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NATIONAL AND REGIONAL DIMENSIONS OF FORWARD TECHNOLOGICAL ANALYSES

A survey of national/regional prospective technological studies in Germany and Spain and the exploitation of their results in the policy-making processes

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About the IPTS

The Institute for Prospective Technological Studies (IPTS) is one of the eight institutes making up the Joint Research Centre (JRC) of the European Commission. It was established in Seville, Spain, in September 1994.

The mission of the Institute is to provide techno-economic analysis support to the European decision-makers, by monitoring and analysing Science & Technology related developments, their cross-sectoral impact, their interrelationship in the socio-economic context and future policy implications and to present this information in a timely and synthetic fashion.

Although particular emphasis is placed on key Science and Technology fields, especially those that have a driving role and even the potential to reshape our society, important efforts are devoted to improving the understanding of the complex interactions between technology, economy and society. Indeed, the impact of technology on society and, conversely the way technological development is driven by societal changes, are highly relevant themes within the European decision-making context.

In order to implement this mission, the Institute develops appropriate contacts, awareness and skills for anticipating and following the agenda of the policy decision-makers. In addition to its own resources, IPTS makes use of external Advisory Groups and operates a Network of European Institutes working in similar areas. These networking activities enable IPTS to draw on a large pool of available expertise, while allowing a continuous process of external peer-review of the in-house activities.

The inter-disciplinary prospective approach adopted by the Institute is intended to provide European decision-makers with a deeper understanding of the emerging S/T issues, and is fully complementary to the activities undertaken by other Joint Research Centre institutes.

For more information: http//:www.jrc.es ipts-secr@jrc.es

About ESTO

The European Science and Technology Observatory (ESTO) is a network of leading European organisations with expertise on Science and Technology Assessment. ESTO provides real-time information on the socio-economic significance of scientific and technological advances. The ESTO Network is directed and managed by the IPTS.

The ESTO network covers now all the fifteen EU Member States as well as Israel. Membership is being continously reviewed and expanded with a view to match the evolving needs of the IPTS and to incorporate new competent organisations from both inside and outside of the EU.
The ESTO Network was formally constituted in February 1997 and its principal tasks are:

- To contribute to The IPTS Report with articles on relevant topics
- To issue, on a periodic basis, a Techno-Economic Analysis report, which reviews socio-economic developments either arising from technological change or driving it
- To produce input to long-range Foresight Studies undertaken by the IPTS in response to EU policy needs
- To provide Quick Responses to specific S&T assessment queries.

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Institute for Prospective Technological Studies

European Science and Technology Observatory

A survey of national/regional prospective technological studies in Germany and Spain and the exploitation of their results in the policy-making processes

An ESTO Project Report

Prepared for the
European Commission – Joint Research Centre (JRC)
Institute Prospective Technological Studies (IPTS)

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Foreword

Scientific advances, technology development and their prospects drive industrial change towards new market opportunities and growth. Society at large is often the driver of the innovation process from which, in turn, it receives most of the benefits (in socio-economic terms). In such an economic system, it has been demonstrated that the sub-national regional dimension is one of the key enabling levels in Europe at which to foster enterprise innovation and competitiveness. This fact is especially valid when small and medium enterprises are referred to, which in turn represent the engine of the present European economic system.

The result of an exploratory study promoted by the Institute for Prospective Technological Studies (IPTS) of the European Commission"s Joint Research Centre in collaboration with the ESTO network presents this argument from the angle of the possible contributions of forward technological analyses to enterprise success and regional economic growth. The rational of the study is briefly introduced hereafter.

Technology foresight studies are often implemented to provide a reference, not only for research or industrial organisation strategies but especially to strengthen the policy-making process aimed at the modernisation of a given economic system to obtain the maximum benefit for society. Nevertheless, the extent to which these prospective studies are used in the policy-making process, especially at regional level, has not been satisfactorily addressed.

IPTS has initiated such a study also in consideration of the growing interest in foresight studies and the assessment of their real impact/contribution to national and regional S&T innovation and enterprise policies.

As a first study, the objectives of the IPTS/ESTO analysis were been defined as follows:

- Give an overview of existing studies at a national level for both countries, Germany and Spain
- Identify the results of different approaches to technology foresight and technology forecasting studies at a regional level, while concentrating on three regions for each country
- Evaluate how the results have been implemented in the decision making process and what impact they have had.
- Work out the consequences and findings in view of a European approach to technology foresight.

We are confident that the findings of such impact evaluation study – which, *inter alia*, point out that the exploitation of results concerning national/regional prospective technological studies initiatives in technological policy is rather minimal – and their further analysis in the European Union, could help both scientists and policy-makers in their respective activities.

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Editors: P. Moncada Paternò Castello, F. Bellido, James P. Gavigan (JRC-IPTS)

Executive Summary

In recent years, virtually all national governments, funding agencies, large enterprises and business organisations have begun to systematise the debate and priority-setting processes around the selection of areas on which to concentrate their respective investments in science and technology. Contributing factors include the shrinking or static S&T budgets of most public authorities, the increasing turnover rate of successive generations of technologies, the increasing difficulties, costs and risks involved in R&D activities, and the resulting need to concentrate available resources on a smaller number of options.

The *central importance of a prospective orientation* at national, regional and local levels, in all sectors and for all stakeholders, is widely recognised throughout the EU.

It is recognised that *structural and cultural as well as local factors* are key determinants for the framework of any prospective initiative.

Divergence in social and economic conditions within and between current and candidate EU Member States are strongly linked with the requirements for prospective initiatives on national, regional, and local levels. Cultural differences, embodied in the principle of subsidiarity, need to be respected whether or not they can be linked to positive or negative impacts of a European community of citizens.

The development of a *harmonised framework for prospective initiatives* and related policies has the potential to be doubly productive: gaining ideas on potential future developments and saving cost for the avoidance of present and future mismanagement.

In the area of prospective needs the national and regional identities are often strong. It is therefore likely that harmonisation policies which promote *common frameworks* of prospective initiatives and comparability between Member States, are likely to be more effective than attempts to unify their *methodological details.*

Arrangements for *co-ordinating national and regional prospective initiatives at Community level* could be further developed. Governmental, professional, academic, industrial and NGO involvement could be increased. By means of increased scientific co-operation a common framework could be developed for *EU-wide prospective reference values*, and for review of national findings on the future.

Improvements could be made to achieve "future monitoring systems" and particular attention could be given to "early warning" systems related to changes in sector specific developments, novel matters, and modifications in public perception linked with common policies and regulations.

Introduction

Background and Contents of the Study

This study was initiated by the Institute for Prospective Technology Studies (IPTS).

In 1998 a growing interest in prospective studies on a broad front was detected by IPTS.

By means of this study the IPTS aims to contribute/help and better assess transnational, national and regional prospective activities concerning S, T& Innovation policies.

It could be the first part of a wider project in this field, dealing with the analysis and comparison of foresight studies and activities for more countries (such as Greece, the Netherlands, France, UK, etc.) on a national as well as regional level. The objectives have been defined as follows:

- Give a rough overview of existing studies on a national level for both Spain and Germany.
- Identify the results of different approaches to technology foresight and technology forecasting studies on a regional level, while concentrating on three regions for each country.
- Evaluate how the results have been implemented in the decision making process and what impact they have had.
- Work out the consequences and findings in view of a European approach to foresight

The study has been conducted by Innovación, Desarrollo y Transferencia de Tecnologia, S.A. - iDeTra (Spain) and the Future Technologies Division of the VDI Technology Centre (Germany) in three steps:

1. Desk research and evaluation of national and regional initiatives.
2. Comparison of studies from different countries and findings.
3. Final report.

The compilation of results, analyses, evaluations and findings is presented in the main report.

Part One of this study is an inventory of the prospective initiatives on a federal level in Germany and Spain.

In Part Two some German and Spanish prospective initiatives on a regional level are described in detail, even though they present only a few examples of currently on-going activities. Part Three gives some examples of other initiatives from both countries which can neither be classified as pure foresight or forecasting, nor as pure national or regional prospective initiatives.

Part Four gives a critical outlook on prospective initiatives in Germany and Spain on the basis of which the final conclusions and recommendations have been drawn.

Prospective Studies: Definition and Historical Background

Of course, it is impossible to predict the future, but every day we take decisions which shape our future. It is therefore important to collect, examine and evaluate knowledge concerning future trends and to open up a discussion of tomorrow"s opportunities among experts from science, technology and industry as well as policy-makers. Foresight can be viewed as a process by which one comes to a fuller understanding of the forces shaping the long-term future which should be taken into account in policy formulation, planning and decision making. Foresight involves qualitative and quantitative means for monitoring clues and indicators of evolving trends and developments and is best and most useful when directly linked to the analysis of policy implications. Foresight is not planning - merely a step in planning." [1]

[1] Martin, B. R, Irvine, J, (1989), "Research Foresight: Priority-Setting in Science", Pinter Publishers, London

Since the terminology around `foresight´ has not been unequivocally defined, the definition of **prospective initiatives** indicated in this report must distinguish between FORESIGHT (the German `Zukunftsschau´ and the Spanish `Prospectiva´) and TECHNOLOGY FORECASTING (the German `Technologiefrüherkennung, Technologiefrühaufklärung´ and the Spanish Previsión Tecnológica).

According to these definitions `foresight´ initiatives, as for instance the Delphi studies, point to the socio-economic and technological evolution in the medium and long run with a special focus on socio-economic impacts and general global developments. Based on socio-economic aspects as background only, the objective of `technology forecasting´ is the strategic management of research and technology, e.g. the identification of potentially emerging technologies early enough to facilitate their development and utilisation.

Leaving aside historical and current developments in prospective actions it makes sense to give a clear definition of the subject. One possible definition of foresight is given by Martin: "Foresight involves systematic attempts to look into the longer-term future of science, technology, the economy, the environment and society with a view to identifying the emerging generic technologies and the underpinning areas of strategic research likely to yield the greatest economic and social benefits"[2]. This definition illustrates one of the possible scales in which future related prospective studies can be integrated. At one end of the scale detailed reflections on technological development itself can be found (the German Technologiefrühaufklärung) including aspects of technological development potential, range in application, structuring in sub-topics, impediments of realisation and application and so forth. These aspects are focused on the classification, development and implementation of technologies.[3]

At the other end of the scale there are prospective studies (the German Zukunftsschau) dealing primarily with socio-economic or socio-cultural developments, taking into account general technological developments, i.e. on questions about globalisation,

[2] Martin, B.R.; (1998) "Technology Foresight: Concepts and Practices" SPRU; Brighton

[3] e.g. Technology forecasting series of VDI-Technology Center, Future Technologies Div.

global or regional availability of resources, migration, sustainable developments and so on[4].

In ideal-typical terms a prospective study contains both aspects in a well-balanced condition. Up to now, in practice all future studies can more or less be classified under a scale between these two poles.

The history of prospective studies in Germany has its ups and downs. Although it flourished during the late sixties and the seventies, when several institutions were active in the field, it was in decline during the eighties - at least partly due to exaggerated hopes on modelling the whole of society and controlling its future development in earlier years.

The German interest in prospective studies as a means of setting research priorities is increasing at present. Germany has a tradition of strong academic independence, a post-war reaction against government influence on academic research (which is embodied in the German constitution), a complex division of responsibility for research between federal and state governments, and a belief that public funding levels for research failed to be adequate. However, reunification gave rise to increased overall costs imposed on the government and to an influx of researchers in need of support. During the last few years an increased interest in approaches to priority-setting and foresight can be observed in Germany.

The Federal Ministry for Science and Education has mainly supported four aspects of general prospective initiatives:

1. Pilot Study on Prospective Aspects in Research (Wissenschaftsrat) as work of the Committee on Basic Science.
2. Technology at the Beginning of the 21st Century
3. Forward Thinking & Future
4. Delphi Studies

In Spain, future-oriented studies have not been carried out on a national level, unlike those of other European Countries (France, Germany, United Kingdom). However, there are currently two important initiatives under way: The Industrial Observatory of Technological Foresight (OPTI) and the Identification of Technological Needs in Spanish Companies (INIDES). They are using different methodologies in order to

[4] e.g. Megatrends in Delphi '98 Survey

detect the technological future needs in several sectors. The sectors analysed are similar in both initiatives. For this reason it will be interesting to compare the results obtained by INIDES and OPTI initiatives upon completion. It is important to highlight the lack of formal connection between both initiatives. There are numerous initiatives on a national level, for instance in the field of technology observation/ technology watch. These initiatives are piloted by technological centres and they focus on the analysis of trends in industrial sectors. However, there is no formal feedback between the results of the studies and the technological decision-making actors.

PART ONE: PROSPECTIVE INITIATIVES AT NATIONAL LEVEL

I. Prospective Initiatives at Federal Level in Germany

I.1 Foresight Initiatives

Prospective studies and their design (implying both conceptualisation and implementation) transcend the narrow limits imposed by individual scientific disciplines. The objective of the Federal Ministry for Science and Education (BMBF) is to stimulate discussion in the Community as a way of identifying and influencing future directions.

I.1.1 Delphi Studies

The ""Delphi"" method of foresight is considered by the BMBF to be one of several sources of information for shaping the technology policy. While the first Delphi study intentionally closely reproduced a previous Japanese exercise, a more narrow study (Mini-Delphi) essentially served to refine the method. In the last Delphi (started in 1996 and published in 1998), the thematic areas were selected by a German expert panel with representatives from science, industry and public institutions. The areas focused on applications in society rather than technological fields. In contrast to the previous studies, experts have directly been asked for their assessment on actions to be taken. A new category of questions concerns potential problems that might be expected to arise from the projected developments.

I.1.1. A Study Initiatives

The German Delphi process began in 1991 when the Federal Research Ministry commissioned a survey closely based on the fifth Japanese Delphi questionnaire. The aim was to produce a 30-year look ahead by experts drawn from industry, universities, the research community and government, with a view to producing non-prescriptive information of value to decision-makers in Germany.

The former German Minister for education, science and research, Mr. Ruttgers, commissioned leading scholars both in Germany and abroad to give their assessment of

technological developments and of the time schedules for their realisation. The Fraunhofergesellschaft, which was responsible for co-ordinating the project, recently presented the results of this analysis, known as "Delphi".

I.1.1.B Type of Studies

The analysis, known as "Delphi" was designed to optimise the use of group opinion whilst minimising the adverse qualities of interacting groups. As such, it has four basic features: structured questioning, iteration, controlled feedback and anonymity of responses. Structured questioning is achieved through the use of questionnaires. This keeps a clear focus on the study and enables the moderator/s to control the process and channel it into a compact product. Iteration is the process by which the questionnaire is presented over a number of rounds to enable participants to reconsider their responses. Controlled feedback is achieved by feeding back to the panel members the responses of the whole group as well as their own response for reconsideration. This means that all the responses of the panel are taken into account. Anonymity is achieved through the questionnaires ideally giving group members the freedom to express their opinions without feeling pressured by the wider group. The results of this Delphi-study were recently presented by the Fraunhofergesellschaft which was responsible for co-ordinating the project. It is anticipated, for instance, that on the Internet the next generation - i.e. the transmission of moving pictures as standard - will have been realised by 2006; 2007 will see the intelligent wheelchair that adjusts automatically to stairs; in 2009 the electronic supermarket will be open around the clock; a vaccination against AIDS will be on the market by 2014; and in 2016 a car consuming just two litres of fuel per 100 km will go into production.

I.1.1.C Development of Studies

Germany"s foresight-related activities began in 1991 when the Federal Ministry for Research and Technology commissioned surveys designed to address longer-term international developments in science and technology. To date, the German work in this

area comprises three Delphi studies and a number of reports considering aspects of technologies of the future.

- The first surveys were conducted in 1992 using 16 separate questionnaires based on individual research fields. They contained a total of 1,147 questions directly translated from the Japanese survey. A total of 6,627 forms were issued to 3,534 people. The return rate in the first round (30%) was low compared with Japan, where the process was already well-established, but a high percentage of those who had submitted first round questionnaires went on to complete the second (80%). The Federal Research Ministry published the results in a single volume in August 1993. The actual results were influential in setting the priorities for German research funding; and a number of Federal States, companies, industrial associations and other organisations also analysed the implications of the results for their own planning. On the whole, however, wider dissemination of the results of the first German survey was low-profile compared with similar exercises in other countries.

- The second Delphi activity in Germany was a smaller-scale exploratory study (mini-Delphi) conducted in parallel in Germany and Japan, following a joint German/Japanese conference held in Berlin in April 1994. A new set of questionnaires, which are shorter but seek in-depth information, have been generated using expert discussions in several areas of interest including environment and medical areas. This leads to conclude that there was a high degree of similarity in the overall results, but that considerable differences became apparent between the two countries in the assessment of individual technologies, even allowing for cultural differences. The mini-Delphi was devised to develop the Delphi method and examine some of the technological key problem areas identified by the first German survey and fifth Japanese one. Like the first full Delphi exercise, the mini-Delphi survey provided for a time frame up to 2020. As for all the German Delphi studies, the Fraunhofer Institute co-ordinated the work for Systems and Innovation Research (ISI), in Karlsruhe. A number of the methodological lessons from this exercise were taken forward into future surveys.

- Between 1996 and 1998 the Prognos AG prepared on behalf of the BMBF a Delphi study on the potential of the knowledge society (Bildungs-Delphi), a multi-level dialogue in the education area. (www.bmbf.de, prospect 3/98). The major issue of this study was to frame and to distinguish the knowledge society of 2005 and 2020. The study was not intended to forecast, nor to offer an implementation plan, but rather to invite for a discussion (www.prognos.de). The expert opinion was that there is a strong correlation between specialised technical knowledge and economic growth and innovation. The fields of basic knowledge in which innovation is smaller are nevertheless meaningful as prerequisite for the emergence of knowledge in other areas. General and less specialised knowledge is very important for the orientation in the knowledge society and the entrance into special fields, for instance: knowledge to handle information technologies, knowledge of foreign languages, curiosity, critical argumentation ability, and the ability to analyse issues, to work in a team or to take over responsibility. Most experts perceive a strong requirement for reform of the education system and expressed many suggestions for improvement of the education system. However, many of them were pessimistic regarding the likelihood that their particular suggestion would be implemented. It was estimated, for instance, that by the year 2020 the hoped-for changes will be six times smaller than desired.

- The second full German Delphi survey was begun in 1996, again working in parallel with the Japanese exercise (their sixth study).[5] The Delphi '98 Study, which was carried out by the Fraunhofer Institute for Systems and Innovation Research (ISI), on behalf of the BMBF, is a model for future developments and forms the basis for decisions on research policy in Bonn, but also for industry. The object of the study is not to predict the future - rather, the object is to prepare for possible scenarios and to collect knowledge for orientation and decision making. In the past few months, approximately 2,000 experts from all fields of science have submitted their assessments for the future. More than 1,000 "visions" which had to be evaluated were worked out previously by more than 100 experts from industry, universities, institutes and research institutions.

The survey covered twelve important areas for the future:

⇒ Information & Communications
⇒ Services & Consumption
⇒ Management & Production
⇒ Chemistry & Materials
⇒ Health & Life Processes
⇒ Agriculture & Nutrition (cf. Excursion)
⇒ Environment & Nature
⇒ Energy & Resources
⇒ Construction & Living
⇒ Mobility & Transportation
⇒ Space
⇒ Big Science Experiments

5 http://www.futur.de/futur/magazine.nsf/AllMagazines/3BEA330EA6C8CFBEC12568410034ECFD?OpenDocument

Excursion

The Fraunhofer Institute for Systems and Innovation Research (ISI) in Karlsruhe conducted a Delphi survey on biotechnology in the Agro-Food sector in Germany, which was financially supported by the European Union. More than 500 experts of industry and research as well as representatives of consumer associations, farmers and critics of biotechnology made their assessment for the development of biotechnology in the next decades. The questionnaire contained 71 statements, partly provocative and controversial, about possible future developments in the Agro-Food sector. The study proved - as was to be expected - that the different representatives came to extremely divergent assessments on the future impacts of biotechnology. The experts from industry and research have a more optimistic view of the future than the consumers; for example, the farmers feel rather ambivalent about the application of biotechnology. A remarkable difference is the fact that the consumers seem to expect the introduction of biotechnological processes and genetically engineered products sooner than the representatives of industry or research. Nevertheless, all the experts agreed in their desire for better information of the consumers about the possibilities of modern biotechnology and its impacts on health. Therefore it is to be expected that food not produced with the help of genetically modified organisms is labelled to that effect. In contrast it was assessed differently whether there will be a comprehensive labelling of genetically engineered food. The experts also agree that probably no additional jobs will emerge in the Agro-Food sector due to the application of genetical engineering in this field. In spite of the high expectations for the development of economy, possibly brought about by reduced costs in agricultural processes or by the opening of new markets, for example by producing optimised renewable resources or pharmaceuticals. The application of modern biotechnology is likewise much more accepted in this field than in the Agro-Food sector, which can be concluded from the responses concerning the development of modern biotechnology. Decisive factors in this context are the availability of research funds and investment capital, the market conditions and political activities, as well as in particular social and ethical aspects. Nevertheless, the expert panel reckons with a high increase in using enzymes to make traditional food production much more efficient in the following decade. Genetically engineered micro-organisms and enzyme systems will soon be widely used in large-scale applications, not only to improve the quality, but also the processing of food products. So possibly the brewing of beer without genetically engineered yeast will soon belong to the past. Further, the interviewees expect savings of energy and raw materials by making use of specific enzymes and thus an easing of the environment. Moreover micro-organisms and specifically developed enzyme systems can reduce the organic waste arising for example in animal husbandry, or can transform organic waste into marketable products. Additionally the experts expect that the genomes of most important bacteria will be completely sequenced in the next few years. On the other hand, the use of genetic engineering in animal breeding and animal husbandry meets with high social and ethical objections, except for the production of genetically engineered vaccines for farm animals.

It covered a total of 1,070 theses, 113 drawn from the first survey and 957 newly drafted by six Delphi panels. The theses were grouped into 12 separate questionnaires. One innovation was the introduction in the first round questionnaires of a separate section on megatrends, which contained 19 theses (cf below) and asked those surveyed to say whether they believed that the development described would happen and, if so, by when. The coverage ranged from the most global issues (world population, climate change, economic globalisation) to specifically German questions such as the impact on the country of large-scale migration, or the possibility of widespread church closures through lack of demand. The returns from this section were not subjected to the normal Delphi process of inviting respondents to re-consider their responses in the light of the overall returns collected from the first round.

Delphi-Megatrends

- World population of 10 billion
- One third of population aged 60+ in industrialised countries
- National economic policies irrelevant (globalisation)
- Higher unemployment (technologies and globalisation)
- Germany must reform to attract investment
- China ahead of EU in per capita income
- Islamic states become strongest block
- Conflict between rich and poor countries
- Massive migrations lead to unrest in Germany
- An EU Government stronger than national sovereignty
- A world government suppresses conflicts
- Climate change leads to depopulation of large areas
- Scarcity of fossil fuels leads to rationing in privation homes
- Most Germans do not start a Family
- Classic democratic machinery becomes irrelevant
- Women occupy one third of management jobs in industry
- Half of Germany"s churches closed (lack of demand)
- Two thirds of workers work from home
- Environmental problems damage health of most people.

According to the expert opinions new information and communication technologies are among the most important subjects for the future, which increasingly influence all spheres of life and work. New materials, such as extremely tear proof polymer fibres or high performance, extraordinarily heat-proof ceramics are increasingly gaining in importance. In addition, a significant increase in the use of biotechnological processes, as well as great steps forward in the production of micro mechanical instruments, right down to the molecular level can be reckoned with. According to the experts, the energy requirements will fall by 80% in ten to fifteen years, thanks to progress in house construction technology and thermal insulation. The separation of industrial and drinking water will then also be a matter of course. Satellites record all damages to the environment, and after a "competition" among the industrialised countries to reach the "most ecological economy", the first steps to save the global ecosystem will become apparent between 2015 and 2025.

These comprehensive technical transformations have drastic impacts on society and social life. The enterprise of the future is characterised, according to the estimates of the experts questioned, by a new, flexible enterprise management with teleworking and videoconferences. Students will study at virtual global universities.

To provide a basis for the study, 7,000 questionnaires were sent to experts (male and female) in the whole of Germany in November 1996. Of these, 2,450 completed questionnaires were returned. This corresponds to a response rate of 35 per cent. A characteristic of the Delphi Study is that, in a second round, the respondents who replied have been supplied with the opinions of the other experts, so that each participant can compare his answer with those of his colleagues and reassess it, if necessary. This leads to clearer conclusions. 1,856 experts took part in the second round, which corresponds to a response rate of 75.8 percent. By using the same text for a number of questions, a comparison is possible with the first German "Delphi Report on the Development of Science and Technology" of 1993.

I.1.1.D Technological Policies

The BMBF received the results of the second full Delphi study towards the end of 1997 and published the findings in March 1998. Greater emphasis will be placed on making the results accessible to small and medium-sized enterprises (SME). Accordingly a

more concerted effort will be made in marketing the outcome by means of sectoral workshops, newsletters and other events, and the report itself will contain suggestions for follow-up steps. Public relations agencies have been invited to tender for this phase of the exercise. The BMBF is also considering plans for a national Delphi conference and an international conference at the Expo 2000 in Hanover. In order to make the results of the survey more accessible and to increase public awareness of the whole Delphi procedure, ISI published a paperback book for the general public *Der Delphi Report Innovation fur unsere Zukunft* (The Delphi Report: Innovation for our Future).
Due to the broad spectrum of topics a concrete transfer of results of such studies is not directly planned. The Delphi studies rather serve as information sources or as basis for discussions on thematic parts. The discussion of the topics concerning the future of science and technology, dealt with in the Delphi Report, should set a process in motion which should lead to a broadly based discussion of important future developments. The Delphi process is continuously under way: technology-oriented enterprises compare their strategic adjustment with the contents of the study, political decision makers check the emphasis of their research programmes, the media launch new series of TV emissions (such as the Future-Report on the SWR station and Project Future of the 3SAT station. Based on the Delphi findings the TV series treat topics of public interest, such as IT, microsystems, medicine, environment and communication systems.

I.1.2 Technology at the Beginning of the 21st Century

With a rather "normative" approach the study on "technology at the beginning of the 21st century" can be defined as an intermediary between the German foresight and technology forecasting method. Conventional systems of classification of research areas were avoided to the greatest possible extent, so as to enable the identification of potential areas showing an overlapping and cross-fertilisation between scientific or technical lines of development.

I.1.2.A Study Initiative

In 1993 the BMBF started a foresight/forecasting activity on "technology at the beginning of the 21st century related to technologically interesting topics. The BMBF guidelines for the study were to concentrate on the fields of information technology and biotechnology. Within these broad areas nearly 100 "critical technologies" were identified that were grouped under the following generic headings:

1. Advanced materials
2. Nanotechnology
3. Microelectronics
4. Photonics
5. Microsystems engineering
6. Software and simulation
7. Molecular electronics
8. Cell biotechnology
9. Information, production and management engineering.

In the course of this process the funding organisations of the BMBF compiled their knowledge and determined in detail the most important technological fields. They described especially the technological, socio-economic and future economic importance of these topics.

I.1.2.B Type of Study

The approach adopted by the study assumed that developments within each of these areas will tend to follow a general temporal cycle, from the early stages of exploratory research to the first commercial applications. The study concluded that pure research will continue to dominate innovative development in some subjects over the next ten years; for example, in bioinformatics, mounting and connecting technologies in microsystems engineering, surface materials, behavioural biology. It is only where

prototypes have already been developed that commercial-scale development could be expected within ten years. [6]

The study identified the following areas as undergoing rapid development during the next decade (with innovation gearing increasingly to the market):

- Functional gradient materials
- Fullerenes
- Signal processing
- Optoelectronics
- Superconductivity
- A range of subjects relating to simulation
- Production logistics
- Broadband communication
- Photonic digital technology
- Nanoelectronics and nanotechnology
- Molecular electronics and areas of molecular biotechnology
- Molecular modelling
- Plasma technology.

These areas are not necessarily regarded as more important than others that may currently have reached different stages in the innovation process. For example, other areas may experience more gradual development after recent rapid growth, or may remain at the early (exploratory or prototype) stages until 2000, before initial applications can be developed.

The demand side of future technology development was considered using the "relevance tree" method, a normative method which starts with future problems and identifies technological performance required to meet those needs. A two-fold set of criteria was used to assess the contribution of technology to solving "social bottlenecks". These criteria are used for the assessment of "framework conditions" required for the development of technology, and the solutions to societal, economic and ecological problems offered by the technology ("technological attraction").

A two-fold set of criteria was used to assess the contribution of technology to solving "social bottlenecks".

[6] Australian Science and Technology Council. Matching science and technology to future needs: an international perspective. Canberra, AGPS, 1994

Assessment criteria for framework conditions:	**Assessment criteria for economic, ecological or societal problems:**
• research and development conditions; • development risks; • human capital; • expenditure on innovation; • commitment of industry; • national competitive position (initial position); • state support; and • international • division of labour.	• (technological) key nature; • (economic) penetration; • economic structure (role of small and medium-sized enterprises); • market size (future competitive position); • European cohesion; • world economic dependency; • health; • social progress; and • environmental improvement.

These criteria relate to the assessment of the "framework conditions" required for the development of technology, and the solutions to societal, economic and ecological problems offered by the technology ("technological attraction"). Each of the detailed individual technologies identified as important by this process was then described in terms of its development at the time of the study and in terms of how the expert panel expected this to change by the turn of the century. The conclusions highlighted the importance of such areas as cellular biology, advanced materials, microelectronics and software, which are now the established priority sectors for German research promotion.

I.1.2.C Study Development

The study guidelines concentrated on the fields of information technology and biotechnology. Nearly 100 "critical technologies" were identified that were grouped under generic headings. The study concluded that pure research will continue to dominate innovative development in some subjects over the next 10 years; e.g., in bioinformatics, mounting and connecting technologies in microsystems engineering, surface materials, behavioural biology. It is only where prototypes have already been developed that commercial-scale development could be expected within ten years. The study identified a number of other areas that would undergo rapid development during the next decade (with innovation gearing increasingly to the market). The Committee on Basic Science developed lists of priorities. The approach used focused primarily on "science-push" rather than "demand" factors and made use of "relevance trees". This exercise began in 1991 and was intended to take a ten-year global look at key future technologies. It was co-ordinated by the Fraunhofer Institute for Systems and Innovation Research (ISI) in Karlsruhe, with the assistance of funding agencies of the BMBF. The expert groups evaluated existing international literature on foresight and supplemented it with their own knowledge in view of defining the key technologies Germany would need to develop in order to be equipped to meet the anticipated needs.

I.1.2.D Technological Policies

The study notes that political decision-makers must supply the weightings to be attached to these multiple criteria if this method of assessment is to be used effectively. In the end a report was produced with about 100 detailed technological areas and their mutual relations. The concrete transfer of the results in R&D projects is only an indirect one, because this study serves more as think tank for diverse actions.

Technology policy for the 21st century requires an active role for government as an intermediary between social players. From a normative viewpoint, future directions of technological development will be increasingly influenced by demands for minimal use of resources, elimination of emissions, circular economy and sustainable development.

The Federal Ministry for Science and Education has initiated an Innovation Dialogue, combining the 21st century and Delphi studies into six fields of social needs. These

include environment and energy, information and communication and so on. Meetings have been held in each of the six fields involving experts from industry, the science and technology communities and relevant ministries. The objective is to deepen understanding in these fields, and it is expected that issues arising will need further expert studies.

I.1.3 FUTUR

During the German presidency of the EU Council in the first half of 1999, the German Federal Ministry of Education and Research (BMBF) organised an international conference on "Forward Thinking: Keys to the Future in Education and Research", and launched ist novel foresight process FUTUR.

This new process is based on the recognition that there must be a dialogue between politicians, scientists, the business community, trade unions, and other social groups in order to develop viable ideas for initiating developments that are technically feasible, ecologically and economically sound and based on the citizens actual needs. In this way, the BMBF is seeking to provide a new decision aid for politics, industry, science and the general public. More immediately, FUTUR is intended to supply the BMBF with ideas for new, strategic R&D programmes.

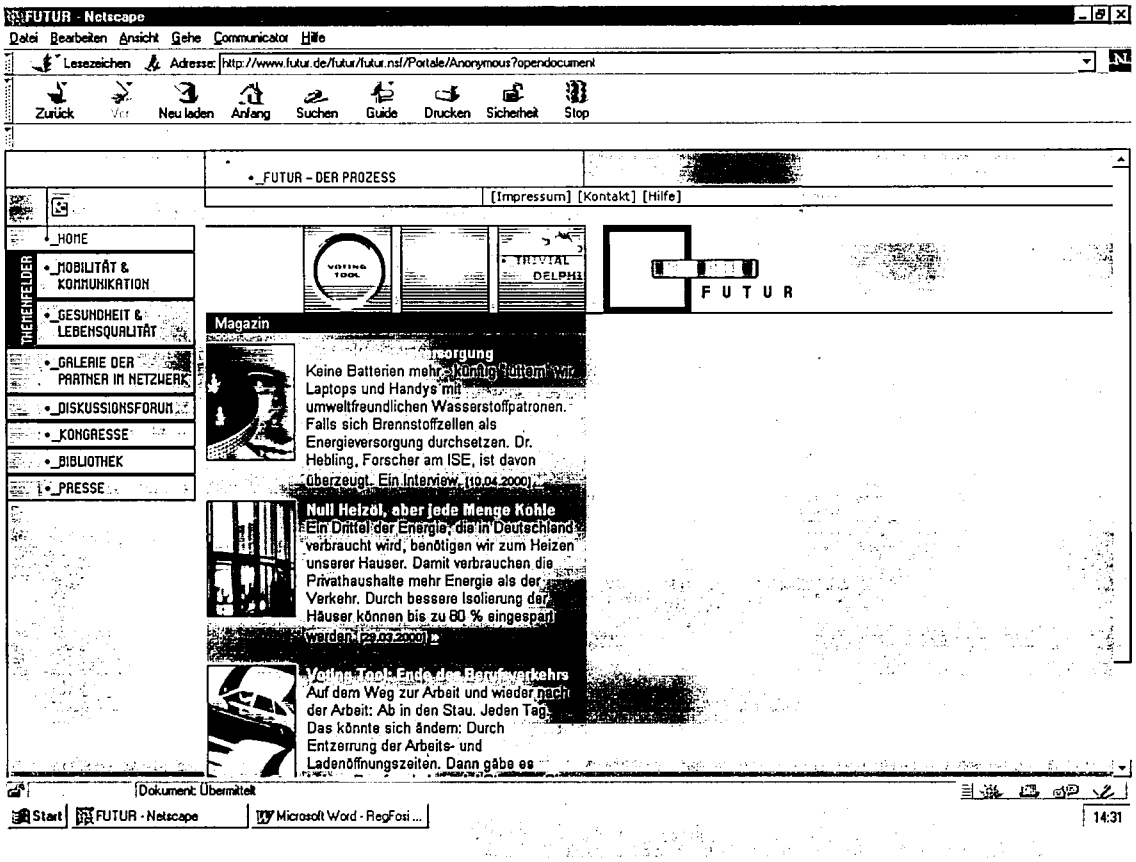
I.1.3.A Study Initiative

In order to co-ordinate a complex communication process on future issues a methodology was developed for gradually expanding and exploiting the participation of a wide array of experts, social groups and interested citizens. A broad discussion on future issues helps to find options and operational solutions in business, government and society, taking into account both "hard factors" (technology, economy...) and "soft factors" (social and cultural ones). The exploitation of different (contradictory) positions, which represent a substantial basis for a co-ordinated participation process, should help to identify alternative scenarios, which - in turn - will be discussed by representatives of various stakeholders. The delineation of their scenarios shall represent a logical potential outcome of current social, economic and institutional trends

and should prepare the floor for consistent conception. The reflections shall be oriented towards topical areas to arrive at the identification of those S&T fields (and their socio-economic relevance) that require further action or that should be particularly supported.

I.1.3.B Type of Study

While the Delphi "98 survey results are based on interviews with experts, no attempt had so far been made to formulate society"s needs and the growing demand for strategic information on which to meet decisions in industry, science and government. The novel FUTUR process therefore is using the Internet (http://www.futur.de/), for providing, retrieving and exploiting globally available knowledge for a broad dialogue on the future.



In addition to the results of the German Delphi studies, FUTUR takes into account the knowledge available world-wide (e.g. studies on national innovation systems, mega-trends, demographic and social developments, road maps, technology assessment, etc.)

and from various levels. The attempt is to use different futures scenarios for identifying different possibilities.

The objective of FUTUR is to make Germany fit for international competition in business, research, science and education. This is to be achieved by fostering communication between the business and the scientific community as well as between large corporations and small and medium-sized enterprises. The aim of FUTUR is to build new networks, through which experts and citizens can provide impetus for modernising our education and science systems. Therefore it is important to carefully record and extend the existing knowledge of future trends.

I.1.3.C Study Development

The FUTUR process will concentrate on selected areas of innovation, as for instance "Mobility and Communication", or "Health and Quality of Life". Initial results are expected to be available by the year 2001. The strategic dialogue under FUTUR is to develop sustainable visions on the basis of which it will be possible to make technically feasible and demand-oriented decisions that are socially acceptable and make sense in ecological and economic terms. The core of FUTUR therefore is a long-awaited dialogue between business and science (new networks will develop) which is supported and moderated by the BMBF.

Experts from both business and science are to agree on joint visions worked out via Internet and in working groups. Furthermore, they work out approaches to realize them. Business, science and the media have, from the very beginning, participated in several workshops which were held by the Federal Ministry of Education and Research.

Future-oriented activities can be organised properly only if relevant issues, (market) visions, and innovations (e.g. new forms of learning, new forms of living) are integrated into the FUTUR process by using means of a problem-oriented approach. Therefore, the dialogue FUTUR clusters around five core issues: innovation/market, technologies, education and work, sustainable development and relevant legal framework conditions. The BMBF wants to use the recommendations of FUTUR to draft new, innovative and interdisciplinary programmes in the areas of education and research, which includes the allocation of funds.

I.1.3.D Technological Policies

In order to secure good performance and international competitiveness, it will be necessary to take decisions which have an impact reaching into the distant future. Relevant needs and demands on the one hand and opportunities and risks for society on the other hand must therefore be identified early on. The partners involved are obliged to reach a consensus on what will be the primary challenges in education, science and research, and they need a common basis for their decisions. It is important for the competitiveness of business and science to establish what competences are to be taught by the education and training system and what programmes and themes are to be tackled in the future.

Experience gained in other countries has shown that the public plays an important role in the development and application of innovations and that, in foresight activities to date, it has been involved too late or has not taken part at all. Introducing innovations without considering their sustainabitity and the benefit to people is not enough. The demand side is as important as to bring together experts and citizens, combining the knowledge and expertise from the very beginning. The BMBF will therefore involve the interested public to deepen the public debate and make political decision-making more transparent.

Interested citizens can contribute directly and constructively to the online dialogues on the Internet. Experts also use the Internet for shifting, commenting on and evaluating knowledge available world-wide. In this way they generate new knowledge which constitutes a generally accessible information pool, thereby becoming available and transparent for decision-makers in business, science, education and government. Furthermore, the BMBF will create a suitable mixture of measures with great public appeal to reach the largest possible audience (e.g. through journals, television and radio programmes, regional events and special events for pupils and students).

I.2 Technology Forecasting Activities

Governments, enterprises and the general public all have an interest in identifying the newly emerging generic technologies which are likely to have a major impact on society, education, the economy and the environment. By their very nature, these new technologies require significant advances in the science base if they are to be developed successfully.

Many of the German activities dealing with national or global trends are technology forecasting studies. They describe the potential and capabilities of known technologies in the near, midterm and far future on a superior level. The technology forecasting process is seen as an active search process, because technical innovations are not announcing themselves and the possible applications usually are not foreseeable. In the case of the evaluation of national or global trends more general aspects of (in the most cases) all technological directions are discussed. This is already an evaluation process and excludes in general the identification process, which took place at an earlier stage.
Science and Technology oriented forecasting activities in Germany are mainly directed towards

- looking for new upcoming scientific phenomena
- developing known technological possibilities towards new horizons
- describing technological fields in an interdisciplinary manner
- evaluating national or global trends.

In general the outline of the most forecasting activities are dealing with

- the description of new technological possibilities in established fields
- society oriented solutions to solve national or global problems
- the rendering of new product chances after new discoveries.

The forecasting process (screening and identification phase and afterwards a first evaluation of the technological parts) is mainly performed by

- discussions with experts during conferences or workshops, or via questionnaires,
- a systematic screening of literature, analyses, patents, conference reports, other prospective studies

- comparing and combining results of research projects (BMBF, DFG, CEC, US- and Japanese Ministries), and
- via building up contacts to corresponding persons in different countries.

Often the forecasting process begins with a short note, stating the degree of newness for a possible technological development out of basic research (e.g. visions for the application of Bose-Einstein condensates), but in the most cases the prediction of a beginning technological breakthrough is very difficult to determine.

The technology forecasting activities *for upcoming scientific phenomena* (like superconductors or near field effects) can not be planned and must be organised as a steady watch function. In that sense some national technology forecasting studies on, for instance, Dendrimeres, Fullerenes, Functional Supramolecular Systems, Nanotubes, New Refrigeration Technologies, SXM-Technologies (Nano tools) and XMR-Technologies have been started and due to the growing research activities have also been completed and published. Some topics have reached a tremendous scientific and industrial interest (like nanotubes), which resulted in new fields of investigation. Some topics have been incorporated in existing funding activities (like XMR in the BMBF program `electronic correlation and magnetism) or in starting R&D actions (like SXM, fullerenes and nanotubes in the superior topic nanotechnology).

Box 1: The development of technology forecasting activities in the field of fullerenes

The following short history of the technology forecasting activities in the field of fullerenes shows that the technology-analysis is one part in the whole chain of technology forecasting and accompanying technology-support measures:

⇒ 1990 : Identification of the technology field

⇒ 1991 : Expert workshop and 1st publication of the Technology-Analysis "Fullerenes"

⇒ 1992-94: Pilot projects funded by BMBF

⇒ 1993 : 2nd publication of the Technology-Analysis "Fullerenes"

⇒ 1996 : Status seminar

⇒ 1995-98: Förderschwerpunkt "Fullerenes" funded by BMBF

⇒ 1999 : Discussion of parts of the topic in the nanotechnology competence centres, in the funding program chemistry of the BMBF (e.g. catalysis), and concerning basic research activities of the DFG.

In some cases technology forecasting activities are focused on *further developments of known effects* (like momentum transfer of light on matter) on technologically usable processes (like light force lithography or laser biodynamics). With this intention the topics, as for example, Biosurfaces and Thin Film Technologies ("BioOstec"), Biomolecular Functional Systems for Technological Application, Combinatorial Chemistry, Femtosecond Technology, Future of Catalysis Research, Laser Biodynamics, Light Force Lithography, and Micro Reactors were described in more or less focused areas. Sometimes further progress in established fields was triggering off the need for some of the aforementioned analyses. But sometimes also the need for a new viewing perspective or the combination of several disciplines led to interesting aspects in a specific field (cf. the Technology forecasting series of VDI-Technology Center: "Zukünftige Technologien" or the publications of Dechema).

In some cases the technology forecasting process is concentrated *on scientific phenomena that have cross-section character* and can be used for entirely different technical application fields. With an interdisciplinary way of viewing synergy effects can arise, which lead to further technical progress and development. Several technology analyses originated from that tendency, as for instance, Adaptronics, Bionics, Functional Gels, and Innovations through Microintegration, Nanotechnology and the Nonlinear Dynamics.

The scientific community realised that physical methods of non-linear dynamics in basic research had advanced so far, that they could be tested on their technical relevance in different application areas. This was the trigger for a comprehensive analysis of new application fields. In other cases (like smart materials, sensors and information technology) the combination of different solid standing areas led to totally new fields with own acronyms (like adaptronics). Another release for an analysis was the international pressure coming out of research and beginning industrial activities in areas with common viewpoints (e.g. miniaturisation, ultra-precise machining, ultra-thin film technology). These common directions of the different fields pointed out the need for an overall description of that understanding (e.g. in nanotechnology).

The first technology analysis of the field of nanotechnology (beginning of ´94) had a strong input on the common understanding about the technological parts of that topic and about the interdisciplinary importance of the corresponding building blocks. This first analysis was written more from the technological viewpoint, but incorporated the

thinkable product spectrum and a rough estimation of the future market potential. Due to a strong interest of the NIST in Gaithersburg (USA) the analysis was additionally published in the English version. Afterwards this version got a high interest in Europe too, was one of the basic pieces of the ESTO work to evaluate this field and served the BMBF to demonstrate the starting German activities also abroad.

Box 2: The development of forecasting activities in the field of nanotechnology

The most important parts of the evaluation and implementation process of the VDI-TZ and the BMBF were:

⇒ 1990 - 91: Colloquium series of technology trends: Nanotechnology
New developments in microstructure and nanotechnology (4/90)
Ultra-precise treatment of surfaces and fabrication of very thin layers (4/91)
Fabrication and application of nanostructures (12/91)

⇒ 1991: Questionnaire action in the field of thin films and nanotechnology

⇒ June '91: Expert discussion concerning nanotechnology (including BMFT*)

⇒ Oct. '91: Workshop with podium discussion (including BMFT)

⇒ 1992: Proposal for the BMFT to organise the funding of nanotechnology

⇒ Feb. '92: Evaluation of the technology and market potential

⇒ March '93: Expert discussion to evaluate the potential of scanning probe techniques

⇒ Oct. '93: First scanning probe research projects

⇒ Jan. '94: Publication of the 1st technology analysis nanotechnology

⇒ Oct. '94: >Start of lithography and x-ray technology research projects

⇒ Jan. '95: Workshop to evaluate scanning probe research results

⇒ 1995: BMFT statement to nanotechnology as cross cutting technology

⇒ June '96: BMBF expert discussion on the industrial importance of nanotechnology

⇒ Oct. '96: Questionnaire to evaluate the "innovations burst out of the nanocosmos"

⇒ March '97: Market inquiry in the ESTO network and with international experts

⇒ March '98: BMBF workshop "Innovationsschub aus dem Nanokosmos"

⇒ March '98: Announcement of a competition to implement nanotechnology competence centres

⇒ Aug. '98: Activation of 6 BMBF nanotechnology competence centers

⇒ April '99: Starting of joint research projects in the field of nanotechnology

*) The former BMFT (Federal Ministry for Research and Technology) has been reorganised in 1996 and became the BMBF (Federal Ministry for Education, Research and Technology), and since 1998 the BMB+F (Federal Ministry for Education and Research)

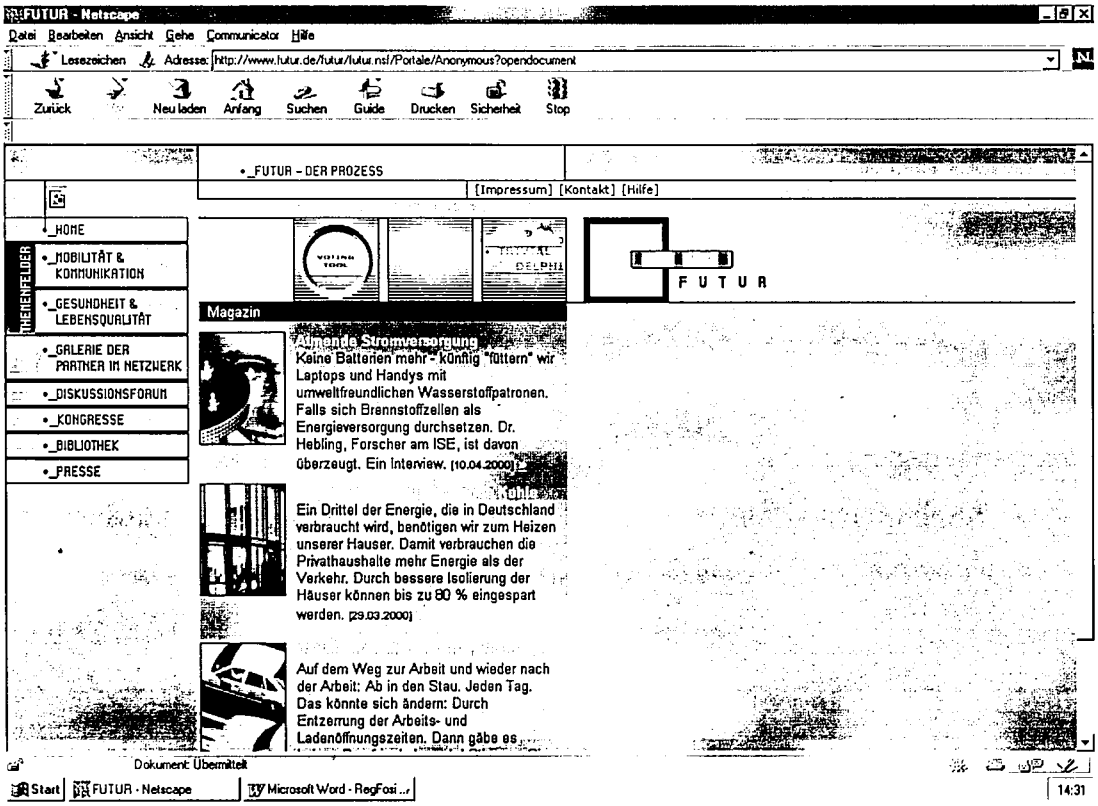
The second analysis was written with a strong view on possible applications:
- now and in the near or long term future,
- distinguishing between different industrial branches and different technological directions,
- and trying to pronounce the interdisciplinary approach.

It summarises the different opinions of the last years discussions and questionnaire evaluations, the BMBF approach via competence centers, and the results of important upcoming technological divisions. It is more or less a description of the BMBF way from the evaluation process to the broad implementation in R&D funding activities.

II. Prospective Initiatives on National Level in Spain

First, it must be taken into consideration that, in Spain, no major Prospective Technology Programmes similar to those realised in other European Countries (France, Germany, United Kingdom) have so far been carried out. However, several initiatives have been identified, some of them with a stable long-term time frame for implementation and others carried out punctually. One first approach to the studies of prospective made on a national level in Spain can be seen in Figure 1.

Figure 1: National initiatives in Foresight/Forecast in Spain



The Office of Evaluation and Foresight (ANEP) has carried out the first prospective activities in Spain, from a chronological point of view. Forthcoming activities concerning prospective technologies, which are of major importance, include: the INIDES initiative, carried out by the Spanish Agency of Science and Technology (OCYT), and the OPTI initiative, carried out by the Spanish Ministry of Industry and Energy (MINER).

II.1 The Industrial Observatory of Technological Foresight (OPTI)

The Industrial Observatory of Technological Foresight is an initiative of the Spanish Ministry of Industry and Energy (MINER). The aim of this initiative is to carry out a stable work in the field of technological foresight in eight different industrial sectors. This initiative is co-ordinated by the EOI (School of Industrial Organisation), with eight participating Technological Centres, each of them in charge of carrying out the technological foresight studies in a specific sector. The partners of the OPTI network are as follows:

* Instituto Catalán de Tecnología (ICT). Sector Information and Telecommunication technologies.
* Centro Tecnológico de Materiales (INASMET). Transport Sector
* ASCAMM. Basic and Manufacturer Sectors
* Instituto Español del Calzado y Conexas (INESCOP). Traditional Sectors
* Instituto de Química de Sarria (IQS). Chemical Sector
* CITMA. Industrial Environmemt Sector.
* Centro de Investigaciones energéticas y medioambientales (CIEMAT). Energy Sector
* AINIA. Agrofood Sector

The Industrial Observatory of Technological Foresight is carrying out a set of Delphi surveys in the above mentioned sectors. The first results of these surveys will be ready in May of the current year.

II.1.A Project Initiative

The Industrial Observatory of Technological Foresight (OPTI) was created in 1998 with the aim to carry out a stable initiative in the field of technological foresight covering eight industrial sectors. The OPTI has a network structure, the foresight in each sector is carried out by one partner of the network with expertise in the sector. The OPTI is currently carrying out a two rounds Delphi survey in several sectors. The first results of these surveys will be ready around the middle of the current year. The OPTI was initiated by the MINER, Spanish Ministery of Industry and Energy. The main reason for promoting the OPTI was to create a stable initiative in the field of technological foresight and technological watching in eight different industrial sectors.

The main objectives of the OPTI are:

⇒ To generate an information system of knowledge on the trends and future development of the technologies and their influence exerted on the industry, employment conditions and competitiveness.

⇒ To support the decision-making processes both in companies and public administration.

II.1.B Type of Studies

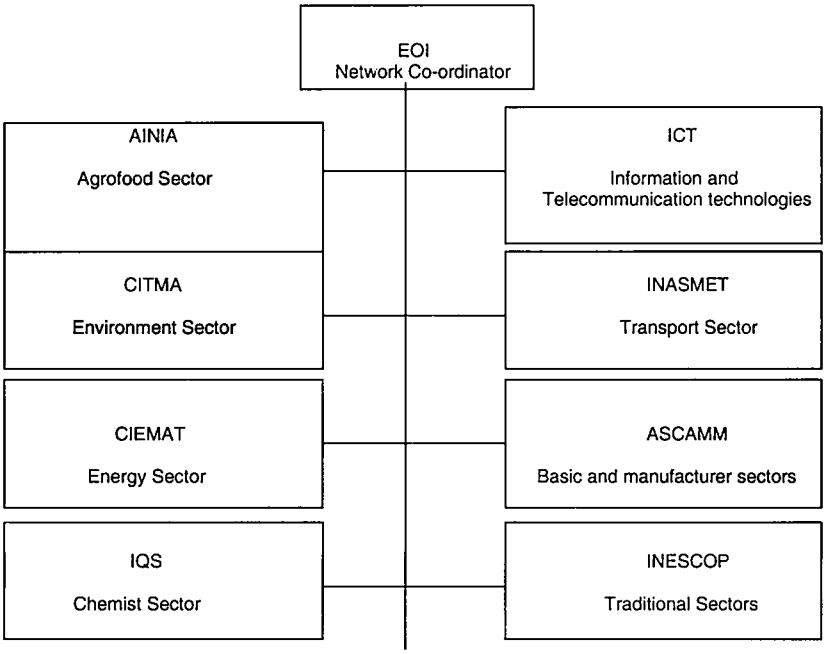
The Project is being carried out on a national level covering the key technologies of eight sectors:

1. Energy
2. Agro-food
3. Environment
4. Chemical
5. Information and telecommunication
6. Transport
7. Basic and manufacturers
8. Traditional sectors

The prospective activities carried out in the frame of the OPTI initiative are implemented by the eight technological centres involved in the network under the co-ordination of the Industrial Organisation School (EOI) entrusted by the Spanish Minister of Industry and Energy (MINER).

The organisation of the OPTI is shown in Figure 2:

Figure 2: OPTI Organisation



On the basis of previous experience gained in other countries, The OPTI has chosen a methodology based on the combination of different prospective techniques:

- Expert panels
- Delphi surveys
- Scenarios analysis

In each sectors to be analysed an expert panel was constituted. The mission of these panels is to advise on the identification of the topics to be analysed in the Delphi surveys, to propose experts to be consulted and to analyse the results of the surveys. There are about 100 experts involved in the panels.

The Delphi surveys serve to obtain the opinion of about 1400 experts in relation to the following variables:

⇒ Impact on the technological development, quality of life, employment.

⇒ Spanish position compared to other countries.

The reply rate to the Delphi survey was about 33%. The project has a long-term time frame (10 years).

II.1.C Development of Studies

The Industrial Observatory of Technological Foresight (OPTI) was created in 1998 with the aim to carry out a stable initiative in the field of technological foresight covering eight industrial sectors. The first results of the Delphi surveys will be ready around the middle of the current year. The entities and people involved in the Delphi Survey in progress are SME"s, large organisations and scientific experts. Table 1 shows the main characteristics of the OPTI initiative.

Table 1: OPTI Initiative

ORGANIZATION	SECTOR	ACTIONS	METHODOLOGY
EOI	Network Co-ordinator		
AINIA	Agrofood Sector	Foresight activity in the field of "Technologies of food preservation"	Delphi survey on 42 topics, gathered in the following technological areas: High Pressures, Biopreservation, vacuum boiling, Irradiation, Microfiltration Microwaves, IV Gama, Electrical pulses, Ultrasounds. The Delphi survey has been distributed among 155 experts.
CIEMAT	Energy Sector.	Foresight activity in the field of "Renewable energies".	Delphi survey on 54 topics, gathered in the following technological areas: Biomass, wind energy, Photovoltaic, Thermal solar, Minihydraulic. The Delphi survey has been distributed among 200 experts.
ICT	Information and telecommunication technologies	Foresight activity in the field of "Digital Industry"	Delphi survey on 60 topics, gathered in the following technological areas: Uses, applications, social topics, regulation topics, Internet, Technologies. The Delphi survey has been distributed among 270 experts.
INASMET	Transport Sector	Foresight activity in the field of "aeronautical sector".	Delphi survey on 45 topics, gathered in the following technological areas: Air transport systems, materials, airframe design , electronic and communications. The Delphi survey has been distributed among 60 experts.
ASCAMM	Basic and manufacturer sectors	Foresight activity in the field of "New technologies to manufacture metallic components"	Delphi survey on 109 topics, gathered in the following technological areas: Machining, electroerosion, laser processing, Plastic deformation cutting, casting, sinterization, Thermal treatments. The Delphi survey has been distributed among 220 experts.
INESCOP	Traditional sectors	Foresight activity in the field of "Design".	Delphi survey on 29 topics, gathered in the following technological areas: Design methodologies, input data systems, software of design, rapid prototyping, Quality control in design, communications and networks, virtual reality. The Delphi survey has been distributed among 210 experts.
CITMA	Industrial Environment Sector.	Foresight activity in the field of "Management and treatment of industrial wastes"	Delphi survey on 51 topics, gathered in the following technological areas: Characterisation, Minimisation, Recycling and valorisation, treatment and disposal. The Delphi survey has been distributed among 160 experts.
IQS	Chemical Sector	Foresight activity in the field of "Fine Chemist".	Delphi survey on 35 topics, gathered in the following technological areas: Legal topics, ecological topics, technological topics, social and economical topics. The Delphi survey has been distributed among 110 experts.

II.1.D Technological Policies

The OPTI initiative is currently on- going, the first results of the Delphy surveys carried out in the above mentioned sectors has been presented in the last Edition of Tecnova Fair held in Cadiz in May 1999. Is too early in order to evaluate the relationship between this initiative and future technological policies However, several remarks are to be made in that respect:

⇒ The main Client of the OPTI , the MINER, designed and managed in the past several Programmes with the aim to support Research and Technology Development in industrial firms. The last of these Programmes named ATYCA was finished in January of 1999. The analysis of the possible implementation of the results reached within the scope of the INIDES initiative in the decision making process must be made upon approval of a new programme.

⇒ It is possible that the new Programme to support the R+D in industrial firms is not integrated in the MINER. In such event the project to support the R+TD in industrial firms would be integrated in the frame of the new Spanish Plan of Research and Development (Dependent on the OCYT).

⇒ The MINER will continue supporting the OPTI initiative during the years 1999 and 2000, in fact the OPTI initiative has forecast to carry out, during the years 1999 and 2000, the Delphi surveys showed in table 2.

Table 2: OPTI Initiative: Forecast activities

ORGANIZATION	SECTOR	Year 1999	Year 2000
EOI	Network Co-ordinator		
AINIA	Agrofood Sector	Foresight activity in the field of "Application of the Biotechnology in the food sector"	Foresight activity in the field of "Technologies of traditional process"
CIEMAT	Energy Sector.	Foresight activity in the field of "New technologies in the conversion of fossil fuels".	Foresight activity in the field of "Energy storage"
ICT	Information and telecommunication technologies	Foresight activity in the field of "The ICT and the digital economy"	Foresight activity in the field of "Convergence of infrastructures and services in the telecommunications sector"
INASMET	Transport Sector	Foresight activity in the field of "railway and naval sector".	Foresight activity in the field of "Automotive sector"
INESCOP	Traditional sectors	Automatization technologies	Clean technologies
ASCAMM	Basic and manufacturer sectors	Foresight activity in the field of "Technologies to manufacture components with plastic and compounds materials "	Foresight activity in the field of "Machinery to manufacture plastic and metallic materials"
CITMA	Industrial Environment Sector.	Foresight activity in the field of "Environmental machinery"	Foresight activity in the field of "Industrial water treatment"
IQS	Chemical Sector	Foresight activity in the field of "Basic organic Chemist".	Foresight activity in the field of "Basic inorganic chemist"

II.2 Identification of Technological Needs in Spanish Companies (INIDES)

The Spanish Agency of Science and Technology (OCYT), acting by order of the Spanish Prime Minister, is carrying out, in collaboration with COTEC Foundation, the project named "Identification of Technological Needs in Spanish Companies" (INIDES). The main objective of these activities is to identify the key technologies involved in ten Spanish industrial sectors.

The characteristics of this initiative are closer to the technological watching approach than to the foresight approach. The tasks to be accomplished under this initiative will be finished around the middle of the current year.

The sectors to be analysed by this initiative are the following:

* Agriculture
* Automotive
* Agrofood
* Electronic
* Information and Telecommunication services
* Chemistry
* Transport
* Machinery and capital goods
* Materials
* Energy
* Manufacture sector

II.2.A Project Initiative

INIDES is an initiative of the Spanish Office of Science and Technology. This initiative is currently in progress and it is planned to be fulfilled in the course of the year 1999. The Spanish Agency of Science and Technology (OCYT) acting on behalf of the Prime Minister took the initiative for the INIDES project. COTEC, a Spanish managerial foundation, also took part in the initiative. The initial founding members of the initiative are OCYT (80% of the budget) and COTEC (20% of the budget). The total budget of the initiative covers 100 Mptas (600,000 Euros). The project could be considered like a marketing study for the Spanish public science and technology system.

The main objectives of the project are:

⇒ To analyse the more important key technologies used in ten industrial sectors.

⇒ To evaluate the evolution of these key technologies in a short-term time frame. The analysis is carried out from the point of view of industrial companies.

Two consultancy companies carry out the study under the co-ordination of COTEC Foundation, while freelance consultants likewise participate in the project.

II.2.B Type of Study

The methodology used in the project serves to analyse the key technologies by means of personal interviews conducted with companies of each sector (35 companies per sector). The interviews follow guidelines collected in a questionnaire previously prepared by the team of consultants.

The objectives were fixed in collaboration with COTEC and OCYT. The design of the methodology was created by COTEC with the assistance of the consultancy firms involved in the project. In the process are involved both SME"s and large companies operating in the analysed sectors. The project has a medium term time frame (2-5 years).

II.2.C Development of Studies

The Project is being carried out at National level covering the Key technologies of eleven sectors:

1. Agriculture
2. Automotive
3. Agrofood
4. Electronic
5. Information and Telecommunication services
6. Chemist
7. Transport
8. Machinery and capital goods
9. Materials
10. Manufacturer sectors
11. Energy

The Project provides for a single study.

Table 2 shows the main characteristics of the INIDES initiative.

Table 3: INIDES Initiative

INICIATIVE	ACTIVITIES	METHODOLOGIY
INIDES. Action financed by OCYT and COTEC. Project Co-ordinator: COTEC. OBJETIVES: - To carry out sector studies focussed on the identification and valuation of the more important technologies for the Spanish companies. - To reach conclusions on the more relevant technologies for the Spanish companies with a temporary horizon of 2-3 years.	Analysis of key technologies in 11 sectors: Agriculture, Automotive, Agrofood, Electronic, Information and Telecommunication services, Chemist, Transport, Machinery and Capital Goods, Materials, Manufactures and Energy.	Questionnaire, surveys to identify key technologies in the considered sectors (35 surveys by sector). Open Meetings. The work will be finished in May of 1999. The pilot study on machinery and capital goods was finished in 1998.

II.2.D Technological Policies

The INIDES initiative is currently on going. (The interviews with the selected companies serving to detect the key technologies are underway.)For this reason it is not possible to evaluate the relationship between this initiative and future technological policies. However, several remarks can be made in that respect:

⇒ The OCYT (the client of the project) is currently involved in the definition of the IV Spanish Plan of Research and Development. These Spanish R+D Plans are the most important source of R+D funding for the Spanish research centres and universities. The analysis of a possible implementation of the results reached under the INIDES initiative in the decision making process must be made upon approval of the new plan.

⇒ It is important to remark that the new Spanish Plan of R+D, to be implemented in the year 2000, will have a specific line devoted to industrial innovation projects. (It represents a novelty compared with previous plans). Due to the fact that the INIDES initiative is focussed on the detection of key technologies from the companies point of view, it will be interesting to check the possible priority-setting concerning these technologies in the new Spanish Plan of Research and Technology.

II.3 The Spanish Agency of Evaluation and Foresight (ANEP)

The Spanish Agency of Evaluation and Foresight (ANEP), entrusted by the Spanish Ministry of Education and Culture, has - since its creation, carried out a set of pilot studies on technological foresight. These studies have been performed from two different points of view:

- Analysis from the point of view of the market or sector application.
- Analysis from the point of view of the technology.

In the first case the studied sectors were "Mobile communications" and "Multimedia"; in the second case the studied sectors were "Optics" and "Advanced Materials". The works were carried out by reduced groups of experts who, under the direction of a specialist in the subject, prepared four documents of general character in which the aspects of major significance were in each case analysed.

In addition to the aforementioned studies, ANEP made or has foreseen to make other foresight studies like for example: "Trends in the preservation of the cultural heritage: Technological and scientific demands" (Blanco, T. Presmanes, B. September 1998 ANEP).

A summary of the most recent studies carried out in the field of the technological foresight by ANEP can be inferred from Table 3.

Table 4: National Agency of Evaluation and Foresight (ANEP): Studies in Foresight

STUDY	STATUS	METHODOLOGY
Prospective study on optics	Finished in 1997	Analysis from technology
Prospective study on advanced materials	Finished in 1995	Analysis from technology
Prospective study on mobile communications.	Finished in 1995	Analysis from market
Prospective study on advanced multimedia services	Finished in 1995	Analysis from market
Trends in the preservation of the cultural heritage: Technological and scientific demands.	Finished in 1998	Expert consultation.

PART TWO: PROSPECTIVE INITIATIVES ON REGIONAL LEVEL

I. Prospective Initiatives on Regional Level in Germany

The constitution of the Federal Republic of Germany does not specify who should subsidise research, nor even whether such research should be subsidised by the Federation as a whole or by the individual Federal states ("Länder"). Nevertheless, differences between the research-funding measures of the Federal government and the "Länder" have developed.

The Federation has particular responsibility for non-university research, while the "Länder" finance research at universities and institutes of university status. From the Federal point of view, research should principally contribute towards strengthening the efficiency of the German economy in international competition. The "Länder", in contrast, pursue the aims of their regional economic promotion and orient themselves mainly towards developments in other Federal "Länder". If, in the case of research objectives, one distinguishes between securing an efficient research infrastructure, the promotion of technology transfer and the promotion of product development right up to investment subsidies, the Federal "Länder" principally pursues the last two aims. The differences between the research funding of the Federation and that of the Federal "Länder" should, however, not be over-estimated: There is a whole series of current projects which could equally well have been financed by the Federation as by the "Länder" and vice versa. The Federation and the "Länder" collaborate in supporting many facilities and projects. The existing distribution of roles between Federation and "Länder" almost defies any kind of generalisation and should really be reconstructed in each individual case.

The following **examples** give a small selection of the vast variety of activities that are relevant to "Foresight" on regional "Länder" level, which also is mirrored in the policy programmes of various "Länder".

I.1 The Bavarian Future Offensive

I.1.A Study Initiative

In order to keep up with global competition, the government of Bavaria has in recent years put forth massive efforts to intensify modernisation. Proceeds from privatisation in the public sector, amounting to DM 5.4 billion, are reinvested in full in the unique Bavaria"s "Future Offensive".

I.1.B. Type of Study

Funds raised under the Future Offensive are disbursed for opening new vocational colleges all over Bavaria, for targeted assistance to natural science and technology research, e.g. with the new Munich II research reactor, in order to promote innovatory technology projects, such *as Bavaria On-line*, and to back vocational training establishments and technology centres.

Revenues from heavily subsidised public funds are additionally employed to ensure bright prospects for Bavaria not only in terms of economy, but in the field of social welfare, culture and environmental protection as well.

The incorporation of three new companies - the Bayern Innovativ in Nuremberg (s. below), the Bayern Kapital in Landshut and the Bayern International in Munich, was designed to enhance technology transfer in medium-sized companies, to provide capital to entrepreneurs launching new technology-oriented businesses and to make medium-sized companies more competitive in European and overseas markets. New centres for key and high-tech research, such as the Biotechnology Centre in Martinsried and the Augsburg Research Centre for Environmental Technology and Equipment, are also sponsored under this project.

I.1.C Study Development

In March 1995 as part of the "Future Offensive", the Bavarian government set up the company known as Bayern Innovativ GmbH, located in Nuremberg. The aim was to provide support for the businesses located in the region - in particular the small and

medium-sized enterprises. Bayern Innovativ will serve as a turntable for technology transfer in Bavaria and as a junction-point for transfer at international level. Funds amounting to 100 million DM, obtained from the proceeds of privatisation, were set aside for Bayern Innovativ. The returns from these funds are to be used for the long-term co-ordination and intensification of technology transfer between science and industry. In addition, Bayern Innovativ is responsible for an EU liaison office for research and technology and, together with the Steinbeis-Europa-Zentrum in Stuttgart and the THATI GmbH in Erfurt, it constitutes one of the 52 Innovation-Relay-Centers in Europe. (http:// www.bayern-innovativ.de)

To maintain and build on Bavaria"s top position as an economic location, the aim of the initiative of the Bavarian government is to accelerate the use of modern telecommunication methods in Bavaria. Three impediments will have to be removed first:

- the deficient knowledge about the possibilities of communications;
- the low number of suppliers with extensive offers in terms of telecommunication services and applications;
- the unattractive cost situation for telecommunication services.

This aim can be met by a three-fold approach:

- Via an information campaign knowledge about the possible uses of the new communication technologies must be widely distributed.
- The range of offers for telecommunication services and applications must be increased.
- The specific costs for telecommunication applications are to be reduced to a level which allows them to be economically applied by companies and which is within the financial means of the majority of the population.

The state government has resolved on the one hand to carry out widely dispersed projects accompanied by effective publicity, and on the other hand, on the network side, to initiate appropriate measures in order to reduce the costs of telecommunication applications (http://www.bayern.de/ BayernOnline). In a combined public-private initiative, the Free State of Bavaria has made 100 million-DM available for user-related pilot projects. Industrial companies have provided an additional amount of 200 million DM. The following projects are grouped under the heading "*Bayernnetz*":

- a BAYERN Server for the state government;
- the electronic land register SOLUM-STARNET;
- a traffic management system covering the whole of Bavaria;
- the freight logistics system Bayern 2000;
- the construction-logistics tele-concept, which uses data, image and linguistic services to improve communication between building contractors, building sites and partners;
- a Bavarian innovation network;
- a news and information service for small to medium-sized companies;
- the multimedia database for the textile industry;
- the Bavarian health network, and
- projects in the fields of digital TV and digital radio.

I.1.D Technological Policies

A new unconventional mechanism to provide technological support to Bavarian economy was established with the inauguration of the Bavarian Research Foundation in 1991. It fosters a number of research institutions, e.g. for artificial intelligence, high-temp conductors, catalysis, biotechnology and genetics, all of which set an example for close interaction between science and industry. Bavaria sets a great store by the innovative potential of its medium-sized businesses. Therefore the Free State backs technology transfer in the day-to-day operations of these companies.

The Bavarian Innovation and Technology Transfer Company, a public limited company established in 1995, is entrusted with the task of promoting collaboration based on partnership between economy and science and enhancing the dynamic advance of technology transfer. To attain such objective this company was granted capital stock in the amount of DM 100 million from the proceeds derived from privatisation. Specialised high-tech centres, such as the one for biotechnology in Martinsried and the one for environmental technology and equipment in Augsburg, increase nascent companies" chances to succeed in introducing key technologies of the future.

The innovation centres in Erlangen, Munich and Würzburg, as well as the prospective Middle Franconia (Mittelfranken) Technology Park at Nuremberg also uphold the launch of new businesses employing innovative technologies. High-risk research and development projects carried out by small and medium-sized companies in any sector

are entitled to state sponsorship under the Bavarian programme for introducing technology. A prior-ranking task of the Bavarian State Government is to promote the establishment of new technology-related companies under the BayTOU programme and through the recently incorporated Bayern Kapital, a PLC for risk-capital investment, financed under the Bavaria"s Future Offensive with DM 150 million. One third of these were earmarked for launching new businesses in the field of biotechnology and genetic engineering.

I.2 Regional Activity in Northrhine Westphalia

I.2.A Study Initiatives

With its "Innovation Programme Research" the State government of Northrhine Westphalia (NRW) promotes modern technologies and intelligent solutions. The innovation programme founded in 1996 assumes that worldwide new growth markets within the areas of information and communication technologies, environmental protection, and health demand for new products and services. The ability to satisfy this demand is a prerequisite for future job creation and the competitiveness of NRW. In this respect science and research are most important since the creation of new jobs will take place predominantly in the know how-based industries and services. The focus of another programme in Northrhine Westphalia, the "Innovation Programme Research", is on new products and production processes in environmental and energy technologies, in transportation telecommunications and public health. A second focus is the promotion of the formation of new business, out of the universities into the business world.

I.2.B Type of Study

Northrhine Westphalia would like to strengthen the innovative dynamics of its economics, in order to cope with the world-wide competition of regions and be able to open up new possibilities for employment. Initiated by the Northrhine Westphalian Ministry for Economics, Technology and Traffic in co-operation with the Fraunhofer Institute for Research on Innovation, a study on the `future-orientation of economic structures and innovation (Zukunftsorientierung der Wirtschafts- und Innovationsstrukturen) was carried out in 1996.

The aim of this study was to analyse the potential of Northrhine Westphalia to translate technological know how into products and business. The product development visions given in the study are based on existing future-studies and on technology indicators taken from various publications.

I.2.C Study Development

The main aim of the Study on future-oriented structure of economy and innovation was the development of concrete suggestions for new product developments and industry networks and the identification of prerequisites of future possibilities and challenges. The results should serve (in workshops) as a basis for discussion of the future strategic action requirements in economics and politics.

The project was successfully concluded and presented to the Ministry. The results indicate that, although there are innovation weaknesses, the chemical and pharmaceutical industry including biotechnology are well positioned compared to the federal level.

I.2.D Technological Policies

Altogether Northrhine Westphalia has a good infrastructure for future technologies, public research, and technology transfer. The results of the study were made accessible for the broad public and should serve as information basis for other Ministries of Northrhine Westphalia.

I.3 The Secretariat for Future Studies Northrhine Westphalia

I.3.A Initiative

The main objectives of the Secretariat for Future Studies are to examine and develop models for a viable future and to promote future studies as a branch of science in Germany. Against the backdrop of aggravating global problems, the SFZ has concentrated in its research on delineating scenarios for a sustainable future in social, ecological, economic and trans-generational terms. SFZ also elaborates concepts for future-oriented solutions in business, government and society, taking into account both "hard factors" (technology, economy...) and "soft factors" (social and cultural ones). Future studies and futures design (implying both conceptualisation and implementation) transcend the narrow limits imposed by individual scientific disciplines.

Most of the studies carried out by the Secretariat for Future Studies GmbH (SFZ) at Gelsenkirchen[7] and the pertinent initiatives have been initiated by the Ministry of

[7] Sekretariat für Zukunftsforschung , http://www.sfz.de/

Labour, Social Affairs, Urban Development, Culture and Sports of the Federal State of Northrhine Westphalia (MASSKS) in close collaboration with SFZ.
The SFZ operates as a multi-disciplinary institute with collaborators from political and social sciences, from physics, engineering, and others. The SFZ often carries out the studies in collaboration with the Future Studies Group (the Network Future maintains various network partners in various German, Austrian and Swiss cities[8]) Z-punkt.büro für Zukunftsgestaltung and the IZT, Berlin.

The Institute for Future Studies and Technology Evaluation (IZT)[9] was founded in 1981. It is a non-profit making research establishment dealing with research on the future and consultation of decision-makers in politics and economics. The work is focussed on analyses of the development and introduction of new technologies as well as the estimation and evaluation of their economic, political, ecological and social consequences. Beyond that, the IZT develops strategies and instruments for technique organisation. Even though it receives a financial base from the Land Berlin, the institute is economically and organisationally independent.

I.3.B Type of Studies

The studies initiated by the Ministry of Labour, Social Affairs, Urban Development, Culture and Sports of the Federal State of Northrhine Westphalia (MASSKS) are entirely devoted to Massks itself, but the SFZ is also engaged in commissioned research, e.g. for German Telekom and other enterprises, NGOs, foundations.
The time frame of the studies is medium and long-term (5-20 years).
From a methodological point of view, priority is given to the application and refinement of qualitative approaches. Particular emphasis is placed on participatory methods, on combining classical futurological methods (Delphi, cross-impact, etc.) with future workshops and other more recent approaches, and on using the scenario method both to define possible and desirable futures and to identify practical steps to reach them.

[8] Netzwerk Zukunft, http://www.icf.de/nwz/zukunft.htm
[9] IZT, Institute for Futures Studies and Technology Assessment, http://www.izt.de/

Various studies have European focus (www.sfz.de), some have been undertaken within the frame of the IPTS, FAST or on behalf of a specific General Directorate of the EU Commission.

For instance, the study on "Perspectives of Call Centres", initiated by the MASSKS and carried out by the SFZ should hint at the possible effects of Call Centres (CC) on urban structures, particularly the communes. It looks at job-effects, chances and risks in order to interest the communes for the potential implication of CC in order to avoid a `muddling through´.

The study was primarily intended for the decision-makers within the MASSKS, particularly for the sector of urban development. Various experts from that particular field, particularly on a local level, were involved in the study conduction. The time frame of the studies is medium to long-term (until 2015). From a methodological point of view, priority was given to expert interviews, secondary analysis, and the development of a kind of Road Map. The study illustrated the German situation compared to the situation in the Netherlands, Great Britain and Ireland.

I.3.C Development of Studies

Up to now, the SFZ has been engaged in quite different fields. It has performed a large study into the history and state-of-art of futures studies, including comprehensive reports on the state of future studies in Germany, Sweden, France, Switzerland and the Netherlands. Technological innovation and technology transfer - as "hard factors" shaping the future - are another focus of research, comprising for instance evaluation studies on the benefits of technology parks in Northrhine Westphalia. This field is closely connected with a research project on futures studies in the business world, where special emphasis is placed on the questions how companies tackle long-term issues, how they organise future-oriented knowledge, and how they adapt their structure to future challenges.

Current projects of the SFZ include investigations into the epistemological and methodological foundations of future research and into the impact of information and communication technologies on business, society and culture, heavily concentrating on tele-cooperation and virtual realities. Commissioned research is for example done for

the German Telekom on factors shaping the future telecommunication/information markets.[10]

According to its future studies philosophy, the SFZ research concept is complemented by information dissemination efforts (www.sfz.de). The SFZ publishes in cooperation with the "Gesellschaft für Zukunftsgestaltung - Netzwerk Zukunft e.V." a journal "Zukünfte", which appears three to four times a year and can be ordered from the SFZ.

A book series "ZukunftsStudien" with about four titles per year is edited in co-operation with the IZT (see above) and NOMOS Publishers.

Futheron the SFZ publishes workshop reports and progress reports (e.g. most studies undertaken for the MASSKS are published as WERKSTATTBERICHTE).

In connection with its research projects the SFZ organises an annual international Summer Academy at which current issues in futures studies are discussed. The topics of past Summer Academy were:

1991	"Solar Energy and Solar Architecture"
1992	"Multi-media City – Developments, Trends and Visions Along the Road into the Next Century"
1993	"Prospects for Russia – Sustainable Development?"
1995	"Telematic Cities – Prospects for Sustainable Urban Development"
1996	"Beyond 2000 - Challenges for Futures Research"
1998	"Powerless? - Doesn"t matter! Communes under pressure"

Another Summer Academy is planned for 1999. Besides the Summer Academy, several workshops and discussion series with guest speakers were arranged, e. g. "Self-organisation in business and society".

The results of the CC study give a road map from the Call Centre via functioning as Communication Centre up to a Competence Centre, point at different qualification characteristics of each stage and give an analysis of the implications for urban development. The job-effects of Call Centres have been identified to be the major qualitative indicators. The results were reported to the MASSKS and will be discussed with representatives from the communes and call centres in a workshop and published as a workshop report. Broad public feedback is expected as soon as the final report will

[10] Initiated by the German Telekom AG, the Technology Center Darmstadt, and the SFZ the project " agenda Setting for information Society " should give qualitative stocktaking of the spectrum of topics relevant Innovation and

have been published. There is no formal self-evaluation mechanism, however, self-evaluation results are reported irregularly to the MASSKS. A Scientific Committee has been convened by the MASSKS and institutionalised with the SFZ (www.sfz.de).

I.3.D Technological Policies

The studies for the MASSKS are entirely devoted to the Ministry, serving for the decision-making process. They serve as information input, as a basis and stimulation for further action, and as a basis for well-informed argumentation. The results of the CC study, for instance, serve as information input, as a basis and stimulation for further action on local level, and as a basis for further strategies in communes. They have the potential to interest the communes for implications of CC in order to avoid a "muddling through" or even undesired developments.
A study on the impact of Call Centres on federal level, as well as further studies on the future of urban development and in the IT sector are planned. However, the definitive structure of the planned study has not yet been definitively defined.

The Summer Academy (1999) and various further studies on the future of urban development and in the IT sector are planned.
The study `Foresight in enterprises" (1995/96) with the focus on methods for the strategic orientation of enterprises and their ability to adapt to future requirements is planned to be repeated in 1999.

There are plans to carry out a follow-up of the Telekom study on the information society.
The definitive structure of the planned study has, however, not yet been definitively defined.

Communication Technologies. The project analyses existing scientific studies, public debates as well as methodologies (" who undertakes which and what? ") and shall result in a set of guidelines for best practice in agenda setting .

I.4. EU RIS Project RAHM, Saxony-Anhalt

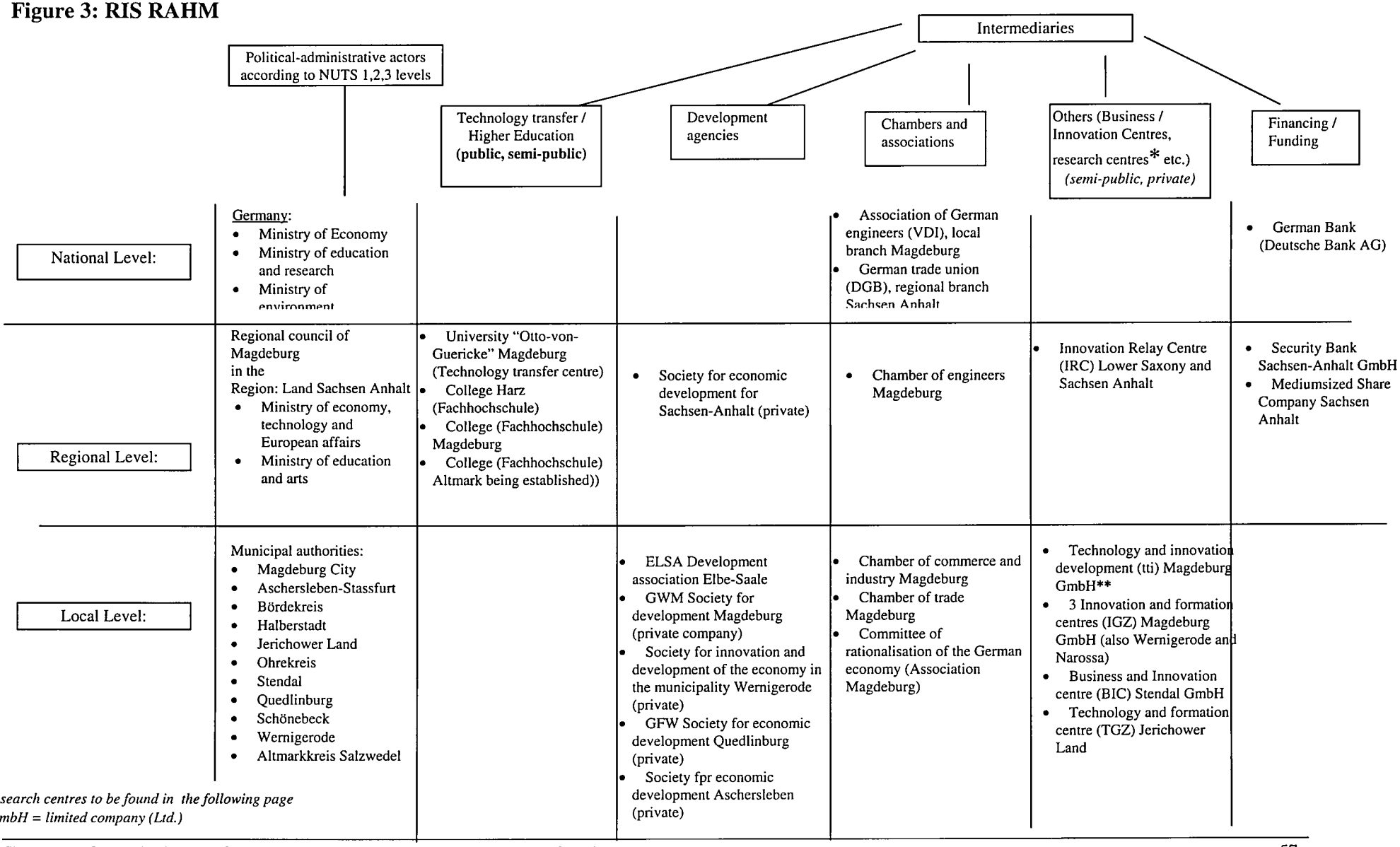
I.4.A Initiative and Type of Study

Among the German regions that receive funding under the EU Regional Innovation Strategy (RIS) and Regional Innovation and Technology Transfer Strategies and Infrastructures (RITTS) programmes are, for instance: Halle-Liepzig-Dessau (1994-96), Weser Ems (1997-99), Altmark-Harz-Magdeburg (1998-2000). They are based on public-private partnership (the private sector and the key regional players should be closely associated in the development and implementation). They should also have a demonstration character (the policy actions tested in a region should be able to be transferred to other parts of the Union); and they should exploit the European dimension through inter-regional co-operation and benchmarking of policies and methods. (http://www.ris-ritts.epri.org)

I.4.B Study Development and Technological Policies

In operational terms, a RIS exercise should aim to: a) promote new techniques and more open and consensus based processes for developing regional policy; b) identify the needs of regional firms for innovation support services and ensure that specific policy instruments or pilot actions developed within the framework of the strategy take better account of these needs. The most recent German RIS project, entitled RAHM (region Altmark-Harz-Magdeburg), is intended to design a policy orientated strategy to stimulating and securing jobs through the promotion of innovative and competitive products and services with the ultimate aim of generating lasting economic growth. Specific aims include a better use of subsidy schemes in the field of innovation; the identification of projects for regional development, innovation and inter-sectoral networking between firms; the support for inter-regional collaboration in the wider European context; and finally the analysis of means of increasing RTDI spending in the framework of the Structural Funds. Ist steering committee consists of the Regierungspraesidium Magdeburg (2 people); Landkreis Altmark-Salzwedel, Harzregion, Landkreis Aschersleben-Stassfurt; Stadtverwaltung Magdeburg; Kulturministerium des Landes Sachsen -Anhalt; Ministerium fuer Wirtschaft, Technologie und Europaangelegenheiten des Landes Sachsen-Anhalt; Technology transfer companies (2); Private sector companies (11); Chamber of Commerce (3); Business incubator (2); Research institutes (3).

Figure 3: RIS RAHM



* *Research centres to be found in the following page*

** *GmbH = limited company (Ltd.)*

I.5 Regional Activities in Berlin

I.5.A Initiative and Type of Studies

Initiated by the EU Commission and the Berlin Senate Administration for Town Development, Environmental Protection and Technology the overriding goals of the so-called "Berlin-Study" are to work out a development strategy and an action plan for the future of the city, partially covering aspects that can also be applied to other European cities with similar structures. Therefore, within the framework of the Berlin-study concrete co-operation with London and Vienna will be agreed on. Furthermore, there will be a continuous exchange of information and experiences with other major European cities. Thus, at the same time, a contribution will be made to the formulation of a European urban policy, i.e. it will show the extent to which cities, as the driving force of the economic development, can contribute to economic and social cohesion in the Community.

In order to face up to the complex challenges of the future, Berlin needs a comprehensive representation of the most important problem areas in their particular context and a clear setting of priorities and models for their solution. In this connection, priorities must be set with a long term view.

The Berlin Senate administration for town development, environmental protection and technology has entrusted the Institute for Future Studies and Technology Evaluation (IZT) with the development of a strategy and concept for a "future-aware Berlin" (Zukunftsfähiges Berlin) on the basis of which and with whose assistance the principles of the Agenda-21-Prozesses should be promoted in Berlin. In this co-operation-oriented project authorities and resources shall be bundled, in order to enhance partnerships between administration and business, science and NGOs regarding sustainable development. The process is supported by `future workshops´. (cf. Annex1 and http://www.izt.de/forschung-grund1.html-ssi).

I.5.B Study Development and Technological Policies

The Berlin study will proceed in three stages. The first step will be a socio-economic analysis of the city"s present state, which will identify the most important areas where significant decisions must be made for the future of Berlin. This first part of the study

was finalised in October 1998. (Workshop: "Problemanalyse – Thesen zur Problemverflechtung", October 1998).

Thereafter these fields of action will be presented in greater detail, and the political solutions worked out by then will be described. This representation will be linked to the first statement on various alternative modes of action. The results will be presented by March 1999 (http://www.berlin.de/deutsch/politik/senwfk).

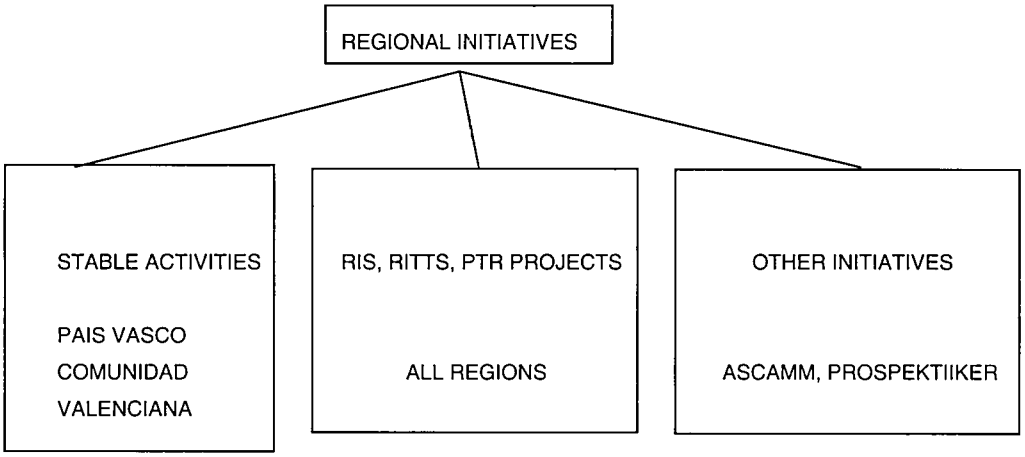
In a third and final stage these alternative ways of action will be evaluated and summarised in a plan of action, which will contain concrete suggestions for the policy of the European Commission and also for political decisions in Berlin. The plan of action will be submitted in May 1999. A steering and monitoring group will be formed to monitor work on the study and evaluate its findings. Workshops planned in the meantime: "Handlungsfelder und – Alternativen; Thesen für interdependente Problemlösungen" (Workshop, February 1999), "Strategien, Programme, Maßnahmen; Politikverflechtung Berlin-Bund-Europäische Union" (Workshop, May 1999) , "Berlin – Zivile Wege in das 21. Jahrhundert" (Workshop, August 1999). It is intended that the results of the Berlin study will indicate modalities of action by which the city can react to the challenges resulting from its completely altered geopolitical situation. The opportunities it can make use of will be described, so that the preconditions can be created for an innovative and socially balanced development into a European metropolis of the 21st century. The study will have as closed and coherent a concept as possible, on the basis of which a plan of action can be developed for the implementation of concrete measures and practical courses of action for those holding political responsibility in the city. Such a plan of action will indicate opportunities for action up to the year 2010. At the same time, the conclusions of the study will contain pointers for the future use of regional, national and European promotion funds from 1999 on. Special attention will be given to the way in which European promotional funds can be even more effectively used to overcome Berlin"s specific problems. The experience and conclusions of comparable European cities will be taken into consideration in the description of alternative actions. In particular, the solutions found in Vienna and London will be examined to see whether they are suited to the solution of problems in Berlin.

II: Prospective initiatives on Regional Level in Spain

There are few Regions in Spain that have carried out, or are carrying out some activity in the field of technological foresight and technological watching of stable form. Among the regions carrying out this type of activities the Comunidad Valenciana and the Basque Country can be highlighted. It must be emphasised here that, in the frame of the Projects RITTS, RIS or PTR, almost all the regions have performed or planned some type of activity in the field of technological foresight. Similar to the developments on a national level, numerous activities of small dimension related to the technological foresight in certain specific sectors.

One first approach to the studies of prospective initiatives taken on a regional level in Spain can be seen in Figure 4.

Figure 4: Regional Initiatives in Foresight/Forecast in Spain



Practically all the RITTS, RIS or PTR projects that were carried out or are in the process of being performed in the different Spanish regions, cover within the field of prospective technologies. Most of these activities have a short-term time frame. The objective pursued by these activities is, in most cases, to define the technological trends in these sectors considered as having high priority in each region.

The approach of all these studies is variable, depending on the state of progress of the corresponding RIS, RITTS or PTR project in each region.

A summary of these studies carried out in the field of prospective technologies within the projects RIS, RITTS or PTR in Spain, can be inferred from Table 5.

Table 5: Technological Trend studies carried out in the frame of RITTS, RIS and PTR Projects

REGION	DEPARTMENT
ARAGON (RIS)	Consejería de Economía
ASTURIAS (RITTS)	Consejería de Cultura
BALEARES (RITTS)	Consejería de Presidencia
CANARIAS (RITTS)	Consejería de Industria y comercio
CANTABRIA (RITTS)	Consejería de Industria
CASTILLA LA MANCHA (RIS)	Consejería de Industria
CATALUÑA (RITTS)	Dirección General de Planificación Económica
MADRID (RITTS)	Dirección General de Innovación
PAIS VASCO (RIS)	Departamento de Industria
MURCIA (RITTS)	Consejería de Industria
GALICIA (RIS)	Consejería de Industria y Comercio
COMUNIDAD VALENCIANA (RITTS)	IMPIVA
NAVARRA (RITTS)	Departamento de Industria y Comercio
EXTREMADURA (RIS)	Dirección General de Promoción Industrial
CASTILLA Y LEON (PTR)	Consejería de Industria-ADE
ANDALUCIA (RITTS)	Instituto de Fomento de Andalucía

All the RITTS, RIS and PTR projects include some kind of technological foresight activity. The kind of methodology used in these studies is variable depending on the Region considered. In spite of this question, the prospective studies carried out under these projects are usually focussed on the analysis of short-term technological trends (5 years at most) in sectors considered strategic for the regional development. The advance of the prospective studies developed in the frame of the RIS y RITTS projects is variable depending on the region under consideration. Some of them are finished: Andalucía, Castilla y León, Castilla La Mancha, Madrid, Galicia..., In other cases the prospective studies are under way and finally a number of studies have not started yet: Asturias, Baleares, Comunidad Valenciana

It is important to highlight that the RIS/RITTS efforts have produced new initiatives with implications in the field of technological foresight, for example the IBERIA-NW project:

The IBERIA – NW project (co-funded by the EC in the frame of TRIP Programme managed by DG XIII) aims at identifying possibilities of inter-regional networking among the partners in the region concerned (the five north-west regions of the Iberian Peninsula: North Portugal, Galiza, Castilla y León and Cantabria).

The IBERIA.NW will promote the networking of the RIS/RITTS results, their managers and steering committees, and regional actors dealing with the identification of common problems and complementary solutions, while one of the aims of the IBERIA Project is to set the foundation for pilot infra-structures named RIO"s (Regional Innovation Observatories) in North-Portugal, Galiza and Castilla León, in order to keep the RIS/RITTS "alive" and to monitor, validate and update the strategies defined.

The objectives of the RIO"s would be:

⇒ To create a coherent and compatible basis for monitoring and updating the innovative capacity of the region initiated by the RIS actions.

⇒ To promote a continuing debate on innovation strategies for the region (so as to assist the continuing development of innovation policies).

⇒ To put into practice, further develop and test the existing innovation measurement methods.

⇒ To allow inter-regional comparison of innovative capability and potential as well as of policy measures, initiatives and innovation support structures.

⇒ To act as a "test bed" for observatories in others regions.

⇒To analyse the strategic evolution through the use of known systems, such as:

* Technology Watch - collect filter, share and report the technology intelligence.
* Technology forecasting – plausible predictions of future technological developments in productive processes, in equipment and useful techniques.
* Technology assessment - anticipating future societal impacts of known new and existing technologies and observation of the technological developments, when and how they take place.

* Technology foresight – identifying present S&T priorities in the light of hypothetical projections of future economic and societal developments and long-term look into the future on the basis of concrete data and figures.

It is currently too early to evaluate the activities carried out in the frame of the IBERIA project.

II.1 Comunidad Valenciana (Valencian Region)

The present study has not served to identify technological foresight/forecast initiatives on a regional level in Valencia Region during the last few years. In the frame of the recently approved RITTS project for the Valencia Region (PRICOVA) it is planned to carry out a study on the impact of emergent technologies in the main sectors of the Region. However, it is important to emphasise that the Valencia Region shows a proactive activity in the field of technological watching.

II.1.A IMPIVA Initiatives

In the past the IMPIVA, an agency entrusted by the Generalitat Valenciana, had a technological watch service named ACTIA. This service performed the task of technology and market watch. The ACTIA service was a pay service destined for industrial companies of the Region. The ACTIA system is not in operation currently.

Currently the technological watching tasks are not carried out by the IMPIVA directly, but rather by several Technological Centres located in the Valencia Region. The IMPIVA co-funded the watching activities of these technological centres by means of the Programme "SME Initiative". The "SME Initiative" is a public action developed by the Generalitat Valenciana with the aim to support the innovation in the small and medium-sized enterprises of the Region. The tasks supported by the Programme include the creation of stable technological watching services in the sectors of major importance in the Valencian Region.

This Programme, managed by the IMPIVA, has funded up to 75% of the costs arising in connection with the technological and market-watching activities carried out for these Centres. The Technological Centres which benefit from the above mentioned Programme are sectorial centres with expertise in a particular industrial sector.

II.1.B Type of Initiative

The Valencia Region has 15 Technological Institutes with expertise in different industrial sectors. The Technological Centres providing technological and market watching services in the frame of the "SME Initiative" are as follows:

⇒ The Food Technology Institute (AINIA) formed by companies in the food-manufacturing sector and related industries. These companies in conjunction with the small and medium-sized enterprises (IMPIVA) created it in 1987.

⇒The Furniture Technology Institute (AIDIMA), formed by companies in the furniture manufacturing sector and related industries. These companies in conjunction with the IMPIVA created it in 1984.

⇒The Research Association for the toy industry (AIJU) was founded in 1985 on the initiative of the Spanish Toy Manufacturers Association with the aim of supporting the development of the industrial sector of toys.

⇒The Metal Technology Institute (AIMME), formed by companies in the sector of metal components manufacturing and related industries. These companies in conjunction with the IMPIVA created it in 1987.

⇒The Plastic Technology Institute (AIMPLAST), formed by companies in the sector of plastic components and related industries. These companies in conjunction with the IMPIVA created it in 1990.

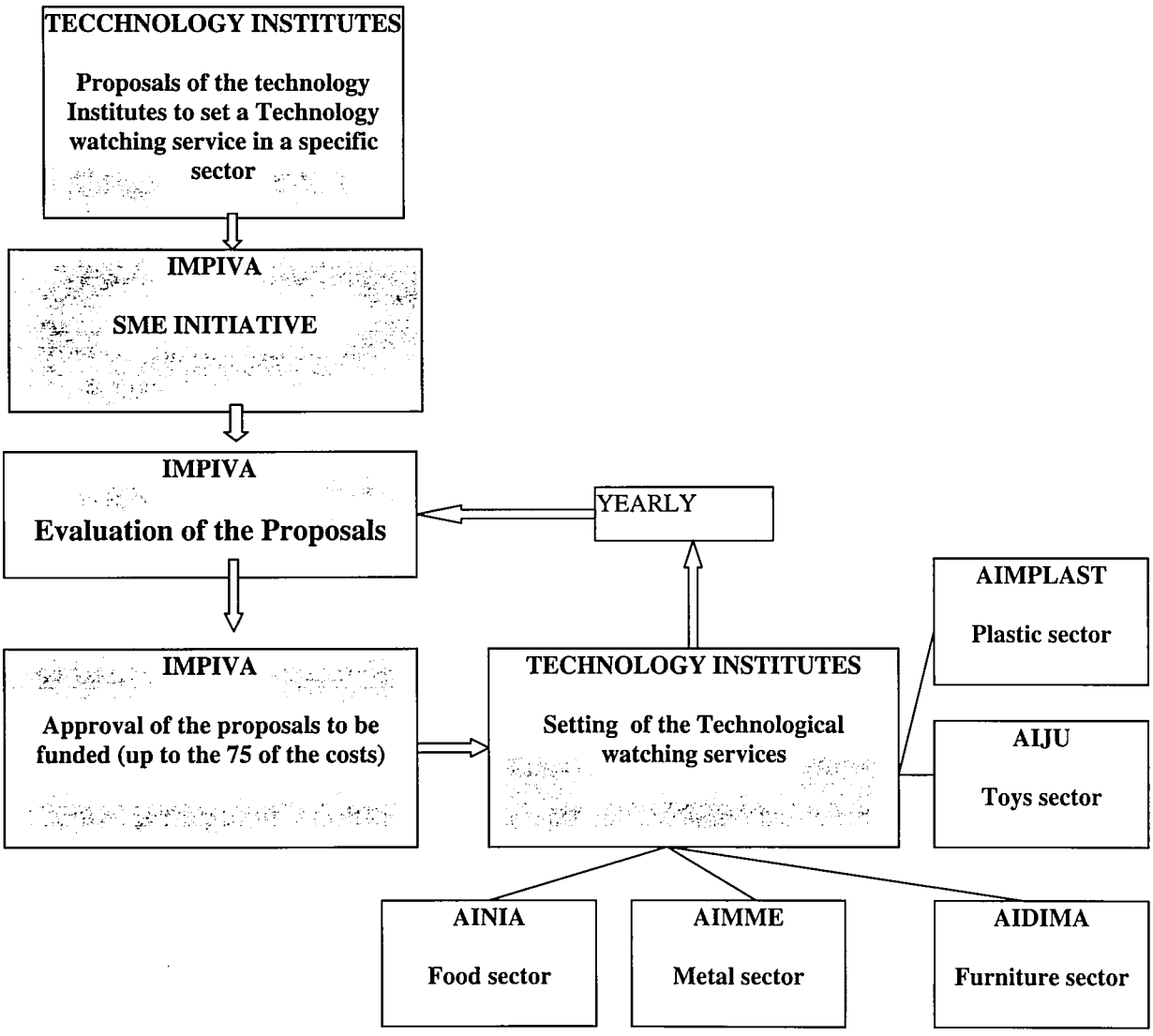
The aforementioned Institutes presented a proposal to the "SME Initiative" with the aim of rendering technological and market watching services in the sectors concerned. The proposals were evaluated and approved by the IMPIVA and the institutes started the watching activities, with each institute working (in the field of technology watching) without any formal relationship with the other institutes.

All the above mentioned watching services are mainly aimed at companies situated in the Valencian Region. The methodology used for these Institutes is based in the collection, organisation and filtering of information coming from several sources: patents databases, specialised publications.... The collected and organised information is provided to the interested companies of the sector.

II.1.C Development of the Initiative

The scheme of this initiative can be observed in the following figure 5:

Figure 5: IMPIVA scheme



II.1.D Technological Policies

There is no relationship between the technological watch initiatives carried out by the Technology Institutes and the Technological Policies implemented by the Valencia Government. The underlying reasons are as follows:

⇒ The short time frame of the aforementioned activities does not allow to introduce the results of these activities in the medium/ large time frame of the Technological Policies.

⇒ There is no formal feedback between the results reached by the Technological Institutes and the IMPIVA. The relationship between the IMPIVA and the Institutes is focussed on the evaluation of proposals and administrative topics. IMPIVA does not deal with any follow-up analyses of the results and conclusions obtained in the frame of the technology watching services.

II.2 Pais Vasco (Basque Country)

The technological forecast activities carried out in the Basque Country during the last few years are linked with the Science and Technology Plan for the Basque Country promoted by the Basque Government for the years 1997-2000. This Plan is set in the context of the Government"s science and technology policy, which in turn forms part of its industrial policy.

The Plan seeks to make the Basque Autonomous Community (BAC) more competitive as a whole by integrating science & technology with business. BAC focuses in the specific support for industrial policy and the optimisation of the resources placed at the disposal of all those involved in the system through the Plan itself and through other areas as well. To make this possible, the Plan will provide leadership in all activities concerned with scientific and technological development in the BAC.

II.2.A Initiatives

The main phases of the definition process of the Science and Technology Plan 1997-2000 for the Basque Country were the following:

- Evaluation of the previous Science and Technology Plan 1993-1996.
- Establishment of the working groups corresponding to the different agents involved in the technology development of the BAC.

The four groups involved are:

- Working group dealing with demand issues, constituted by companies and managerial associations.
- Working group dealing with supply issues, constituted by technological centres and universities.
- Working group dealing with administration, constituted by the Public Administrations involved in the Plan.
- Working group dealing with technology analyses, constituted by technology experts with the aim to develop the technological forecast works.

Development of the basic Plan 1997-2000 including the basic scheme of the Plan, and the definition of the Cluster Technology Plans which determine the strategic objectives of each cluster in the field of technology. In the Basque Country there are eight clusters in the sectors under consideration, serving the development of the Basque economy. The aim of the clusters is to improve the competitiveness, to join leading companies together and to carry out inter-company activities with the help of the Basque administration and technology suppliers in the Basque Country. The clusters are as follows:

- Aeronautical
- Automotive
- Energy
- Environment
- Telecommunications
- Electrical appliance sector
- Knowledge

- Machine tool

When defining the Clusters Technology Plans a technological trend analysis was carried out with the aim to identify the factors of major importance in the sphere of the technology concerned.

Definition of the Specific Technological Programmes: These are inter-departmental programmes which co-ordinate the work of the industry department with that of other technology-related Basque Government departments. As with horizontal technology programmes, they are guided by the actual needs of the companies involved and by the technology development and public investment programmes of the different departments. Priority areas set by other, supra-regional programmes are also taken into account here.

The scope of the plan is very broad, as it not only groups together all science and technology policies of the BAC as they have been understood, but also extends to all aspects which are necessary to promote the development of the innovation system.

Scope of the STP:
It is aimed at the business sector as a whole.
It covers the entire supply side of science and technology.
It results from co-operation between different areas of the BAC authorities.
It includes all activities concerned with technological innovation.
It will cover the period from 1997 to 2000.

The specific instruments promoted in the STP and their implementation through science and technology programmes form the real core of the Plan. These instruments and Programmes are not envisaged as unconnected, but rather as a clearly inter-related whole.

STP Design		
Instruments	**Management**	**Programmes**
Infrastructure	Management bodies	Basic Research
Programmes		
R&D Projects	Funding Program	Horizontal Technologies
Technological Innovation	Assessment and Monitoring	Specific Technological Program
Training	Indicators	

II.2.B Type of Initiatives

Two different forecast initiatives were carried out in the frame of the preparation of the Science and Technology Plan 1997-2000 for the Basque Country:

The forecast activities were carried out by the Working group of Technology Analysis, constituted by technology experts in several disciplines. This working group worked on an independent basis in order to detect the main technologies trends exerting influence on the Basque country.

The forecast activities carried out by the clusters in order to define technologic trends in each of the eight sectors (aeronautical, automotive, machine tool energy, environment, telecommunications, knowledge and know-how, electrical appliance sector). The methodology used in the trend analysis was different in each one of the above mentioned sectors. The results of these studies were taken into account upon the development of the Technologic Plan of the Clusters. In addition these plans were used to identify the areas of the Programmes implanted by the Science and Technology Plan 1997-2000 for the Basque Country:

II.2.C Development of the Initiatives

The development of the forecast initiatives under the Science and Technology Plan 1997-2000 destined for the Basque Country were linked with the general management areas of the plan. The bodies charged with the management of the Plan and the associated basic responsibilities are as follows:

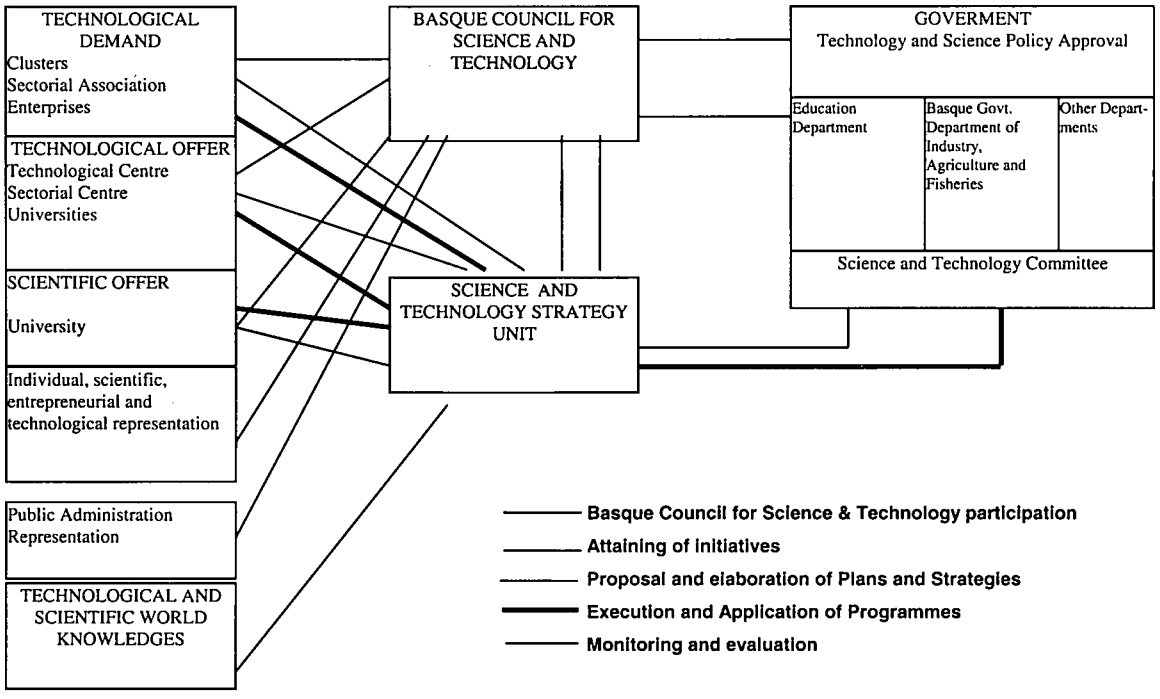
⇒The Science and Technology Committee, an interdepartmental forum where the science and technology policies of Basque Government departments are drawn up.

⇒The strategic Science and Technology Unit, set up to bring together various technological schemes as well as prepared plans and programmes for their presentation to the Basque Science and Technology Council, on the one hand, and to execute and apply the programmes within the scope of the Plan, on the other hand.

⇒ The Basque Science and Technology, set up to co-ordinate and integrate the different scientific technological and institutional players active in the BAC.⇒ The Basque Government, which approves the science and technology policy and allocates the relevant budget funds.

Figure 6 shows the management structure of the Science and Technology Plan 1997-2000 for the Basque Country.

Figure 6: Management structure of the Science and Technology Plan 1997-2000



II.2.D Technological Policies

The technological forecast activities carried out in the definition phase of the Science and Technology Plan 1997-2000 for the Basque Country exerted a clear influence on the final implementation of the Plan. In this context it is important to highlight that the results of these activities were taken into account when the Technologic Plan for the Clusters was developed. In addition these plans were used to identify the areas of the Programmes implanted by the Science and Technology Plan 1997-2000 for the Basque Country.

The plan is to be funded from three main sources: Basque Government funding, public funding from other bodies on Spanish and European levels and contribution from business. The figures of the resources involved in the plan are the following:

Basque Government funding: 42,300 Mpts (254.23 MEuros)
Other Public funding (EU FP, National R&D Plan)
MINER): 16,000 Mpts (96.2 MEuros)
Private Funding: 54,200 Mpts (375.25 MEuros)
TOTAL: 112,500 Mpts (725.68 MEuros)

Public funding for the Plan mainly comes from two Basque Government departments: the Department of Industry, Agriculture and Fisheries (DIAF) and the Department of Education, Universities and Research (DEUR), though there are also contributions from other departments and bodies.

Assessment and monitoring of the Plan comprises partly the monitoring of the progress indicators of the Plan. These indicators are established not only for informational purposes, but also as a guide to decision-making. Thus, specific quantitative targets are set for each of them. In this way monitoring and assessment can show any divergences and suggest corrective actions to redirect the Plan as necessary.

The following are the most representative indicators of the intended purpose and results of the Plan:

- Response to the needs of a significant part of the production system (one third of the companies in the BAC, which account for two thirds of GDP).

- Support for maintaining the technology infrastructure, which in total accounts for 1500 very highly qualified jobs in activities with high added values.

- Direct job creation in both R&TD and other production activities, to reach a total of 800 jobs within 4 years.

- Improvement of the technology balance by increasing the capability to generate, develop and assimilate own technology.

The evaluation of the technology forecast activities carried out in the definition phase of the Science and Technology Plan 1997-2000 for the Basque Country are linked to the general evaluation of the Plan.

PART THREE: OTHER PROSPECTIVE INITIATIVES

I. Other Prospective Initiatives in Germany

The following presentations are examples of the great variety of other initiatives with prospective character, which cannot be clustered as pure national, regional, sectoral or private activities.

I.1 The Pilot Study about Prospective Aspects in Research

I.1.A Study Initiative and Type of Study

The Pilot Study about Prospective Aspects in Research of the Committee on Basic Science was based on discussions in committee, using "brainstorming" to develop lists of priorities that were progressively synthesised. The results were a focus on increasing the priority given to environmental and life sciences. The approach used focused primarily on "science-push" rather than `demand´ factors.

I.1.B Study Development and Technology Policies

The scientific council of the German Research Minister recommended in 1994 to systematically organise sciences accompanying an independent prospective study (*prospection*) in the field of research in the BRD. Prospection is understood in that context as an attempt to identify research tasks, to gain scientific insight in upcoming or up to now neglected areas. The activities to fulfil this challenge are:

- the establishment of a scientific discussion about development perspectives in R&D,
- the identification of scientific potential of R&D fields for valuable applications,
- the demonstration of an early and long-term based creation of foci of interest. The council described an organisation model to realise that research foresight and discussed the topics molecular architecture, molecular and bio-electronics and materials determined by inner interfaces. The study has not foreseen any follow-up actions. The BMBF has the chance of recommending appropriate actions.

I.2 Initiatives of individual "Länder"

The vast variety of activities on Federal State level is mirrored in the programmes of various "Länder" that are relevant to socio-economic or business-innovation oriented " Foresight".

I.2.A Baden-Wuerttemberg

The Future Committee Economy 2000 set up by the Minister President has recommended the pursuit of a dual strategy: To safeguard competitiveness in international markets and at the same time to maintain the leading edge in new technologies and up-coming fields of industry. Baden-Wuerttemberg benefits from an above-average research infrastructure, which offers optimum conditions for a well-oiled technology transfer between science and industry. The successes achieved today form a solid foundation for the technologies of tomorrow (http://www.baden-wuerttemberg.de/biwifo/e_42.neuetechnologien.html).

I.2.B Schleswig-Holstein

Initiated by the State administration of Schleswig Holstein and the Institute for Future Studies and Technology Evaluation (Berlin), the starting point for a social discussion process relating to the future development of the country Schleswig-Holstein should be worked out by alternative scenarios and visions for " Schleswig-Holstein in the year 2010 ". These scenarios will be presented in a congress on Youth and the Future by the Institute for Future Studies and Technology Evaluation (IZT) in July 1999. Four central topics of interest are to be treated with priority: Economics and work; education and qualification; future ecological protection; Schlewig Holstein in the Baltic Sea space. Desk research, experts interview, analyses of global trends and specific development parameters of Schleswig-Holstein are the major tools for the scenario development (http://www.izt.de/forschung-grund1.html-ssi).

I.2.C Hamburg

Founded in 1996 the `Future Council Hamburg´ (Zukunftsrat Hamburg) refers to the "Agenda 21" as sustainable concept for the 21st Century. It is an open platform for institutions, federations and initiatives, which want to operate in the spirit of a local

"Agenda 21" for a future-oriented Hamburg. The main aim is the promotion of citizens" participation and the bundling of initiatives, competencies and scientific, technical, ecological, economic, cultural and social potentials (http://www.hwk-hamburg.de/agenda21/).

I.2.D Hesse

The Ministry of Economic Affairs in Hesse initiated an investigation entitled : "future-oriented managerial policy in Hesse". The aim of the study is to develop an economic strategy and to identify Best-Practice examples for the adoption of the concept of sustainability (http://www.hessen. de/wirtschaft).

I.3 Other Innovation Supporting Processes

The federal government as well as the regional governments promote innovations in research and economics, invention wealth, pioneer spirit. Examples are the German future award for technology and innovation of the Federal President (http://www.deutscher-zukunftspreis.de and http://www.kfa-juelich.de), the innovation award of the German Economy (http://www.innovationspreis.com), or the innovation award of the Ruhr district (http://www.innovationspreis-ruhrgebiet.de).

Another example of supporting innovation processes is the establishment of "Kompetenzzentren" (Competence Centres) in which important strategic and technical subjects from science, economy and capital management (from all over Germany) are brought together. The objective is to develop the technologies into products and system solutions up to marketability. The main task of these centres is to establish a network infrastructure and to use common resources as well as to gain a competitive advantage through synergetic effects.

Examples of "Kompetenzzentren" on different levels:

Federal institutions:

* national level: Kompetenzzentrum for nanotechnology
* regional level: BioRegio Zentren
* local level: "Demozentren" for medicine

Regional institutions:

* Multi-media-NRW-Kompetenzzentrum in Dortmund
* CeNS Center for Nanoscience in Munich

I.4 Subject/Sector specific foresight initiatives

There are many sector-specific initiatives and activities with prospective character. The following initiatives present some examples of activities with prospective character for the Information Technology Sector only.

- In the so-called Bangemann Report ("Europe and the Global Information Society", Brussels: CEC 1994) it is estimated that ten million new jobs will have been created in Europe by the year 2000 by the victorious march of multimedia, two million of them in Germany alone.
- The engineering journal "VDI-Nachrichten" foresees for Germany a million new jobs in the digital media communications area (VDI-Nachrichten, 24 March 1995).
- In a study published by the German Trade Unions Federation ("Multimedia: Living and Working in the Media Society", Hannover 1995) an investigation undertaken by the Arthur D. Little market research organisation is quoted as saying that five million new jobs will be created by multimedia in Europe by the year 2000. The changeover to tele-work shall account for a further five million workplaces.
- In 1994 the business consultancy Roland Berger (Munich) forecasted a rise in turnover and also a three-fold increase in multimedia workplaces in Europe by the year 2000. The function of Electronic Services as an instrument of rationalisation and decreasing average costs for multimedia productions accompanied by rising turnovers have thus entirely been neglected. In 1996 Berger admittedly reduced the

estimate to a maximum of 100,000 to 200,000 jobs throughout Europe ("Frankfurter Rundschau", 25 January 1996).

- In a model calculation up to the year 2010 the German Institute for Economic Research comes to the conclusion that the demand for media and communication services will increase. But only 200,000 extra jobs could be created by the year 2010 (Deutsches Institut für Wirtschaftsforschung, Weekly Report, 10/1996, Pages 165-173).

II. Other Prospective Initiatives in Spain

In addition to the described actions previously existing in Spain, on a national level, there are also other initiatives of minor importance including activities in the field of technological foresight. Most of these actions are closer to the technological watching approach than the technological foresight approach. These actions usually are focussed on the analysis of the technological trends in a certain sector.

Table 6 shows some of these initiatives. It is necessary to emphasise that this table is not meant to be exhaustive, but rather to give a sample of the type of initiatives we are talking about.

Table 6: Other Actions in the Field of Prospective Initiatives (National Level)

ACTION	SCOPE OF THE ACTION	ACTIVITY
OTSEEMA:Technological observatory in the field of electrical energy and environment . Dependent upon the OTRI of Universidad de Comillas. Co-financed in the frame of ATYCA initiative of MINER.	National	To carry out studies of foresight and technological watching. Analysis of the legal frame of technological requirements.
Technological Watch Service of the Association of Toys companies (AIJU).	National	Technological watching in the toys sector.
Delphi survey on scientific-technological trends in Spain. Carried out by UNED University (Prof. Tezanos).	National	Delphi survey carried out in the fields of: Information and Telecommunications technologies (24 surveys), Robotic (26 surveys) y Biogenetic (26 surveys). Study carried out in two rounds. The experts consulted come from the Industry and research centres. Temporal Horizon: ten years. Finished in 1998.
Technological and market watching systems of big Spanish companies: Iberdrola (energetic sector), CAF (railway sector)....	National	Collection and filtration of information on technological and market topics.
Technological watch Service of ITENE	National	Technological and commercial watching in the packaging sector.

In table 7 some of these initiatives are presented. It must be emphasised that this table is not meant to be exhaustive, but rather to give a sample of the type of initiatives we are talking about.

Table 7: Other Actions in the Field of Prospective (Regional Level)

ACTION	SCOPE OF THE ACTION	ACTIVITY
Red Únete: Network constituted by: Technologic park of Andalusia, S.A. BIC Euronova S.A. and the OTRI of the Malaga University . Network co-financed in the frame of ATYCA initiative of MINER	Regional: Andalusia	Network of dissemination, foresight and technological transfer of the Andalusia Technological Park.
Foresight study carried out by ASCAM for INCANOP.	Regional: Catalonia	Prospective study on the manpower qualification in the Catalonian sector of moulds. Year 1998
Several prospective studies of PROSPEKTIKER	Regional: Basque Country	Delphi survey on the production techniques. Evolution of the automotive sector. Future trends of the telecommunications sector.

PART FOUR: OUTLOOK ON PROSPECTIVE INITIATIVES

I. Outlook on Prospective Initiatives in Germany

Studies and initiatives with a foresight intention that have been produced on behalf of the Federal Ministry for Science, Research and Education (BMBF) in collaboration with scientific consultants on various levels are:

Identification and Evaluation of Emerging Technologies[11]	1992
Technologies of the 21st Century	1993
First German Delphi Report	1993
Critical Technologies for the Information Age	1995
German/Japanese Mini-Delphi Report	1996
Second full German Delphi Report	1998
Delphi Report on the Knowledge Society in Germany	1998
Updated report on Innovation in German Industry	1998
The Report on Germany"s Technological Capabilities[12]	
Annually since 1995, most recent	1999
The Forward Thinking Congress[13]	1999
The FUTUR Process, inauguration of the Web Site	1999

While the Report on Critical Technologies for the Information Age attempts to collect relevant information from Delphi reports and other surveys conducted in Germany and elsewhere, the annual report on Germany"s Technological Capabilities seeks to benchmark Germany"s position as compared to leading technological competitors[14]. The 1998 report concludes that Germany now leads in the first category and has also gained ground in the second, now occupying the third place behind Japan and the US. In fact, it is extremely difficult to make a well-founded assessment of the impact of technological changes on employment at the macroeconomic level. This difficulty

[11] Technology Forecasting Series (VDI-Technology Center)

[12] Zur Technologischen Leistungsfähigkeit Deutschlands

[13] Congress Centrum Hamburg, 14 and 15 June 1999, "Forward Thinking: Keys to the Future in Education and Research"

[14] It is submitted each year to the Federal Economics Minister by a team of five Economic Institutes and places particular emphasis on the application of technology within industry. The reports draw a distinction between higher added value industrial sectors (where R&D accounts for 3.5%-8.5% of turnover), and true high-tech sectors *(Spitzentechnologien)* where the percentage exceeds 8.5%.

increases further into the future the time horizon extends. Growth and employment are most likely to be maintained where technological opportunities are recognised and exploited in economically rational fashion; this means that an economy must face up to structural change. In spite of meaning a first step towards public awareness, the Delphi-studies do not comply with the major requirement of current interest: the necessary implementation of the results into political and economic planning does not become evident. Technological developments are extrapolated in isolation without taking into account the way in which the market as a whole adapts to these innovations. Under the ceteris paribus condition, new technologies always mean that the same output can be produced with a reduced input of resources. A key to success in foresight appears to be the involvement and commitment of companies. They could benefit from a better understanding of foresight techniques, enhanced communication with other groups, a better knowledge of specific technology forecasts and an improved understanding of the capacity of research to meet their future needs. Yet there may be concerns to protect their commercially sensitive technological developments.

With the changeover into the next millennium, new prospects are emerging for Europe. Some countries have already successfully established national Foresight exercises. In Germany a national dialogue about the future has just been initiated. During its presidency of the European Council, Germany has brought the subject of forward thinking into the public. The German Minister for R&D, Mrs. Bulmahn talked of a "dialogue on the Future". The Forward Thinking Congress[15] (organised by the BMBF and VDI-Future Technologies) as well as the German FUTUR process (cf. chapter I.1.3) is concerned with discussing those trends and forces propelling future scientific and technical developments which are now becoming apparent. Both initiatives represent also the German search for a model of how the future ought to develop in a common Europe. The aim of the conference on "Forward Thinking" was to identify possibilities in education and research which can be realised jointly in future in order to boost European competitiveness and create new networks of science, industry and policy in Europe. The BMBF would therefore like to stimulate Europe-wide Foresight activity. In addition, the conference attempted to explore the interaction between

[15] Congress Centrum Hamburg, 14 and 15 June 1999, "Forward Thinking: Keys to the Future in Education and Research"

pervasive technological trends, on the one hand, and social and economic spheres, on the other hand, in a dialogue with policy-makers and a broad range of stakeholder representatives. It shall provide motivation for long-term European co-operation (e.g. the creation of new networks) in order to make the "forward thinking process" successful.

World-wide the need for knowledge on future developments and trends is growing. The constantly rising number of forecasts, studies and future scenarios supports this observation. Especially, in the technical-industrial area as well as within the adjacent socio-economic area the requirement increases for technology and trend analyses, Delphi studies, scenarios, innovation studies, market forecasts, monitoring reports, technology assessments, etc.. However, this accessible knowledge is not broad enough to ensure frictionless strategic national policy- and decision-making processes, which requires a stronger public participation and acceptance. Decisions "for or against" technologies require a broad society-base and the awareness of this requirement is increasing on an international level.

II. Outlook on Prospective Initiatives in Spain

What has first to be taken into consideration is that, in Spain, no major Programmes for prospective Technologies have been carried out on a national level, similar to those of other European Countries (France, Germany, and United Kingdom). However, there are currently two important initiatives under way: The *Industrial Observatory of Technological Foresight (OPTI)* and *Identification of Technological Needs in Spanish Companies"(INIDES).*

The above mentioned initiatives make use of different methodologies in order to detect the technological future needs in several sectors. The time frame of INIDES and OPTI actions is different, however the sectors analysed are similar in both initiatives (see *Table 8:comparison between INIIDES and OPTI initiatives*). For this reason it will be interesting to compare the results obtained by *INIDES* and *OPTI* initiatives when they are finished. It is important to highlight the lack of formal connection between both initiatives.

The OPTI initiative is funded by the ATYCA Programme dependent of the MINER. This Programme will be finished in 1999, which is the reason for some feelings of uncertainty as to the future funding of the OPTI Initiative.

The OCYT (the client of the project) is currently involved in the definition of the new Spanish Plan for Research and Development. This plan will start in the year 2000 and will replace the current Plan. These Spanish R+D Plans are a major source of R+D funding for the Spanish research centres and universities. The analysis of the possible implementation of the results reached in the INIDES initiative in the decision making process must be made upon approval of the new plan.

There are numerous initiatives, on a national level, in the field of technology watch. These initiatives are piloted by technological centres and are focussing on the analysis of trends in industrial sectors. There is no formal feedback between the results of the studies and the actors making decisions in the field of technology.

Table 8: Comparison between INIDES and OPTI initiatives

CHARACTERISTICS OF THE STUDY	INIDES *Identification of Technological Needs in Spanish Companies*	OPTI *Industrial Observatory of Technological Foresight*
Initiative of the study	OCYT (Spanish office of Science and Technology)	MINER (Spanish Ministry of Energy and Industry)
Organisations charged to carry out the study	COTEC (Entrepreneurial Foundation)	Technologic Institutes +EOI
Actors involved in the study	Spanish Companies	Experts from: Research Institutes +Universities +Spanish Companies
Methodology	Surveys to identify key technologies	Two rounds Delphy Survey
Time frame of the study	2-3 Years	10 Years
Target sectors	Energy, Information and communication services, Transport, Chemical sector, Agrofood, Agriculture, Manufacturer sector, Automotive, Electronic, Machinery and capital goods, Materials.	Energy, Information and telecommunication sector, Transport , Agrofood, Chemical sector, Basic and manufacturer sector, Traditional sectors, Environmental sector
Results	First Results at the middle of the year 1999	First Results in may of 1999

Practically all the RITTS, RIS or PTR projects, which were conducted or are under way in the different Spanish regions, contemplate activities that can partially be included in the field of technological prospective initiatives. Most of these activities have a short-term time frame. The objective of these activities is in most of the cases to define the technological trends affecting these sectors considered to be prior ranking in each region. The progress each study is variable, depending on the state of progress of the corresponding RIS, RITTS or PTR project in each region.

There are important activities in the field of technology and market watching in the Valencian Autonomous Community. This activity is co-funded by the IMPIVA agency (dependent of the Valencian Government) . The technology watch activity is piloted by Technological Institutes. These Institutes develop an important technology watch, focussing their efforts on the analysis of the technological trends in selected sectors.

There is no formal feedback between the results reached by the technological institutes and the IMPIVA. The relationship between the IMPIVA and the Institutes is focussed on the evaluation of proposals and on administrative topics. The IMPIVA does not carry out a follow-up of the results and conclusions obtained in the frame of the Technology Watching services.

The Basque Autonomous Community is carrying into effect an important plan, namely the Science and Technology Plan 1997-2000. During the definition phase of the Plan technological forecast activities were performed. Under this Plan the technological forecast activities are connected to the technological policies applied by the Plan.

The Plan seeks to make the Basque Autonomous Community more competitive as a whole by integrating science & technology with business through specific support of industrial policy and the optimisation of the resources. Business needs are articulated in this Plan by drawing up of Cluster Technology Plans, which determine the strategic objectives of each cluster in the field of technology.

PART FIVE: OBSERVATIONS AND CONCLUSIONS

The first and foremost observation from this underlying investigation is that the number of comparable prospective initiatives is limited for countries, Germany and Spain. The national prospective initiatives (such as the Delphi studies in Germany or OPTI and INDES in Spain) differ in their focus and their methodologies.

Very often the technological foresight studies are focussed on the identification of the technological trends from the point of view of the sector application. However the methodologies used to achieve this objective are different depending on the initiative considered. The actors involved in the regional technological prospective initiatives come rather from the entrepreneurial sector than from the research sector. It seems that industry or specific interest groups themselves undertake the regular technology watch and other prospective activities very often. Maybe this is the reason for the low diffusion rate of the results. Very often the accessibility of information on the initiative itself is difficult. As for the regional efforts results are considered to be proprietary and devoted to the improvement of the stakeholders" innovation capacity.

Hence, the exploitation of the results obtained by these initiatives for the decision-making process of technological policies is rather insignificant.

It has been recognised that "objective" measures serving the quality of prospective studies are not developed for many important reasons. There are significant differences in the definition of `prospective-, foresight- and forecasting initiatives" on a national and regional level, in their aims, their time frame, and their methodologies. This problem persists on regional level, where initiatives mirror innovation policies (of a specific Ministry) rather than prospective analyses. Mostly they are either organised around a very specific sector (such as the German NRW State Initiative on Future Energies) or are devoted to support business and innovation. Hence, as such, the regional initiatives are rather economic recommendations than prospective initiatives.

What becomes evident from the underlying survey: Foresight and forward thinking cannot be amenable to bureaucratic direction. Politicians are responsible for providing the structures in which visions can develop without central steering or control, where new challenges can be recognised and the necessary changes initiated. Politicians can

promote prospective initiatives only indirectly by creating incentives, developing strategies, and concluding performance agreements. The real forward thinking initiatives however, apply particularly to academic interdisciplinary teams and networks since the applications arise when scientists from different disciplines team up.

A clear vision of what everyday life will look like in about 20 years would require harmonised methods. Harmonising the methodologies of prospective studies within the EU has clear attractions, but faces many practical difficulties including differences in available resources and political requirements and priorities. Many of the harmonisation problems associated with prospective surveys apply to both levels: national and regional. The variety of concepts, and the differences between them, raises the question regarding to what extent harmonisation is desirable and possible. It is important to appreciate that prospective initiatives, however they may be defined, are partly based on scientific criteria and partly on current patterns and technology events as well as other (cultural) characteristics.

Given these substantial differences, the goal of an EU-wide harmonised "prospective approach" needs to be tackled in a sensitive manner. This is a context in which subsidiarity is an important consideration. Common policy could concern the development of a common framework and terminology, the mechanisms of validation and control of foresight claims by national authorities, and an exchange of experience from public campaigns for improved public perception.

Forward thinking is not necessarily solution oriented but question oriented in the sense of stopping to reflect for a while about key issues. Technology foresight / technology policy is not something that can be seen in isolation. Indeed it makes more sense to recognise technology policy as a part of innovation policy (as well as being an important dimension of other policies – industry, education, environment, energy, etc.), which has relevance in different forms at different levels – different territorial levels, and different organisational levels. Technological competence and knowledge, which is the currency of forward thinking, does not leak away at zero cost from one region to another in a global world.

What remains is working from the ideal of what the future should be, and developing the necessary steps to get there. The first step could be the collection of existing knowledge on a subject and a corresponding publicly available presentation of this composition. The second: a discussion between relevant organisations and institutions resulting in a final statement of each of them, including public availability of the ensuing results. The third step could consist in an accompanying public discussion via media like TV, Internet etc., monitoring the whole process.

Co-ordination of policy in this area might be accomplished by entrusting expert committees with the task of defining common criteria rather than setting identical values. Regional and common values may be sought that are valuable for clustering (as for example the Scandinavian and the Mediterranean countries and for Central Europe).

Harmonisation and resource sharing could be further developed on a broader EU level, with a first practical EU initiative involving:

- A review of the current utilisation and perceived value of existing national and regional prospective initiatives with the aim of identifying strengths, weaknesses and opportunities in relation to the national and European contexts.

- A review of the public requirements for those initiatives and related activities hinting at an increased public and professional awareness and accession to `future´ issues by using the mass media.

- A review of potential benefits and resource savings, of EU collaboration and harmonisation of prospective initiatives, methods and data sharing.

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- AIJU: Association of Spanish toys companies. Technological watch service, http://www.aiju.es
- AIMME: Institute of metal working technology. Technological watch service, http://www.aimme.es
- AIMPLAS: Institute of polymers technology. Technological watch service, http://www.aimplas.es
- AINIA: Institute of agrofood technology. Technological watch service, http://www.ainia.es
- ANEP: Spanish Agency of Evaluation and Foresight, http://senix.seni.mec.es/Inves_Cientifica_Tec/anep.html
- Berlin Senat Administration for Urban Development, Environment & Technology and IZT
- BERLIN-STUDY, http:// www.berlin.de/deutsch/politik/senwfk
- BMBF: German Ministry for Education and Research, http://www.bmbf.de

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- Future Council Hamburg, http://www.hwk-hamburg.de/agenda21/
- http://www.izt.de/forschung-grund1.html-ssi
- IMPIVA, http://www.impiva.es
- INCANOP: Prospective study on the manpower qualification in the Catalonian sector of moulds, http://www.xtec.es/incanop
- Internet-Platform for Questions on the Future, http://www.zukunft.de
- IPTS: http://www.jrc.es
- ITENE: Technological and commercial watching service, http://www.itene.com
- IZT Institute for Futures Studies and Technology Assessment, http://www.izt.de/
- NETWORK Future, http://www.icf.de/nwz/zukunft.htm
- OTSEEMA: Technological observatory in the field of electrical energy and environment, http://www.otri.upco.es/otseema/principal.htm
- PROSPEKTIKER, http://www.eirelink.com/prospektiker
- RED UNETE: Network of dissemination, foresight and technological transfer of the Andalusia Technological Park, http://www.bic.es
- VDI, Technology Centre, Future Technologies Division, http://www.zukuenftigetechnologien.de
- FZ, Sekretariat für Zukunftsforschung , http://www.sfz.de/,
- Z_punkt büro für zukunftsgestaltung GmbH, http://www.zett.de

ACRONYMS:

AIDIMA: Technological Institute of Furniture and allied trades

AIMME: Research Association of the Metal-Mechanical sector

AIMPLAS: Research Association of Plastic Materials

AINIA: Technological Institute of Agrofood

ANEP: Spanish Office of Evaluation and Foresight

ASCAMM: Technological Centre of moulds and allied trades

BAC: Basque Autonomous Community

BMBF: German Ministry for Education and Research

CIEMAT: Research Centre of Energy and Environment

CITMA: Centre of Technological Innovation in Environment

COTEC: Foundation for the Technological Innovation

CREST: Science and Technology Research Committee

EOI: School of Industrial Management

ICT: Catalonian Institute of Technology

iDeTra: Innovacion, Desarrollo y Transferencia de Technologia

IMPIVA: Institute for the Small and Medium Enterprises of the Valencian Region

INASMET: Technological Centre of Materials

INESCOP: Spanish Institute of footwear and allied trades

INIDES: Identification of Technological Needs in Spanish Companies

IPTS: Institute for Prospective Technology Studies

IQS: Chemical Institute of Sarria

ITENE: Technological Institute of packaging

IZT Institute for Futures Studies and Technology Assessment

MEC: Spanish Ministry of Science and Education

MINER: Spanish Ministry of Industry and Energy

NRW: North Rhine Westphalia

OCYT: Spanish Agency of Science and Technology

OPTI: Industrial Observatory of Technological Foresight

OTRI: Office of Research Transfer Results

OTSEEMA: Technological Observatory of Energy and Environment

R&D: Research and Development

RITTS: Regional Innovation and Technology Transfer Structures and Strategies

RIS: Regional Innovation Strategy

S&T: Science and Technology

SFZ: Bureau for Future Research , http://www.sfz.de/,

SME: Small and Medium Enterprises

STP: Science and Technology Plan

SXM (SPM): Scanning Probe Methods

VDI: Association of German Engineers

XMR: Magneto Resistant Technologies

Annex 1a: Inventory of prospective initiatives and activities in the German `Länder´

Region	studies/initiative	year	producer/Address	expected results
Berlin	Berlin-Study	1998-1999	EU Commission and Regional EU Commission Tel 0 30 - 24 01 22 43 and 0 30 - 24 01 25 61 E-Mail: Andreas.Wehr@skzl.verwalt-berlin.de www.berlin.de/deutsch/politik/senwfk	workshops, May 1999
Berlin	Futures-aware Berlin (Consultancy and Future Concept)		Berlin Senat Administration for Urban Development, Environment & Technology and IZT http://www.izt.de/forschung-grund1.html-ssi	
Berlin	Institute for Future Studies and Technology Evaluation (IZT)	1981-running	Institute for Futures Studies and Technology Assessment IZT Berlin gGMBH, ttp://www.izt.de/ Schopenhauerstr. 26, D-1429 Berlin Tel. (030) 803088 -0 , Fax: (030) 803088-88 e-mail: 100726.2351@compuserve.com	
Berlin	Network Future		Erkelenzdamm 47, 10999 Berlin http://www.icf.de/nwz/zukunft.htm	Network `knots´are present in many German towns and regions
Baden-Wuerttemberg	The Future Committee Economy 2000	running	set up by the Minister President http://www.baden-wuerttemberg.de/biwifo/e_42.neuetechnologien.html	To safeguard competitiveness in international markets and at the same time to maintain the leading edge in new technologies and up-coming fields of industry
Baden-Wuerttemberg	Research Baden Wuerttemberg 2000		State research council www.baden-wuerttemberg.de	1997 Recommendations to R&D
Baden-Wuerttemberg	Future Commission	1990-running	`Future Commission´ www.faktenbericht.bmbf.de, www.bw-innovativ.de, www.afta-bw.de/themen	1993 Technology & 1994 Innovation Council
Baden-Wuerttemberg	"Innovations for business, jobs and labor" Regional Innovation Systems		Akademie für Technikfolgenabschätzung in Baden-Württemberg www.afta-bw.de/themen	
Baden-Wuerttemberg	Offensive Future Young Generation		Enquetekommission JugendArbeitZukunft 1997 www.bw-igm.de/enquete	results expected for 1999

			www.bwplus.fzk.de	
Baden-Wuerttemberg	Local Agenda 21: Zukunftsfähiges Karlsruhe		http://members.aol.com/mihub/th_idx.htm	Karlsruhe hat das Thesenpapier "Karlsruhe braucht Taten für die Zukunft", 1998
Bavaria	Offensive Zukunft Bayern, (The Future Offensive)	1994-running	WTB, Wissenschaftl.-Techn. Beirat d. Staatsregierung http://www.bayern.de/BayernInfo/wirtschaftE.html#kap2 http://www.bayern.de/Zukunft/	
Bavaria	Bavaria Innovativ	1995-running	www.bayern-innovativ.de	
Bavaria	Bavaria Online		http://www.bayern.de/Zukunft/bayernnetz-fragen.html	
Brandenburg	Innovation market Brandenburg	1996-running	TINA Brandenburg GmbH www.tina-brandenburg.de	
Hesse	Future oriented business policy for Hesse		Hessisches Ministerium für Wirtschaft, Verkehr und Landes-entwicklung, Kaiser-Friedrich-Ring 75, 65185 Wiesbaden Tel: 0611/815-2026, Tel: 0611/815-2227, e-mail: hmwvl@wirtschaft.hessen.de, http://www.hessen.de/wirtschaft	
Lower-Saxony	Strategy 2005		Wirtschaftsministerium http://www.niedersachsen.de/MW4.htm	Wirschaftspolitische Konzeption
Mecklenburg-Western Pommerania			http://www.mv-regierung.de/wm/index.html	
Northrhine-Westphalia	Future Orientation of Economic Structures and Innovation NRW		Forschungsministerium http://www.mswwf.nrw.de	
Northrhine-Westphalia	Innovation Program Research		Forschungsministerium http://www.mswwf.nrw.de/navi/naviwf.html www.wswwf.nrw.de/miak/FL-NRW/lfp1.phps	
Northrhine-Westphalia	Sekretariat for Futures Research (SFZ)	1990-running	Sekretariat für Zukunftsforschung , http://www.sfz.de/, Munscheidstr. 14, 45886 Gelsenkirchen, Tel. 0209/167-2800, Fax: 0209/167-2801, kleinschmidt@sfz.wipage.de	
Northrhine-Westphalia	Z_punkt büro für zukunftsgestaltung GmbH	1997-running	www.zett.de	
Northrhine-Westphalia	Internet-Platform for Questions on the Future		www.zukunft.de	

Northrhine-Westphalia	State Initiative Future Energies (Zukunftsenergien NRW)		Ministerium für Wirtschaft und Mittelstand, Technologie und Verkehr des Landes NRW Haroldstr. 4, 40213 Düsseldorf Tel.: (02 11) 8 66 42 - 0 Fax: (02 11) 8 66 42 - 22 e-mail: baumann@energieland.nrw.de	results: http://www.energieland.nrw.de/leit.htm
Rhineland-Palatinate			http://www.rheinland-pfalz.de/ Wirstschaftsministerium http://www.new-work.de/main.htm	
Saarland	Innovative Saarland		2nd R&D Commission http://www.saarland.de/links/text2b.htm http://www.saarland.de/links/zip.html www.saarland.de	Innovationsforum Saar" Regionales Netzwerk von Wirtschaft und Wissenschaft regional network of economy and science
Saxony	Business Development Centre Innovationsprogram Solaris 2000		(SMWA) Sächsisches Staatsministerium für Wirtschaft und Arbeit, Wilhelm-Buck-Straße 2, 01097 Dresden Postanschrift: Postfach 100329, 01073 Dresden Telefon: (03 51) 5 64-0, Telefax: (03 51) 5 64-8069	
Saxony	Commission for Future Related Questions		Kommission für Zukunftsfragen der Freisstaaten Bayern und Sachsen, http://www.sachsen.de/deutsch/publikationen/download.htm	Studies Part I: Entwicklung von Erwerbs-tätigkeit und Arbeitslosigkeit in Deutschland und anderen frühindustrialisierten Ländern
Saxony-Anhalt	RAHM-RIS	1998-2000	Technologietransfer Und Innovationfoerderung GmbH Bruno-Wille-Str, 39108 Magdeburg, Germany Tel: +49-391-671 85 33 Fax: +49-391-671 12 13	www.sachsen-anhalt.de
Schleswig-Holstein	Future Scenarios "Schleswig-Holstein in the year 2010"		Staatskanzlei des Landes Schleswig-Holstein, http://www.izt.de/forschung-grund1.html-ssi)	Technologiestiftung since 1991, Die Rolle SchlHolst´s im Europa der Zukunft
Schleswig-Holstein	Future Technologies as Precondition for Economic and Societal Changes	1998	Technologiestiftung Schleswig Holstein, 24103 Kiel Tel: (0431) 51937-10	February 1998 printed study results
The City Of Bremen			www.bremen.de www.bildung.bremen.de	
The City Of Hamburg	Zukunftsrat Hamburg ("Future Council Hamburg")	1996-running	Zukunftsrat Hamburg, Osterstr. 58, 20259 Hamburg Telefon: 040/4907/1390 , Fax: 040/4907/1399	

			E-Mail: Zukunftsrat-Hamburg@t-online.de http://www.hwk-hamburg.de/agenda21/	
The City Of Hamburg	Innovationsstiftung Hamburg ("Innovation Foundation Hamburg")	1996	www.hamburg.de www.faktenbericht.bmbf.de	
Thuringia	STIFTFoundation for Technology and Innovation		www.thueringen.de http://www.th-online.de/technologie/f%5Fgrundsaetze.htm	

Annex 1b: Inventory of prospective initiatives and activities in Spain

Region	Studies/initiative	Year	Producer/Address
National	Industrial Observatory of Technological foresight (OPTI initiative). Energy sector	1998-running	CIEMAT Avda. Complutense, 22. Madrid 28040 Tel +34 91 346 63 11 http://www.ciemat.es
National	OPTI initiative. Information and telecommunication technologies	1998-running	ICT C/ Ciutat de Granada, 131. Barcelona 08018 Tel +34 93 485 85 85
National	OPTI initiative. Transport sector	1998-running	INASMET C° de Portuetxe, 12. San Sebastian 20009 Tel +34 943 316 622 http://www.inasmet.es
National	OPTI initiative. Basic and manufacturer sectors	1998-running	ASCAMM Avda.Universitat Autonoma, 23. Cerdanyola del Valles (Barcelona) 08290 Tel +34 93 594 47 00 http://www.ascamm.es
National	OPTI initiative. Traditional sectors	1998-running	INESCOP Polig. Ind. Campo alto. Elda (Alicante) 03600 Tel +34 96 539 52 13 http://www.inescop.es
National	OPTI initiative.Chemical sector	1998-running	IQS E-mail: trausell@iqs.url.es

Region	Studies/initiative	Year	Producer/Address
National	OPTI initiative. Industrial environment sector	1998-running	CITMA
National	OPTI initiative. Agrofood sector	1998-running	AINIA València parc tecnòlogic, S/N,. Paterna (Valencia) 46980 Tel +34 96 131 80 34
National	Identification of technological needs in Spanish Companies (INIDES Initiative).	1999	COTEC C/ Marqúes de Urquijo, 26.Madrid 28008 Tel +34 91 542 01 86 http://www.cotec.es

Annex 2: Regional Innovation Strategy (RIS) and Regional Innovation and Technology Transfer Strategies and Infrastructures (RITTS)

RITTS - Regional Innovation and Technology Transfer Strategies and Infrastructures	RIS - Regional Innovation Strategies
Projects may be financed throughout the EU and the European Economic Area	Confined to regions where a significant share of the population is an ERDF-assisted area
A project may involve only part of a region (no formal administrative structure)	A RIS must cover a NUTS level II classified region
The project beneficiary is not necessarily a regional authority (e.g. an innovation agency, university, etc.)	The project beneficiary must be the authority responsible for the economic development of the region
Projects designed to evaluate, develop and optimise regional infrastructure and policies and strategies for supporting innovation and technology transfer	Projects designed to create partnerships among key actors in a region with a view to defining an innovation strategy for the region in the context of regional development policy
Use of a team of approved consultants to carry out the majority of the work and including at least one consultant from another EU Member State (for at least 1/3 of the work)	Use of a process consultant selected by the region to aid particularly in the management of consensus building; use of a consultant from another EU Member State for the analysis of the regional innovation support infrastructure recommended
Projects are self-standing and are carried out for their intrinsic benefits to the region	Projects should seek to improve the effectiveness with which EU Structural Funds are used for promoting innovation schemes
EU part-financing through the Innovation Programme up to a maximum of 250 000 ECU for assisted regions and 175 000 ECU for other regions	EU part-financing through Article 10 of the ERDF up to a maximum of 250 000 ECU

Although the administrative and financial responsibility for the RITTS project is incumbent on Directorate-General XIII (Telecommunications, Information Market and Exploitation of Research) and that of the RIS projects befalls Directorate-General XVI (Regional Policy and Cohesion), the projects are jointly managed by the two Directorates-General (with the support of their respective Technical Assistance Units). The most recent RIS exercises in Spain and Germany have been:

Country	Region	Beneficiary organisation
Germany (1994-96)	Halle-Liepzig-Dessau	Governments of Saxony and Saxony Anhalt
Spain (1994-96)	Castilla y Léon	Junta de Castilla y Léon
Germany (1997-99)	Weser-Ems, RIS WESER-EMS	Landkreis Emsland
Spain (1997-99)	Aragon, RIS Aragon	Diputacion General de Aragon
	Castilla La Mancha, PRICAMAN	Junta de Comunidades de Castilla La Mancha
	Extremadura, RIS Extremadura	Junta de Extremadura
	Galicia, ESTREIA	Junta de Galicia
	Pais Vasco, BSTP-2000	Gobierno Vasco

Excursion: Some Theoretical Considerations on Foresight

It becomes evident from - at least - the underlying study, that increasing differentiation of planning and decision-making processes seems to reflect the general differentiation of societal subsystems in developed countries[16] and give indication of new mechanisms for mediation between the splitting up of economic, political and scientific subsystems of society.

Parallel to this, a shift in all areas of political and economic discussion on future prospective initiatives is evident in the last decade. Prospective analyses shifted from a potential option usable for the preparation of decision-making to a necessity, a prerequisite, which has to be taken into account seriously; from a political point of view it appears to be more and more required (political correctness). The demand for transparency and legitimisation in decision-making requires instruments and processes satisfying that demand.

From a philosophical point of view, reflection on the future could be understood as prevention, in order to avoid unpleasant developments. Discussions about precautionary measures including the pretension of *shaping* technological development are quite close to the term technology assessment. Jonas" term of the "comparing futurology"[17] is close to the position of Flechtheim, one of the well-known early futurologists[18]. Flechtheim comes to the conclusion that the traditional cultural sphere can be distinguished from the newly established industrial one, especially in view of the temporary nature of newly obtained knowledge. This turning away from orientation towards traditional behaviour implies the tremendous dynamics of technical and societal developments of industrialised societies. Due to permanent redefinition of its foundations, demands in provision are shifting from historical to prospective analysis. From that situation, Flechtheim derives the necessity of futurology as an independent disciplinary approach: "futurology is future research, shaping and vision, it combines prospective approach, planning and philosophy of the future..."[19].

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16 "Soziale Systeme" Luhmann, N; Frankfurt a.M. (1984)

17 "Das Prinzip Verantwortung. Versuch einer Ethik über die technische Zivilisation" Jonas, H;. Frankfurt a.M. (1984)"

18 The item futurology as systematic und critical treatment on questions on future was coined by Ossip K. Flechtheim in 1942 in the USA (Pforte und Schwenke 1973, S.12).

In the German historical context, broader public reflection was first achieved by discussions on technology assessment in the 1970s. Other instruments like foresight-activities reached this degree of public awareness much later with the Delphi-studies in the 1990s[20]. This development is not finished for the time being. In spite of constituting a first step towards public awareness, the Delphi-studies do not comply with two major requirements of current interest. At first, the necessary implementation of the results into political and economical planning does not become evident. One reason for that is the inadequate involvement of public institutions, organisations and the public in general during the Delphi-process. This brings up the second deficit: As can be seen in Great Britain Foresight does not solely mean a product of expert panels. Currently demand for participation in reflection on future is increasing. Some hopes are being connected with a foresight-process including a heavier public involvement. Stronger participation is expected to achieve an easier implementation of foresight results because learning to become familiar with new ideas during the process increases farsightedness and acceptance of necessary steps to be taken along with predicted future developments.

A widespread reflection on future, technology and society is regarded as giving reason for an increased openness to the growing speed of new socio-economic developments and a greater acceptance of new technological developments.

[19] "Futurology, der Kampf um die Zukunft" Flechtheim, O.K.; Frankfurt a.M. (1972)

[20] "Delphi'98 Umfrage, Studie zur globalen Entwicklung von Wissenschaft und Technik", FhG-ISI; Karlsruhe (1998)

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