Biotechnology And Public Perception Of Technology[1]

The German Case

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Nr. 99/ MAI 1998

Arbeitsbericht

ISBN 3-932013-24-7

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[1] This paper is part of a Concerted Action of the European Commission (BIO4/CT95/0043), „Biotechnology and the European Public" coordinated by Martin Bauer, John Durant and George Gaskell, London, UK and part of the Concerted Action funded by the German Ministery for Education, Science, Research and Technology „Chancen und Risiken der Gentechnik aus der Sicht der Öffentlichkeit" (PLI 1444) and coordinated by Jürgen Hampel and Ortwin Renn from the Center of Technology Assessment, Stuttgart, Germany.

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1 INTRODUCTION

In the two centuries since the beginning of the first industrial revolution technology changed the face of the world like no other human invention. But since its beginning, the technical development found its critics. The philosopher of the age of enlightment Jean Jacques Rousseau was one of the first of them and a critical tradition of thinking about technology can be observed in Germany from the Romantic Period up to the presence (see Huber 1991).

A sceptical view on technology had not been limited to Germany. The fundamental tensions between technological developments and the social and cultural systems had been also described by classical anglo-saxon authors who wrote sceptical novels about modern developments like Mary Shelley (Frankenstein), Robert Louis Stevenson (Dr. Jekyll and Mr. Hyde), Aldous Huxley (Brave New World) and George Orwell (1984). And the introduction of new technologies in production processes in the 19th. century did not occure without severe conflicts (f.e. Randall 1995).

During the first decades following World War II it seemed that technology was out of discussion. Technology has been seen as a guarantor of progress and better living conditions, not only in Germany (see Touraine 1995). And technological development has been seen as a major cause of the so-called ”Wirtschaftwunder”, the rapid growth of the post-war-economy in Germany. But the overwhelming acceptance of technology which dominated the period of the ”Wirtschaftswunder” has disappeared. As can be shown by longitudinal studies the seventies and eighties experienced a considerable decline of public acceptance of technology (see Kliment, Renn, Hampel 1994). The discussions on new technologies in Germany, the discussion on Genetic Engineering is the most recent example, got more and more the shape of conflicts and these conflicts seem to be more fierce in Germany than in other European countries.

2 THE EMERGING DEBATE ON TECHNOLOGY, NATURE AND SOCIETY

This development raises the question, what causes this decrease of the social support of technology.

An intensive public debate on the negative outcomes of technology can be observed in nearly every industrialized and modernized country. An initial-point of a more critical

view on technology was the famous study of the MIT Institute on the ”Limits to Growth” (Meadows 1972) and the follow-up-study ”Global 2000” which questioned the western model of economic and technological development. Both studies had been intensively discussed also in Germany. But the fundaments of the environmental movement in Germany had been established already in the late sixties, strongly influenced by the student movement (see Brand, Busser et al. 1986) and its criticisim of the western model of economic prosperity. In the course of the seventies a strong environmental movement emerged in Germany. Environmental themes appeared on the agenda together with discussions on quality of life.

One of the most important and the most fierce controversies in the seventies could be experienced in conjunction with nuclear energy. In 1975 the site for the construction of the designed nuclear plant in Wyhl had been occupied by citizens who forced the state government of Baden-Wuerttemberg to give up their construction plan. In general, the anti-nuclear movement succeeded to stop the further implementation of nuclear energy in Germany and also succeeded to stop the intended construction of a nuclear reprocessing plant in Gorleben. The conflict on nuclear energy ist still on the agenda. A transport of nuclear waste to a depot in Gorleben in February 1997 had to be protected by 30.000 policemen.

Not only the further implementation of nuclear energy in Germany could be stopped in this conflict, the anti-nuclear movement succeeded also in creating new political and scientific institutions which are shaping debates on technology up to now. The Green Party as an environmentalist party is a steady and meanwhile widely accepted member of the German party system since 1981 and not on the federal level but on the state level the Green Party is involved in several governments. New scientific institutes opposed to traditional science like the Öko-Institut in Freiburg and Darmstadt had been founded in 1977 to support the resistance towards nuclear energy with scientific knowledge. Strong NGOs like the BUND (Association for the Protection of Environment and Nature) could be established in this period. According to a publication from 1996 (Rudzio 1996:71) Greenpeace has 520.000 members in Germany, the BUND has 220.000 members and the Naturschutzbund Deutschlands has about 190.000 members.

However, in Germany controversies about new technologies had not been restricted to nuclear energy. They also take place in other fields of new technology. In the early eighties, Germany experienced a fundamental debate on new communication and information technologies (see Noller, Paul 1991) and since the eighties a conflict on Genetic Engineering appeared on the agenda. This conflict seems also to be very fundamental and of a greater fierceness than in other countries. For quoting one example, most of the experimental fields in Germany which had been cultivated with genetically

modified plants had been destroyed by opponents of Genetic Engineering[4]. And this happens up to now.

3 THE ARGUMENTATIVE BASE OF THE DEBATE ON BIOTECHNOLOGY

An analysis of the argumentation patterns of opponents and proponents of a new technology who are involved in the public debate is very helpful for an understanding of the background of the debate.

One dimension of the debate on Genetic Engineering is related to the technology itself and the risks connected with it. Opponents of Genetic Engineering evaluate the risks associated with Genetic Engineering as 'new' Risks (see Beck 1986). They argue, that the implementation of Genetic Engineering is an experiment which is unforseeable in its consequences and irreversible. Once released, a genetically modified organism can not be fetched back. If it is not absolutely and without any doubt possible to exclude any damage, so the risk-related argumentation of the opponents of Genetic Engineering, Genetic Engineering and its application should not be allowed.

The debates on Genetic Engineering are not concentrated on Genetic Engineering itself but on its different applications. The debates are elements of much broader debates in society where possible future developments can be seen with more clearness than in other areas. For taking an example: the application of methods of Genetic Engineering in the agricultural production is evaluated by opponents as the spearhead of a rationalization of agriculture oriented only at economic criterias. The conflict on Genetic Engineering can be seen as a conflict between two different paths of development, as has been described by Beatrix Tappeser from the Öko-Institut in Freiburg in their comment to the report of the Enquete-Commission of the German Parliament on "Chances of Risks of Genetic Engineering":

The one path will increase the industrialisation, the technical control of nature and the re-shaping of nature to allow a better exploitation. It is feared that this functionalisation of life will not be limited to plants and animals.

The other, desired path of development is described as a path where technological and non-technological solutions of problems are developed which guarantee a protecting and sustainable dealing with nature (Tappeser in Grosch, Hampe, Schmidt 1990:10f).

[4] According to a press release from one of the major German companies in the field of applications of genetic engineering in agriculture, 16 out of 20 experimental fields of this company had been destroyed (Berliner Zeitung, January, 22nd, 1997).

Even more fundamental is the debate on medical and diagnostical applications of Genetic Engineering. As Ulrich Beck (1988) describes, these applications are not only allowing but also forcing new eugenic applications. Not only that genetic screening allows to select embryos according to their characteristics, parents want healthy children and what healthy is depends on cultural definitions, but also that the birth of ill or handicapped children becomes the result of a voluntary decision of their parents. This is discussed to have severe consequences for the system of health insurances and for social solidarity.

As can be shown by looking to the argumentation patterns in the controversy, the debate is more concentrated on the social and environmental embedding of technology than on the technological method itself, it is not only a technological debate but also a debate focussing on social, economical, ethical and ecological subjects. Along with the new technological opportunities the basic relation between man and nature is as questioned as the relation between the scientific and political elites and the population (Kliment, Renn, Hampel 1994).

4 THE SOCIOLOGICAL VIEW

The classical paradigm in the sociology of technology has been a deterministic view of the technological development, which has been seen as being independent from social and economical influences (Ogburn 1957, Ellul 1964). Technological development has been seen as forcing societies and cultures to adapt to the technological rationality, as has been formulated by the thesis of the ‘cultural lag’ (Ogburn 1957).

Modern sociological analysis about the process of technological development has corrected this simple view. Research on technological innovations has proved the thesis of the independence of the process of technological development to be wrong (Mensch 1975, Rammert 1993). Not every invention is leading directly to an innovation. For being successful, they require auspicious conditions (Mensch 1975). Rather than being determined by technological rationality, the innovation process is a social process of high complexity with several filters which control, whether a developmental path shall be continued or not (Gold 1981, Dosi 1988). As a consequence, technological development can no longer be seen as a genuine, autonomous process in the technological system itself but as a process which is highly determined by social and economical factors. Technological development is a process controlled by social, political and economical institutions (see Rammert 1993).

Therefore the sociological analysis of technology and of perception of technology can not be restricted to the technological artefact or method. This is also reflected by the sociological discussion of technology. Compared with the use of the term ”technology”

in colloquial language and in technical sciences, the sociology of technology has developed a term of technology which exceeds the technical artefact. According to Ropohl (1988:125), for quoting one of the definitions, technology is not only the set of technical artefacts but also the set of actions and institutions in which these artefacts are developed and produced as well as the set of actions, in which these technical artefacts are used. The artefact can not be separated from the embedding scope of actions. Such an extension of the term ”technology” has implications for the measurement of attitudes towards technology: research can no longer focus on the technical artefact or on technology alone as technologists understand it. The relevant elements of the socio-technological system (Lenk, Ropohl 1978) should be considered when studying perception and evaluation of technology.

This modern view on technological developments which estimates technological development as a social project which is guided by social values and interests raises new questions. If technology is seen as a result of an autonomous process, the direction of technological development can not be questioned, it has to be accepted. If technological development is seen as being based on social, economic, cultural and legal goals, which are selected in the society of in parts of the society, then it is necessary that these goals are legitime. The problem of the social embedding of technology appears on the agenda.

There are two dimensions which have to be reflected:

- The dimension of decisions (legitimacy).

  Are the decisions about the goals of the development result of a process which is seen as legitimate or is the legitimation of these decisions questioned?

- The dimension of control (legality). Even if the goals of technological development are seen as being legitime, it may be that there is seen a fear that a technology is either uncontrollable or that the control is to weak to avoid misuse of this technology.

This refers also to the importance of perceived trust, trust in the decision-making institutions which are managing and regulating the technology, trust in the principles that will be used to apportion liabilities for undesired consequences and trust in the procedure by which collective consent is obtained for a course of action acceptable to those who must bear its consequences (see Rayner 1992:95). What looks on a superficial level as the problem of a lack of trust into the technological and scientific development is in fact a lack of trust to the the social mechanisms which promote, control and guide the develoment in ways which are desired by the public (Dierkes, Marz 1993). Under this perspective resistance towards a new technology can be seen as resistance against an undesired future development. So discussions on new technologies are reflecting the problems modern society have with the coordination and regulation of the different subsystems (see Bauer 1995). We have to prove whether this might be an explanation for the German debates.

5 ATTITUDES TOWARDS NEW TECHNOLOGIES

In the public and political debate the acceptance problems new technological developments have in Germany are often discussed as a result of an irrational, general emnity towards technology, a general scepticism about technological development. To prove this thesis, we first want to answer two questions:

- Are the attitudes of the Germans towards Genetic Engineering really as sceptical as it is discussed?
- Do the attitudes towards Genetic Engineering reflect a general attitude towards technology or are they specific ?

A general question in the Eurobarometer surveys from 1991, 1993 and 1996 and in the CTA study from 1997[5] allows us to answer both questions. This question asks for the expectations people have about the implementation of several modern technologies[6], whether their further implementation will have positive or negative outcomes for the quality of life. Because there had been two fundamentally different political systems and also different political and economical cultures in West- and East-Germany until 1990, we differentiated in our longitudinal analysis between West-Germany and East-Germany.

As can be seen in Figure 1, the thesis of a general german emnity towards technology can be rejected. With one exception, for each of the technologies only six up to eight percent of the respondents are expecting, that the further implementation of this technology will reduce their quality of life. The most positive expectations are raised by solar energy (more than 75% up to 82% in 1997), computer- and information technology (up to 70%). For new materials and space-exploration the expectations are not as positive as for the solarenergy and computer-technologies (40% up to 55% expected a positive outcome of the implementation of these technologies). This is due to a high level of ambivalence, not rejection. Less then 10% of the respondents think that the implementation of these technologies will have negative outcomes. From 1991 to 1993 there is a high decrease of positive expectations about new technologies. Between 1993 and 1996 we can observe a small increase of technological optimism, but the positive expectations did not reach the level of 1991. In general, the perception that technology is ambivalent increased from 1991 to 1997. For each of the technologies we found an increasing number of people with non-evaluations and non-attitudes.

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5 A description of these surveys can be found in Appendix I.

6 The technologies are: solar energy, computer and information technology, biotechnology/genetic engineering, telecommunication, new materials or substances and space exploration.

Figure 1a: Positive Evaluation of New Technologies (West Germany): Approval of the Item: Will improve our way of life in the next 20years (in %)

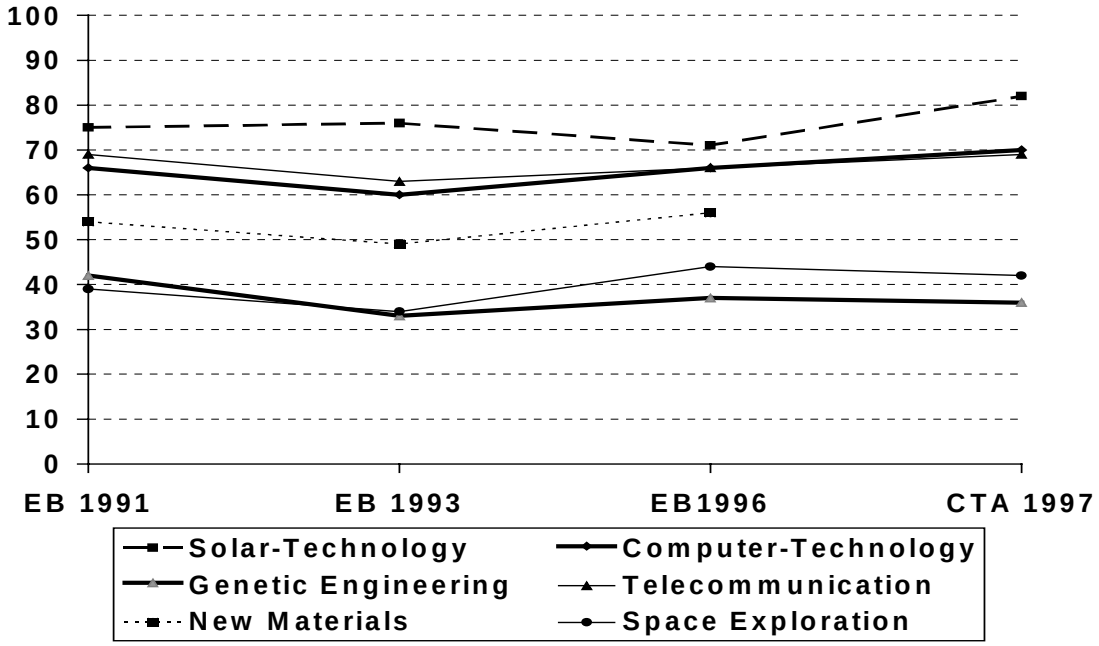


Figure 1b: Negative Evaluation of New Technologies (West-Germany): Approval of the Item: Will make things worse. (in %)

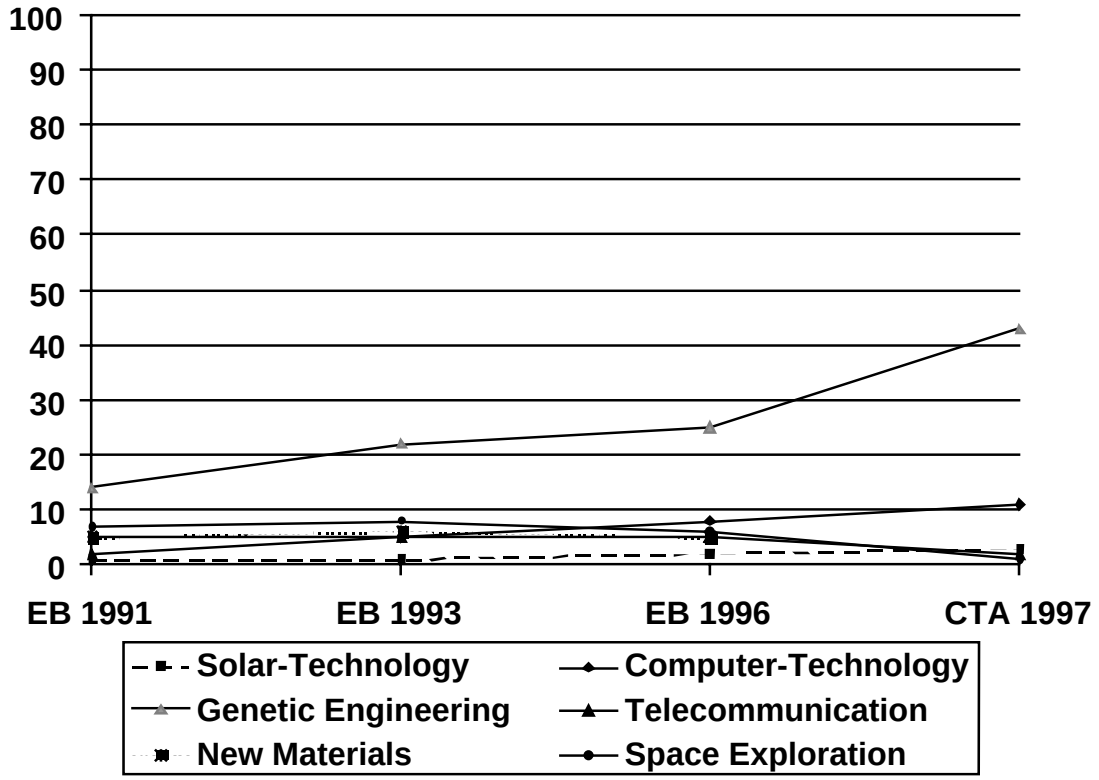


Figure 1c: Positive Evaluation of New Technologies (East-Germany):Approval of the Item: Will improve our way of life in the next 20 years (in %)

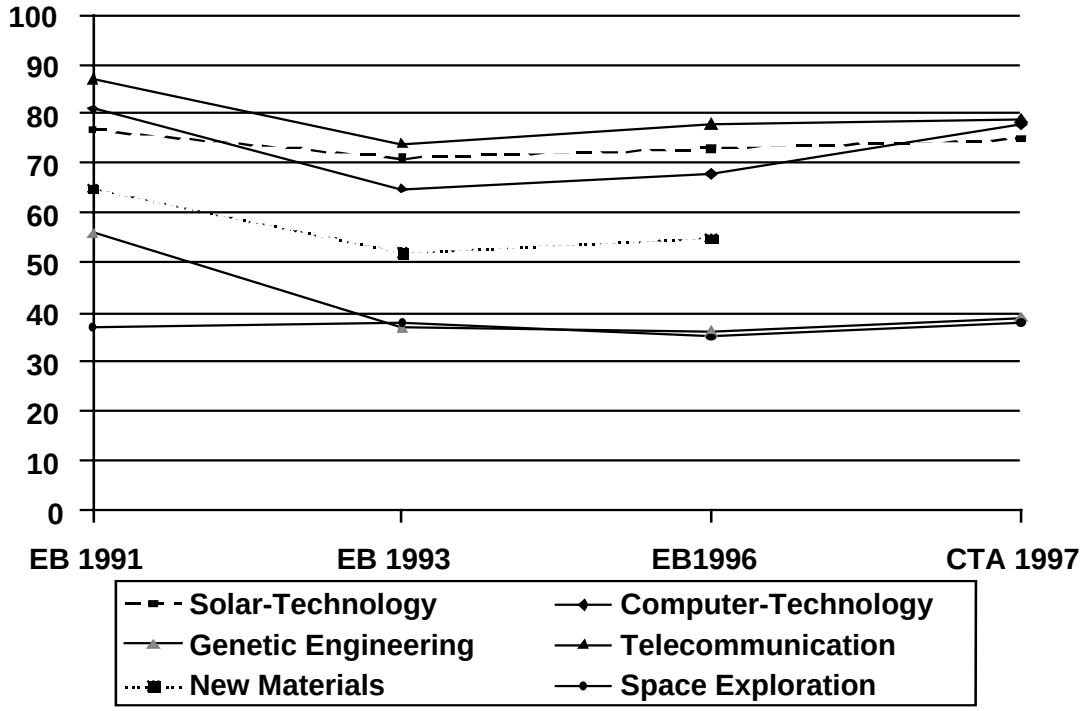
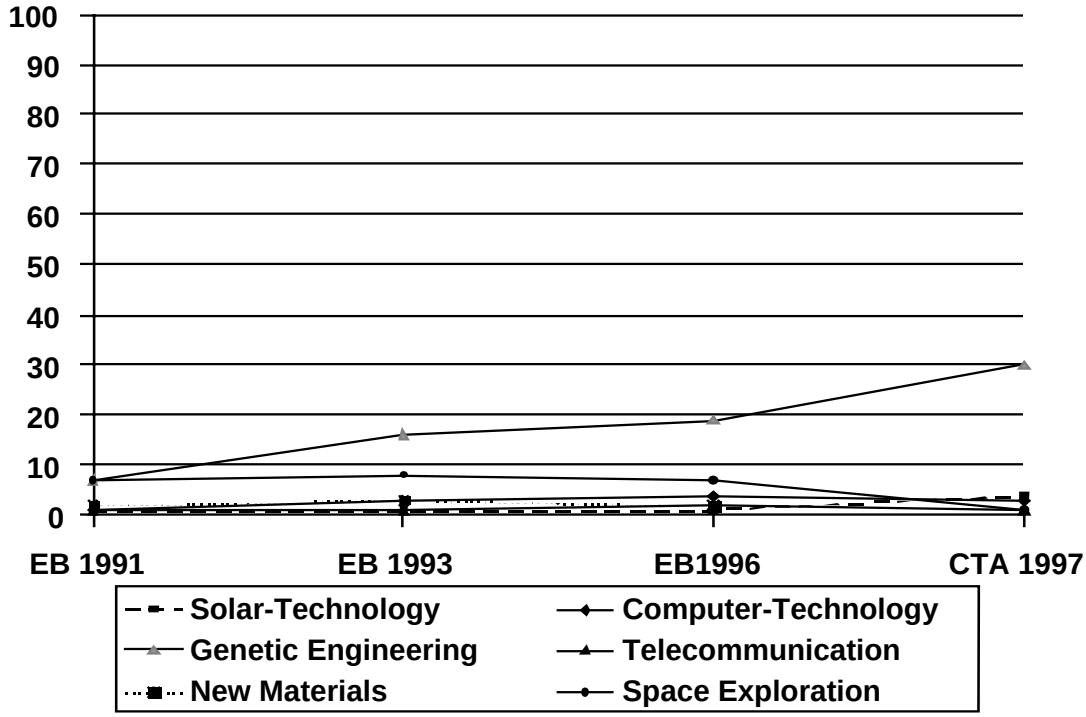


Figure 1d: Negative Evaluation of New Technologies (East-Germany): Approval of the Item: Will make things worse. (in %)



Compared to this positive evaluations of the other technologies the evaluation of Genetic Engineering is very negative. And the sceptic view on genetic engineering becomes more and more important. The proportion of Germans who think that Genetic Engineering will make their way of life worse is increasing over time. In 1991, only 15% of the West-Germans thought that Genetic Engineering will have a negative impact on their lifes, in 1996 this view was shared by 21% and in 1997 by 42%. And whe can observe a substantial decrease of positive evaluations of Genetic Engineering in Germany from 1991 to 1997. In 1997 there is the highest percentage of negative expectations from Genetic Engineering in our time-series and for the first time there are more people with negative expectations than people with positive expectations. In 1991, the East-Germans had much more positive expectations about new technologies than the West-Germans, but this difference decreased in time.

If the thesis of a general emnity towards technology in Germany is true, we must be able to identify a strong group with consistent negative attitudes about the different technologies. Looking at the results of the Eurobarometer 1996, 71% of the respondents did not expect negative consequences from any of the technologies in question. About 19% of the respondents expected negative outcomes from one single technology and only 9% had negative expectations from more than one technology.

Another argument against the thesis of a general critical attitude towards technology is the weak correlation between the attitudes towards the different technologies. The correlation-coefficients reached values between .23 and .54. The average correlation is .36. The correlations between Genetic Engineering and solar-technology (.23) and telecommunication (.27) proved to be the weakest.

These results support the view. that critical attitudes towards Genetic Engineering are not the result of a general emnity towards technology. People with a sceptical view about Genetic are not sceptical about modern technologies in general. Most of the respondents with negative expectations from the further implementation of Genetic Engineering had positive expectations on many other new technologies.

6 THE DEVELOPMENT OF ATTITUDES TOWARDS DIFFERENT APPLICATIONS OF GENETIC ENGINEERING

Attitudes towards Genetic Engineering are very different from attitudes towards other new technologies and they are only weakly correlated with the attitudes towards other technologies. Assessment of a specific technology does not follow a general attitude towards technology.

But Genetic Engineering itself is more a scientific method with very different applications in different fields than a specific technology. Therefore, in a second step of our a-

nalysis we looked for the evaluation of different applications of genetic engineering. The thesis of a general emnity towards Genetic Engineering would imply very similar evaluations.

Our data base does not only allow to compare the different applications of Genetic Engineering, it also allows to analyse the development of attitudes towards the different applications over time. For five applications or areas of applications, food-production, cultivation of plants (i.e. crop-plants), medicine, breeding and manipulation of animals and genetic screening for diseases by human beings, we are able to make time-series-analysis, although with methodological restrictions which are caused by different formulations of survey-questions. For example, the Eurobarometer-Surveys in 1991 and 1993 asked for research on different applications, the Eurobarometer-Survey in 1996 and the CTA-Survey in 1997 asked for applications, which is a substantial difference. So the comparison can only show a trend.

In table 1 the developments of the attitudes towards the different applications of Genetic Engineering from 1991 to 1997 are listed.

Table 1: Evaluation of different Applications of Genetic Engineering in West- and East-Germany (%)

	EB 1991		**EB 1993**		**EB 1996**		**CTA 1997**	
Application	West	East	West	East	West	East	West	East
Food-Production								
- agree	48	71	40	53	39	48	7	11
- disagree	42	25	52	39	48	41	78	67
- ambivalent	9	4	8	8	13	11	14	22
plant cultivation								
- agree	70	84	55	70	50	60	34	47
- disagree	22	12	36	21	37	30	33	25
- ambivalent	8	4	8	8	13	10	31	29
medicine								
- agree	73	86	79	87	65	74	63	67
- disagree	18	8	15	7	22	17	11	8
- ambivalent	9	6	6	5	13	9	26	26
animal breeding								
- agree	37	56	35	47	30	39	5	7
- disagree	56	39	58	45	58	51	85	77
- ambivalent	7	5	7	7	12	9	10	16
Genetic screening								
- agree	60	72	54	63	63	75	72	82
- disagree	30	29	36	30	25	15	20	5
- ambivalent	10	5	9	7	12	10	12	13

As in Europe as a whole (see Biotechnology and the European Public Concerted Action Group 1997), we can find substantial differences when looking at the evaluation of different applications of Genetic Engineering in Germany. Some applications are widely accepted, while others are rejected. Applications in medicine including genetic screening find high acceptance rates. This positive evaluation of genetic screening is insofar surprising, as the negative consequences of Genetic Screening are very critically discussed (see chapter 3). On the other hand, applications of Genetic Engineering in food production, plant cultivation and animal breeding are evaluated much more sceptical. As for the different technologies for any of selected application of Genetic Engineering ambivalent assessments are increasing, this is especially true for the cultivation of plants, medicine and genetic screening. One can see too, that East-Germans have consistently more positive attitudes towards the different applications than West-Germans, even when the difference is becoming smaller. As with Genetic Engineering in general we can find that the support of the applications of Genetic Engineering was higher in 1991 than in the later surveys. The only exception is genetic screening, which becomes more and more accepted. But the most important result is the dramatical decrease of acceptance of application of Genetic Engineering in food-production and animal breeding from the Eurobarometer 1996 ti the CTA Survey from 1997. In the few months between these surveys the acceptance of genetically modified food produced decreased from 39% in West-Germany and 48% in East-Germany to 7% in West-Germany and 11% in East-Germany. The same reduction of acceptance can be observed when we are looking at applications of Genetic engineering in animal breeding. Here the acceptance rate reduces from 30% to 5% in West-Germany and from 39% to 7% in East-Germany. This clear change raises the question what happened between the two surveys what might explain this dramatic development? One explanation is, that just in the period between the two surveys two major events happened. The first genetically modified soya beens had been exported from the US to Germany and the cloning of the Dolly the sheep.

We have seen, that people assess different applications of Genetic Engineering in very different ways. The next question is, whether the reasons for the assessments are the same for each application. In the Eurobarometer 1996 Survey respondents had been asked for each of the applications, whether it is useful, risky, morally acceptable and whether they should be supported. It is already known, that moral acceptability followed by usefulness are the most important predictors of support and that the perception of risk is rather unimportant (Biotechnology and the European Public Concerted Action Group 1997). But the question still remains whether there are differences between the applications. Are there applications, where usefulness is more important than moral acceptability? We made regression analyses for each of the applications to look for the relativ importance of the perceived risk, usefulness and moral acceptability for the sup-

port of the application[7]. These models distinguish two third (Food) and three fourth (application at animals) of the variance of the support. As indicated in the Nature-paper for Europe (Biotechnology and the European Public Concerted Action Group 1997), moral acceptability and usefulness are the best predictors of support in Germany too. Whether an application is seen as being risky or not makes no difference for the support, when moral acceptability and perceived usefulness are given. But there are some differences in the relative importance of these factors. At applications related to man and animals, this includes also medical and pharmaceutical applications, moral acceptability is much more important (beta-coefficients between 0.53 and 0.59) than usefulness (beta-coefficients between 0.33 and 0.34). The only exception of this general rule is the application of Genetic Engineering for food production, where the relative importance of usefulness is slightly stronger than the importance of moral acceptability (0.46 and 0.41). These results support the results, that Genetic Engineering and its applications are only accepted, when there are no moral concerns.

7 THE SOCIAL BACKGROUND OF ATTITUDES TOWARDS GENETIC ENGINEERING

Are different social groups evaluating Genetic Engineering in different ways? Is higher education leading to more positive expectations from Genetic Engineering? Are there differences between women and men? Are younger people more in favor than older people?

Men and women show significant differences. Men (about 40%) are more optimistic about Genetic Engineering than women (about 33%) while women (28% in West-Germany, 22% in East-Germany) are more sceptical about Genetic Engineering than men (21% in West-Germany, 17% in East-Germany).

With increasing age we find a substantial decline of positive expectations[8]. This is not leading to a general scepticism but to more indifference. The elder people are, the more they think that the implementation of Genetic Engineering will have no effect. The most supportive group in West-Germany are younger women (up to 24), followed by men in the age between 40 and 54. In East-Germany both men and women between 25 and 39 are most supportive. The most critical group are women aged 55 and older in West-Germany.

[7] For this analysis we used the West-German data only.

[8] In West-Germany 28% in the age of 55 and older, in East-Germany 32% compared to 37% on average.

The higher the educational level, the more positive are expectations about Genetic Engineering. In West-Germany, only 26% of those who finished their education before the age of 15 had positive expectations from Genetic Engineering, but more than 46% of the people that finished their education in an age of 20 and more (in East-Germany the rates are 30% to 41%). The higher the educational level, the lower is also the share of people who say that this technology will have no effect and of people who do not know. Respondents with negative expectations from Genetic Engineering do not differ according to their educational level. This is only true for West-Germany. In East-Germany, the higher educated people have more negative expectations from Genetic Engineering (25%) than people with a lower educational level (17%). As expected people with a training in natural science had more positive expectations than people with a training in humanities (58% to 48%), but this difference is not significant. The results of this analysis are very similar for West- and East-Germany.

In the Eurobarometer 1996 ten questions had asked to measure knowledge about Genetic Engineering. Respondents have rather little knowledge about Genetic Engineering in Germany. Only 10% of the respondents in West-Germany gave more than 70% of correct answers and only 12% in East-Germany. There is no significant correlation between the generalized attitude towards Genetic Engineering and this knowledge scale.

Figure 2a: Attitude towards Genetic Engineering by Age and Gender in West-Germany Database: Eurobarometer 46.1 (1996)

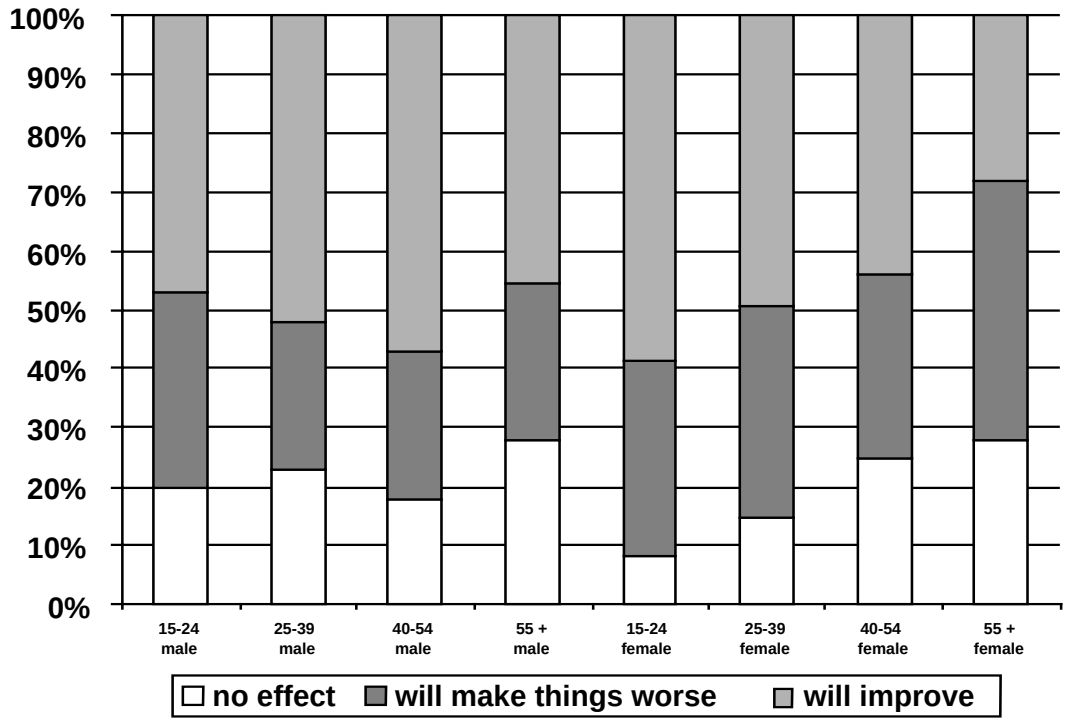
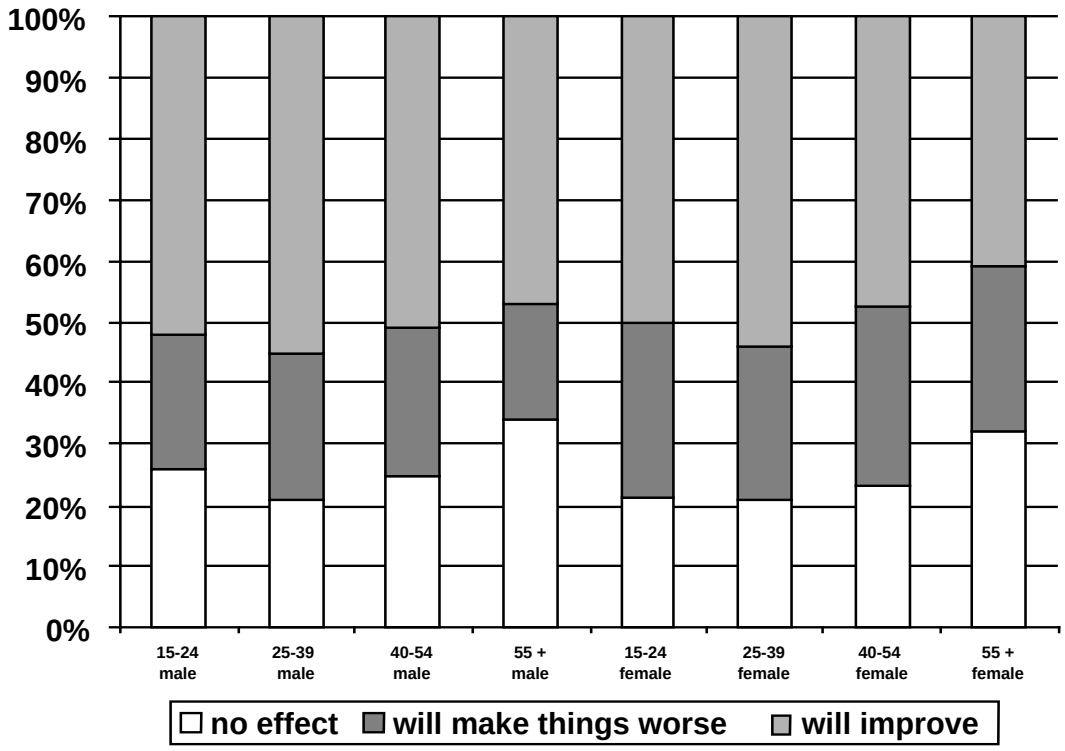


Figure 2b Attitude towards Genetic Engineering by Age and Gender in East-Germany
Database: Eurobarometer 46.1 (1996)



8 THE SOCIAL EMBEDDING OF GENETIC ENGINEERING

Technology is not only the technological artefact or the technological method, technology is the technological artefact and its social embedding. In the Eurobarometer 1993, 80% up to 90% demanded for control of the research for the different applications of Genetic Engineering. The proportion of respondents demanding for control was not differing according to different applications of Genetic Engineering. In the EB 1996 a modified item-battery was used. 58% of the german respondents did not believe that law and formal regulations are sufficient for the control of Genetic Engineering, 72% wanted genetically modified food to be labeled and 60% did not accept involved risks in genetic applications to gain economic benefits. On average, about 81% of the respondensts think that controls are not sufficient and believe, that there are high risks caused by Genetic Enginering.

In the CTA-Study 1997 only 30% of the people believed that it is real possible to control Genetic Engineering. Nevertheless, about 75% did not believe that laws and regulation are sufficient in Germany, a substantial higher score than the 58% of the Eu-

robarometer 1996. People do not only think that regulations are insufficient, more than 80% think that consideration of the existing regulations is not controlled rigorous enough. Not only the control of the technology is seen as being problematic but also the control of scientists themselves. About 58% of the respondents of the Eurobarometer 1996 believe that scientists do whatever they want without respecting law and regulations.

So the results are very similar from 1993 to 1997. There is a strong need for control and regulation, and not only the existing regulations and laws as well as the institutional control are seen as beeing insufficient but also the trust in the seriousness of the controls is very limited.

The index variable for the evaluation of risk and control is only weakly correlated with the general evaluation of genetic engineering (eta=.08, Cr.V=.10, p=.006). This surprising result means that even people with a positive estimation of Genetic Engineering are seeing this technology as being associated with risks. And also respondents with a positive view on Genetic Engineering demand for control and agree with the statements about high risks of genetic applications.

In the CTA Study 1997 we included items to measure general attitudes on technological development which lead to substantial differences between supporters and opponents of Genetic Enginerring. Supporters of Genetic Engineering:

- do much more think (61%) than opponents (49%) that interests of the society should get priority over individual interests or needs[9],
- think more (77%) than opponents (57%), that technology is necessary to solve social and economic problems,
- think more (58%) than opponents (32%), that we have to accept some risks to gain advantages, but only 27% of the respondents of the Eurobarometer think that we must accept the risks which are associated with Genetic Engineering for economic reasons.
- think less (57%) than opponents (73,5%), that we should renounce a new technology if the consequences cannot be foreseen.

If we are looking at trust, Germany shows the same pattern as the other european states, people trust in NGOs, not in governments and not in science. According to the Eurobarometer 1996, more than 40% of Germans have the highest trust in consumer organisations. If we add to these 40% the 26% who expressed the highest trust in environmental organisations and the 7,5%, who had the highest trust in animal welfare organisations,

[9] The correlation is not very strong but significant (Cr.V=.10, p=.0001) because many supporters and opponents marked their judgement as ambivalent

almost three of four Germans trust most in NGOs. On the other hand, only 8% say that they trust most in schools and universities, compared to 12,5% on the european average. Political organisations, public authorities and industry are institutions which are not the first adresses if we ask people whom they would trust most. If we differentiate between different applications of genetic engineering, we find that only with medical applications people trust the professionals most, in this case the medical profession.

The strong need for regulation and the low trust in political organisations and institutions are leading to question, who is assigned to controll Genetic Engineering in a sufficient and competent way? According to the CTA-Study from 1997, 32% think that international organisations like the UN or the WHO should regulat Genetic Engineering, 19% see the regulation of Genetic Engineering as a task of the science system itself and 13% think that german national authorities are best to regulate genetic engineering. The result that international organisations are very important for regulation and control seems to be surprising because these organisations cannot be controlled by the people. It may be that people think that Genetic Engineering cannot be regulated on the national level because GMOs don't stop at national frontiers.

There is a strong need of people to get involved into the decision-making processes. Only 21% agreed to the item that any public discussion about Genetic Engineering is useless and unnecessary because biotechnology is too complex and cannot be understood by "ordinary" people at all. Two thirds of the respondents (65%) rejcted this statement. The rejection of this item is stronger in Germany than in most other european countries (with the exception of the Netherlands, Sweden and Finland). Only 17% think, that regulation should be left to industry.

This strong demand for participation and involvement is contrasted by the fact that most Germans think that the development and implementation of Genetic Engineering can not be stopped even when it is rejected by the public. This view is shared by 64% of the supporters, but also by 58% of opponents of Genetic Engineering (Cr. V=.09, p=.011). It seems, that even a majority of the opponents do not evaluate resistance as being promising.

9 SUMMARY

The public resistance to Genetic Engineering in Germany is not a result of an overall rejection of technology as implicated by the concept of "Technophopia", on the contrary, most of the technologies which had been investigated find a high amount of acceptance in Germany. Genetic Engineering is the only one with dominating negative attitudes. If we analyse the development of attitudes towards Genetic Engineering, we can

observe that negative estimations are increasing while positive and neutral evaluations are decreasing.

The overall rejection of Genetic Engineering is not leading to a rejection of each application of Genetic Engineering. The rejection of Genetic Engineering is almost focused on applications for food production and animal breeding. The strong decrease of the support of applications in these sectors and the global evaluation of Genetic Engineering and the stability of the evaluation of the other applications between the Eurobarometer 1996 and the CTA 1997 supports the assumption that the transport of manipulated soya beans and the Dolly-Cloning had a negative impact on the acceptance of Genetic Engineering.

Strategies to improve the technological knowledge in Germany to support acceptance of Genetic Engineering do not seem to be very promising.

- As already mentioned by the Biotechnology and the European Public Concerted Action Group in their Nature-Article in june 1997 the thesis t that technical knowledge is leading to a higher acceptance of Genetic Engineering which is popular amongst natural scientis has proved to be wrong.
- The most important predictors of the attitudes towards Genetic Engineering and the different applications of Genetic Engineering are the moral evaluation and the estimation of usefulness.
- Control and regulation of Genetic Engineering are of high importance if one is looking at the estimations of the respondents. It seems to be paradox but even the supporters of Genetic Engineering demand for more control of Genetic Engineering. This strong need for regulation can not be satisfied because a majority thinks that Genetic Engineering can not be controlled at all. Even the existing regulations. although seen as being too weak, seem not to be controlled strictly enough. This refers directly to the result, that trust in political and administrative institutions which are the normal adressees of needs for regulation and control is very low.
- The opponents of Genetic Engineering show some signs of helplessness. A majority of them thinks, that whatever the society may think about a technology, their implementation can not be hindered. This feeling of being at the mercy of a development which is not controlled and not controllable may also be one reason for the strong decline of acceptance of genetically modified food and applications of Genetic Engineering.

Resistance towards Genetic Engineering is more a symbolic act where people declare their concerns about the path of technological development and further rationalisation than the result of a technolocratic balancing of opportunities and risk. So discussions on Genetic Engineering have to include the moral dimension of the applications, and they have to include questions of control and regulation.

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Appendix:

For our analysis we used data from the Eurobarometer-Surveys from 1991 (35.1), 1993 (39.1), and 1996 (46.1)and also data from a national survey in Germany from 1997.
The Eurobarometer is a european survey which is conducted in each member state of the European Union. In general, each state is represented by 1.000 respondents. With the enlargement of the EU the Eurobarometer is done in more and more countries. The question-program of the Eurobarometer has also been asked in surveys in other countries outside the EU (for example: the Eurobarometer 1993 has been replicated in Austria in 1994). Eurobarometer-Surveys in 1991, 1993, and 1996 focussed on Genetic Engineering and Biotechnology. The first Eurobarometers had been more political studies than scientific survey. All Eurobarometer contain trend-questions, which had been replicated in each survey. So it is possible to make time series analysis. The Eurobarometer 1996 is insofar an innovation as for the first time the questionnaire had been formulated by social scientists, the ”Biotechnology and the European Public Concerted Action Group” coordinated by John Durant, George Gaskell and Martin Bauer, formulated the questionaire. So the new Eurobarometer combines a replication of some questions of the Eurobarometers from 1991 and 1993 with new items for a better analysis of the perception of Genetic Engineering and ist explanation. A speciality of the Eurobarometer-Surveys is that they treat Germany as still being divided. So we have 1.000 respondents in both East and West-Germany. The Biotech-Survey (CTA 1997) focusses also on public perception of Genetic Engineering, but unlike the Eurobarometer-Surveys it is only a national german study. The survey is a component of a multi-disciplinary and multi-method german research project on ”Public Perception of Chances and Risks of Genetic Engineering” which is coordinated by Dr. Jürgen Hampel and Prof. Dr. Ortwin Renn from the Center of Technology Assessment in Baden-Wuerttemberg. The project also analyses the media reporting in Germany, the reception of media-reports by the public, attitudes of journalists about Genetic Engineering, discussions in social networks, and the attitude building in schools. Both qualitative methods as focus groups and qualitative depth interviews and quantitative methods of social research are used. This work is done by the Center of Technology Assessment and several University Institutes and Resarch Institutes in Germany.

Zusammenfassung

Die Gentechnik zählt zu den modernen neuen Technologien des 20 Jahrhunderts. Ihre Applikationen und Verfahren umfassen die Bereiche Medizin, Pharmazie, Umwelt, Landwirtschaft und Lebensmittelproduktion. Sie ist eine typische Querschnittstechnologie mit unterschiedlichsten Objektbezügen.

Zugleich ist sie eine der umstrittensten Gegenwartstechnologien in der Bundesrepublik Deutschland, deren sozio-ökonomischen und sozio-kulturellen Auswirkungen kontrovers diskutiert werden. Ihre Anwendungen berühren Grenzfragen humaner Gesellschaften, z.B. zur Freiheit und Ethik in den Naturwissenschaften, zum Verständnis von Evolution und Religion, zur Ökonomisierung des Lebens.

Unter soziologischen Gesichtspunkten ist gerade die Wechselwirkung zwischen Technik und Gesellschaft von Interesse. Inwieweit hängt die Akzeptanz und Diffusion einer neuen Technik von sozialen Faktoren ab und inwieweit verändert und relativiert eine neue Technik die Bedingungen für ihre Akzeptanz, z.B. durch Forschungserfolge oder ein Relativieren der geltenden Moral und Rechtsetzung zu bestimmten Anwendungen?

Unsere Analysen zeigen auf, daß die Gentechnik in einer sehr differenzierten Weise von der Bevölkerung bewertet wird. Abhängig vom Einsatz in bestimmten Bereichen fällt die Akzeptanz bzw. Inakzeptanz höchst unterschiedlich aus. Bei einigen Anwendungen (Nahrungsmittel und die Veränderung von Tieren) ist im Vergleich von sozialwissenschaftlichen Umfragen zwischen 1196 und 1997 ein Trend abnehmender Akzeptanz erkennbar. Ein Zeitraum, in dem die Einführung gentechnisch veränderten Sojas und die erste Klonierung eines erwachsenen Säugetiers (Dolly) geschah. Beides Ereignisse, die offensichtlich nicht ohne Auswirkungen auf die Einstellungen blieben.

Insgesamt nehmen ambivalente Haltungen zu und Polarisierungen im Meinungsbild ab. So scheint die Gentechnik an jenem Punkt einer sozialen Diffusion angelangt, an dem der gesellschaftliche Diskurs über Legitimität und Legalität beginnen kann.