpluses if the domestic market is not able to absorb the extra supply and subsequently to more exports, or it could reduce the import needs because of an increasing self-sufficiency rate. In both cases, the country where rBST is adopted and used on a huge scale affects the trading possibilities of other exporters, with possible consequences for prices on the international markets. Furthermore, it is conceivable that countries where opposition against rBST is strong, may try to demand the strictest import requirements for dairy products processed from milk from rBST-treated cows. In those countries, product quality rules may be implemented and when such regulations differ between countries they may act as trade barriers.

In this chapter the focus will be on the international trade position of the EU and the intra-EU trade between member states. The chapter will end with a discussion of developments that will affect the international perspectives of the EU dairy sector in the years to come, plus supply and demand projections for the world market until the year 2000. These developments will play a role in the scenarios discussed in chapter 7 with respect to regulation of the use of rBST.

6.2 Position of the EU on the international dairy market

The EU is the most important milk producing region in the world (table 6.1). In 1994, a quarter of total world production of cow milk was produced in the EU-12. The EU is the world's major producer of cheese and dry milk powder, with a share of around 40% of the world production of both dairy products. The former Soviet Union was an important producing region with a share of about 23% of total world production of cow milk in the second half of the 1980s. In recent years, production in the CIS-states declined sharply because of the structural adjustments related to the political and economic upheaval. Still, the production within the region is 18% of the world's total. The US share in world milk production is slightly less (15%) than for CIS states in 1994 and has increased somewhat throughout the years. To indicate the level of concentration of milk and dairy production in the world, the figures for the EU and the USA together show that both areas account for 40% of world cow milk production, for about 55% of world dry milk powder production and for 60% of total cheese production in the world. When the region of the former Soviet Union

Table 6.1 Cow milk and dairy production in selected regions of the world

			1980	1984	1988	1992	1993	1994
World production	cow milk	(mil. mt)	422	452	471	463	461	459
	butter & ghee	(1,000 mt)	6,927	7,491	7,399	6,934	6,884	6,712
	cheese, total	(1,000 mt)	11,518	12,739	14,272	14,650	14,740	14,880
	dry milk, total	(1,000 mt)	6,995	7,820	7,584	7,343	7,435	7,457
Share in world production (%)								
EU (12)	cow milk		28.2	27.7	25.0	24.2	24.1	24.1
	butter & ghee		32.7	32.5	26.3	23.0	22.9	22.9
	cheese, total		35.7	36.7	35.7	37.7	38.3	38.6
	dry milk, total		52.8	48.4	43.8	42.0	42.3	42.4
USA	cow milk		13.8	13.6	14.0	14.8	14.8	15.2
	butter & ghee		7.5	6.7	7.4	9.4	9.1	9.2
	cheese, total		19.6	20.1	20.7	22.5	22.4	22.7
	dry milk, total		12.9	12.9	14.2	15.2	14.6	15.9
Area of ex-USSR	cow milk		21.4	21.6	22.5	19.5	18.8	18.0
	butter & ghee		20.0	21.2	24.4	20.4	19.6	18.3
	cheese, total		13.0	13.1	13.9	11.6	11.1	10.3
	dry milk, total		7.7	9.9	13.3	11.7	11.2	10.2
Oceania	cow milk		2.9	3.0	3.0	3.3	3.5	3.6
	butter & ghee		4.9	5.2	4.6	5.3	5.5	5.6
	cheese, total		2.3	2.1	2.1	2.3	2.4	2.8
	dry milk, total		6.0	7.2	7.8	9.6	10.3	11.2
Rest	cow milk		33.6	34.2	35.5	38.3	38.8	39.0
	butter & ghee		34.9	34.3	37.3	41.9	42.9	44.1
	cheese, total		29.3	28.1	27.6	25.9	25.8	25.5
	dry milk, total		20.7	21.6	20.9	21.6	21.6	20.3

Source: FAOSTAT.

is included, 10 to 20% can be added to these shares. Asia - as part of the rest of the world - produces around 15% of total world production. India provides around half of this production. Oceania (Australia and New Zealand) account for an increasing part of total world production but their share was only 3.6% in 1994. Although Oceania is a relatively small production region, it exports a major part of its production. Therefore, developments in milk production in Australia and New Zealand are relevant for the international dairy markets.

The EU is by far the biggest supplier of dairy products on the international market, followed at a distance by New Zealand and Australia (see table 6.2). The EU accounts for almost half of the world's dairy exports and the EU, New Zealand and Australia together had a share of 88% in 1994. New Zealand and Australia are extremely dependent on the international market as dairy exports account for almost 70% and 50% of their milk production, respectively.

Table 6.2 Export position of major suppliers on the world market for dairy products in 1994 (in milk equivalents)

	Export quantity (million tonnes)	Export as % of world exports	Export as % of country's production
EU a)	12.0	48.6	10.8
New Zealand	5.8	23.5	69.2
Australia	4.0	16.2	48.0
USA	1.1	4.5	1.6
EFTA-countries b)	1.5	6.1	10.1
Canada	0.3	1.2	3.9
Total c)	24.7	100	11.2

a) EU external trade; b) Norway, Sweden, Finland, Austria and Switzerland; c) Total of countries mentioned.
Sources: PZ, World Trade in Dairy Products 1994, p. VIII; FAO Agrostat.

The EU and EFTA export 10% of their dairy production to the world market in 1994. Only a very small part of US dairy production is exported. The same is the case with regard to Canadian dairy production.

EU exports to third countries mainly consist of cheese and whole milk powder (WMP) (table 6.3). In some years the export of skimmed milk powder (SMP) accounts for a big share too, but the export of SMP fluctuates strongly from year to year. The export of condensed milk and butter are in terms of milk quantities of minor importance.

Looking at the trends since 1984, cheese exports as a share of total dairy exports declined until 1988, have increased since then, and accounted for somewhat more than one-third of dairy exports in the 1990s. Whole milk powder was, in terms of milk equivalents, the biggest export product in 1984, and its position has become even stronger. In 1994, WMP accounted for 40% of the EU export package. SMP exports account for about 25-30% of total dairy exports in normal years within the period under consideration. Big export quantities in 1988 were possible because of EU efforts to reduce the large stocks built

Table 6.3 Composition of EU dairy exports to third countries (in mil. tonnes of milk equivalents)

	Cheese	WMP	Condensed	SMP	Butter(-oil)	Total	Index (1984=100)
1984	3.9	4.1	1.1	3.4	0.4	12.9	100
1986	3.1	3.9	0.9	2.9	0.3	11.1	86
1988	3.6	4.7	0.8	6.4	0.6	15.8	122
1990	4.0	3.9	0.7	3.0	0.2	11.5	89
1992	4.4	4.7	0.7	3.8	0.2	13.2	102
1994	4.5	5.0	0.7	1.6	0.5	12.3	95

Sources: PZ World Trade in Dairy Products 1994 (part 1), p. VI.

up in the EU. SMP export was encouraged by targeted export supports to sell the product on the world market. Since stocks were low in 1994, exports of SMP were also limited so that the export share of this product dropped to less than 15% of total EU dairy exports.

EU dairy exports find their way to other regions all over the world. The most important destination, in terms of milk quantities, is Asia (table 6.4). Within Asia, the Middle East region (Saudi Arabia, Iran) and some countries in the Far East are primary customers of EU dairy products. Asia was more important for the EU in the 1980s than in more recent years. The share of total dairy exports to Africa, the second important destination of EU dairy products, is also declining. Still, the densely populated North African countries are very important clients for the EU. The emerging markets for EU dairy export appear to be the other European countries, like Central and Eastern Europe, the former Soviet Union, and Latin America.

Table 6.4 Destination of EU-12 dairy exports to third countries (in million tonnes of milk equivalents and in % of total exports)

	1984 a)		1988		1992		1994	
Other Europe	1.0	(8)	2.3	(15)	1.9	(14)	1.8	(15)
Africa	3.7	(29)	4.1	(26)	3.4	(26)	2.5	(21)
North America	0.6	(5)	0.6	(4)	0.7	(5)	0.8	(7)
Latin America	1.9	(15)	2.4	15)	2.7	(20)	2.4	(20)
Asia	5.4	(42)	6.4	(40)	4.5	(34)	4.4	(36)
Oceania	0.1	(1)	0.1	(1)	0.1	(1)	0.1	(1)
Total third countries	12.8	(100)	15.7	(100)	13.3	(100)	12.0	(100)

a) 1984 refers to EU-10, other years refer to EU-12.
Source: PZ, World Trade in Dairy Products (several years).

Table 6.5 Major markets for EU dairy products outside the EU (export value in million ECU)

Product (total export value to non-EU countries)	Most important markets
Cheese (1,406)	USA (252), Switzerland (138), Japan (106) Saudi Arabia (88), Austria (72)
WMP (1,117)	Algeria (141), Saudi Arabia (118) Taiwan (57), Russia (52), UAE (33)
Condensed milk (327)	Saudi Arabia (48), UAE (21), Hong Kong (20) Libya (20), Nigeria (17)
SMP (435)	Mexico (131), Algeria (56), Malaysia (24), Indonesia (18)
Butter(-oil) (313)	Russia (43), Egypt (35), Saudi Arabia (34), Mexico (16), Algeria (14)

Source: Eurostat Trade Statistics (EXMIS/LEI-DLO).

Looking at the export value of EU dairy products in 1993 for the most important markets of EU countries outside the EU, some observations can be made. Cheese and whole milk powder (WMP) are by far the most important dairy export products, as both products together account for about 70% of total dairy export value. Major markets for EU cheese are countries with high income levels, while other dairy products from the EU mostly go to markets in developing countries (table 6.5). The USA is by far the most important market for EU cheese. The cheese exports to the USA, Switzerland and Japan accounted for 35% of total cheese exports in 1993. WMP finds its way mainly to North Africa (Algeria) and the Middle East (Saudi Arabia and UAE). Saudi Arabia appears to be a major market for all products except for SMP. Russia, Algeria, and Mexico are important markets for more than one EU dairy product, too.

6.3 Intra-EU trade in dairy products

Most exports of EU Member States find their way to other Member States of the EU. In 1994, EU countries exported 34 million tonnes of milk(equivalents) of which 22 million tonnes had a destination within the EU.

The intra-EU dairy trade is dominated by four suppliers; Germany, France, the Netherlands and Belgium/Luxembourg (table 6.6; appendix 7 gives a more detailed table). These four countries have a share of around 75% in the total intra-EU dairy exports (11,964 million ECU in 1993). The main exporting countries are also important in the intra-EU imports. The countries just mentioned have a 60% share in the intra-EU imports of dairy products. In addition to these countries, Italy is also a large importer.

The fact that Germany, the Netherlands and Belgium/Luxembourg are among the main exporting, as well as among the main importing, countries shows that there is a lot of mutual trade. For instance, Germany has a 31% share of total Dutch dairy imports, while the Netherlands have a 44% share of total German dairy imports. Germany has a 56% share of the very large Italian dairy imports (Kelholt, 1995).

Table 6.6 EU-intra trade in dairy products in 1993 (million ECU)

Product	Total value of exports	Main exporters		Main importers	
		country	value	country	value
Dairy total	11,964	Germany	3,129	Germany	2,240
		France	2,467	Italy	2,124
		Netherlands	2,242	Netherlands	1,691
		Belg./Lux.	1,421	Belg./Lux.	1,527

Source: Eurostat Trade Statistics (EXMIS/LEI-DLO).

Having a large share in the intra-EU dairy exports does not necessarily mean a high export surplus in the intra-trade. The countries with the highest surplus (in descending order) are: France (1,063 million ECU), Germany, Ireland, the Netherlands and Denmark. All the other EU-countries are net importers. Italy has by far the largest import surplus (1,680 million ECU) in the intra-EU dairy trade.

Cheese is the most important product in the intra-EU dairy trade (5,022 million ECU in 1993). Its share in the total intra-trade value in dairy products has risen from around 35% in 1984 to 42% in 1993. After the introduction of the quota system, not only the share of milk processed into cheese rose, but the absolute quantity of milk processed into cheese increased also. The dairy industry produced more cheese and developed several new types of cheese to generate more value added.

The Netherlands, France and Germany are the leading exporters. Although Germany is among the leading exporters, its intra-EU trade balance for cheese is negative. In the Italian cheese market, it has a share of over 40%, but this does not compensate for its imports (mainly from France and the Netherlands). The type of cheese that Germany exports to Italy is also different from the types of cheese that are imported from France and the Netherlands.

The internal market for fresh dairy products and ice-cream has more than quadrupled since 1984. This market segment (877 million ECU in 1993) also has a potential for new products that generate value added. France, Belgium/Luxembourg and Germany are the main exporting countries.

The internal market for fresh milk (1,627 million ECU in 1993) is dominated by one exporter (Germany) and one importer (Italy).

The internal EU markets for butter, whole powder, skimmed powder and condensed milk together represent around one third of the total internal dairy market. Although these products are still very important, there have been little or no new developments. It may be expected that in the future they will become less important.

6.4 Perspectives for EU on the international dairy market

World cow milk production stabilized in 1994 after several years of decline. The production in Europe went down by 1% while production increased in the USA (2%), Asia (3%) and Oceania (5%). Prices in the international dairy markets increased because of limited supply. During the first half of 1995, prices for milk fat rose steeply due to the sudden demand for butter in Russia in early 1995. World production of skimmed milk powder went down, while consumption remained at much the same level pushing international prices upward. Increased demand for cheese has been matched by increased production. In addition to these factors of supply and demand, the upswing in US dollar prices was accentuated by the weakness of that currency (OECD, 1995b:5-8). The future EU position in the world dairy market depends on all those factors affecting supply, demand and international prices. Numerous as they are, attention will be paid to what are considered to be the most important factors affecting future perspectives for EU dairy industry.

The most important factors playing a role in the analysis of international market perspectives for EU dairy are the future international trade policy shaped by GATT/WTO agreements, the enlargement of the EU with Central and Eastern European countries, and market developments inside and outside the EU with respect to central regions of supply and demand. Besides these factors, the present and future EU dairy policy is of prime importance to the market perspectives for EU dairy. Market organization may change in level as well as in the use of instruments. Furthermore, due to environmental concerns, political support may change too. Environmental policies also may have an impact on the development of the dairy sector. Production circumstances (farm management, processing techniques) as well as product supply (diversification, quality, etc.) may be affected by technological changes. All these aspects mentioned are related to each other and affect each other. This has to be kept in mind in discussing the factors below.

6.4.1 International trade policies

The EU has made commitments in the GATT agreement of 1994 to improve market access and reduce export restitutions. For its international trade, a reduction of export support may have major consequences. The impacts will concentrate on the export of cheese, and to a lesser extent on skim milk powder and butter. Because of the reduction of subsidized cheese exports by the EU and an increasing demand for cheese in the world due to economic growth, international prices may increase in the years to come. The general expectation is that such price developments will stimulate production in Australia and New Zealand (OECD, 1995b). It has to be noted however, that the potential growth of cheap production in these countries has its limits too. A production decline in the EU is foreseen by the OECD, mainly because of less export support. An increase of the internal EU demand could prevent a production decline but market saturation may occur in the medium-term. Furthermore, more competition on the internal market from foreign suppliers is to be expected in the years to come, because of the reduction of import barriers. An increase in exports to non-EU countries without the support subsidies would relieve the possible oversupply on the internal market. Most important is, if and how the EU can make use of the opportunities the international dairy markets will offer.

6.4.2 Developments on the international dairy market

Because of the changes in the export regime due to the GATT agreement, competition on international dairy markets will increase for EU countries. First of all, EU countries are competing among each other for a decreasing budget for export support and on foreign markets. Secondly, competition with non-EU countries will increase, especially with countries where production circumstances are beneficial for milk production. Countries like Australia and New Zealand are the first to be mentioned in this respect. Large potentials for an increase in milk production in the former Soviet Republics are probably not to be developed fully in the short to medium term because of the huge problems milk producers face in these regions. The US dairy industry is growing, but is still mainly focused on the large internal market. Growth in demand will be strongest in regions where purchasing power and population growth are highest. This will be in (Southeast) Asia and, to a lesser extent, in Latin American countries, North Africa, Central and Eastern Europe, and the former Soviet Union. In most of these regions, consumption patterns are changing rapidly and becoming more Western. Because of the geographical proximity, and the traditional trade contacts, EU sales perspectives will be affected mainly by demand developments in North Africa, Central and Eastern Europe, and the former Soviet Union.

6.4.3 EU enlargement with Central and Eastern European countries

Present competitiveness of the dairy industry in Central and Eastern European countries is rather weak in the international markets. Since the upheaval caused by the breakdown of the communist system in 1989/90, production and exports did fall significantly in the whole region. In the years to come, supply of milk and dairy products from Central and Eastern European countries will stay at a low level, mainly because of the structural adjustment problems these countries still face. Competition from the countries at the eastern border will therefore be limited. Furthermore, because of the border protection, EU member states still have a preferential position on the EU market. Border protection will be abolished, however, when new member states from the East join the EU and there will be one internal market. The question is whether the dairy sector in the EU-12 can stand the competition from these new member states. Much depends on the way these countries use available resources in the years to come to strengthen their dairy sector. The process of political and economic structural adjustment in the former East Bloc countries will take time. The shrinking herds and declining production, which the dairy sector within the Central and Eastern European countries had to face during the last five years, may be history in the near future. However, to develop a modern dairy industry that may play a role in the international markets one needs capital and knowledge, both scarce resources in these countries. In the meanwhile, the EU dairy industry may be able to strengthen its market position in these candidate member states. It is expected that due to increasing purchasing power, the dairy consumption in Central and Eastern European countries will grow.

6.4.4 EU dairy policies

From the very start in the 1960's, the market and price policies of the CAP have been the object of almost permanent renegotiation. The present post-Mac Sharry CAP is also very much under discussion. The evaluation of the Mac Sharry reform, the implementation of the GATT Uruguay Round Agreement and the future enlargement of the EU with Eastern European countries may induce new adjustments in the common market organizations, which may be reinforced by EU environment policy. The Mac Sharry reforms of 1992 left dairy policies about unchanged. Moreover, the milk quota system is to be maintained until the year 2000. What will happen after that date, however, is unclear. Abolishment of the dairy quota system may have significant impacts on the structure, location and competitiveness of the EU dairy industry (see also chapter 7). The industry may also be affected by changes in agricultural policies aimed to respond to environmental concerns. Such changes may imply a reorientation of support towards production methods making use of land and other resources (except labour) less intensively than is common nowadays. An integration of environmental objectives in the agricultural policies may change the international competitiveness of the sector and its structure. Furthermore, environmental policies formulated outside the sector will affect its competitive position as these policies focus on the use of scarce production resources and therefore may set important limits to the agricultural sector. Looking at all these factors presently playing a role in discussions about the future agricultural policy, it is very likely that the CAP which can be seen in operation today, will change. Much is undefined about the future CAP, but apparently there will be less support for agricultural production forcing the EU dairy sector to increasingly orientate itself towards the market.

6.5 Projections of future developments on the world dairy market

According to OECD's (1995b) medium term outlook for dairy markets, world milk production will increase between 1995 and the end of the decade. In OECD countries the annual growth will be modest, and by the year 2000 the production will exceed the 1990-94 average by 4.7%. This increase should be largely due to the US, where output is expected to rise with the use of rBST, to Australia, where exports should increase following the GATT Uruguay Round Agreement and to Mexico, which has several milk production support programmes. Milk production in the rest of the world (except former Soviet-Union and Czech Republic, Slovak Republic, Poland and Hungary) is projected to grow more rapidly than in the OECD area.

Projections made by the OECD indicate that world dairy production will focus more and more towards cheese production and less towards bulk products such as butter and skimmed milk powder. Cheese production in the OECD is projected to rise by about 15%, to meet higher demand in the OECD area. Each of the OECD countries will see output rise. New Zealand and Australia will show the strongest growth in relative terms while the US and the EU will experience the highest growth rates in absolute terms. Butter production in the OECD countries is expected to fall (-2%) due to a sharp drop in output in the EU. Production in non-OECD countries is expected to rise steadily so that overall world butter production in 2000 will be somewhat higher than the average for 1990-94. World butter consumption is expected to rise, mainly due to increased demand in the non-OECD countries. Also consumption in the US and Australia is expected to go up. World production of SMP is expected to fall (-15%), most significantly affected by the drop in output in the EU. Consumption in the

OECD area will fall largely due to declining consumption in the EU owing to the reduction in subsidies for animal-feed products. The decline expected in the rest of the world is likely to be offset by a rise in the consumption of whole milk powder.

As a result of these supply and demand trends, trade patterns will change. The exports of butter and SMP from OECD countries are expected to decline. A further increase in the demand for cheese is expected to boost trade among OECD countries. Because of these trends, major exporters are likely to see a change in their market shares between 1994 and 2000. According to OECD estimates, the EU is likely to see its market share fall for SMP and cheese. With respect to butter, EU exports are likely to decline, just as exports of other major exports decline, so that the EU should register virtually no change in its market share. Australia's shares are expected to rise on all three dairy commodity markets.

As a result of the above trends (declining subsidised exports following the Uruguay Round agreement, falling surplus stocks, high demand in the non-OECD area - notably in Asia, and shrinking world production of SMP), world prices in current terms for butter, SMP and cheese are forecast to rise between 1995 and 2000. SMP and cheese prices should rise steadily over the period, whereas butter prices should level out between 1998 and 2000.

The future increase in world market prices is expected to be largely due to an adjustment in the supply and demand balance for dairy products. The GATT Uruguay Round Agreement is primarily expected to reduce subsidized exports from the EU and increase US, Canadian and Japanese imports of dairy products between 1990-94 and 2000. However, the rise in exports from New Zealand and Australia to meet the greater export opportunities generated by the agreement is expected to dampen the beneficial impact on prices. Price levels are expected to be increasingly affected by demand from non-OECD countries, which is largely income-related. The position of the EU on the international dairy markets - at present more than substantial in the markets of all dairy products - is projected to decline. The OECD does not give its opinion to what extent such a decline will occur.

7. EU DAIRY SECTOR UNDER DIFFERENT POLICY ALTERNATIVES: FOUR SCENARIOS

7.1 Introduction

In this chapter, we will elaborate several policy scenarios for the EU dairy sector after the year 2000. Until the turn of the century, there will not be much room for policy adjustments. The current quota system for EU milk production will last until 2000. The ban on the use of rBST within the Union will not expire before December 31, 1999. The Mac Sharry reform measures are currently being implemented and will be fully in place in the year 1996. Finally, the agreements made in the GATT Uruguay Round will be fully effectuated in 2000. Apart from these, no fundamental changes in the CAP are expected until the end of 1990s. Therefore, the year 2000 is taken as the starting point for future dairy market scenarios. In the next century, external circumstances such as the enlargement of the EU with Central and Eastern European countries or international agreements to further liberalize international trade may force the EU to adjust its agricultural policy again. We do not want to take into account all implications of these external drivers to policy changes. Assuming that further agricultural policy adjustments after the year 2000 will take time to materialize, the period for our projections runs only between 2000 and 2005.

The policy scenarios focus on the quota system and rBST. The quota system is a core element in EU dairy market organization and will be maintained at least until 2000. A debate about the continuation of this policy is about to begin and will definitely intensify when the expiration date comes nearer. The same is likely to happen to the ban on the use of rBST: discussions on the pros and cons of rBST use will intensify when a decision has to be taken whether to extend the ban into the 21st century or not. For the time being, there is no major support in the EU member states for dismantling the quota system. However, dairy farmers, processing industries, policy makers and politicians may change their positions if markets for dairy products decline and policy adjustments are considered necessary to adapt to the changing circumstances. If economic conditions in the dairy sector deteriorate, then also farmers' skepticism about the benefits of using rBST may disappear. Crucial in the sector's position in such a case is whether consumers will accept dairy products from milk of rBST-treated cows. Presently, EU consumers' attitude towards rBST is negative.

The resistance to eliminate the quota system and to allow the use of rBST presently seems to be rather strong in the EU. Therefore, it may appear to be rather premature to outline scenarios in which there is no quota system anymore and rBST-use is permitted. Still, it is useful to think about the possible implications of such policy alternatives, as it may contribute to the process of preparation of all involved. The qualitative impact assessments of the four scenarios outlined in the following sections are affected by assumptions, exclusions and simplifications. Therefore, the analysis surely does not pretend to be comprehensive enough to tackle all problems involved or show all possible impacts. However, this scenario approach can be helpful in clarifying the possible impacts of the policy alternatives discussed.

Alternatives	Quota	rBST
Scenario 1 (baseline)	continued	not allowed
Scenario 2	continued	allowed
Scenario 3	eliminated	not allowed
Scenario 4	eliminated	allowed

Figure 7.1 Policy options

In the following sections, the four policy options, shown in figure 7.1, are elaborated. We start with scenario 1, in which no policy changes compared to the current situation are projected. This is the baseline scenario, and serves as a point of reference for scenarios 2, 3 and 4. For each scenario, the following variables will be assessed: production and consumption of milk within the EU, export of dairy products to third countries, internal price level, and structure of EU dairy sector, e.g. number of dairy farms, number of cows per farm, and regional concentration of milk production.

7.2 Scenario 1 (baseline)

The baseline projection of developments in the EU dairy market to 2005 is based on the estimated impact of full implementation of the 1992 CAP reform and of the GATT agreements on external trade in agricultural products. It is assumed that there will be no major changes until the year 2005 in the dairy policies after the full implementation of the Mac Sharry reforms. The quota system will be maintained and rBST use is not allowed in EU countries. This baseline projection builds mainly on the ECAM-projection of the Mac Sharry reform package (Folmer et al., 1995), supplemented with estimated impact assessments of future developments from other sources. Internal and external price developments are part of the baseline projection (for international prices, see section 6.5).

The 1992 CAP reform implied very limited changes in the dairy market organization (see section 5.2). Policy changes focus on small price reductions for the intervention products butter and skimmed milk powder. For the period beyond 1995, Folmer et al. assume further price declines in real terms, but the impact of those price adjustments on the milk production is absent: the annual growth rate of dairy production is estimated to be zero for the period 1992-2005 (Folmer et al., 1995:186-188). The milk quota regulation continues to constrain EU milk production.

According to the model simulation, consumption of dairy products in the EU is expected to increase slightly during the period until 2005 (Folmer et al., 1995:191). Total human consumption and intermediate use of dairy products may grow with 0.3-0.6% annually. This projection of consumption growth of dairy products does not correspond to the Commission's view and OECD projections towards 2000 on most likely developments in the EU-15. Both the Commission (CEC, 1994) and the OECD (1995b) state that the consumption of butter and skimmed milk powder will decrease in the years to come, due to a decline in the use of animal/milk fats and a reduction in subsidies for use of SMP in animal feed. Cheese consumption, however, is expected to continue to increase but at a slower rate than before. Total dairy consumption is assumed to be more or less stable in the near future.

The projections for production and consumption according to Folmer et al. result in less excess supply in 2005 compared to 1992. Net exports of butter remain negligible throughout the period though there are some gross imports, since the EU has a commitment to import butter from New Zealand. Total net export of all dairy products decreases and falls according to model calculations by about 25% in the simulation period (Folmer et al., 1995:193). The Commission's and OECD's view on most likely consumption trends in the Union imply that the EU's net trade position would not change significantly.

The commitments under the GATT agreement may have a serious effect on the net export position of the EU. Export support has to be reduced in terms of subsidized volume (minus 21%) and in terms of outlays for export subsidies (minus 36%) in the period 1995-2000. As subsidized cheese exports have increased considerably during the late eighties and early nineties, a reduction of export support may have a major impact on the EU cheese market (Van Berkum, 1994). With reference to the export volume of 1991-92, subsidized EU cheese exports have to be reduced by 20,000 tonnes (i.e. 4.75% of total cheese exports of 1991-92) annually during the period 1995-2000. If EU consumption of cheese continues to increase, the internal market may be an alternative for export to third countries. However, competition from non-EU suppliers may increase because of the GATT requirement to enhance market access. When reduced export support leads to declining exports of EU cheese, cheese prices may go down, forcing processing companies to reduce their cheese production and change their production pattern towards other products. Such an adjustment in the processing industry may lower milk prices paid to EU dairy farmers.

EU exports to third countries are dependent on subsidies rather than on supply and demand conditions in the world market. International dairy prices are expected to increase in the coming years, mainly because of reduced subsidized EU exports and a continuous increase in world demand (see section 6.5). Higher international prices will help the EU to fulfill GATT requirements as lower subsidies will be needed for EU cheese exports. Because of the GATT guidelines for minimum access commitments - 5% of 1986-88 consumption in the year 2000 - some quantities of butter (2,000 tonnes), skimmed milk powder (69,000 tonnes) and cheese (104,000 tonnes) may be imported under more favourable conditions. Although import tariffs are subject to a reduction under the GATT agreement, substantial EU market protection remains; the level of the tariffs appears to remain high enough in the period until 2000 to prevent (further) downward pressure on internal prices, caused by market access commitments (Van Berkum, 1994; Folmer et al., 1995:222).

Changes in dairy farm structure will occur through changes in the number of dairy farms and number of cows per farm. Parallel with the general trend of a declining number of farmers, the number of EU dairy farms is diminishing year by year. In 1973 there were about 2.4 million dairy farms in the EU-9. Twenty years later, in 1993, only 800,000 dairy farms were left in those nine member states; about two thirds of the dairy farmers went out of business. Besides economic pressure to quit dairy farming, induced by technological and policy changes, demographic factors affect the restructuring process. In all EU member states, a significant proportion of farmers are aged 55 and over (EU average is 30%; CEC, 1995). In the baseline scenario it is expected that the current trend in farmers discontinuing their operation will continue into the 21st century. Most likely, the smallest dairy farms are closed first because they are the least profitable and/or have minimal economic prospects.

This trend of a declining number of farms also has consequences for the average number of cows per dairy farm. Due to technological advances, milk production per cow is increasing 1) with fewer cows needed to produce the (fixed) quota. Hence, the number of cows per dairy farm may fall. However, as dairy farms staying in business take over production rights from those who leave the sector, they will most likely expand their herd size. The number of cows per dairy farm has increased in the period 1985-1991 (see chapter 4). It is assumed that this trend will continue under the baseline scenario.

Under the baseline scenario, the quota system is continued until 2005 (or beyond). Since the division of quota between countries is assumed to remain unchanged, there will be no shifts in the shares of EU member states in total EU milk production. On a national level, some shifts of production from regions with less attractive features towards regions with more favourable conditions for dairy farming have occurred. Such shifts depend on the tradeability of the quota between farmers located in different parts of the country. Under the baseline scenario, no further change in regional concentration of dairy farming within countries is assumed to occur in the period under consideration.

7.3 Scenario 2, 3 and 4

In *scenario 2*, the milk quota system is extended beyond the year 2000, while dairy farmers are allowed to use rBST. These policy choices lead to the same total milk production in the EU as under the baseline scenario because the quota system constraints growth of production. However, the consumption level may be affected by consumers' negative attitude towards milk from cows treated with rBST. In this scenario, it is assumed that the decision to allow milk

---

1) Folmer et al. (1995:189) expect the average dairy cow to produce 16.5% more milk in 2005 than in 1992.

producers to use rBST, is based on consumer acceptance of milk from cows treated with rBST. Therefore, we assume no changes in EU dairy consumption patterns compared to the baseline scenario. This assumption builds on the experiences in the US where, since the introduction of rBST in February 1994, milk consumption has not declined. In fact, US dairy consumption (especially cheese) continues to grow. Since dairy production and consumption are assumed to show the same pattern as in the baseline scenario, the EU net export position will also be the same. EU internal prices would follow the same downward trend as in the baseline scenario.

The use of rBST will have an impact on the structure of the dairy sector. The use of rBST increases the yield per cow and will therefore affect the size of the farms, as a dairy farmer needs fewer cows to produce the quantity of milk he is allowed to produce. Compared to the developments described under the baseline scenario, the number of cows per farm is still expected to increase, though at a slower rate. This slower growth rate is due to the combined effect of long term structural growth in the number of dairy cows per farm and a decrease in the number of cows per farm due to rBST use. With lower per unit production costs, rBST adopters will have an incentive to purchase quota from non-adopting neighbours, thereby speeding up the process of structural change. The less efficient non-adopters will sell their quota and leave the sector. As a consequence, the number of farms is expected to decline slightly more than the trend. Some regional concentration of production may occur. There will be no shifts in production concentration between countries since no change in the operation of the milk quota system is assumed and quota cannot be traded among member states. Within countries, the probability of regional shifts in production depend on the possibilities for quota trade. This may be restricted in some member states, because the production rights are tied to the land. For the EU as a whole, the impact on further regional concentration of production are expected to be limited.

In *scenario 3*, dairy farmers are not allowed to use rBST but the quota system is abolished. Market prices are expected to go down because of a rise in production, caused by increased supply from producers with lower production costs. Those producers with relatively high production costs will not be able to continue their business when milk prices go down. The net effect will be that total milk production will increase, and milk prices will be lower than under the baseline scenario. Only a small increase in domestic consumption is expected due to the rather low price elasticities of demand. Lower prices will strengthen EU's competitive position on international markets, and therefore net EU exports of dairy products are expected to be somewhat higher than under the baseline scenario.

Structural adjustments will occur under this scenario: the decline in the number of dairy farms is accelerated and there is an increasing concentration of cows on farms (more dairy cows on fewer dairy farms). Furthermore, a shift in regional concentration will result. Milk production will be concentrated in the most profitable production regions of the EU. The most favourable regions for dairy farming, i.e. the regions with the lowest production costs and highest family income, are Niedersachsen (G), Bretagne (F), Lombardia (I), West England (UK), the Netherlands and Denmark (Habraken, 1994).

Compared to scenario 3, the *fourth scenario* includes the use of rBST. Using rBST will give a push to milk production. Thus, prices will go down more than under scenario 3. Production growth will likely exceed increases in consumption. Consumption is expected to be stimulated by lower prices but, given the low price elasticities of demand, the effects will be rather limited. Consequently, there is a need to expand exports. With GATT commitments restraining export support, an increasing effort to export pushes internal prices downwards. This price development will induce a reorganization of the dairy sector. Structural adjustments as described under scenario 3 will accelerate under this scenario: fewer dairy farms and on average more cows per farm. Production will become even further concentrated in the regions most favourable for dairy farming.

According to our scenario projections, the abolishment of the quota system is expected to result in an increase of production and net exports, and in an acceleration of structural change in the dairy sector towards more concentration, on a farm as well as on a regional level (scenario 3+4, see figure 7.2). The adoption of rBST reinforces the effects assumed under the no quota scenarios: more production and exports, lower internal prices and fewer, but bigger dairy holdings, more regionally concentrated (scenario 4). Elimination of the quota system and/or introduction of rBST will accelerate structural change, with possibly profound social consequences. On the other hand, structural change may be considered to be inevitable if markets decline, prices go down, and the economic performance of the sector deteriorates. In such a situation, a policy with rBST and without a quota system may be an option in order to strengthen the competitive position of those who are able to stay in business

Scenario	1. (baseline) quota no rBST	2. quota rBST	3. no quota no rBST	4. no quota rBST
Production	stable	0	+	++
Consumption	up/stable	0/0	+	+
Net export	down/stable	0/0	+	++
Internal real price level	down	0	+	++
Number of dairy farms	decline	+	++	+++
Farm size in number of cows	increase	-	+	++
Regional concentration	stable	+	++	+++

Figure 7.2 Summary of scenario outcomes for EU dairy sector

0 = no change with respect to scenario 1; + = reinforcement of development under scenario 1; - = weakening of development under scenario 1.

under less market protection. The question is whether rBST is an appropriate instrument for improving EU's competitive position in international dairy markets.

7.4 Will rBST improve the position of EU dairy on the international market?

The future EU position in the international dairy markets depends on several issues, of which the most important are reviewed in chapter 6. A conclusion from that chapter was that the international position of the EU in international dairy markets will decline, mainly due to the GATT commitment to reduce subsidized exports. Generally speaking, price competition seems to become much more important for selling in the international markets, although for exporting high value-added products, the price level may not be the decisive competitive factor. In this situation, EU exporters will have to consider lowering their prices for dairy commodities to be sold in the international market. This will lead to a downward pressure on milk prices in the EU. Dairy farmers, processors and trade will have to reduce their costs as much as possible in order to improve their competitiveness. Both elimination of the quota system and approval of rBST could contribute significantly to lower production costs.

If rBST is allowed in the EU, consumers' attitudes with respect to rBST in the EU export markets must be taken into account. If consumers in these countries do not accept dairy products from cows treated with rBST, the EU could lose customers. EU's most important export markets are developing countries in North Africa and in the Middle and Far East (see table 6.4). However, some important markets for EU cheese are countries with high income levels, like the USA, Japan and Switzerland. It is important to know the consumers' attitude in all these countries towards dairy commodities produced with the help of rBST.

In the USA, experiences since the introduction of rBST appear to show that the vast majority of the consumers accepts dairy products processed from rBST milk. There is no reason to suppose that US consumers would refuse to buy EU cheese produced with rBST. In Japan and Switzerland, consumers feel very strongly about food quality and safety. In both countries, dairy farmers are not allowed to use rBST. Consumers could be strongly opposed to imports of dairy products produced from rBST milk, although information about this is scarce. The attitude of consumers in developing countries seem to be different: concern is more about food availability than about quality and safety. In a number of developing countries rBST is permitted (see chapter 2), which may indicate that consumers accept dairy products produced with rBST. Exports from the EU to important markets in North Africa and the Middle East would therefore not be under pressure from negative consumer reactions. The same could hold for Russia and probably also for most countries in Central and Eastern Europe. In some of these countries, dairy farmers are allowed to use rBST. Information about the application rate of the hormone is lacking. Also, consumers' attitude towards rBST milk in Central and Eastern European countries is unclear because no results are known of any research on this topic. There is still a lot of uncertainty about the acceptance of rBST in EU's most important export markets. Recent experiences of US dairy trade might throw some light on this issue.

The most important US dairy export markets are Canada, Mexico, and East Asia, especially Japan and Taiwan. The most important dairy export products of the USA (in value) are cheese and nonfat dry milk powder. US cheese exports in 1994/95 were higher compared with the previous year. Shipments mostly went to Canada, Mexico, Japan and South Korea. Shipments of butter, nonfat dry milk and dry whole milk under the Dairy Export Incentive Programme (DEIP) were much larger in 1994/95 than in the previous year because of high demand. Mexico and Algeria have been the principal export markets for US nonfat dry milk. Also the South-East Asian region is a customer of US SMP. Sofar, there has been no indication that consumers in the importing countries would not accept US dairy products from rBST milk.

Competition between the US and the EU could increase in the years to come in markets where rBST is (most likely to be) accepted. Looking at their top markets, the EU and the US seem to compete mainly in North Africa (Algeria) and in Japan. In North Africa, purchasing power is very low, so the region can be considered a dump market: in selling EU dairy products, trade can be realized mainly because there is enough export support available from the EU. EU exports to North Africa are rather volatile from year to year. The same holds for US dairy exports to countries like Algeria and Egypt. Most of the transactions are supported by the DEIP. Competition between the EU and the US depends very much on the availability of funding for export support. Both countries have to reduce export subsidies under the GATT agreement. This may result in less support for exports from the EU as well as from the US to North Africa in the years to come. An increase in commercial exports from the EU and/or US could offset this decline, but depends on the development of purchasing power in this region. As already noticed above, acceptance of rBST is very likely in this region. This could strengthen US competitive position in these markets.

Japanese consumers are requesting food products of highest quality and are willing to pay for that. In volume, Japan is an important importer of cheese: it has the second position (after the USA) as the world's largest non-EU importers of cheese. Around two-thirds of total cheese imports comes from Oceania, while imports from the EU cover around 15-20% and those from the USA only 1-2%. Cheese consumption in Japan has increased by almost a quarter since 1990, boosting imports to around 30%. Consumption per capita is, however, still rather low compared to other high income countries: only 1.4 kg, which is around 20% of the consumption level in countries like Australia and New Zealand, and no more than 10% of the EU and US levels. These consumption figures indicate that Japan can be considered as a growing market for dairy products, especially for cheese. The OECD expects a significant increase of SMP and cheese consumption between 1994 and 2000, together with an almost stable milk production (OECD, 1995b:35). As a consequence, Japanese cheese imports are projected to increase by 20% in the period under consideration. Most likely, Oceania will be able to benefit mostly from this consumption growth;

the already strong position of Australia and New Zealand in the Japanese market shows that these countries are very competitive. EU exports to Japan may grow too, but can be endangered when rBST is allowed in the EU. Experiences of US dairy exports to Japan do not give indications strong enough to draw conclusions on that. US dairy exports to Japan have been increasing strongly since the beginning of the 1990s, but the USA is still a very small player in the Japanese market. Perhaps for this reason, import of US dairy products made from rBST milk is not really in discussion in Japan.

The net effect of rBST use in the EU on its international position also depends on the extent the productivity enhancer is used in other countries than the USA and the EU in the next century. In around 20 countries, rBST is licensed for sale, while rBST is being sold already in 8 countries (section 2.4). Excluding the USA, within the latter group of countries, the use of rBST is still, as far as known, very limited. However, in the years to come, adoption of rBST could become much more widespread. If so, milk production is stimulated in these countries, of which some of them may explore attributed export potentials. The result may be an increasing competition on international markets. Presently, in important dairy exporting countries like Australia, New Zealand and Canada, rBST is not permitted. Of these three countries, Canada could well change its position shortly, as the moratorium on the sale of rBST has ended in July 1995. However, no final decision has been made as of February 1996. The possible benefits to the EU dairy industry from using rBST would be limited if more countries adopt rBST in the near future. At the same time, if the productivity enhancer is adopted more widely, the EU may be forced to allow rBST use because of the threat that its exports might decline. However, the EU could also benefit from extending the ban on rBST use, if consumers in their major export markets insist on rBST-free dairy products and are willing to pay for that. Besides carefully examining all possible effects on the internal market and the structure of the sector, the decision whether to use rBST or not in the EU has to be taken by scrutinising the possible reactions by consumers on the export markets and the policy in other countries with respect to rBST use.

7.5 Concluding remarks

The abolishment of the quota system is expected to result in increased production and net exports, plus an accelerating structural change in the dairy sector towards more concentration of production, on farm as well as on regional level. The adoption of rBST reinforces these effects: more production and exports, lower internal prices, fewer but bigger dairy holdings, and more regional concentration of production. Those effects may be socially negative if the pace and extent of structural changes exceed certain limits, i.e., many farmers have to leave the sector. The introduction of rBST may also have environmental effects, but these are not unambiguous. The use of the hormone may induce less intensive farming if the increase in the yield per cow results in less milk cows per hectare. However, the need for more feed concentrates may counteract such a positive environmental effect. Furthermore, an increase in concentration of dairy farming is expected when rBST is used and this may reinforce depopulation of rural areas. Fear for such possibly negative developments may cause policy makers to refrain from milk quota abolishment and rBST use.

On the other hand, a scenario in which no milk quota system exists and rBST is allowed, may contribute to an improvement of the international competitiveness of the EU dairy, as it creates opportunities for increasing operation of scale, inducing more efficient dairy farming with lower production costs. Such a structural development seems to become more and more necessary as agricultural support changes from product-tied support to other forms. More specifically, export support has to be reduced under GATT commitments. However, the EU's international trade position in dairy markets also depends on aspects of food quality, food safety and animal welfare, all aspects that can be related to the use of rBST. If the EU introduces rBST, it has to be sure that its exports are not endangered by consumers who do not accept products processed from rBST milk in the importing countries; especially in certain high income countries, consumers may have a strong resistance to accept dairy products produced with rBST. These high income export markets will grow in importance as export support is reduced. Presently, there is too little information about consumers' attitude towards rBST in countries of importance to EU dairy exports to have a clear idea of the risks involved. Further research on consumers' attitude in the major EU export markets may provide the information that is now lacking.

REFERENCES

Almås, R. (1991)
Norske of amerikanske bønders syn på bioteknologi i landbruket (Norwegian and American farmers view on agricultural biotechnology); Centre for Rural Research, Trondheim; Report 1/91

Almås, R. and B. Nygård (1994)
European Values and the new Biotechnologies. Post-materialism or a New Arena of Rural-Urban Conflict?; Paper to the XVth European Congress of Rural Sociology, August 2-6, 1993; Wageningen, the Netherlands, Centre for Rural Research, Trondheim; Paper 4/94

Almås, R. and B. Nygård (1995)
New Biotechnologies: Attitudes, Social Movements and Regulation. A comparative Analyses of a European discourse; Paper to the XVIth European Congress of Rural Sociology; Prague, Czech Republic, 31 July - 4 August 1995; Centre for Rural Research, Trondheim; Paper 2/95

Andersen, S. (1992)
Debatten om bioteknologi i Tyskland (The debate on biotechnology in Germany); In: Bioteknologi og etik i den offentlige debat; København, TeknologiNævnet; Report 1992/3

Baumgardt, Bill R. and Marshall A. Martin (eds.) (1991)
Agricultural Biotechnology. Issues and Choices. Information for Decision Makers; West Lafayette, IN, Purdue University Agricultural Experimentation Station

Barham, Bradford L. et al. (1995)
The Political Economy of rBST Adoption in America's Dairyland; ATFFI Technical Report No. 2; Agricultural Technology and Family Farm Institute, College of Agricultural and Life Sciences, University of Wisconsin, Madison, WI

Beck, U. (1992)
Risk Society: Towards a New Modernity; London, Sage Publishers

Bent, Martin (ed.) (1993a)
Livestock Productivity Enhancers: An Economic Assessment; Wallingford, CAB International

Bent, Martin (1993b)
The European Approval Procedures for Livestock Productivity Enhancers; In: Bent, 1993a; pp. 24-42

Berkum, S. van (1994)
Gevolgen van het GATT-akkoord voor de EU-landbouw (Consequences of the GATT agreement for EU agriculture); The Hague, LEI-DLO; Mededeling 505

Berrier, R.J. (1987)
Public Perceptions of Biotechnology; In: L.R. Batra and W. Klassen (eds.), Public Perceptions of Biotechnology; Bethesda, Agricultural Research Institute

Blayney, Don P. and Richard F. Fallert (1990)
Biotechnology and Agriculture: Emergence of Bovine Somatotropin (bST); Washington, DC, United States Department of Agriculture, Economic Research Service, Commodity Economics Division; Staff Report AGES 9037

Caswell, M.F., K.O. Fuglie and C.A. Klotz (1994)
Agricultural Biotechnology. An Economic Perspective; Washington, DC, United States Department of Agriculture; Agricultural Economics Reports No. 687

CEC- Commission of the European Communities (CEC) (1994)
Report on the market situation for milk and dairy products; Brussels, CEC; COM(94)64 def.

CEC - Commission of European Communities (1995)
The Agricultural Situation Report

Dixon, B. (1991)
No more Shallow Alarms; Bio/Technology, Vol. 9, No 1

D'Silva, Joyce (1994)
The cynical abuse: BST - A welfare analysis; Petersfield, UK, Compassion in World Farming

Fallert, Richard et al. (1987)
bST and the Dairy Industry: A National, Regional, and Farm-level Analysis; Washington, DC, United States Department of Agriculture, Economic Research Service; AER No. 579

Folmer, C., M.A. Keyzer, M.D. Merbis, H.J.J. Stolwijk and P.J.J. Veenendaal (????)
The Common Agricultural Policy beyond the Mac Sharry Reform; Amsterdam, Elsevier Science Publishers

Habraken, R. (1994)
Een verkennend onderzoek naar de ideale vestigingsplaats in de EG voor een melkveehouderijbedrijf; The Hague, Den Bosch, LEI-DLO/Agrarische Hogeschool

Hallberg, Milton C. (ed.) (1992)
Bovine Somatotropin & Emerging Issues. An Assessment; Westview, Boulder, CO

Hamstra, A. (1991)
Biotechnology in foodstuffs, towards a model of consumer acceptance; The Hague, SWOKA Institute for Consumer Research; SWOKA Research Report No. 105

Hamstra, A. (1992)
Consumer research on biotechnology; In: John Durant (ed.), *Biotechnology in Public: A Review of Recent Research*; London, Science Museum, for the European Federation of Biotechnology

Hamstra, A. (1993)
Consumer Acceptance of Food Biotechnology, The relation between product evaluation and acceptance; The Hague, SWOKA Institute for consumer research; SWOKA Research Report 137

Hoban, T. (1989)
Anticipating Public Response to Biotechnology; The Rural Sociologist, Vol.9, No.3, pp. 20-23

Hoban, T., E. Woodrum and R. Czaja (1992)
Public opposition to Genetic Engineering; Rural Sociology, Vol.57, No.4, pp. 476-493

Hoop, D.W. de et al. (1988)
Economische effecten van het gebruik van Bovine Somatotropine; The Hague, LEI; Publikatie 1.21

Hubbard, L.J. (1992)
Two-tier pricing for milk: a re-examination; Journal of Agricultural Economics, September

Husted, J. (1992)
Debatten om bioteknologi i Storbritannien (The debate on biotechnology in Great Britain); In: Bioteknologi og etik i den offentlige debat; København, TeknologiNævnet; Report 1992/3

INRA (1993),
Eurobarometer 39.1; Biotechnology and Genetic Engineering: What Europeans think about it in 1993; Brussels, Commission of the EC

Jervell, A.M. (1993)
Farmers' attitudes to milk quota policy in Norway; Sociologia Ruralis, Vol. XXXIII (3/4), pp. 365-382

Juskevich, Judith C. and C. Greg Guyer (1990)
Bovine Growth Hormone: Human Food Safety Evaluation; Science, Vol. 249, pp. 875-884

Kelholt, H.J. (1994)
Ontwikkelingen in de melkverwerking en intra-EG-handel in zuivelprodukten Trends in Milk Processing and Intra EU Trade in Dairy Products; The Hague, LEI-DLO; Interne Nota 426

Knoblauch, Wayne A. et al. (1995)
Dairy Farm Performance with bST Supplementation; Unpublished manuscript; Ithaca, New York, Department of Agricultural, Resource, and Managerial Economics, Cornell University

Kraft (1994)
Bioetisk debatt i Norge 1993 (Bioethical debate in Norway 1993); In: J. Josefsson (ed.), Bioetisk debatt i Norden 1993; Copenhagen, Nordic Committe for Ethics in Biotechnology, Nordic Council; TemaNord 1994:550

Kuitert (1985)
Genetische manipulatie: waar willen we ermee naartoe?; Christen Democratische Verkenningen 9/85, pp. 435-442

Kvistgaard, M. and A. Neimann-Sørensen (1992)
Sammenfattende vurdering af anvendelse af BST (Summarized appreciation of the use of BST); In: Sejrsen and Vestergaard (red): Kvægvæksthormon; København, TeknologiNævnet; pp. 89-103

Lager (1994)
EU drøfter hormonbruk (EU discusses the use of hormones); Bondebladet 14 September

Lassen, J. (1993)
Food Quality and the Cunsumers; Århus, Denmark; MAPP Working Paper No. 8

Lewis, H. W. (1990)
Technological Risk; New York, NY, Norton & Company

LNV (1995)
Dynamiek en vernieuwing; beleidsvoornemings op het gebied van Landbouw, Natuurbeheer en Visserij (Dynamics and renewal; policy plans on the field of agriculture, nature management and fisheries); The Hague, SDU

Manchester, A., M.R. Weimar and R. Fallert (1994)
The US dairy pricing system; USDA/ERS, Washington, DC; Agriculture Information Bulletin Number 695

Marlier, Eric (1992)
Eurobarometer 35.1: Opinions of Europeans on Biotechnology in 1991; In: John Durant (ed.); Biotechnology in public: a review of recent research; London, Science Museum, pp. 52-108

Nilsson (1994)
Bioetisk debatt i Sverige 1993; (Bioethical debate in Sweden); In: J. Josefsson (ed.), Bioetisk debatt i Norden 1993; Copenhagen, Nordic Committe for Ethics in Biotechnology, Nordic Council; TemaNord 1994:550

Nord (1995)
Yearbook of Nordic Statistics 1995 (Vol 33); Copenhagen, Edited by the Nordic Statistical Secretariat, Nordic Council of Ministers

OECD (1993)
Agricultural policies, markets and trade; Monitoring and Outlook; Paris, OECD

OECD (1995a)
Agricultural policies, markets and trade; Monitoring and Outlook; Paris, OECD

OECD (1995b)
OECD Agricultural Outlook, 1996 edition; Paris, OECD

Rabobank, (1995)
Internationale concurrentiekracht in de melkveehouderij; Utrecht, Rabobank

Rama, D. and M.J. Keane (eds.) (1993)
Production costs for milk in European countries; Milan, FrancoAngeli

Rama, D. and R. Pieri, (1995)
The European dairy industry: consumption changes; vertical relations and firm strategies; Milan, FrancoAngeli

Rogers, E.M. (1992)
Diffusion of Innovations; New York, NY, Free Press

Sejrsen, K. (1992)
Forøgelse af mælkeydelsen ved anvendelse af BST (Increase in milk production with the use of BST); In: Sejrsen og Vestergaard (red); Kvægvæksthormon; København, TeknologiNævnet; pp. 20-26

Senauer, Ben, Elaine Asp and Jean Kinsey (1991)
Food Trends and the Changing Consumer; St. Paul, MN, Eagan Press

Sjödèn, P.O. (1990)
Oro och uppfattningar bland konsumenter; Vår Föda, Vol. 42, Nr.3, s.176-185

Smith, B. J. and Warland R. H. (1992)
Consumer Responses to Milk from BST-supplemented Cows; In: Milton C. Hallberg (ed.)

Steenkamp, J.E.B.M. (1992)
De Europese Consument van Voedingsmiddelen in de Jaren '90; Assen/Maastricht, Van Gorcum

Thompson, P. B. (1992)
Ethical Issues and BST; In: Milton C. Hallberg (ed.)

Tracy, M. (1989)
Government and agriculture in Western Europe 1880-1888; New York, Harvester Wheatsheaf

Troil, H. von (1994a)
Bioetisk debatt i Finland 1993; In: J. Josefsson (ed.), Bioetisk debatt i Norden 1993; København, Nordic Committee for Ethics in Biotechnology, Nordic Council; TemaNord 1994:550

Troil, H. von (1994b)
Bio- ja geeniteniikan tiedotustarve Suomessa (The need for information on bio- and genetechnology in Finland); Unofficial report to the Ministry of the Environment in Finland

Weimar, M.R. and D.P. Blayney (1994)
Landmarks in the US dairy industry; Washington, USDA/ERS; Agriculture Information Bulletin Number 694

White paper no. 8 (1992-93)
Om lov om framstilling og bruk av genmodifiserte organismer (The Norwegian Gene Technology Act); Oslo, Miljøverndepartementet; Ot Prp nr. 8

Zechendorf, B. (1994)
What the Public Thinks About Biotechnology; Bio/Technology, Vol. 12, No.9, pp. 870-875

APPENDICES

Appendix 1 Workshop report

Introduction

As part of the project on SOCIO-ECONOMIC ASPECTS OF MODERN BIOTECHNOLOGY IN THE EUROPEAN UNION: THE CASE OF rBST, a workshop was held at LEI-DLO, The Hague, the Netherlands, on Tuesday, January 30, 1996.

This workshop had several objectives. The first was to present preliminary findings of the project to representatives of various stakeholders. Secondly, these representatives were asked to give their comments on these findings, in order to improve them. All participants were asked to present and discuss comments and to suggest modifications and additions to the findings. Thirdly, the workshop participants were asked to give suggestions for a useful research agenda for future socio-economic impact studies of agricultural biotechnology in general, and of rBST more specifically.

This workshop report consists of the following parts:

- the programme of the workshop;
- the participants;
- a summary of presentations and discussion;
- suggestions for future research on socio-economic aspects of agricultural biotechnology.

workshop programme

socio-economic aspects of modern biotechnology in the European Union: the case of rBST

Tuesday January 30, 1996 at LEI-DLO, The Hague

9.00	Welcome and opening by chairman Hans van der Kooi (Dutch Ministry of Agriculture)
9.15	Introduction of participants
9.30	Outline of research project on 'Socio-economic aspects of modern biotechnology in the European Union: the case of rBST, by Jos Bijman (LEI-DLO)
10.00	Experiences in the USA, by Marshall Martin (Purdue University, USA)
10.30	Questions
10.45	**Coffee Break**
11.00	Public acceptance in the EU, by Berit Nygård (University of Trondheim, Norway)
11.30	Questions
11.45	First round of reactions, by consumer organization, farmer organization, dairy industry, producer of rBST, animal welfare group, government Plenary discussion
13.00	**Lunch**
14.00	International trade aspects, by Siemen van Berkum (LEI-DLO)
14.30	Questions
14.45	Second round of reactions, by consumer organization, farmer organization, dairy industry, producer of rBST, animal welfare group, government Plenary discussion
15.30	Research agenda for future socio-economic impact studies of agricultural biotechnology
16.15	Conclusions, by chairman
16.30	**Drinks**

Participants of the workshop on 'Socio-economic aspects of modern biotechnology in the European Union: the case of rBST'

Mr. R. Almås	Centre for Rural Research, University of Trondheim, Norway
Mr. S. van Berkum	Agricultural Economics Research Institute (LEI-DLO)
Mr. W.J. Bijman	Agricultural Economics Research Institute (LEI-DLO)
Mr. P. Einarsson	Ecological Farmers of Sweden
Mr. E.M. Epstein	Arbeitsgemeinschaft der Verbraucherverbände (Cooperative of Consumer Associations), Germany
Mr. A. Haslinger	Ministry of Sience, Research and Art, Austria
Mr. H. van der Kooi	Dutch Ministry of Agriculture
Mr. R. Lang-Ree	Norwegian Cattle, Norway
Mr. M. Linskens	Eurogroup for Animal Welfare, Brusssels
Mr. M. Martin	Department of Agricultural Economics, Purdue University, USA
Mrs. A. van der Neut	Dutch Ministry of Agriculture
Mrs. B. Nygård	Centre for Rural Research, University of Trondheim, Norway
Mr. C. Oldenbroek	Institue for Animal Science and Health (ID-DLO), the Netherlands
Mr. B.J. Pastoor	COPA-COGECA (European Farmers Organizations), Brussels
Mr. B. Staes	European Parliament, Brussels
Mr. H. de Vriend	Stichting Consument en Biotechnologie (Foundation for Consumer and Biotechnology), the Netherlands
Mr. J.M. Vrij	Netherlands Dairy Organization (NZO), the Netherlands
Mr. P. Witlox	Produktschap voor Zuivel (Commodity Board for Dairy Produce), the Netherlands

Summary of presentations and discussions

No full text of the presentations will be given here. The information that was presented can be found in the main report. Below, the reader will find the highlights from the individual presentation, the discussion that followed each presentation and the general discussion.

OUTLINE OF RESEARCH PROJECT
by Jos Bijman (LEI-DLO)

Bijman gave an outline of the history, the goals and the organization of the full project. It was carried out for the European Commission, as part of the BIOTECH programme, subprogramme on socio-economic impacts of biotechnology. The research team was put together to incorporate knowledge on European public attitude towards biotechnology (Centre for Rural Research, University of Trondheim, Norway), on rBST adoption in the USA (Department of Agricultural Economics, Purdue University, USA) and on dairy policies and competitiveness of the EU dairy industry (Agricultural Economics Research Institute, the Netherlands). Subsequently, Bijman briefly presented the main issues in the societal debate on agrobiotechnology: safety of biotechnology products for human consumption, environmental impact, socio-economic impact on farming, animal health and welfare aspects and ethical aspects. Finally, Bijman stressed that the future of rBST in Europe depends on two main issues: (1) public attitude towards biotechnology in general and towards rBST in particular, and (2) the competitiveness of the EU dairy industry, given the GATT/WTO commitments and the use of rBST by major competitors.

- *Discussion*

The short discussion that ensued the presentation by Bijman, focused on the limitations of the project. It was stressed by Bijman that this was only a small project, and that many issues that may play a role in the European debate on rBST were not explicitly taken up in the study. Thus, in this project, no specific attention has been given to animal welfare issues. They are considered to be part of the larger public attitude issue. It is acknowledged, though, that perhaps the main topic underlying the public attitude towards rBST is the impact on animal welfare. This is still a worry of the European Commission, although many studies on animal health and welfare suggest their is no significant impact. Also the human health issue was not incorporated in the study, because the authorities have repeatedly stated that rBST is safe for human consumption.

A connection was made to the European conference on the use of hormones in animal production, held in Brussels, in November 1995. At this conference, most scientists stated there are no significant human or animal health reasons to ban the use of certain hormones. However, despite this scientific evidence, almost all non-governmental organizations present expressed their concern and disapproval over the use of hormones in animal production.

EXPERIENCES IN THE USA
by Marshall Martin (Purdue University, USA)

Martin gave a presentation on the experiences with rBST in the USA. His presentation included information from Monsanto, from the FDA and from several university studies (for detailed information, see chapter 4).

After several years of controversy and national debate, the Food and Drug Administration approved, in November 1993, the commercial use of Posilac™, the version of rBST developed by Monsanto. Commercial sales began in February 1994. Now with two years of experience with its use, slightly more than one in ten US dairy farmers, representing some what more than one fourth of the US dairy herd, are using rBST.

Based on available farm-level economic studies, rBST use does increase productivity about 10 pounds per cow per day during the final 250 or so days of the lactation. At current market-determined milk prices, these studies suggest that adopters of rBST can expect increased profits per pound of milk produced and per farm.

To date there is no evidence of any significant adverse consumer reaction in the United States, despite the debate in the news media before the approval of rBST, and efforts by some activist groups to create fear among the public about potential adverse impacts of rBST on food safety and family dairy farms. In fact, both milk production and consumption have continued to increase. Government stocks of dairy products remain at historic low levels. Milk prices at the farm level remain at or slightly above levels of the period just before the approval of Posilac™. Moreover, these market determined milk prices are about 20% higher than the government support price. In fact, farm-level milk prices have been consistently above the government price support level since the mid-1980s.

While there may be some resistance to rBST adoption by dairy farmers in some traditional states such as Wisconsin and some New England states, farmers in the rest of the United States seem to be willing to use this new product of genetic engineering. rBST adoption rates seem to be following those projected by researchers in the *ex ante* studies conducted by the USDA in the late 1980s.

For Americans, the debate and controversy over rBST appears to be essentially over. Furthermore, US government agencies have now approved several genetically engineered crops with insect or herbicide resistance including soybeans, canola, corn, cotton, and potatoes. They will be planted on a commercial basis in 1996. Thus, the United States, after huge private and government investments in the research and development of agricultural biotechnology, is beginning to see the adoption of these new technologies and a return on these private and public investments.

There are several key questions that must be addressed at this conference. What will happen in the European Union with rBST in particular, and biotechnology in general? How long will the ban on rBST use last in the European Union? Will educational and informational efforts, decisions by regulatory agencies, and actions by farmers, processors, and consumers permit adoption of these new technologies in the European Union? Will Europe lag behind the United States and experience a comparative technological disadvantage in terms of higher production costs, slower gains in improved product quality, slower rates of productivity gains, and possibly less environmentally friendly ways to produce food and fibre?

PUBLIC ACCEPTANCE IN THE EU
by Berit Nygård (University of Trondheim, Norway)

Nygård gave a presentation on public acceptance of agrobiotechnology and of rBST in several countries of the EU, as well as in Norway. Most of her findings on agrobiotechnology in general were based on the Eurobarometer studies, regularly repeated public opinion polls carried out in all countries of the EU. The conclusions on the public acceptance of rBST are based partly on the Eurobarometer information and partly on more specific information on the rBST debate in the individual countries.

The content and intensity of the public discourse on biotechnology in European countries is rather different. Two aspects are of great importance: knowledge of biotechnology and fundamental values. First, the degree to which biotechnology has been an object of public discourse correlates with the degree of knowledge about biotechnology as well as the ability to influence its development. There has been considerable discourse in those countries for which the Eurobarometer shows relatively high responses for knowledge of biotechnology.

Second, cultural differences and variation in fundamental values contribute to forming people's attitudes towards modern biotechnology. Recent studies have shown that these attitudes are based on fundamental values. In contrast to (scientific) knowledge, fundamental values remain relatively stable over time.

In all countries selected for this study, there are organizations opposing the introduction of rBST. While in the UK the concern for animal health especially is mentioned to reject rBST, in Germany and the Netherlands the expected negative consumer reactions are also major reasons to reject rBST. German consumers are especially sensitive to the product and process characteristics of their food. In Norway, Sweden and Finland there is also strong support for the idea that rBST is an undesirable product. In all these countries, hardly anyone can be found who is in favour of using rBST. Only the biotechnology industry is in favour. However, according to the Eurobarometer results, people's confidence in information coming from industry is very low.

Given that the current opposition to rBST is large, that the attitude towards biotechnology is for a large part determined by basic values, and that these values remain relatively stable over time, there is no reason to expect that the public attitude towards rBST will dramatically change in the near future.

- *Discussion*

The discussion after Nygårds presentation focused on the value of the Eurobarometer studies. As it is the only public opinion survey available for the EU as a whole, the comparisons are very useful. However, some participants expressed their doubts about the value of the answers, as most questions and the added information are stated in a rather positive way. Another limitation of the Eurobarometer is the very general character of the biotechnology questions. From national public and consumer attitude studies is has become clear that people, in their opinion on biotechnology, make important distinctions between various applications of biotechnology. Transgenic animals, for instance, are rejected by almost anyone, while genetically modified plants with enhanced disease resistance are welcomed by most. One participant stressed that for assessing the future attitude on rBST it is more important to look at the debate on hormones in animal production than to the debate on biotechnology. Many people object to rBST because it is a hormone supplemented to cows, and not because it is made with the use of modern biotechnology.

- *First round of general discussion*

In the first round of reactions to the presentation the discussion focused on the public attitude and consumer behaviour aspects of rBST. The following points were put forward:

- Europe is culturally a very diverse continent. Therefore it is difficult to compare public and consumer attitudes in the USA with those in the Europe;
- *Ex ante* surveys of public attitude do not always measure eventual consumer behaviour after a technology has been introduced. The US experience has shown that large public opposition to rBST did not lead to a large number of consumers rejecting milk from cows treated with rBST;
- for the acceptance of a biotechnology product it makes a big difference whether there is a need for such a product (i.e., new drugs), and whether there is a clear advantage for the consumer, the environment or the farmer (and not just for the company selling the new biotechnology product);
- rBST will have a small impact on the ongoing structural change in agriculture. It very much depends on the individual values how this structural change is perceived. Moreover, the advantages and disadvantages of structural change are felt by different groups;
- according to studies on the impact of rBST use on milk prices, the economic advantages of rBST use will eventually be felt by the consumer, mostly the low income consumer. However, normally only a part of the decrease in milk prices at the farm gate will be transferred to the consumer. The other part of the price decrease is taken as extra profit by processors and retailers;
- consumers are increasingly interested in the way food is produced. Therefore, one should be very careful in introducing new farming technology that is criticized by consumers;
- in assessing the expected consumer behaviour towards milk products from cows treated with rBST one should take into account the increasingly differentiated dairy market. Some consumer primarily look at prices and therefore they may accept milk from cows treated with rBST, while others are more interested in quality, and therefore reject such milk.

COMPETITIVENESS OF EU DAIRY AND INTERNATIONALE TRADE ASPECTS,
by Siemen van Berkum (LEI-DLO)

Van Berkum, in his presentation on the international trade and competitiveness aspects, focused on the EU perspectives on the international dairy market and discussed the impact on EU's competitiveness of an abolition of the quota system and a lift of the ban on rBST use. The EU plays a very important role on the international dairy market: it is the most important production region in the world (25%) and by far the biggest supplier of dairy products on the international market (50%). However, future perspectives are not so promising. Due to binding GATT-commitments to reduce export subsidies emerging markets in far-away Asia where the EU has a relative weak position, and to possible changes in EU dairy policy (also related to eastward enlargement of the EU), the position of the EU on the international dairy market is projected to decline. In order to stay competitive, Van Berkum stated that the EU dairy industry may press for lifting the ban on rBST use. In pointing out some policy alternatives that focus on the issues of the quota system and rBST use, Van Berkum concluded that rBST is economically much more attractive to farmers once the quota system is eliminated, although structural changes and regional concentration of EU dairy industry are expected to be most pronounced under that scenario. Van Berkum stressed that the potential positive contribution of the rBST use to EU dairy competitiveness depends strongly on the consumer attitude, not only in the EU, but also in the major export markets.

- *Discussion*

In the discussion following Van Berkums presentation one participant asked why so much emphasis should be put on the competitiveness of EU dairy products on the world market. Another participant answered that for several EU countries, notably the Netherlands, the export of dairy product to third markets is of great importance.

Once again it was stressed that consumers are increasingly searching for quality products. In Sweden and Denmark there has been a rapid expansion of the market for biological (or organic) dairy products. rBST does not fit into this trend.

If prices decline due to the abolishing of the quota system and the lifting of the ban on rBST use, consumption of dairy products will change. The amount of change depends on the price elasticity of demand for dairy products.

- *Second round of general discussion*

In the second round of general remarks, the discussion focused on the economic aspects of using or not using rBST. The following gives the highlights of the discussion:

- the future of rBST use in the EU is closely related to the future of the quota system. Under the quota system, the advantages of rBST use are much smaller than without the production limitations;
- rBST is just one of the issues that determine the future of the dairy industry in the EU. Therefore, it should be assessed in relation to other issues like the environment, product and market development, and more emphasis on quality instead of quantity;
- rBST can be seen as an threat but also as an opportunity. If approved, it will probably stimulate the growth of biological (organic) dairy products, while it also supplies cheaper dairy products for those who have low income;
- in looking at the adoption process in the USA, we may learn for our own near future: does the EU look like California (very large dairy herds), Wisconsin (many small family farms) or like New York (average size, modern dairy farms).

Suggestions for future research on socio-economic aspects of rBST and other applications of agricultural biotechnology

The following suggestions for future research on socio-economic aspects of agrobiotechnology and rBST were made during the workshop. These suggestions can be categorized according to the five dimensions of socio-economic impact studies mentioned by Bijman is his presentation at the workshop. These five categories are:

- safety of biotechnology products for human consumption;
- environmental impact;
- socio-economic impact on farming (changing structure of agriculture, multinationals dominating farming, patenting, etc.);
- animal health and welfare aspects;
- ethical aspects.

1. On animal health and welfare aspects:
   - carry out large scale field trials, for comparison of rBST treated cows with a control group;
   - carry out forecasting studies.

2. The eventual price of the rBST product will be partly determined by the way it is distributed to the farms and administered to the cow. What role does the veterinarian play in this context? How will the method of distribution and administration impact the price of the product, and thus the profitability for farmers?

3. Some concern has been raised about the impact of the use of rBST on the breeding programmes for dairy cows. How does the use of rBST interfere with cattle breeding?

4. Some participants feel that the EU decision making process is not transparent and some issues are left out. How can the decision making process be broadened, so that other information and data (particularly on socio-economic impact and animal health/welfare) are incorporated?

5. By closely monitoring the socio-economic effects of rBST use in the United States we may see what may happen in the EU once rBST is approved (of course with the specific European conditions taken into account). Does the European perspective look like the developments in Wisconsin or in other states?

6. Research on consumer attitudes towards rBST should focus on:
   - consumers in EU dairy export markets;
   - under different kinds of information supplied;
   - ifferences in consumption patterns and consumer behaviour between EU and USA;
   - more detailed consumer response questions in the Eurobarometer;
   - study differences between attitude and (eventual) behaviour.

7. We should not only look at rBST for productivity growth, but we should also look at alternatives in the cost/benefit analysis of rBST.

8. If rBST will be approved, what will be the effect of two milk streams (milk from treated and from untreated cows), and what kind of labelling may be introduced?

9. If rBST is approved, segmentation of the dairy market may appear: bulk production with rBST for processing into whole milk powder, e.g. for cheap exports, and non-rBST milk for high value added products, for internal markets and some quality export markets.

Appendix 2 The most trustworthy sources of information about bio-/gentechnology (national percentages)

Question: Now I would like to know which of the following sources of information you have conficence in, to tell you the truth about biotechnology and genetic engineering.
A) Please select from this list the one source you would have most confidence in (one answer only, mark under A)).
B) Indicate also which other sources you would trust to tell you the truth about biotechnology and genetic engineering (multiple answers possible, mark under B))

Column 1: question A) Column 2: question B)	N		B		DK		D WEST		D OST		E		F		GR	
Consumer organizations	24	31	24	28	31	32	26	46	37	35	21	24	40	29	14	26
Environmental org.	14	24	23	30	17	29	39	34	31	41	26	30	23	35	27	31
Animal welfare org.	5	16	6	25	7	15	7	36	6	31	4	21	5	26	2	20
Political organizations	1	4	1	3	0	3	1	4	1	3	1	3	0	3	1	3
Trade unions	1	6	1	4	1	4	1	6	1	5	1	3	1	4	1	3
Religious organizations	2	4	1	3	1	1	2	10	2	5	1	4	2	3	2	4
Public authorities	21	27	3	9	18	27	4	11	6	14	5	10	5	13	5	11
Industry	1	5	1	6	1	4	1	4	1	2	2	5	1	5	1	4
School or university	20	29	27	25	21	28	9	23	7	21	20	21	13	22	28	26
Don't know	12	17	14	24	5	13	10	11	10	11	20	30	11	18	20	30

Continuation

Column 1: question A) Column 2: question B)	I		IRL		IRL N-		L		NL		P		UK		EC12	
Consumer organizations	19	30	18	31	28	27	21	30	34	29	17	36	21	24	25	31
Environmental org.	36	31	31	30	24	33	28	32	20	31	25	40	30	28	26	32
Animal welfare org.	7	34	6	22	4	17	8	27	7	27	5	40	8	18	6	25
Political organizations	0	2	2	6	0	6	1	6	1	7	1	11	1	3	1	4
Trade unions	1	4	2	7	0	8	2	8	1	7	1	6	2	3	1	5
Religious organizations	3	8	5	9	9	13	0	6	1	5	8	17	3	6	3	6
Public authorities	2	9	6	12	8	16	7	13	10	20	4	17	6	15	7	15
Industry	1	6	2	6	1	12	1	6	1	6	1	9	1	5	1	5
School or university	17	26	17	23	14	27	19	31	16	25	18	32	21	24	17	25
Don't know	15	12	13	19	11	14	13	8	9	17	22	8	9	19	13	17

Appendix 3 Information about biotechnology, supplied with Eurobarometer questions

1. Plants

'Scientists are trying to use biotechnology and genetic engineering to change plants, in ways that may be quicker or more precise than traditional breeding programmes, in order to make the plants more useful. For example make them resistant to diseases or pests, make them ripen faster or give them the ability to grow in dry or salty soil. Please indicate to what extent you agree or disagree with each of the following statements concerning plant research.'

2. Animals

'Another development is the application of biotechnology and genetic engineering to farm animals, to change them in quicker or more precise ways than traditional breeding programmes, in order to make them more useful: for example, make them resistant to disease, or grow faster, or produce more or better quality meat or milk. Please indicate to what extent you agree or disagree with each of the following statements concerning such research on farm animals.'

3. Micro-organisms (A)

'Let us now talk about micro-organisms, such as the yeast we use to make bread, or beer, or yoghurt; or the micro-fungi we use to make medicines such as penicillin. Scientists know how to change these micro-organisms through biotechnology and genetic engineering, in order to improve their performance - that means, getting them to work faster or even to produce new products. Please indicate to what extent you agree or disagree with each of the following statements concerning research and micro-organisms.'

4. Micro-organisms (B)

'Some of these micro-organisms are used to break down sewage and other waste products and to turn them into materials harmless to the soil. Here again, scientists are trying, through biotechnology and genetic engineering, to improve these micro-organisms. They are trying to make them work faster or to make them clean up oil-slicks or other contaminants in the environment. Please indicate to what extent you agree or disagree with each of the following statements concerning micro-organisms and the environment.'

5. Food

'These new methods of biotechnology and genetic engineering are also being applied to the production and processing of foods. Scientists say that they can improve the quality of food and drink - for example by making it higher in protein, or lower in fat, or making it keep longer, or taste better. Please indicate to what extent you agree or disagree with each of the following statements concerning such research on food.'

6. Medicines and vaccines

'Yet another application of biotechnology and genetic engineering is the development of new medicines and vaccines to improve human health, for example, the production of human insulin for the treatment of diabetics. Please indicate to what extent you agree or disagree with each of the following statements concerning such research on medicines and vaccines.'

7. Human beings

'Science is also trying to apply some of the new methods of biotechnology and genetic engineering to human beings, or to their cells and tissues, for various purposes such as detecting, or curing diseases, and characteristics we might have inherited from our parents. Please indicate to what extent you agree or disagree with each of the following statements concerning such research on human beings, medicines and vaccines.'

Appendix 4 Support for various forms of biotechnological research

In the Eurobarometer, the informants were asked to indicate whether they definitely agree, tend to agree or disagree, or definitely disagree with different three statements about different types of biotechnological research:

- 'Such research is worthwhile and should be encouraged';
- 'Such research may involve risks to human health or to the environment';
- 'In any case, this research needs to be controlled by the government.

In order to compare the support for the various technologies, we will look at the national breakdowns of means for each technology. These means are calculated by applying the coefficients +2, +1, -1 and-2 to the responses 'definitely agree', 'tend to agree', 'tend to disagree' and 'definitely disagree' respectively; the central point is therefore 0: below this point, negative responses predominate, and above, positive responses. 'Don't knows' are excluded from the calculation. This simplification will also make it easier to compare the opinions in different countries.

The following table presents the national breakdown of means for each technology for the statement 'Such research is worthwhile and should be encouraged'.

	Plants	Farm animals	Microorg (A)	Microorg (B)	Foods	Medicine vaccins	Human beings	Means of means
Norway	0.67	-0.12	1.04	1.41	0.56	1.59	0.64	0.83
Denmark	0.83	-0.23	1.07	1.60	0.17	1.64	1.15	0.89
Netherlands	0.86	-0.60	1.28	1.63	0.57	1.56	1.00	0.90
W-Germany	0.29	-0.39	0.68	1.15	-0.21	1.02	0.22	0.39
E-Germany	0.86	0.14	1.19	1.49	0.30	1.48	0.57	0.86
Great Britain	1.00	-0.23	1.22	1.53	0.41	1.58	1.05	0.94
Luxembourg	0.57	-0.26	0.92	1.29	0.13	1.54	1.05	0.75
Belgium	1.17	0.15	1.36	1.61	0.83	1.66	1.33	1.16
Ireland	0.93	0.13	1.14	1.44	0.62	1.59	1.21	1.01
N-Ireland	0.70	-0.30	0.94	1.24	0.47	1.47	0.96	0.78
France	1.01	-0.11	1.32	1.56	0.53	1.61	1.36	1.04
Greece	0.76	0.40	0.89	1.53	0.49	1.67	1.30	1.01
Italy	0.82	0.12	1.18	1.50	0.52	1.53	0.88	0.94
Spain	1.08	0.51	1.21	1.41	0.85	1.52	1.22	1.11
Portugal	0.94	0.29	1.26	1.47	0.86	1.63	1.40	1.12
Average, all countries	0.83	-0.04	1.11	1.46	0.47	1.54	1.02	0.91

Appendix 5 Concern about the risk of using biotechnology

'Such research may involve risks to human beings or to the environment', national breakdowns of means for each technology.

	Plants	Farm animals	Micro-org (A)	Micro-org (B)	Foods	Medicine aaccines	Human beings	Means of means
Norway	0.68	0.72	0.60	0.29	0.68	0.29	0.95	0.60
Denmark	1.09	1.16	1.10	0.92	1.20	0.94	1.21	1.09
Netherlands	0.66	1.10	0.69	0.42	0.68	0.59	0.86	0.71
W-Germany	1.03	1.20	0.88	0.63	1.16	0.83	1.11	0.98
E-Germany	0.68	0.86	0.57	0.38	0.87	0.47	0.87	0.67
Great Britain	0.34	0.60	0.35	0.38	0.47	0.36	0.69	0.46
Luxembourg	0.89	1.02	0.95	0.65	0.98	0.61	0.81	0.84
Belgium	0.27	0.83	0.41	0.20	0.69	0.26	0.66	0.47
Ireland	0.54	0.83	0.53	0.50	0.59	0.45	0.74	0.60
N-Ireland	0.68	0.91	0.82	0.70	0.83	0.54	0.81	0.76
France	0.44	0.83	0.37	0.28	0.60	-0.01	0.36	0.41
Greece	1.05	1.12	0.96	0.50	1.09	0.15	0.48	0.76
Italy	0.37	0.54	0.13	-0.10	0.40	-0.14	0.35	0.22
Spain	0.22	0.51	0.16	0.15	0.37	-0.04	0.24	0.23
Portugal	0.72	0.96	0.66	0.48	0.75	0.58	0.77	0.70
Average, all countries	0.65	0.88	0.60	0.41	0.75	0.39	0.73	0.63

Appendix 6 Results of adoption and non-adoption of rBST in New York

Selected factors	Level of bST usage							
	did not use bST 137 farms		≤25% of herd 24 farms		>25% of herd 85 farms		stopped bST in 1994 13 farms	
	1993	1994	1993	1994	1993	1994	1993	1994
Size of Business								
avg. # of cows	89	93	100	104	237	258	135	138
avg. # of heifers	69	70	76	81	178	195	116	118
milk sold, lbs.	1,600,654	1,658,515	1,963,535	2,102,733	4,676,475	5,541,468	2,670,266	2,756,558
worker equiv.	2.77	2.76	3.51	3.63	5.94	6.28	3.74	3.83
total tillable acres	276	280	321	327	558	582	371	373
Rates of Production								
milk sold per cow, lbs.	17,926	17,918	19,570	20,259	19,716	21,468	19,814	19,920
hay DM per acre, tons	2.34	2.62	2.70	2.97	3.14	3.36	3.11	3.46
corn silage per acre, tons	14	16	15	16	16	17	17	17
Labor Efficiency								
cows per worker	32	33	29	29	40	41	36	36
milk sold per worker, lbs.	578,626	299,933	559,810	578,787	787,789	882,062	714,510	719,108
Cost Control								
grain & conc.pur. as %mlk. sls.	29%	28%	28%	26%	29%	28%	30%	29%
dairy feed & crop exp./cwt. milk	$ 4.58	$ 4.65	$ 4.69	$ 4.47	$ 4.68	$ 4.60	4.72	4.76
labor and mach. costs per cow	$ 1,004	$ 1,015	$ 1,096	$ 1,132	$ 962	$ 979	994	1,050
oper.cost of prod.milk per cwt.	$ 10.07	$ 10.24	$ 9.78	$ 10.20	$ 10.42	$ 10.64	9.80	10.40
vet. & med. exp. per cow	$ 52.63	$ 57.86	$ 96.43	$ 99.37	$ 84.19	$ 86.48	69.34	74.12

Continuation

Selected factors	Level of bST usage							
	did not use bST 137 farms		≤25% of herd 24 farms		>25% of herd 85 farms		stopped bST in 1994 13 farms	
	1993	1994	1993	1994	1993	1994	1993	1994
Cap. Effic. (avg. per cow)								
farm capital per cow	$ 6,763	$ 6,670	$ 7,092	$ 7,401	$ 6,108	$ 6,104	6,771	6,872
mach. & equip. per cow	$ 1,343	$ 1,330	$ 1,335	$ 1,356	$ 1,003	$ 993	1,304	1,326
asset turnover ratio	.41	.43	.45	.46	.52	.56	.45	.46
Profitability								
net farm inc. w/o appr.	$ 29,836	$ 32,627	$ 43,955	$ 44,495	$ 79,528	$ 100,096	$ 53,614	$ 46,627
net farm inc. w/ appr.	$ 37,946	$ 39,600	$ 55,353	$ 57,952	$ 97,884	$ 120,017	$ 64,609	$ 62,555
labor & mgmt.inc.per op/mgr.	$ 3,899	$ 5,675	$ 8,594	$ 6,637	$ 20,604	$ 30,892	$ 15,835	$ 9,913
rate return on equ.cap. w/appr.	1.52%	1.96%	2.19%	2.31%	5.99%	7.71%	4.02%	3.07%
rate return on all cap. w/appr.	3.14%	3.48%	3.43%	3.73%	6.21%	7.30%	4.97%	4.57%
Financial Summary								
farm net worth	$ 423,100	$ 432,026	$ 521,540	$ 560,764	$ 873,707	$ 952,733	$ 548,492	$ 571,794
debt to asset ratio	.31	.31	.29	.29	.42	.41	.41	.41
farm debt per cow	$ 2,062	$ 2,070	$ 2,071	$ 2,069	$ 2,517	$ 2,484	$ 2,821	$ 2,724

Source: Knoblach et al., 1995.

Appendix 7 Intra-EU trade in dairy products in 1993 (million ECU)

Table A7.1 Intra-EU trade in dairy products in 1993 (million ECU)

Product	Total value of exports	Main exporters		Main importers	
		country	value	country	value
Dairy total	11,964	Germany	3,129	Germany	2,240
		France	2,467	Italy	2,124
		Netherlands	2,242	Netherlands	1,691
		Belg./Lux.	1,421	Belg./Lux.	1,527
of which:					
Cheese	5,022	Netherlands	1,357	Germany	1,479
		France	1,228	Italy	907
		Germany	950		
Butter	1,744	Netherlands	438	Netherlands	365
		Ireland	340	France	355
		Belg./Lux.	299	Germany	331
				Belg./Lux.	313
WMP	690	France	291	Netherlands	155
		Germany	151	Belg./Lux.	125
		Belg./Lux.	84		
SMP	1,205	Germany	662	Netherlands	455
		Ireland	135	Italy	250
		France	122		
Condensed milk	473	Germany	196	Greece	141
		Netherlands	145		
Fresh dairy products and ice-cream	877	France	210	United Kingdom	169
		Belg./Lux.	207	Netherlands	139
		Germany	203	Germany	124
				France	116
				Belg./Lux.	115
Fresh milk	1,627	Germany	749	Italy	654
		Belg./Lux.	311	Belg./Lux	270
		France	291	France	265

Source: Eurostat Trade Statistics (EXMIS/LEI-DLO).