WP 1 – REVIEW AND ANALYSIS OF NATIONAL FORESIGHT

D1.1CR – CASE STUDY

CZECH REPUBLIC - TECHNOLOGY FORESIGHT 2002

STATUS: PUBLIC

PARTNER RESPONSIBLE:
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WHAT IS FISTERA?

FISTERA is a Thematic Network on Foresight on Information Society Technologies in the European Research Area.

The **FISTERA** network is supported by the European Community under the FP5 specific program for research, technological development and demonstration on a user-friendly information society (1998-2002).

The aim of the FISTERA Thematic Network is bring together on a systematic and extended basis, actors and insights in national foresight exercises on IST in the Enlarged Europe.

Main objectives:
- ◆ Compare results of national foresight exercises and exchange visions on the future of IST
- ◆ Provide a new forum for interactive consensus building on future visions for IST
- ◆ Contribute to the European Research Area through benchmarking and community building, by providing a dynamic pan European platform on foresight on IST

In order to meet these three key objectives, FISTERA will:
- ◆ Review and analyse the national foresight exercise outcomes (a country synthesis report)
- ◆ Build aggregate pan European Technology trajectories (a roadmap of potential developments of key emerging technologies)
- ◆ Map the European IST actor space (an analysis of the EU IST actor space)
- ◆ Provide an IST Futures Forum (strategically selected scenario exercises that will look at wider aspects of applications of IST)
- ◆ Disseminate the results to a targeted audience by various means (a dynamic website at the address http://fistera.jrc.es, an e-mail alert service, publications, conference presentations, a "road-show" of workshops and a final conference)

Network Membership:
Core partners (coordinators, work package leaders):
- JRC-IPTS (Institute for Prospective Technological Studies), part of the European Commission's Joint Research Centre, Scientific Coordinator of the network.
- FZK - ITAS (Forschungszentrum Karlsruhe GmbH in der Helmholtz-Gemeinschaft, Institut für Technikfolgenabschätzung und Systemanalyse), Germany.
- TILAB (Telecom Italia Lab – Scenarios of the Future), Italy.
- ARC/sr (ARC Seibersdorf research GmbH, Division Systems Research Technology-Economy-Environment, Seibersdorf), Austria.
- PREST (Policy Research in Engineering, Science and Technology) of the University of Manchester, United Kingdom.
- GCI (GOPA - Cartermill International), Belgium, Administrative and Financial Co-ordinator.

The group of **Members**, which is expected to grow over the duration of the contract, currently includes the following organisations: TNO-STB (The Netherlands), Danish Teknologisk Institut (Denmark), TecnoCampusMataró (Spain), Observatório de Prospectiva da Engenharia e da Tecnologia-OPET (Portugal), ARC Fund (Bulgaria), IQSOFT (Hungary), Tubitak (Turkey), The Researchers' Association of Slovenia (Slovenia), NMRC, University College Cork (Ireland) and BRIE-Berkeley University (USA). In addition, McCaughan Associates (McCA) runs a group of High-level Experts to the Network Management Committee.

FISTERA Web site: http://fistera.jrc.es/

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Summary

This was a one-year exercise lasting from 2001-2002 with the aim of drafting a natio. nal Research Programme (NRP). Work included the identification of key technologies and setting up a proposal for the administration of the Programme. There were 14 expert panels on thematic fields in addition to 3 on cross-cutting subjects. The panels drew on foreign expert advice and specially prepared reports. The final outcome is titled "Proposal of the National Research Programme". Foresight was selected as a suitable means towards achieving this aim. The project completed its work in a relatively short period of time. Participation was restricted to interviews of experts and production of expert reports and there were none of the usual methods, such as Delphi surveys or scenario techniques involved. There have been presentations to the public at various points of the exercise, which is currently at the stage of widespread dissemination

1   Background and Objectives

The Czech technology foresight project is the result of preparations of a National R&D policy (NRADP) run jointly by the Research and Development Council of the Czech Government and the Ministry of Education, Youth and Sport. This set up 9 working groups in 1999 and as a result of their work, technology foresight was identified as a means to develop a National Research Programme: "Annex III.2 to NRADP is the *"proposal of the Procedure for Determining the Partial Thematic Programs (Priorities) of the National Research Program (2001-2004)"*, which is the document stating that one of the modern and verified procedures suited to defining the particular priorities (of the *National Program of Oriented Research*) is "Technology Foresight", utilizing the Delphi method". (Aim 2000, p. 5).

The National Research and Development Policy was adopted by the government of the Czech Republic in January 2000. The Ministry of Education, Youth and Sports issued a public tender for the elaboration of a proposal for the National Research Programme (NRP), with a final deadline in September 2000.

The value of the contract has not been made public, but the amount is thought to be equivalent to the funding given foresight in other countries, such as the UK, adjusting for the size of the country (Aim 2000, p. 7). The resulting sum is approximately 255,000 GBP (€400,600, ibid.).

The aims of the foresight study were to specify the selection of priority research activities and to propose a process for programme implementation. The time horizon was 10 years. More specifically, the goals of foresight were to identify the research directions of greatest strategic importance for favourable economic development and for the fulfilment of the social needs of society, while making best possible use of limited public funds.

The contract for the project was awarded to the Technology Centre of the Czech Academy of Sciences in cooperation with the Engineering Academy of the Czech Republic. The project had a duration of twelve months with the final report published in March 2002. The Czech Foresight Study is the second such study, following the Hungarian Technology Foresight, to have been completed in a Central and Eastern European EU candidate country.

The proposal for an NRP necessitated the design of separate main programmes and cross-cutting programmes, their specification by devising sub-programmes consisting of systematic measures and the allocation of key research directions to each such sub-programme.

Equally important was the task of drawing up a proposal for the organisation of the National Research Programme, covering such matters as organisation, management and supervision, regulation of competition and principles for financial support, evaluation, international cooperation and information policy. The organisation of the NRP was the subject of a special panel, while the programme itself was developed by means of a multi-step foresight exercise

2   Organisation of the Foresight Exercise

The preparation phase for the Czech technology foresight project included an evaluation of information on similar projects in other countries. A number of foreign experts from France, Germany, Hungary, Portugal, the UK, the European Commission and the JRC-IPTS provided advice and guidance on matters of methodology and procedure.

The project itself consisted of six phases:

1. A preparatory phase in which the structure of the project was determined.
2. Collection of information and documents for work in the panels, e.g. by interviewing industrial users, compiling statistics and computing costs, studies by external experts (e.g. analyses of strengths, weaknesses, opportunities and threats - SWOT).
3. Work in the panels, consisting of the identification of important and key research directions, on cross-cutting issues, the proposal for NRP management and organisation, and preparation of final reports of the panels.
4. The working group on the structure and management of the NRP, implementation and management principles.
5. Production of a final synthesis report for the client.
6. Final conference, publication and dissemination.

A major part of the work for the project took place in the panels, which each consisted of 15 to 20 experts representing both the supply side of R&D (production of knowledge and innovations), and the demand side (utilisation of knowledge and innovation, usually industry, but also the State). The panels produced justified proposals for priorities in the individual thematic and cross-cutting programmes of the National Research Programme. The proposals were in the form of written reports. There were a total of 18 panels, 14 of them thematic, 3 cross-cutting and the remaining one concerned with the organisation and management of the NRP.

The focus of the panels is partly on groups of technologies, partly on industries and application areas, and partly on social functions.

The subjects of the cross-cutting panels were:

1. Human resources for research and development
2. Integrated research and development
3. Regional and international competition in research and development.

In addition, there was the previously mentioned panel on management and implementation of the National Research Programme. Each panel was managed by a chairperson supported by the panel's secretary. These were recruited according to the same principles as the panels themselves, i.e. a mixture of representatives of research organisations, associations (mainly industrial), and industry. The project was managed by a "management group", headed by a project coordinator from the Academy of Sciences, with a deputy from the Engineering Academy, and a staff of seven, five of whom came from the Academy of Sciences, and the other two from the Engineering Academy.

3   Method and Procedure

The panels started their work with a sector analysis, identifying the importance of each sector for the Czech economy and analysing existing R&D efforts. This phase also included an analysis of existing strategic documents and R&D programmes of the ministries.

Additional information was collected by interviewing managers responsible for R&D strategy in the individual sectors covered by the panel.

The panels held brainstorming sessions and structured discussions with a total of 5 meetings per panel. (cf. Klusacek 2001). Each panel also commissioned a series of expert studies. Preliminary results were produced about half-way through the project and the contents of the resulting interim report were presented to the public. Following a panel meeting, the interim report was revised, and following another round of panel meetings and expert comment, the final report was presented at a national conference.

Participation appears to have been restricted mainly to experts, either through involvement in the panels or the expert interviews.

The final report bears the title "Proposal of the National Research Programme – Technology Foresight in the Czech Republic 2002". It includes a proposal for an organisational structure of the national research programme, which reflects the priorities pinpointed by the experts participating in the panels. The programme is subdivided into five main thematic programmes:

1. Quality of life
2. Information society
3. Competitiveness and sustainable development
4. Energy for economy and society
5. Modern society and its changes.

Each of these thematic programmes is further subdivided into so-called sub-programmes, of which there are in all 19 containing a total of 90 key research directions. There are furthermore three cross-cutting programmes: Human resources for R&D, integrated R&D, and regional and international cooperation in R&D. These three programmes were sub-divided into 19 cross-cutting sub-programmes.

4   IST in the Czech Foresight Exercise

IST played a role in several of the thematic panels in the Czech foresight study. The main panel with IST as a topic was titled "information society", rather than information technology. IST figured in the work and thematic priorities of several other panels: agriculture and food, environment, health care, pharmaceutics, civil engineering, urbanism and housing, materials and technologies for their production, discrete manufacturing, modern instruments and devices, the transport system, social transformation and integrated research and development.

4.1   General findings on IST

The primary objective of the Czech foresight project was to prepare a National R&D Policy. The organisational structure included a separate panel on the information society, but IST were also treated in other panels. There is recognition that the country is heading for a "knowledge-based and information society", but treatment in the other panels was largely casual. The outcome of the project is a Proposal for a National Research Programme, which includes five main thematic programmes, among them "information society.

IST were mentioned specifically in the main findings and recommendations as follows:

* **Thematic panel on agriculture and food**: proposes research on the development of IT and a "new economy" in the agrarian sector including food production.
* **Thematic panel on the environment:** no specific reference to information technology but does mention modern technologies for the environment, sustainable development and power engineering.
* **Thematic panel health care**: panel expects instruments to be miniaturised and information technology to be applied for telemedicine and the remote transfer of patient data. Among the research priorities singled out by this panel are technological aspects including sensors, medicine informatics and telemedicine.
* **Thematic panel on pharmaceutics:** recommendation for research on pharmacological informatics.

- **Thematic panel civil engineering, urbanism and housing**: recommended research priorities include the design of structures with intelligent behaviour and response and the development of new generation ground communication.
- **Thematic panel on materials and technologies for their production**: anticipates the growing importance of materials required for information technology, such as semi-conductors and "intelligent" materials. The panel's recommendations for priority setting include research on intelligent materials and structures and the use of modelling in the engineering of materials.
- **Thematic panel on discrete manufacturing and products**: recommendations for research priorities include software engineering, production automation including measurement and control, mechatronics, the development of methods for product quality control and monitoring of production.
- **Thematic panel on modern instruments and devices**: recommends prioritising research on instruments and systems on the basis of modules with standardised interfaces as well as on various application areas dealt with by other panels, such as health care or the environment.
- **Thematic panel on the transport system**: priorities for research in this field include development of transport telematics and intelligent transport systems.
- **Thematic panel on "social transformation"**: anticipates an increase in demand for so-called symbolical analysts of various kinds, including those specialised on Internet services. In the social system, the panel recognises the ongoing development of a "knowledge-based and information society", which is exerting pressure on the education system to adapt. The priority issues for research identified by this panel include international integration and globalisation, the knowledge-based society and new forms of education.
- **Cross-sectional panel on integrated research and development:** expects a major impact of the accession of the Czech Republic to the European Union, as well as a similar impact of the forces of globalisation. The panel expects the skilled labour force, especially researchers, to migrate in greater numbers ("brain drain"). To some extent, this could be compensated by an inflow of similarly skilled labour from non EU countries (particularly Asia). Research will be increasingly organised in "clusters" tackling large-scale, interdisciplinary projects. The overall development is toward the creation of a "knowledge-based society".

Thematic panel on the information society: expected a two-level use of research results in this field:

1. Export of know-how and software products with only minimum production in the Czech Republic using raw materials and energy.
2. Cooperation with strong foreign partners, mainly strategic investors. This would result in production, including software.

The panel also anticipated opportunities for the Czech Republic in the production of components, such as parts, transmitters, hardware for embedded applications and wireless communications, and sub-systems for man-machine interfaces. Networks and communications technology are expected to develop and GRID computing to become commonplace within the next decade. Mobile communications will continue to be of importance in the CR, there will also be a gradual transition to digital TV and broadcasting, with an extension of their use to services such as those in State administration or health care. The panel also expects the personal chip card to become commonplace within the next ten years.

The proposals for R&D priorities in their order of importance as identified by the panel are:

1. Systems for automatic control and data acquisition

2. Mathematical and computer modelling, simulation of systems, multi-media presentation.
3. Sophisticated integrated circuits and systems, modelling and description, complex systems on a single chip
4. Large scale systems for computing, databases and information
5. Artificial intelligence and its applications
6. Information and knowledge-based systems for health care and services
7. Sensors, activators and other types of human-machine interfaces
8. Electronic documentation for health care and social security systems etc.
9. Multifunctional communications networks with focus on safety and data protection
10. Digital television and audio broadcasting with application of terrestrial digital TV for interactive information services.
11. Reliability, diagnostics for materials for semi-conductors.

These research priorities were grouped into four sub-programmes for the National Research Programme.

The key technologies identified by this panel were: modelling and simulation tools, including virtual reality, embedded single-chip applications, automated testing of software systems and components, cryptographic techniques for transfer protection and security, software support for virtual enterprises, and finally, mutual interconnections between systems using wireless communication (e.g. Bluetooth, autonomous control and diagnostic systems.

The "materials" panel identified intelligent materials as a key technology with information technologies one possible area of application. The panel on chemical products and processes identified nano-technologies, specifically mentioning as one possible application among others "parts of computers of a new generation". Telematic systems in transport will be a key technology according to the "transport systems" panel, which also pinpointed electronic control, security and navigation systems.

4.2   Analysis of National Strengths and Weaknesses

While the Czech foresight programme included an analysis of strengths, weaknesses, opportunities and threats in the work of its panel, the available literature does not include any explicit reference to its results. A major concern appears to be the threat of a "brain drain" of qualified personnel to other countries in Europe and elsewhere.

4.3   IST Visions

The Czech foresight study does not contain any coherent visions of future society or of the role of IST within such a future society. It does however contain isolated predictions or other statements related to the development of society. Thus it foresees greater participation, the development of democracy and the market economy. The downside of this development is a possible increase in political radicalism and extremism among those left out of development or unable to come to terms with it. Demographically, the Czech Republic is faced with the problem of an ageing population. There is perceived to be a need for lifelong education, the expectation of greater importance of science and more attempts to influence science.

As a result of the good skill level of Czech IST specialists, there will be an export of know-how and software. The country hopes to attract inward investors (production, software, technology centres). The Czech Republic already has a good position in mobile communications, which are expected to increase importance. A development foreseen is the use of digital TV, e.g. as a platform for health care, state administration

5   Other Important Results of Czech Foresight

Other important findings by the panels include:

- **Cross-sectional panel "regional and international cooperation in R&D":** identified growing importance for institutions of higher education in regional development and for competitiveness of the regions, importance of innovation for economic growth and the complementariness of innovative SMEs and large-scale industry. Threatening shortage of well-educated personnel and the danger of migration could be compensated by similarly qualified personnel from non-EU countries, principally in Asia. Joint action by all regions is required to compensate for disparities among themselves, i.e. to support less advantaged regions. The importance of cooperation and participation in the European Research Area (ERA) is also underlined by this panel.
- **Special panel for the management and implementation of the National research Programme**: investigated two basic options for the management of the National Research Programme namely centralised management with a single authority and decentralised management with the consequence of greater participation by ministries and official administrative bodies. The panel favoured centralised management and drew up a set of principles for its implementation.

The final report from the Foresight Project recommends the continued use of the pool of experts to develop updated versions of the NRP through the setting of newly identified priorities. Another recommendation by the Czech experts, supported by the international expert panel, is to continue foresight activities in the Czech Republic. A first step toward this goal is a detailed evaluation of the first project with the aim of developing a proposal for a follow-up. Further steps include setting up the required institutional structure to carry out complex strategic studies focused on the identification of research and technology priorities and participation in EU level activities in the area of foresight.

The results of the project have been used for the preparation of the proposal for the National Research Programme, which was scheduled to become effective in January 2003.

6   Literature

Aim, K. 2000
(Preparations for) The Czech Foresight Exercise. 2nd Meeting "Prospective Dialogue on Enlargement: Science, Technology and Society. Tallin, September 13-14, 2000

Ministry of Education, Youth and Sports of the CR, Research and Development Council 2002
Proposal of the National Research Programme – Technology Foresight in the Czech Republic 2002, Prague, CD-ROM 2002, also available at http://www.foresight.cz

Annex 1: Tabular Overview

Foresight effort "Technology Foresight 2002" Czech Republic		
Categories, Criteria & Questions	**Answers**	**Comments**
Project promoter / initiator	– Ministry of Education, Youth and Sport/Research and development Council of the Czech Government	
Agency or organization responsible for the foresight activity	– Technology Centre, Czech Academy of the Sciences/Engineering Academy of CR	
Scope / areas covered	– 14 thematic panels, 3 cross-cutting, proposal for management and implementation of National Research Programme	
Time horizon	– 10 years	
Societal dimension	– "social transformation", information society	
European dimension	– not explicit, but impact of joining EU, integration of transport and education systems, "brain drain" to other EU countries; integration of R&D in ERA	
Major explicit objectives	– draft proposal for National Research Programme	
Second order objectives and indirect effects	– "networking"	
Impact	– used for National Research Programme	
Target groups	– Government	
Participation	– c. 300 experts plus further interviews of managers responsible for R&D strategies	
Major Characteristics	– 5 meetings per panel – studies by external experts – interviews – SWOT analysis (but results not included in final report	
Methodology	–	
In which way have IST been included and treated in the FS exercise?	– panel on the "information society" – some mention of IST in work of other panels	
Strengths/opportunities weaknesses/threats identified in IST	– not explicit – threat of "brain drain" to other countries	
Dissemination	– website, CD-ROM (in English also) – final conference	