# Advocacy Coalitions, Policy-Oriented Learning and Long-Term Change in Genetic Engineering Policy: An Interpretist View

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## 1. Introduction[1]

In 1973, Stanley Cohen and Herbert Boyer introduced a technique to transfer genes from one organism to another artificially. Scientists, industry, farmers, medicine, and several social movements have associated different kinds of hopes and risks with the use of gene technology. Eventually, it became a permanent controversial political issue (cf. Hindmarsh/Gottweis 2005: 299). The controversy led to a regulatory framework that differs between OECD countries although there was an international scientific debate to connect the national discourses (cf. Gottweis 1998). Even though the European Union gained a lot of legal competencies, national actors and the Member States still dominate the political debates. Within the multi level governance system most decisions are developed bottom up, and the implementation of European directives differs between the Member States (cf.

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Dolata 2003: 279). In Germany, the debate became more controversial than in other countries and led to strikter regulations (cf. Aretz 1999). In the meantime there were several changes of the original regulatory framework. So, we now have the opportunity to observe policy change over more than three decades.

How and why did the regulation of gene technology in Germany change during the last decades? Policy Analysis provides several theoretical lenses to analyse this question. Most of them refer to the relevant actors within the policy subsystem (Fink 2003: 9). As the subject of genetic engineering policy has changed, and the actors have gained new knowledge and experiences, it is important to consider the beliefs, arguments and the interpretation of information by policy actors. Changes of actors' belief systems might contribute to an understanding and explanation of the development of the policy outcome. Political actors face uncertainty about the effects of chosen policies in the field of genetic engineering as they lack reliable information and experience about the risks and benefits of this technology. Therefore new information could be more important than it is for distributive or re-distributive policies.

The following analysis will use a theory of policy learning in order to understand change of gene technology policies. The paper starts with a presentation of the policy outcome. In a second step the Interpretist Learning Theory will be presented to provide a theoretical lens for the analysis. Subsequently, methodological problems of any attempt to confront interpretist theory with (comparative) case study research will be discussed. Thereby the paper presents some methods to use interpretist theory within policy analysis. It then adopts the theory to long term change of gene technology policy.

## 2. Longterm Change in Gene Technology Policy

Since 1973 there is a controversy how the (unknown) benefits of gene technology could be used, and in what way it is necessary to develop a regulatory framework to control its (unknown) risks (cf. Schell 1994). The first actors to join the new policy subsystem of gene technology policy were scientists themselves. In 1974, eleven scientists called for a total ban of genetic engineering, which was followed by the whole scientific community (Berg et al. 1974). In 1975, 140 leading scientists met at Asilomar/CA to discuss the future regulation of gene technology (cf. Krimsky 1982). The conference lifted the ban and introduced a classification of genetically modified organisms (GMOs) based on the risk level of organisms used as donators and receivers of desoxyribonucleic acid (DNA). Even though this approach seems to deny any special risk of recombinant DNA biotechnology, the scientists were aware of their lack of knowledge regarding the actual risks. Therefore they proposed guidelines that contained strict safety provisions and actually only enabled the use of harmless donator and receiver organisms and also restricted the deliberate release of GMOs. In 1976, the US-American National Institute of Health enacted the first national guidelines based on the new classification. Since 1978 the German Federal Ministry of Research and Technology adopted similar guidelines. Both the American and the German guidelines were very strict compared to later regulations. In 1979, 1980, 1981 and 1986 the German Research Ministry followed the American guidelines by lowering the regulations step by step (cf. Bandelow 1999: 95-96). So the regulations converged at the original beliefs of the proponents.

In the late 1980s a main policy change occurred. Opponents of genetic engineering became more influencial by criticizing the guidelines. They complained about the lack of legal liability and control and, consequently, demanded legally binding solutions. The debate about a German gene technology act followed earlier attempts to develop a legal framework (cf. Bandelow 1999: 97). While these attempts failed in 1970s, in 1990 both the European Union and the German parliament adopted a genetic engineering law. The European directive 90/219/EEC on the contained use of genetically modified micro-organisms and the directive 90/220/EEC on the delibate release of genetically modified organisms fulfilled core demands of the opponents (cf. Bandelow 1999: 104-106). Environmental groups managed to shape the formulation of these directives substantially. The DG XI (Environment and Nuclear Safety) of the European Commission that shared the core beliefs of the opponents was in charge of proposing the directives and developed close relations with single critics of genetic engineering. At the same time, the European biotechnical industry still lacked effective associations to influence the policies successfully (cf. Rosendal 2005: 88; Cantley 1995: 535-537; Greenwood/Ronit 1992). Proponents of gene technology within the European Commission did not influence the core of the directives either: The DG III, which should have been in charge of the directives, was fully stretched with the formulation of a medical device directive. In a similar way the DG VI was busy with the preparation of the GATT negotiations (interview European Commission).

The effect of the European directives, that produced higher demands for any use of genetic engineering, was even strengthened by the German gene technology act. The German act was mainly prepared by a Bundestags enquete commission on chances and risks of gene technology

(1984-1987). Originally, the commission majority adviced to abstain from binding regulations but nonetheless developed a framework that could be referred to by formulating a gene technology act. The main reason to produce an Act against the original advice was a decision of the Hessian Administrative Court in 1989 to ban a plant that the former Hoechst Company wanted build for creating insulin through genetic engineering (cf. Vitzthum/Geddert-Steinacher 1990: 67-76).

Additionally other external effects produced a power-shift that strengthened the opponents of gene technology in Germany. In 1983 the Green Party was elected into the Bundestag for the first time. In the wake of the Chernobyl disaster of 1986 there was an increase of public interest in ecological issues, and the skepticism towards new technologies rose. So the gene technology act should enable gene technology on the one hand and pacify the critics on the other hand. Therefore the act included the critics into the Central Commission for Biosafety even though this was not demanded by the European directives. Even more influencial became the opponents with regard to the implementation of the German gene technology act. The German federalism gives the main administrative competencies to the Länder. Since 1985, the Green Party joined the State government of Hesse, which was one of the most important locations for gene technology, hosting the former Hoechst Company and several universities. As the Greens took over the department of environment they were responsible for the authorization of activities related with the contained use of genetically modified micro-organisms. As the Green Party at this time was a fierce opponent of genetic engineering it used this authority to develop even higher hurdles for applications than intended by the gene technology act (interviews with scientific gene technology

users). Eventually, in the early 1990 there were very strict regulations for any use of gene technology.

However, the regulations of the early 1990s turned out to be only an interruption of the general policy development. In the course of the 1990s both the European directives and the German act became amended several times to simplify regulations (cf. Bandelow 1999: 126-143). In Germany, the "First Act Reforming the Gene Technology Act" of 1993 lowered the requirements for the use of genetically modified organisms that were assumed to be riskless essentially. Especially the participation of the Central Commission for Biosafety and the public involvement in permission procedures was limited to the use of donator and receiver organisms with high risks for people and environment.

The European Commission introduced similar amendments of the European directives at the early 1990s. It reinforced the simplification of the deliberate release of common plants by several directives to to implement the deliberate release directive (93/584/EEC, 94/211/EC and 94/730/EC). In 1994, the first amendmend of directive 90/220 introduced a simplified procedure for repeat releases of common plants (directive 94/15/EEC). In 1997, the Commission enacted a second directive adapting to technical progress for the delibate release that braught a further simplification of the procedure (97/35/EC).

The requirements concerning the contained use of genetically modified micro-organisms were simplified in the same way: Several amendments of the original law were all in line with the demands of the proponents: the first Commission "Decision Concerning the Guidelines for Classification" referred to in directive 90/219/EEC (91/448/EEC), the "Commission Directive Adapting to

Technical Progress of Council Directive 90/219/EEC" (94/51/EC), and the "Second Commission Decision Concerning the Guidelinies for Classification" (96/134/EC). In 1998, the Council amended the directive 90/219 by abolishing requirements for classification, streamlining administrative procedurs and simplifying the authorization process (98/81/EC).

The last years were stamped by different developments of requirements for contained use on the one hand and deliberate release on the other hand. In the field of deliberate releases there was a political u-turn in 1998 on EU-level. From 1998 until May 2004, the governments of Austria, Denmark, France, Germany, Greece, Italy and Luxembourg banned every application for delibate releases. The so-called moratorium on the authorization of GMOs was a second phase of policies in favour of the opponents. It was always controversial and there were several attempts to pave the way for further deliberate releases. In 2001, the directive 90/220 was replaced by directive 2001/18/EC of the European Parliament and of the Council. The new directive aimed to make the deliberate release more transparent and to fulfill some demands of the opponents. Any consent was limited to a period of ten years (renewable). The directive also made public consultation and GMO labeling compulsory (Abels 2005).

In 2004, the "Genetic Modifaction Act" was adopted. The modification act was the second amendment of the gene technology act after 1993 and has come in force in February 2005. It implemented provisions of directive 2001/18/EC but also contained additional requirements for the release of GMOs. The centre of the act was the liability in case of damage caused by GMOs. The European directive has not addressed liability concerns directly (Gerdung 2006: 8). The modification act introduced a

collective risk liability for all users of GMOs in the environment. GM-farmers were made responsible collectively for all damages caused by GMOs if it was impossible to find a single causer.

A Second Reform Bill of the red-green government has not been adopted. The former government had split both bills to separate the procedural issues that needed the appovement of the Bundesrat. As the Bundesrat was dominated by Christian democrats and Liberals that governed most of the Bundesländer the second bill failed to gain the approval of the Bundesrat (cf. Gerdung 2006:1-2).

Recently, the Minister for Food, Agriculture and Consumer Protection, Horst Seehofer (CSU), introduced a new proposal to implement the overdue provisions of directive 2001/18. The "Third Gene Technology Reform Act" presents a list of information to be made public as demanded by the EU. Seehofer also has announced to present another reform bill that is much more in line with the demands of GMO-users and especially revise the liability rules of the first reform act. As the Greens had to leave the federal government after the general election of Sepember 2005, the new grand coalition of CDU/CSU and SPD is supposed to adopt new liability provisions that simplify the use of GM-plants by farmers. The politicians therey follow the demands of a coalition of scientific research institutes comprising of seven large foundations (cf. Innovations Report 2004).

Summarizing the developments, one can find both policies that lifted regulations and others that led to stricter demands. Institutional rational choice provides us with sufficient explanations for each single negotiation and outcome. So the complete ban of 1974 has been influenced by ecologists within the scientific community. The

lowering of the regulations during the 1970s and early 1980s can be seen as an effect of the economic crises that forced governments to enable a promising technology of the future. The original European directives 90/219 and 90/220 reflect the early institutional design of the European Community that gave environmentalists more influence than they have now: Many decisions have been made by the European Commission without major changes by the Council. The Parliament did not have real influence and even the industry lacked efficient organizations at EU level (cf. Greenwood/Ronit 1992). At the same time, the emerging Green Party that used the fight against genetic engineering as a major legitimization for its founding has influenced the German genetic engineering law. German federalism contributes to an explanation of the actual rigidity of German genetic engineering regulations which even surpassed the aims of European directives and German law (cf. Bandelow 1997a; 1997b). Similar explanations can be given for the subsequent decisions to lift regulations in the mid 1990s: The influence of proponents rose as biotechnology firms established new forms of lobbying that proved to be much more efficient (cf. Greenwood/Ronit 1994).

In the late 1990s there was another power shift that can explain the second stage of intensification of requirements. Left wing and "Third Way" parties gained power in several EU states like France (1997), the UK (1997) and Germany (1998). In Germany the Green party became part of the federal government. So a "parties do matter" perspective might be helpful to analyse the policy process of that stage. The last years brought back Conservatives, Liberals and Christian democrats to power in several member states. As the policy outcome seems to be in line with this change, again party politics seems to provide a fruitful explanation. So the rational choice

institutionalism presents sufficient explanations of each decision by assuming stability of policy beliefs.

Therefore, policy learning is not necessary to explain single decisions. However, it helps to understand the developments within the subsystem on the long run. Rational choice theory does not present any convincing explanation for the long-term change of policy outcomes. Why has there been a tendency to lift regulations since the 1970s that has well been interrupted but never completely stopped? Why can we find the same tendency at all political levels even though there are different institutional settings, and though the competing coalitions had different opportunities to influence policies at different political levels? How can we understand the different tendencies of the regulations for the contained use and for deliberate releases? These long-term developments can only be understood by introducing the concept of policy learning. Policy learning took place because of new information. The perception of this information was disputed between (and sometimes even within) the subsystem, so one needs an interpretist learning theory to understand and explain the long term changes of genetic engineering policy.

## 2. Assumptions and Hypotheses of an Interpretist Learning Theory of Policy Analysis[2]

Since the mid 1970s international relations, sociology, and policy analysis have evolved theoretical frameworks that use ideas, arguments, and beliefs to understand and explain political processes and policy outcomes (cf. Heclo 1974; Etheredge 1983; Hall 1993; Rose 1993; 2004; Knoepfel/Kissling-Näf 1998; Bandelow

[2] A detailed version of the ILT can be found at Bandelow 1999: 21-73.

2005; Levi-Faur/Jordana 2005). All theses perspectives force the researcher to give up assumptions about both regular dependencies between variables and any neutral evaluation of the policy outcome. However, this dispensation of assumptions has its price: positivist theoretical lenses like rational choice institutionalism need only few — and often quite plausible — assumptions and provide explanations for policy outcomes in innumerable fields (see for example Scharpf 1997; Tsebelis 2002). If one gives up these assumptions, the explanatory power of the theory must decrease.

Therefore, advocates of interpretist analysis must prove the added value of their perspective. One might use three strategies to justify interpretist theory: the theoretical, the political and the analytical strategy. The theoretical strategy refers to the philosophy of science that has provided evidence against the assumption of scientific proven reality, most famously by Thomas Kuhn (1962). Even though the analysis provided by Kuhn and his followers is convincing for constructivists, it has not convinced everybody yet (cf. Lakatos/Musgrave 1970).

The political justification refers to the democratic tradition of policy analysis (cf. Schubert 2002). From this perception, policy analysis should help to reveal all political choices people have at the present time. Unproven assumptions about the goals of political actors, the way institutions work, or the efficiency of policy choices might be helpful for parsimonious explanations, but they reduce the perception of democratic choices instead of widening them. However, not everybody within the scientific community shares the democratic task of policy analysis. Positivists can refer to the double tradition of policy analysis and policy science and stressing to the latter (cf. Tribe 1972; Torgesen 1986). From this view, democratic

tasks are not to be fulfilled by social scientists but by politicians.

As both the theoretical and the political justification of interpretist policy analysis are disputed, this article aims at presenting an analytical justification. It takes the criticism of positivists against the theoretical and political justifications for granted and argues that there is also some analytical added value by admitting different perceptions of reality by different people. From an analytical point of view, different perceptions may become important in two ways: different perceptions explain political goals of relevant actors, and perceptions can be the foundation of changes of beliefs and attitudes. However, modern rational choice theory has already integrated the idea of different perceptions — at least if one looks at "softer" approaches of this family of theories (cf. Elster 1984, 2000; Braun/Busch 1999). Therefore, the only way to proof any added analytical value of interpretist thinking is to build a theory that focusses on perceptions and learning as the main explanations of policies instead of using learning as a secondary explanation for the remaining variance of policies that cannot be understood within the rational choice model.

Within policy analysis, the Advocacy Coalition Framework (ACF) developed by Paul Sabatier and Hank Jenkins-Smith became the most prominent learning theoretical approach that has been applied to several policy areas and countries (Sabatier 1987; Sabatier/Jenkins-Smith 1993; Sabatier 1998). Nevertheless, within the last decade not only positivists and advocates of economic frameworks but also constructivists and post positivists criticized the ACF (cf. Maier et al. 2004). Both the positivists and post positivists disapproved of the contradictory assumptions of the ACF as it refers to rational choice institutionalism and

to learning-based theories at the same time (Nullmeier 1997). Not only the ACF but also other learning-based approaches like the concept of policy-transfer still lack clear theoretical and methodological foundations (cf. James/Lodge 2003). There are many competing definitions of policy learning, political learning, social-learning, lesson-drawing and related concepts that all have lead to different assumptions about the causes and results of policy-oriented learning (Table 1).

Considering the different definitions of learning, there is only a minimal agreement upon learning as a change of beliefs and attitudes based on new information. The broadest use of the concept includes learning of individuals and collective actors. Both individuals and collective actors learn if they change their beliefs and attitudes due to new information (and not based on power shift). "Policy-oriented" learning as it is used here also includes a limitation of topics that are relevant for learning: If actors change their beliefs on the basis of information that is not related to the policy problem, they learn, but this sort of learning should not be called policy learning. The purpose of an Interpretist Learning Theory (ILT) is to develop assumptions and hypotheses that contribute to a better understanding of the relationship between policy learning and policy change. The theory is interpretist, because it does not share the positivist epistemology. On the contrary it assumes, that interpretation and social construction are important for the way political actors view at the world (cf. Marsh/Furlong 2002: 26-30).

*Table 1: Explanations of major policy change by frameworks referring to policy learning*

| *Authors* | *Named explanations* |
|---|---|
| Sabatier 1987: | – changes in socioeconomic conditions<br>– changes of public opinion<br>– change in systemic governing coalition<br>– policy-decisions and impacts from other subsystems |
| Hall 1993: | – cognitive contradictions<br>– deficits of explanations in existing paradigms<br>– political, economic, and social crises |
| Howlett 1994: | – power shift between actors representing different paradigms because of reasons external to the subsystem |
| Dudley/ Richardson 1996: | – change of the nature of a policy<br>– problems of public finances<br>– tactics of involved actor groups |
| Mintrom/ Vergari 1996: | – policy entrepreneurs |
| Dolowitz/ Marsh 2000: | – voluntary lesson-drawing<br>– coercive policy-transfer |
| Levi-Faur 2002: | – role model of instigators (if acting as shepherds)<br>– uncertainty, manipulation of information, high cost of information, public revelation of information |
| Bandelow 2005: | – new ideas (mostly developed by minorities within the core executive)<br>– power change within the core executives<br>– solidaristic veto players |

*Source: authors' compilation*

By developing the ILT one can largely rely on two assumptions introduced by the ACF which belong to the interpretist core of the framework: firstly, the ACF assumes that the goals of policy actors are caused by hierarchical belief systems. Secondly, it expects that the actors of policy

subsystems join together to advocacy coalitions (Table 2). These assumptions are interpretist as they admit that political decisions depend on the way politicians see the world and that political interpretation belongs to social constructions. Therefore they do not demand any objective reality that would be perceived in the same way by all actors but admit that political actors might differ in the way they interpret new information. Nonetheless, the ACF — and to a lesser extent the ILT — are quite pessimistic about the probability that political elites might use new information to change their interpretation of a policy problem and, in consequence, of the best way to handle the problem.

Table 2: Theoretical assumptions of the Interpretist Learning Theory (ILT)

| *a) Assumptions transferred from the Advocacy Coalition Framework (ACF)* |
|---|
| 1. Policy actors follow hierarchical structured belief systems. |
| 2. Within policy subsystems, actors join advocacy coalitions. The members of each coalition share their core beliefs. These core beliefs are stabilized by communication between coalition members. |
| *b) Further assumptions* |
| 1. Policy-external information is interpreted on the basis of belief systems, too. |
| 2. Policy-oriented learning by communication between members of different advocacy coalitions is possible on the basis of shared external beliefs that are the results of common culture and socialization. |

*Source: authors' compilation*

The concept of belief systems is based on the assumption that the beliefs of policy elites are arranged at different levels. Each belief system contains a deep normative core of fundamental normative and ontological axioms, followed by a policy core including fundamental positions about the policy area and secondary aspects like instrumental decisions within the subsystem. The concept includes the idea that early experiences within individual socialization lead to relatively stable beliefs that work as a filter for later information. Therefore, it assumes general beliefs to be less affected by policy learning than by instrumental beliefs. This assumption is based on the philosophy of science and on social psychology (Converse 1964; Lakatos 1971; Putnam 1976).

The second assumption of the development of one or more advocacy coalitions consisting of actors who share general beliefs is originally justified by a rationalistic argumentation: actors need the help of other coalition members to reach their policy goals and thereby must join a coalition. However, the coalition building also has social consequences that become clear if one concentrates on individual actors. Individual actors communicate predominantly with other members within their coalition. As all members of the coalition share the same core beliefs or attitudes, nobody questions these attitudes — even if there is empirical evidence that might contradict some of the common assumptions of all coalition members.

To develop a learning theory we must supplement these assumptions with two additional basics: firstly, there is no reason to restrict the idea of filtered reality-perception to policy related events like the ACF does. Therefore, the ILT will enhance this assumption to policy external events. For example, changes of socioeconomic conditions do not deliver any objective constrains and resources of subsystem

actors but must be interpreted by each actor. Therefore, even the influence of these "external" events is related to existent beliefs and perception.

Even more important is a second supplement to the assumptions: the ACF assumes that there is a conflict between (usually two) coalitions, based on controversial core beliefs. Even though this might be correct, one must bear in mind that there are common beliefs and perceptions in every culture that enable argumentation and learning even if it questions the core of a policy related belief system. Therefore, it is not of interest if this argumentation is based on 'truth' from an ontological perspective or if it is only a consensual construction. It is sufficient to see the possibility of a consensus that theoretically questions every policy related beliefs. Therefore, one should not distinguish between policies that are affected by qualitative or quantitative information but between information that is perceived by all actors within the subsystem and information that is relevant only for some actors or that is perceived differently by competing actors.

The result of this supplementation can be seen in Table 3. Unlike the ACF, the ILT does not distinguish between an interpretist subsystem that is open for policy learning and quasi-objective external events, but it presents a classification that is open for every empirical event.

***Table 3: Dimensions of information, change and learning***

| | policy related information | policy external information |
|---|---|---|
| consensual perception | 1 policy-oriented learning within the subsystem | 2 external impact |
| disputed perception | 3 policy-oriented learning within coalitions | 4 tactical change |

*Source: authors' compilation*

Table 3 distinguishes between consensual and disputed perception of information. This distinction refers to the epistemological dispute among positivists and post positivists. As long as there is full consent in the perception of information, interpretist theories are useless. In these cases one can analyze the effects of variables on other variables without caring about the socialization of politicians. It is even useless to discuss if something is "true" in an ontological sense as long as nobody disputes the interpretation of information. But if information is perceived differently one has to understand each actor's perception to understand (and thereby explain) policy processes and outcomes.

A major result of the presented theoretical supplementation is the expectation that on the long run even major change can be traced back to new information and learning. Thereby the ILT distinguishes itself from the ACF that assumes policy-oriented learning to usually only cause instrumental change. Additionally, the ILT assumes

that short-term changes can be explained by policy external information — while the ACF only uses external "events" to explain major (long term) changes. These assumptions, therefore, lead to hypotheses that are different from the hypotheses of the ACF:

> Hypothesis a: Policy external information is used by individual and collective actors to change their secondary beliefs during negotiations and therefore can explain short-term policy changes. (Reason: individual actors are not likely to change their policy core beliefs because they follow their belief systems and they confirm their policy core beliefs and attitudes within their advocacy coalition.)
>
> Hypothesis b: Collective policy-oriented learning causes major policy changes on the long run. (Reason: as changes of individual core beliefs are not to be expected, any changes of core beliefs require the exchange of individuals within the coalitions. While existing policy actors have already chosen their policy core and will not change it, new actors develop their policy core on the basis of the then existing information. Therefore, new policy-oriented information may lead to a change of the composition of individual beliefs within the advocacy coalitions and then will lead to changes of policies after a decade or more.)

The hypotheses presented here distinguish the learning theoretical approach from rational choice institutionalism. Economic theory may also assume that new information need not lead to policy change in the short run. Its major argument is that political institutions like veto points prevent the formulation and implementation of new policies even though the majority of actors favor the

change. However, the learning theoretical approach traces back political stability to the stability of policy beliefs of leading actors. Therefore, it would not assume that political institutions hamper policy change but it explains policy stability by referring to social institutions.

The main problem of every learning theoretical perspective is the empirical examination. Therefore, the methods of the examination will be explained in detail before applying the theory to the example of genetic engineering policy.

### 3. Methods and Data

The empirical application of the Interpretist Learning Theory requires a mixture of methods. The most important method of data collection is document analysis. Documents can be analyzed both by using qualitative and quantitative methods. Quantitative methods demand a standardization of findings that always is connected with a loss of information. On the other hand, standardization helps to improve the reliability of findings. One can use content analysis of public documents to analyze beliefs and contacts between actors. Nonetheless there are only few examples of the use of quantitative analyses of policy learning (cf. Jenkins-Smith/St. Clair 1993; Sabatier/Brusher 1993). Sometimes interpretive policy analysis is even defined the qualitative approach contrasted to “traditional” cost-benefit analysis (Yanow 2000). However, this view is not shared here. Like researchers that believe in the existence of general dependencies between variables to explain policy outcomes, research that is interested in beliefs, attitudes and learning of policy actors can use standardized methods, as it was shown by applicants of the ACF using public statements of actors for measuring beliefs and learning. In detail, these studies aimed at

- proving the existence and development of advocacy-coalitions by performing cluster analysis on the basis of expressed policy positions,
- showing the resulting coalitions by using dendograms
- showing long-term developments of actors' beliefs
- showing changes in the polarization between advocacy coalitions,
- and analyzing the relative stability of different beliefs of different actor groups (cf. Jenkins-Smith/Sabatier 1993: 246).

Nevertheless there are some shortcomings of these methods:

- The data collection shows a major problem with missing data; particularly the statements are seldomly explicitly related to core beliefs. Ideally one should use long-term panel studies in order to proof individual learning.
- The researchers predominantly use statements of collective actors while the theoretical core of the ACF uses justifications transferred from social psychology and the philosophy of science that originally referred to individuals, not organizations (cf. Schlager 1995: 266).
- Most statements were made at official hearings. As each hearing has different subjects there is the danger that changes of expressed beliefs are not based on learning but on a change of the discussed subject.
- The statements treat all actors equally without considering differences between different levels of importance for the policy decisions.
- The method does not proof any linkages between the members of the assumed advocacy coalitions. However, the original definition of advocacy coalitions not only requires a closeness of core beliefs but also

some form of linkage within the coalition. This problem can be quite important: For example, in Germany there might be some agreement between members of the Green Party and representatives of the Lefts/PDS, but the competition between both parties does not allow any cooperation yet.

To reduce some of the named problems one should see individuals instead of organizations as members of advocacy coalitions. The application of learning theories to organizations requires additional assumptions that have to consider institutional environments and decision-making rules within the organization (cf. Bandelow 2005). However, following the examples of Jenkins-Smith/St. Clair 1993 and Sabatier/Brusher 1993, the empirical work will include the use of standardized document analysis. Like the applications of the ACF, research uses written statements made at public hearings as a main source (see Chapter 4, Table 6). In the case of gene technology policy, one can use the published statements that are available for all hearings up tu 1997. To reduce some of the named problems, other sources of information are added: First of all, further public statements of political actors are used to complete the information. Additionally, some interviews were made with selected actors to complete and to proof the measurement made on the basis of the written information. The analysis uses 15 variables that are coded by values between –2 and 2 (cf. annex a). As the variables show internal correlation, the weight of beliefs for the final assessment of advocacy coalition differs deliberately. The coding is proved by a reliability test that shows agreement between two coders for 70 per cent of measurement and differences for 30 per cent (cf. annex b). Most of the differences result from the use of statements for different points of the evaluation sheet. Nevertheless, there are only very few differences in the actual measurement of

statements as belonging to the supporting or the opponent side of genetic engineering. Therefore, the differences between two coders do not lead to major differences of the measured distance between two actors. However, the experiences allow recommendating further studies to use only very few categories and to use examples for the formulation of coding guidelines.

The standardized data is only used to demonstrate policy learning between 1973 and 1997 as it is difficult to acquire all statements of the last ten years. The policy goals and perceptions of relevant actors in recent times have to be added by a qualitative research. Recent statements were taken from printed publications and webpages. Other researcher's interpretation could be used to supplement and control the results.

## 4. Application to long term change of genetic engineering policy

The following chapter applies the Interpretist Learning Theory to explain horizontal policies protecting people and environment against the risks of scientific and industrial production of genetic modified organisms (GMOs) in Germany.[3] It will be shown that the general tendency of simplifying regulations from 1973 to 2006 can be explained by policy-oriented learning that follows the theses of the ILT.

[3] Horizontal policies are general measures that are valid for all uses of GMOs. Especially the EU also sets several vertical (specific or product-related) measures like the famous Novel Food Regulation EC/258/97, the Regulation on GM Food and Feed EC/1829/2003, the Regulation on Labeling and Tracebility EC/1830/2003 and several regulations for the authorization of medicinal products (cf. Behrens/Meyer-Stumborg/Simonis 1997; Hervey 2001: 321).

Like most other subsystems, genetic engineering policy has been influenced by two competing coalitions (Table 4). Contrary to a central assumption of the Advocacy Coalition Framework, not the core beliefs but general attitudes have determined the formation of the coalitions (Bandelow 1999: 220). Actors that generally supported the use of genetic engineering and advocated lesser demands for scientists and industry joined one coalition. The other coalition comprised of opponents of gene technology that were motivated by different core beliefs and fought against the extension of uncontrolled use of genetic engineering. Within both coalitions, internal communication led to the development of specific beliefs and attitudes including more than the originally shared general attitude towards genetic engineering. For example, the proponents of genetic engineering shared the perception that it is a technology that must be separated from other biotechnologies like in-vitro-fertilization. From this view, most of the ethical questions raised by opponents have nothing to do with the method they want to enable. Proponents also shared a common perception of the opposite coalition: from their point of view, critics belong to a homogeneous group of people that lack the necessary know-how to evaluate genetic engineering sufficiently and that base their opinions solely on ideology instead of information (cf. Hobom 1995: 142). On the other hand, the opponents also saw the proponents as a homogeneous group of people. From their point of view, proponents follow selfish interests and ignore democratic, social, and ecological needs of mankind and nature (cf. Herbig 1978).

***Table 4: Advocacy coalitions in the subsystem of genetic engineering policy***

| *genetic engineering proponents* | *genetic engineering opponents* |
|---|---|
| Actors representing the following groups:<br>– industry and industry associations,<br>– IG Chemie-Papier-Keramik (union of chemical workers),<br>– scientists and scientist associations<br>– liberal and conservative parties,<br>– social democrats,<br>– civil servants,<br>– GD III and GD XII of European Commission<br>– majority of governments in European Council,<br>– media,<br>– jurisprudence,<br>– social sciences. | Actors representing the following groups:<br>– environmental and consumer associations,<br>– majority of unions,<br>– citizen's initiatives,<br>– green parties,<br>– social democrats,<br>– civil servants,<br>– GD XI of European Commission,<br>– minority of governments in European Council<br>– media,<br>– jurisprudence,<br>– social sciences. |

*Source: Bandelow 1999: 221.*

Both coalitions — unlike in other subsystems — have not totally been restricted to a country or a political system. Actually, actors of all involved policy-levels have participated in the policy-making process. However, the importance and role of the different actors have both changed by time.

During the 1970s and early 1980s, science and industry invented new applications of genetic engineering step-by-step. While proponents perceived this information as a confirmation of their expectation of major profits by genetic engineering, ethically and religiously motivated opponents interpreted the new applications as additional risk. Therefore, the new applications were policy-related

information that led to a radicalization of the opponents' collective belief system. It is difficult to measure this collective learning on the basis of new applications, but one can symbolize the learning by measuring the cluster center that is calculated on the basis of actors' statements. Thereby a sinking cluster center from –16 to –25 in the 1980s for the opponent coalition symbolizes the radicalization of critics. At the same time, the proponents also strengthened their collective beliefs, symbolized by a cluster center of 21 (Table 5).

However, the radicalization of the conflict based on new information does not contribute to a better understanding of the long-term policy change even though the change was basically influenced by new information. Particularly experience and scientific information led to policy-oriented learning – but not of all actors within the subsystem. The more genetic engineering was used without major accidents, the more political actors believed in the controllability of this technology. Only ethically and religiously motivated opponents of genetic engineering have remained critical, while the cluster center of the proponents has step by step changed from 20 to 25 (Table 5).

***Table 5: Cluster centers***

| Nr. | ’73 - ‘83 | | ‘84 - ‘91 | | ‘92 - ‘97 | |
|---|---|---|---|---|---|---|
| | P* | O** | P* | O** | P* | O** |
| 11 | 0 | –1 | 1 | –1 | 1 | –1 |
| 12 | 0 | –1 | 1 | –2 | 1 | –1 |
| 13 | 1 | –1 | 1 | –1 | 1 | –1 |
| 14 | 1 | –1 | 1 | –2 | 1 | –2 |
| 15 | 1 | –1 | 2 | –2 | 2 | –2 |
| 16 | 1 | –2 | 1 | –2 | 2 | –2 |
| 17 | 1 | 0 | 1 | –1 | 2 | –2 |
| 18 | 2 | 0 | 2 | –2 | 2 | –1 |
| 19 | 2 | –2 | 2 | –2 | 2 | –1 |
| 20 | 2 | –1 | 2 | –2 | 2 | –2 |
| 21 | 2 | –2 | 1 | –2 | 1 | –2 |
| 22 | 1 | –1 | 1 | –2 | 2 | –2 |
| 23 | 2 | –1 | 2 | –2 | 2 | –2 |
| 25 | 2 | –1 | 2 | –1 | 2 | –2 |
| 26 | 2 | –1 | 1 | –1 | 2 | –2 |
| Total | 20 | –16 | 21 | –25 | 25 | –25 |

*Cluster centers, calculated by SPSS for windows 7.5.2.G, two cluster, and 10 iterations.*

* Proponent ** Opponent

Nr. Short Version

11: Optimal solution or fair balance
12: Relationship between mankind and nature
13: Freedom vs. solidarity
14: Economy vs. environment
15: Scientific vs. political problem
16: Specific risk
17: Economic opportunities
18: Solution for major problems
19: General proponent or opponent
20: Legal ban
21: State control
22: Public hearings
23: Flexible reaction or democratic control
25: Reference to proponents
26: Reference to opponents

The change of collective beliefs within the coalitions provides evidence for the existence of policy learning in the 1980s and early 1990s. There is some evidence that the development of beliefs towards the contained use of GMOs has followed the same line during

the last decade. For example even the Greens do not oppose gene technology in the same radical way as they did in the 1980s and the proponents underwent a further radicalization of their beliefs at the same time. Both proponents and opponents of gene technology realized that the contained use never caused any damages to human health or environment and what is even more important: The experience did not provide any evidence to prove theotical risks for health and environment. The scientific information changed beliefs within both coalitions. Additionaly, there was information that only was seen as policy related by some actors. The most important field of information apart from scientific results was economics. The defeat of eastern European political systems led to a loss of reputation for any economic theory that was seen as close to socialism and planned economy. As a result, locational competitiveness became the most important criterion for the evaluation of policies. Even though the theory of supply-side economics was not shared by all actors, it became relevant even within the opponent coalition. Therefore, any new industrial application of gene technology took effect as policy related information. Contained use of genetic engineering contributed to medical progress in fields like cancer treatment. The existence of positive effects was nearly indisputed between both coalitions. However, some opponents rated these effects low and still stress the existence of ethical problems (cf. GID 179/2006).[4]

While both coalitions gave increasing trust towards the contained use, deliberate releases became a rising

[4] The ethical controverse is only of minor relevance fort he regulations analyzed in this article as they are covered by the Embryo Protection Act and not by the Gene Technlogy Act (cf Rothmayr in this issue).

policy issue. Proponents radicalized their beliefs in this area, too. But the critics of genetic engineering interpreted the experience with deliberate releases as a confirmation of their original distrust. This can be shown by the controverse about risks of deliberate releases of BT-176 maize. The genetically modified BT 176 maize has been introduced by Ciba Geigy (now Novartis) in the mid 1990s. There were several reports from single scientist and scientific committees on both the national and the EU level. Even though the majority of scientists did not find risks to human health some reports disagreed with these findings (for example GID 178/2006). They named risks to human health from the use of marker genes that are used to identify resistance to antibiotics. These genes could lead to antibiotic resistances of micro-organisms and thereby reduce the efficiency of antibiotics used for medical purposes. Additionaly, critics of gene technology refered to reports discussing possible food allergies caused by released GMOs (Hervey 2001: 323-324; 327). However, proponents of genetic engineering assessed these findings as mere theoretical discussions without empirical basis.[5] The enduring conflict about the assessment of studies concerning deliberate releases helps understanding the contradictory direction of regulations in this area.

Like in the area of contained use it was economics that became relevant for policy-oriented learning apart from scientific information. Deliberate releases are primarily used to develop efficient ways of farming. In contrast to medical progress, efficient farming is appreciated by all actors. Genetic engineering proved to have distributive effects in national and international

[5] Further information that was relevant for the proponents can be found in several issues of the European Biotechnology News and other periodicals of proponents.

economics. GMO seed made farmers dependent on multinationals as they are able to produce sterile seed that can not be grown by the farmers themselves (cf. FoEE 2006a). The disadvantages for small farmers and developing countries are seen as policy related information by some opponents and therefore prevented policy learning that could have increased the acceptance of deliberate releases (cf. FoEE 2006b[6]). Thereby the use of genetic resources became not only relevant for policy-oriented learning but also led to an international framework of regulations to sustain biodiversity (cf. Rosendal 2006).

Changes of beliefs cannot prove the causal relationship between learning by new information and policy change. Therefore, one must take a deeper look into the coalitions to illustrate changes of beliefs and attitudes. First of all the composition of actors within both coalitions changed. Originally, the genetic engineering conflict resulted from an internal conflict within the scientific community. The rising applications of genetic engineering contributed to an increasing interest of party politicians within the coalition of proponents. The opponents were also able to win party politicians, but they also won environmentalists and consumer protectors. On the other hand, the opponents continuously lost independent scientific support (Table 6).

[6] Further information that was relevant for the oppenents can be found in several issues of the FoEE Biotech Mailout, the Genethischer Informationsdienst and other periodicals of opponent groups.

***Table 6: Participants at government hearings on genetic engineering***

| **Institution*: Year of Hearing** | **BMFT 1979** | **EP 1985** | **BT 1990** | **BT 1992** | **BT 1993** |
|---|---|---|---|---|---|
| *a) Proponents* | | | | | |
| Representative of industry or industry association | 3 | 3 | 8 | 4 | 4 |
| Scientists or representatives of scientists' association | 19 | 4 | 7 | 6 | 10 |
| Labor unionist | | | | | 1 |
| Conservative politician | | | 5 | 7 | 3 |
| Liberal politician | | | 2 | 2 | 1 |
| Social democrat | | | 1 | 2 | 2 |
| Civil servant | 2 | 1 | 1 | 1 | 2 |
| Other proponent | 2 | | 2 | | 1 |
| Share of proponents | 53 % | 42 % | 40 % | 56 % | 69 % |
| *b)* Without clear assignment to advocacy coalition (for example only short statements) | | | | | |
| Expert | 3 | 5 | 15 | 7 | 1 |
| Politician | 7 | 2 | 5 | 5 | 5 |
| Share of participants without clear assignment | 20 % | 37 % | 31 % | 31 % | 17 % |
| *c) Opponents* | | | | | |
| Institution*: Year of Hearing | BMFT 1979 | EP 1985 | BT 1990 | BT 1992 | BT 1993 |
| Representative of environmental group | 1 | | 4 | 2 | 2 |
| Labor unionist | 2 | | 1 | 1 | 1 |
| Scientist | 4 | | 3 | | |
| Green politician | | 1 | 7 | | |
| Social democrat | | | | 1 | 1 |
| Civil servant | 1 | | 2 | | |
| Other opponent | 5 | 3 | 2 | 1 | 1 |
| Share of opponents | 27 % | 21 % | 29 % | 13 % | 14 % |

*BMFT: (former) German Ministry for Research and Technology (Bundesministerium für Forschung und Technology), EP: European Parliament, BT: German Parliament (Bundestag).*

***Table 7: Issues named in statements by proponents and opponents***

| | p* ‘73-‘83 | o** ‘73-‘83 | p* ‘84-‘91 | o** ‘84-‘91 | p* ‘92-‘97 | o** ‘92-‘97 |
|---|---|---|---|---|---|---|
| 1 | 83 % | 87 % | 80 % | 94 % | 59 % | 38 % |
| 2 | 13 % | 40 % | 1 % | 18 % | 31 % | 31 % |
| 3 | 21 % | 73 % | 1 % | 88 % | 38 % | 38 % |
| 4 | 33 % | 20 % | 47 % | 0 % | 83 % | 31 % |

*Source: Statements of chosen actors at hearings and in publications. For a list see Bandelow 1999: 270-272. The numbers represent the share of statements that contain references to the named issues of all statements within each coalition at each phase.*

* Proponent ** Opponent

1: Statements about chances and risks of genetic engineering
2: Statements about the public opinion
3: Statements about social, economic and ethical effects of genetic engineering
4: Statements about effect of genetic engineering regulation

In addition to the actor composition the areas of the conflict changed (Table 7). During the 1970s the struggle was mainly about general risks and chances of genetic engineering. During the 1980s the critics additionally named the social and ethical problems, while proponents started to complain about the economic results of the existing regulations. It is not easy to clarify the relationship between the changes of personal composition within the coalition and changes of information used to justify the respective political goals. Nonetheless one can state that the development of genetic engineering regulation between the mid 1970s and the mid 1980s was dominated by scientific information. During the 1980s the homogeneity within both

coalitions decreased and other information became more important. Today's proponents emphasize economic arguments much more while opponents still refer to social and environmental arguments. But the content of the arguments changed: As genetic engineering has become a major issue for farming, problems of patent claims were seen as more and more important. Environmental arguments have changed from general threats for environment and life toward specific threats for neighbouring farmers of GM users. Especially the proponents have learned from experiences with the implementation of directive 90/220. They have learned that it was impossible to overcome the European resistance against deliberate releases on the basis of the directive. There was no authorization procedure without objections from at least one Member State. In 1996, the application of Ciba-Geigy to permit the release of BT-maize produced objections of 14 Member States. The governments followed the persistant public skepticism against the agricultural use of gene technology (Abels 2005).

To summarize the developments, one can see a long-term policy change that resulted from scientific, economic, and social information. The absence of major accidents and the development of new applications strengthened the support for gene technology within the industrial and scientific community. Scientific information led to policy learning even between the coalitions in the field of contained use as even the opponents had originally been composed of scientists. Thereby the ethical critics were separated. While criticism was supported by members of major parties like the SPD in the 1980s, meanwhile even some members of the Green party must be counted as proponents of the contained use of genetic engineering.

The expansion of regulatory discretion for deliberate release of GMOs can partly be explained by the ambiguous precautionary approach of European environmental policy (cf. Majone 2002). The precautionary principle has been developed in Germany in the 1980s and was then introduced into the Environmetal Article of the EC Treaty (174 EC, ex Art. 130(r), Majone 2002: 93). However, even though the actors within the Commission and within the European Parliament tried to use the principle to expand the European regulatory regime, precautionary does not necessarily mean that the control of risks will be strikter. Majone argues, that there may be opportunity costs of precautionary measures because of the limitation of resources to control risks. Therefore the precautionary control might lead to a reduction of the control of well-known risks (cf. Majone 2002: 101).

The importance of policy learning becomes even clearer if one compares gene technology to the related field of nuclear energy policy. In contrast to genetic engineering, nuclear energy faced the Chernobyl accident in 1986. The accident did not immediately change the policy outcome in Germany but contributed to the decision of the government to back out of the nuclear energy programme in the long run. Therefore, despite similar institutional settings and actor's interests of both policy fields, the long-term policy development is contrary. Thus, nuclear power policy presents some evidence for the assumption that genetic engineering regulation would not have shown the same long-term development if there had been a major accident.

## 5. Conclusions

This article aimed at understanding long-term change of gene technology policy by using an Interpretist Learning Theory. First of all it was shown, that the

development of gene technology regulations only partly can be understood by rational choice theory. On the one hand single policies followed the power shift between actors caused by elections, economic trends and the shift of political authority within the European multilevel system. Therefore rational choice institutionalism might be the best approach to explain these results. On the other hand there are long term changes that can not be understood by the power shift: The regulation of the contained use of GMOs has been simplified on the long run despite of single contradictory political decisions. The regulation of deliberate releases followed the same tendency up to the late 1990s. During the last decade however deliberate releases became regulated strikter than before. The main thesis of the article is that these long term developments can be analyzed by applying the Interpretist Learning Theory.

The theory gave up fundamental assumptions of rational choice and other positivist research. Firstly, it does not assume stability of policy goals and therefore concentrates on policy learning. Secondly, it includes the possibility that there are different perceptions of information related to existing belief systems and thereby the theory presents an interpretist perspective.

From this perspective, the long term developments of actors' beliefs were analyzed. Thereby two advocacy coalitions involved into the struggle on regulations of genetic engineering were found. The beliefs within both coalitions changed significantly during the last three decades because of policy-related information. These results comply with hypothesis b of the presented theory. However, individual changes of core beliefs could hardly be shown. On the contrary: new information did not influence policies on the short run. Every single negotiation

was dominated by actors' struggle to succeed in gaining power and reaching existing policy goals. Policy learning, therefore, must be seen as a collective process: new information changes the beliefs and attitudes of future actors that have not entered the subsystem yet, while the established actors get their existing beliefs confirmed by mates within their own advocacy coalitions even if the new information provokes contradictions.

It could also be shown that there were different perceptions of information about risks and benefits of genetic engineering. In genetic engineering policy, scientists usually only consider scientific evidence of risks, while entrepreneurs and labor unionists take note of economic chances. Some party politicians consider everything beyond public opinion and votes as not belonging to their "subsystem", while representatives of churches see ethical questions as being relevant for the subsystem and everything else as external. Therefore, one should abstain from any ex-ante predefinition of "external events" and make the question of external and internal information a question of perception by the actors.

It is also possible that even information that all actors perceive as "external" is disputed within the subsystem. For example, it is anything but clear how actors evaluate the influence of European directives to the German genetic engineering law. While some actors judge these directives as final decisions given to their reality by some higher power, other actors see the European level as an additional arena to gain support for their goals. The different perceptions of the European level need not be related to the policy core or the advocacy coalition. However, sometimes the different perceptions of external events are related to the advocacy coalitions. For example, only the supporters of genetic engineering perceived the

economic crises as a rising external pressure on the subsystem for lower regulations. On the other hand, only the opponents perceived evidence for risks caused by some other technology (for example the accident of Chernobyl) as evidence for risks caused by technology including genetic engineering.

A lot of questions about the use of the presented Interpretist Learning Theory still remain. First of all, the major methodological problems have only partly been solved. It is still difficult to name methods of understanding (or even measuring) policy-oriented learning in a reliable way. Secondly, one might dispute the presented assumptions and hypotheses. Even though it was possible to present some evidence for theses, a single case study is only a first step to proof the use of the presented perspective for policy analysis. Particularly the role of learning and different perceptions of information within less knowledge-based (re-) distributive policy fields will be of interest for further research.

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**Annex a: evaluation sheet**

| Source(s) |
|---|

*A) Person*

| | | |
|---|---|---|
| 1 | Name of person | |
| 2 | Number of evaluation sheet | |
| 3 | Number of person (not of evaluation sheet!) | |
| 4 | Year of stated beliefs, perceptions and attitudes | |
| 5 | Source(s) (**1** = written statement; **2** = oral statement/interview; **3** = interview by phone; **4** = internet; **5** = secondary analysis (interview)) | |
| 6 | Classification of person or organization (**0** = scientist; **1** = government/EU; **2** = private firm or association representing economic interest group including labor union; **3** = non-profit interest group; **4** = observer (e.g. journalist; **5** = conservative party; **6** = liberal party; **7** = social democratic party; **8** = green party) | |
| 7 | Political level (**1** = regional/state (Bundesland); **2** = federal state; **3** = EU; **4** = non-German EU-member state; **5** = non-EU country) | |

| | | |
|---|---|---|
| 8 | Context of statement (**1** = general; **2** = guidelines of the German research secretary or of the NIH; **3** = first proposals for German genetic engineering law; **4** = first proposals for European directives for genetic engineering; **5** = original German genetic engineering legislation in Germany (including the discussion of the enquête commission); **6** = European directives of 1990; **7** = implementation of genetic engineering law and proposals for the amendment of 1993; **8** = amendment of European directives) | |

*B) Linkages*

| | | |
|---|---|---|
| 9 | (Former) membership at other organizations within the subsystem (**1** = association of critics (e.g. BUND, GeN, consumer association, women group); **2** = association of proponents (e.g. industry association); **3** = conservative party; **4** = liberal party; **5** = social democratic party; **6** = green party; **7** = state authority; **8** = no other membership) | |
| 10 | Regular personal contact to other actors (classification of named contact actors: –**2** = individual opponents of genetic engineering; –**1** = individual proponents of genetic engineering; **1** = association of opponents of genetic engineering; **2** = association of proponents of genetic engineering; **3** = conservative party; **4** = liberal party; **5** = social democratic party; **6** = green party; **7** = state authority; **8** = no regular personal contact to other actors) | |

*C) Deep normative core beliefs*

| | | |
|---|---|---|
| 11 | Should politicians look for general solutions that improve the quality of life for all members of the society or do we have to assume unbridgeable interest conflicts in the society, and politicians should find a fair balance between competing interests? (**–2** = fair balance (to) **2** = general solution for the whole society) | |
| 12 | How is the relation between mankind and nature defined? (**–2** = mankind as a part of nature (to) **2** = mankind rules over nature) | |
| 13 | How are the political goals of individual freedom and solidarity within the whole society evaluated? Which of these goals is evaluated as more important? (**–2** = solidarity (to) **2** = freedom) | |
| 14 | How are the political goals of economic growth/full employment and protection of nature/environment evaluated? (**–2** = protection of nature/environment much more important (to) **2** = economic growth/full employment much more important) | |

*D) Perceptions of genetic engineering*

| | | |
|---|---|---|
| 15 | Is the protection of people and environment by using genetic engineering a task for scientists or a task for society/politics? (**–2** = society/politics (to) **2** = exclusive task for scientists) | |
| 16 | Is genetic engineering related to specific risks? (**–2** = major risks (to) **2** = no major risks) | |
| 17 | Does genetic engineering offer economic opportunities?? (**–2** = no opportunities (to) **2** = major opportunities) | |
| 18 | Does genetic engineering offer the prospect of help for major problems (e.g. healing of diseases, world nutrition problems)? (**–2** = no prospect (to) **2** = major prospect) | |

*E) Deep policy-related attitude*

| | | |
|---|---|---|
| 19 | Is genetic engineering generally seen positively or critical? (**–2** = clear opponent of genetic engineering; **–1** = moderate opponent; **0** = neutral; **1** = moderate proponent, **2** = clear proponent) | |

*F) Attitudes towards selected issues*

| | | |
|---|---|---|
| 20 | Should a legal ban of genetic engineering exist? (**–2** = general ban (to) **2** = no ban) | |
| 21 | Should a state authority control the use of GMOs? (**–2** = always (to) **2** = never) | |

| | | |
|---|---|---|
| 22 | Should there be public hearings within the process of state authorization of genetic engineering? (**–2** = always (to) **2** = never or no obligation of state authorization) | |
| 23 | Should regulations for the protection against the risks of genetic engineering contain the possibility of flexible reaction to technical process or should there be democratic (parliamental) control before enacting any amendment? (**–2** = democratic control (to) **2** = flexible reaction) | |

| | | |
|---|---|---|
| 24 | Should genetic engineering policy be decided at the level of states (Bundesländer), countries or international organizations? (**–2** = states (to) **0** = countries (to) **2** = international organizations) | |

*G) References to other actors*

| | | |
|---|---|---|
| 25 | Reference to studies or statements of proponents (–**2** = negative reference (to) **2** = positive reference) | |
| 26 | Reference to studies or statements of opponents (–**2** = positive reference (to) **2** = negative reference) | |

*H) Regards to issues and questions*

| | | |
|---|---|---|
| 27 | References to risks and prospects of genetic engineering (**0** = no; **1** = yes) | |
| 28 | References to public opinion (**0** = no; **1** = yes) | |

| | | |
|---|---|---|
| 29 | References to social, economic or ethical consequences of genetic engineering (**0** = no; **1** = yes) | |
| 30 | References to consequences of genetic engineering regulation (**0** = no; **1** = yes) | |

*Coding instructions:*

- Unknown author should be coded with 0; the sheets were not used to number the actors.
- Missing date should be coded with 9.
- Number 5, 7, 8, 9 and 10 allow multiple coding.
- Number 6 should consider if the individual represented the organization officially by giving the statement. Other memberships should be coded at number 9.
- Please add "10" to each coding if the statement was made officially at a public hearing. For example code with "13" for official statements made at the hearing of the research secretary in 1979.
- Number 11 to 22 and number 24 to 26 allow the following coding: –2; –1; 0; 1; 2 and 9. Please use the codings between –2 and 2 to measure the statements and consider for example, if the statement makes a difference between applications of genetic engineering.
- Number 10: At hearings, multiple questions of the same politician to the same expert are taken as evidence for some sort of linkage between both actors.

– “Specific risks” of number 16 refers to what scientists call the “synergistic model.” Please consider that there is no “specific” risk if the risk of GMOs is only seen as depending to the risk of “original” and “delivering” organisms. Therefore code “0” if the statement demands to take out any work of “risk level 1” from regulation

**Annex b: Results of intercoder reliability test**

| | | Actual results | | Expected random results | |
|---|---|---|---|---|---|
| Both coders agree not to code | | 36 | (32%) | 26 | (23%) |
| Both coders agree to code | | | | | |
| | Both codes similar | 43 | (38%) | 15 | (13%) |
| | Codes differ | 2 | (2%) | 15 | (13%) |
| Only coders codes | | 31 | (28%) | 56 | (50%) |
| Total | | 112 | (100%) | 112 | (99%) |