TECHNOLOGY FORESIGHT IN SLOVENIA

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Summary

The paper deals with the foresight research activity conducted in Slovenia in 2004. In first section we present an overview of technology foresight experiences in several relevant countries. On the basis of previous research studies and on the basis of expert panel discussion eight thematic fields were chosen in Slovenia: information and communication technologies; advanced materials; biotechnology, pharmaceuticals, nutrition; environmentally acceptable manufacturing; sustainable construction; traffic and mobility; life-long learning; medicine – care for the elderly. The respondents - experts in research organizations and firms - were asked to evaluate each of approximately 40 topics in the eight investigated fields. As a result of the first round of Delphi survey priority topics were chosen in each thematic field.

Keywords: Strategic decision making, technology foresight, budgetary R&D priorities, thematic fields, new EU member states

1. INTRODUCTION

Technology foresight is a relatively new mechanism for strategic decision-making. Its wide application in certain countries dates back to the beginning of the 1980s. It is also highly regarded as a tool for anticipating future market demand and designing development strategies for transnational companies (UNIDO, 2002).

Meanwhile, technology foresight is being increasingly recognized worldwide as a powerful instrument for establishing common views on future development strategies among policy-making bodies, bridging the present with the future. One of its unique features is the participation of a large number of stakeholders, namely governmental institutions, scientific communities, industrial enterprises and civil society.

The following definition of foresight can be accepted (Martin, 2002): "Foresight is the process involved in systematically attempting to look into the longer-term future of science, technology and economy, the environment and society with the aim of identifying the emerging generic technologies and the underpinning areas of strategic research likely to yield the greatest economic and social benefits."

There are several important aspects of this definition. Foresight is not a technique but a process, bringing together key participants from different stakeholder groups. The attempts to look into the future must be very systematic. The longer term period means the range between 5 and 30 years. Successful foresight involves balancing between the technology "push" approach and the market demand "pull" model. Contemporary foresight focuses on the prompt identification of emerging generic technologies that are still in a pre-competitive stage in a particular country. Last but not least, attention must be paid to the likely social benefits or adverse consequences of new technologies.

2. OVERVIEW OF FORESIGHT ACTIVITIES IN DIFFERENT COUNTRIES

Towards the end of the 1960s **Japan** decided that technology foresighting[1] was a potentially useful policy tool. After consulting with foreign experts, the Japanese Science and Technology Agency and National Institute of Science and Technology undertook several studies over the next few decades in an attempt to foresee the future trends in science and technology. So far they have performed 4 Delphi exercises with the participation of a great number of stakeholders (businesses, scientists, public administrators etc.). The Japanese believe that the main benefit of foresight is not the direct outcome (for instance the identification of emerging technologies) but communication, concentration on the longer term, coordination, consensus building and the commitment of all participants.

Prior to 1990, in the USA the doctrine prevailed that the government does not need an explicit technology policy. After 1990 the general attitude and opinion changed and the foresight practitioners began to draw up lists of critical technologies for their sectors and often produced a wide range of emerging technologies.

[1] The semantic difference between forecasting and foresight should be pointed out. Forecasting means a very precise prediction of future events. Due to its deficiencies forecasting has not been accepted as an efficient tool for policy making. Foresight is just an attempt to look into the future at the focus of scientific methods (scenarios, expert panels, Delphi surveys, trees of relevance etc.).

The Netherlands is the European country with the longest tradition in technology foresight activities. Since 1980 the sector councils have carried out various technology foresight exercises (agriculture, environment, health). The objectives were to produce an input to technology policy and to provide enterprises with early warnings of opportunities and threats and to create networks. Besides the Ministry of Economic Affairs, the Ministry of Education and the Science and Foresight Steering Committee became involved in the foresight activities. The main benefits of technology foresight in the Netherlands as recognised by experts (van der Meulen, 1999) were: setting priorities and negative priorities, flexibility in dealing with implementation issues, change of general thinking beyond the usual framework and ad hoc problems.

In **Germany** several foresight studies have been conducted since 1990. In the exercise known as "Technology at the threshold of the 21st century" the Fraunhofer Institute for Systems and Innovation Research produced an extensive list of critical technologies. In another initiative Fraunhofer ISI collaborated with NISTEP in Japan (Cuhls, 2003) in a large survey and published a mini Delphi study. A comparison of German and Japanese responses showed close agreement on the likely timing of technological advances and differences between the two sets of results. Foresight has had important impact on German society:

a) it has influenced budgetary research priorities, b) it has played a role in strategic talks with industry and large research organisations, c) in large industrial branches (i.e. pharmaceuticals) specific foresight exercises were carried out in order to identify competitive advantages.

There were several interesting foresight initiatives in **France** in the 1980s and 1990s. In 1984, the Centre National de la Recherche Scientifique identified 20 strategic themes. Ten years later a Delphi survey was conducted by the Ministry for Higher Education and Research. A comparison of the results with German and Japanese Delphi reports showed that French experts held very similar views on the timing of technological developments or innovations to their German and Japanese counterparts.

In 1983 a study was carried out in **Great Britain** with the purpose to find out exploitable areas of science (Irvine and Marvin, 1984). The results were not applied due to the change of government and an unfavourable economic situation. In the early 1990s an extensive Technology Foresight programme was launched using Delphi methodology. The main findings were grouped into six categories:

- harnessing future communicating and computing
- from genes to new organisms, processes, and products (e.g. bioinformatics, health and lifestyle)
- new materials, synthesis and processing
- precision and control in management (e.g. management and business process engineering, and security and privacy technology)
- cleaner world (e.g. environmentally sustainable technology and product and manufacturing life cycle analysis)
- social trends and the impact of new technology

The objective of **Austrian** foresight exercises in 1997/98 differed substantially from foresight studies in technologically leading countries such as the USA and Japan (Aichholzer, 2002). While these countries concentrated their efforts on new technologies and radical innovation breakthroughs on markets in order to profit from first-mover advantages, Austria was seeking market segments and technological niches within the global market. The combination of Delphi technology and Delphi society/culture was oriented towards the following thematic fields: housing and environmental construction, lifelong learning, medical technologies and support for the elderly, clean and sustainable production, organic food, physical mobility and tailor-made materials, structural change of work and social segmentation. The Austrian approach should be followed also by smaller emerging economies.

The application of technology foresight has become crucially important in strengthening the development processes in the **new EU members** of Central and Eastern Europe and narrowing their competitive gap in the global economy. Although technology development planning has traditionally been carried out by governments, the change of the socio-economic systems in those countries has necessitated the introduction of the new approach encapsulated in technology foresight processes. Applied at the national and regional levels, those processes would allow those countries to benefit from the globalisation process and integration of their economies into the EU and the global market. Compared with the other Central and Eastern European countries and new EU member states, Hungary adopted technology foresight early on (Havas, 1998). A few other countries, such as the Czech Republic, Poland and Slovenia, have undertaken the first steps towards promoting technology foresight at the national level.

The **Hungarian** Technology Foresight Programme was launched in the middle of the transition process (1997) and contributed to the analysis of:

- world market opportunities
- trends in technological development
- strengths and weaknesses of the Hungarian economy and its R&D system (Havas, 2002)

The Foresight Programme used a holistic approach based on panel activities and a large-scale Delphi survey. 9 cross-cutting issues were defined (education, training and re-training, information technology, environment, accession to the EU, competitiveness, social cohesion, the role of large (multinational) and small and medium-sized (indigenous) firms, control and self-control of different systems, research and development, manufacturing, services and marketing, new materials). The results were disseminated through different documents, final reports and policy recommendations as well by strengthening the national innovation system through communication and cooperation among various professional communities.

In 2000, the **Czech** government approved the National Research and Development Policy as a key strategic document defining the relationship of the state to research and development activities (Klusacek, 2002). The fundamental priorities of the National Programme of Oriented Research were grouped into 5 thematic and 3 cross-cutting programmes. The thematic programmes included quality of life, information society, competitiveness, energy for economy and society and social transformation. The cross-cutting fields included human resources for R&D, integrated research and development

and regional international cooperation in R&D. On the basis of 5 thematic programmes, 10 business sectors were selected (agriculture and food, environment, health and pharmaceuticals, information society, building and construction, materials and their processing, machinery, instruments and equipment, chemical products and processes, transport, energy and raw materials) as well as social transformation as a separate expert panel.

In **Slovenia** in 1996/1997 a special study was conducted on key (critical) technologies on a voluntary basis (Kos, 1996) as a Delphi survey with the participation of experts from science and industry, eliminating 88 technologies using several criteria such as R&D capacities, engagement of industry, government participation in the most important technologies, weighting their relevance for economic development. At this writing, there has not yet been any significant impact on science and technology policy.

3. METHODOLOGICAL APPROACH

The decision as to which type of Technology Foresight (TF) approach was selected in Slovenia was influenced by comparison with similar research activities in other countries (for instance with the Austrian and Hungarian exercises) and by the domestic societal, institutional and regional framework which contributed to anticipatory thinking when setting up technology policies and industrial strategic options. The technology foresight study in Slovenia was commissioned by the Ministry of Education, Science and Sport and the Ministry of the Economy. The first phase of the exercise was conducted from September 2003 to September 2004.

The advantages of TF in a small country can be summarized as follows. The key experts usually know each other or at least use a common contact network enabling them to successfully exchange various types of information about technological development and its conditions. This is done through informal channels in the absence of any organised procedures whatsoever. Of particular importance in this regard are the establishing and enhancing of continuous forward thinking which should be closer to decision-making bodies and development communities than to establishing separate TF institutions. It is important that such anticipatory thinking be integrated into planning and processing at the industrial, governmental, regional and local community levels. Moreover, it should be adequately considered when preparing research and policy action programmes of individual ministries and agencies. The future orientation and involvement of stakeholders should be viewed as the most vital programme element. Activities associated with TF should cover analyses of anticipated technological (mega) trends and related market opportunities on one hand and the organisation of workshops and panels on the other. The latter would provide support to networking and the identification of research and innovation challenges demanding concentrated effort. This mostly applies to tasks regarding technological networks and industrial clusters, the establishing of which is presently increasing. The first conferences on the Slovenian technological networks and industrial clusters were held in 2004.

On the basis of previous studies (Kos, 1996, Stanovnik, 2003) and on the basis of a decision made by the steering committee, 8 thematic fields were chosen:

1. Information and communication technologies
2. Advanced materials
3. Biotechnology, pharmaceuticals, nutrition
4. Environmentally acceptable manufacturing
5. Sustainable construction
6. Traffic and mobility
7. Life-long learning
8. Medicine - care for the elderly

The basis common to all the assessed thematic fields were questionnaires showing scores with which an aggregate evaluation of each of the topics under our investigation was obtained, thus allowing for their priority classification. The questionnaire is shown in Table 1.

Table 1: Questionnaire about the topics under investigation over thematic fields

Topic no. 1 and no. 2 ….. no.45	Knowledge of the respondent	Innovation evaluation with regard to Slovenia	Importance of the topic in Slovenia	Chances for thematic leadership of Slovenia with regard to R&D	Organisational and public transformation	Economic evaluation	Prospects for accom-plishment within 10-15 years in Slovenia	Evaluation of the level and adequacy of topic

1. Questionnaires filled out by experts (companies) whose knowledge of the topic under consideration was evaluated with scores ranging from 1 to 2 were eliminated from the further evaluation procedure.
2. Experts involved in a particular thematic field were selected from the rest of respondents. They were given questionnaires just for their particular field.
3. Some of the broadly knowledgeable respondents (large companies, large research institutes) were given the questionnaires for several thematic fields.

Depending on the individual thematic field, the number of respondents varied considerably. The same applies to the quota of responses. In some cases they were half the quota and in others even less. They are shown in the reports on individual fields.

The respondents were asked to evaluate each of the topics in the eight investigated fields as well as their own knowledge of each topic. The evaluation criteria were as follows:

1. Knowledge of the respondent
2. Innovation level of a particular topic
3. Importance of development (of a particular topic) for Slovenia
4. Prospects for accomplishment of the topic within the period of the next 10-15 years
5. Development stage
6. Possibilities for Slovenia for assuring a leading position (within a particular topic) with regard to its R&D stage
7. Possibilities for Slovenia for assuring a leading position (within a particular topic) with regard to organisational transformation

8. Possibilities for Slovenia for assuring a leading position (within a particular topic) with regard to economic use in terms of new products/services
9. Slovenia's willingness to invest according to desirability and importance for future development

Evaluation

As foreseen by the pertaining questionnaire instructions, the respondents employed three different evaluation scoring methods:

- Questions 1 to 4 were evaluated with a rating scale ranging from 1 to 5. A rating of 1 meant very poor knowledge of the respondent/innovation level/development importance or very poor prospects for the accomplishment of the topic, and a rating of 5 meant a very high knowledge of the respondent/innovation level/development importance or good prospects for accomplishment of the topic within the period of the next 10-15 years.

- Question 5 had to be evaluated with ratings 5, 4 or 3. A rating of 5 meant that the observed technological topic was still under development, rating 4 meant that it was already available (but not yet generally used), and rating 3 meant that it was already generally used.

- The answers for questions 6 to 9 were either "yes" or "no".

Input and processing of data

The input and processing of the respondents' answers were made in the MS Excel program. An example of the form used for data input is shown in Figure 1.

Figure 1: An example of the filled form for data input

Topic No.1: Broadband systems and convergence of communication systems

Respondents	Knowledge of the respondent	The innovation level	Importance of development for Slovenia	Possibility of realisation within next 10-15 years	The progress status in Slovenia	Slovenia – leading position in the field			Investment in the field	Average (2+3+4)/3
						Research and development	Organisational and social restructuring	New products useful in economy		
	1	2	3	4	5	6	7	8	9	10
1										
2	3	3	3	3	4	1	1	1		3
3	5	5	5	5	4	1	1	1	1	5
4	4	4	4	5	4	0	0	1	1	4,333333
5										
6	4	3		5	4					
7	4	5	4	4	4	0	0	1	1	4,333333
8										
9	3	3	4	3	4	0	0	1	1	3,333333
10	3	4	3	3	4	1	0	0	0	3,333333
11	3	3	4	5	5	0	1	1	0	4
12	3	3	3	4	4	1	0	0	0	3,333333
13	4	2	2	3	4	0	0	0	0	2,333333
…	…..	…..	…..	…..	…..	…..	…..	…..	……	…..

The procedure used for the selection of priority topics

The data processing procedure was based on elimination of non-prosperous technological theses. From the 40-50 proposed topics in each thematic field we thus identified the 10-15 topics demonstrating the highest innovation rate. At the same time, their development was believed to be of the greatest importance for Slovenia, their prospects for being accomplished within the next 10-15 years were the most realistic and were estimated as assuring Slovenia the best possibilities for gaining a leading position world wide. The criteria were: R&D economic use of new products/services, and last but not least, the willingness to invest in them. As our focus was on the *development stage*, our closer selection addressed topics still being investigated (second round of Delphi survey).

Step 1 – Elimination of answers of respondents ranked as "worse"
In the first step of our evaluation processing we eliminated answers of those respondents who assessed their knowledge of individual topics as being below 3. The answers of the rest of the respondents were then further processed.

Step 2 - Determination of shares of individual answers (assessments) for each of the observed topic
For each of the eight assessed fields we first determined the share of "important answers", i.e. rankings 4 and 5 for *fields 2 to 4,* answers of "yes" for *fields 6 to 9*, and shares of individual answers for the field regarding the *development state* (i.e. answers "under development", "available" and "in general use").

Step 3 – Elimination of topics
In the next step, the theses were eliminated on the basis of the following selection criteria:

- First elimination: elimination of topics whose share of scores 4 and 5 was 50% lower for the following variables: innovation level, importance of such development for Slovenia, prospects for accomplishment of the topic within the period of the next 10 – 15 years.
- Second elimination: elimination of topics for which the share of "yes" answers was 60% lower for the variables: prospects for Slovenia for a leading position in this area with regard to R&D, prospects for Slovenia for a leading position in this area with regard to economic use and level of willingness to invest.
- Third elimination: elimination of topics being already available or being generally used and retention of topics still in their development phase.

Step 4 – Examination of the selection of technological topics
In the next step we made an in-depth analysis of the thesis selection and assessed its suitability. With this target in mind we organised a workshop that involved participation of experts in specific fields. In accordance with their knowledge of the field under consideration, a few more topics were eliminated as inadequate.

Step 5 – Priority classification of the selected topics
The criterion used for the priority classification of the selected topics was the value obtained by adding two values, i.e. the average of the scores allotted to variables 2 to 4 and the average of field 5.

By adhering to the above procedure we obtained a preliminary priority classification of the key technological topics in each thematic field shown in section 4.

4. PRELIMINARY RESULTS ON TF OVER EIGHT THEMATIC FIELDS

Our research in the priority topics identified in 8 thematic fields was made in accordance with the principles of TF in two subsequent phases. In the first phase, in which we used questionnaires and personal contacts, we collected topics for individual thematic fields. In the second phase, we collected assessments of individual criteria which we received from respondents who answered our questionnaires. By using TF principles, various assessments of each investigated topic were obtained. In this way, the impact of arbitrariness or predominance of individuals exhibiting strong bias and authoritativeness was eliminated, as recommended by TF theoreticians (Barré, 2002; Cuhls, 2003). For our computer processing we thus obtained topics with the most positive assessments and support. The topics with the worst assessments and the least support were left aside. The most important element of the employed criteria was the economic aspect, i.e. the desirability for Slovenian development as well as the topics for the best position in the innovation sense, since they represent only the first phase in R&D and have not yet been implemented. The topics thus obtained are consequently the ones with the best prospects for assuring Slovenia's recognition for filling up a gap for which Slovenia might gain the leading position. In Slovenia, the development stage of both industry and services is on a different level compared to other countries and the emphasis is laid on different products and services. The structure of the Slovenian economy therefore plays an important role in the assessment of the first round of the Delphi survey.

4.1. Technological topics obtained in the first round of TF

Information and communication technologies

Due to their generic nature, Information and Communication Technologies (ICT) have contributed to the new development paradigm in the past 20 years and are currently one of the most rapidly developing fields. Advanced technologies and information age solutions are present in every aspect of life and work, and society has adapted its functioning and organization to the rapid pace of technological development in ICT. Increased competition among equipment suppliers and operators has resulted in a decrease in communication costs. The development of new applications and services further accelerates the widespread use of information and telecommunications technologies. Coinciding with the increasing use of electronic communications are the processes of the "integration of technologies" and/or the "convergence of media" which merge and interconnect various hitherto separate segments such as computers, electronic entertainment systems, electronic measurement systems, and electronic automobile systems. These segments are combined into connected units which interact, communicate and form links through telecommunications networks. Because of convergent development, information and telecommunications technologies are becoming platforms for advanced and penetrating development projects of the majority of developed enterprises and economies.

As a result of the survey the following topics were ranked in the first places:

- Intelligence in next-generation ICT networks
- New transport methods and protocols
- Methodology and test methods for fast software development without errors and object technologies
- System security and reliability
- Broadband systems and convergence of communication systems

- Bioelectronics
- Interactive telecommunication services and advanced interfaces for users
- Intelligent microsystems in one chip
- Scientific and technical translation systems
- Optoelectronics and high definition (resolution) displays

Biotechnology, pharmaceuticals and nutrition

In terms of performance, the Slovenian pharmaceutical industry is at the pinnacle of the Slovenian economy, and is an important factor in the generics field on a global scale. It is one of the main generators of exports, which are indispensable for increasing the prosperity of the Slovenian economy. One of the Slovenian pharmaceutical industry's distinct advantages is the vertical integration of all of the segments of development, research and technologies in the field of generic product development and manufacturing process. The upgrading of vertical integration with horizontal links, i.e. networking, both in the narrow and wider environment, means that this industry will maintain its favourable position and in some segments make important steps towards even better results.

Biotechnology is an activity that is complementary with and closest to pharmaceuticals. Particularly in the field of pharmaceutical technologies, process optimisation, and above all in-vitro and in-vivo evaluations, the convergence and overlapping of these two industries is unavoidable. In addition, a part of pharmaceutical agents are the result of biotechnological processes, i.e. pharmaceutical biotechnology.

Over the last ten years, biotechnology has become a key generator of progress biosciences and related industries in economically advanced countries. Such development is primarily the consequence of discoveries in the field of molecular biology and biochemistry, which constitute the foundation of modern biotechnology, and the realization that the quality of life can be enhanced only by a comprehensive knowledge of the bioprocesses in the human organism and in nature. Unfortunately there are currently very few commercial operators in the field of biotechnology in Slovenia, which means that Slovenia has limited chances for development in this important high-tech area.

As a result of the survey the following topics were ranked in the first places:
- Active pharmaceutical ingredients
- New delivery systems
- Development and analytical methods for pharmaceuticals, food technologies and environment
- Food biotechnology
- Nutrition and health
- Environmental technology
- Sustainable agriculture, biological plant protection
- Cell culture technology and therapeutic cloning
- Tissue engineering
- New production processes in the pharmaceutical and food industries

Advanced materials

For any kind of manufacturing industries and construction activities, different materials are needed. In addition, advanced intelligent materials have a major role in the life of all citizens. Also in any material science new technologies and analytical techniques offer a wide spectrum of chances for further development.

As a result of the survey the following topics were ranked in the first places:

- Nanocrystalline materials
- Intelligent materials with sensor and actuator capacities
- Liquid polymers for electrical building materials
- Availability of centres for material development with particular attention paid to simulation, modelling, engineering and consulting
- Materials for medical-technical purposes
- Water-based metal cleaning
- Steels reinforced with particles, construction steels reinforced with dispersion, composite materials, Al-composites
- Multifunctional materials
- Highly permeable electric sheet-metals either alloyed or unalloyed
- Composites for thermal durability
- Types of steel manufactured according to the methods of dust metallurgy
- Environmentally acceptable materials (elements etc.)
- Metals for weight reduction in transport of the car and railway industry
- Improvement of high-temperature gas combustion systems
- Materials in the car industry

Environmentally acceptable manufacturing

In order to achieve environmentally acceptable and energy saving manufacturing processes control technologies have been widely introduced. The process control technology (i.e., control/automation technology/engineering) integrates the principles of automatic process control, informatics and cybernetics. It concerns the infrastructure technology, since it is present in every more complex device or process, and therefore its potential and influence is very high. International experience shows that the introduction of the process control technology contributes significantly to an increase in economic competitiveness, since it results in increasing the scope and adaptability of production, improving the quality of products, reducing the consumption of energy and raw materials, decreasing the environmental pollution, and increasing the occupational safety, etc. At the same time, investment in these technologies are proven to be widely viable and profitable.

As a result of the survey the following topics were ranked in the first places:

- Air protection: equipment for air purification, dust collectors, incinerators
- Wastewater management and surface water safety: ventilation systems, separation technologies, filters, chemical cleaning, pumps, pipes
- Waste management/recycling: waste reprocessing equipment, recycling equipment, waste collection equipment, waste handling equipment
- Protection of surface and ground waters: air filters, absorbents, anti-erosion barriers, ground-preservation/conservation processing
- Noise and vibration control: silencers, dampers, vibration control systems

- Environmental contracting/engineering services: measuring and monitoring equipment, sampling systems, process inspection systems
- Environmental monitoring and analyses: measuring equipment and monitoring equipment, sampling systems and process inspection systems
- Renewable energy sources: equipment for exploitation of water, wind, solar, photon, tidal, and geothermal energy
- Production optimisation
- (Thermal) power management (efficient and rational use of energy and heat): equipment for power monitoring, software for power efficiency
- Sea protection: sea pollution management and preventive equipment, absorbents, water obstructions

Sustainable construction

Construction is one of the largest industrial sectors in Slovenia, representing some 7% of GDP. Increased international competition for large projects (buildings and civil engineering works) will mean that companies must explore new materials, production technologies and business opportunities. In the construction industry globally, the business arena is changing constantly and new business models and technologies are introduced frequently.

As a result of the survey the following topics were ranked in the first places:
- Energy-efficient manufacture of building materials and buildings
- Energy-saving building of low-energy and "passive" houses by using modern materials, elements, equipment and systems – ecological building with a minimal impact on the environment and human health by using organic building materials
- Engineering high-rise structures (new materials, polymers, ceramics),
- Use of renewable energy sources (bio-mass, solar photo-voltaic cells allowing for transmission into the public network, exploitation of renewable energy sources in the manufacture of new building materials)
- Interconnected activities within the framework of industrial "clusters"
- Cleaning equipment systems for complete water purification – cleaning equipment for water purification, systems for sustainable water management
- Cost-effective technologies for sanitation of old buildings (installation of elevators for old people, new types of installations)
- Water-construction buildings
- Replacement of harmful materials with the environmentally friendly ones
- Decontamination of the ground with separation methods
- E-construction site
- Methods and approaches to monitoring and maintenance of buildings on traffic roads (highways, motorways)
- Prefabricated construction systems
- Modern types of concrete (self-spreading, micro-concrete)
- Neutralisation of harmful substances in the manufacture of building materials

Traffic and mobility

The transport sector is an important part of any national economy. The contribution of this sector to the total gross value added in Slovenia is between 8 and 10 percent. The efficiency of transport services is predominantly determined by the density and quality of the available transport infrastructure and by regulatory framework.

As a result of the survey the following topics were ranked in the first places:

- Introduction of railways into quality-shipment transport
- Manufacture of composite parts for vehicles to considerably reduce noxious emissions
- Development of new-generation containers for non-heavy goods; re-switching of the shipped goods between railroad, road and ship; integrated systems for storage and dispatching
- Systems for vehicle emission and motor control
- Automatic toll collection to avoid traffic peaks; systems for satellite navigation for electronic toll collections
- Transit cargo traffic obligatory on knapsack trains for reasons of environmental protection
- Termination of personal passenger traffic in urban areas
- Traffic policy on the national level to promote faster traffic with a higher road exploitation rate; adaptation of existing railway lines to allow for higher speeds
- Improvement of road-traffic facilities by centralisation of information about traffic conditions
- Strategy for modernisation and combining traffic systems
- Optimisation of the connected systems (road-railway)
- Goods and vehicles tracing technology
- Logistics technology with organisation of the transportation commodities; uninterrupted border crossing with permanent phyto-laboratory control
- Battery recycling
- Technology of separate monitoring of vehicles and cargo

Life-long learning

The reform of educational system is seen as a crucial factor in Slovenia's transition to a knowledge-based economy. Education does not stop with employment. One of the central characteristics of a knowledge-based society is the importance of continuing education during employment – the ideal of life-long learning.

As a result of the survey the following topics were ranked in the first places:

- Learning organisation
- Information and consulting centres for adult education
- Paradigmatic shift from learning to education (from formalised education to education permitting knowledge development throughout the life period)
- Methods for integrated teaching and learning
- Inter-business and inter-branch education centres for education of employed persons
- Project learning for the young
- Network of development and research centres for adult education (from the general, professional to the university-level education)
- Centre for independent learning, organised independent learning

- Credit study system
- Moderation, efficient group leading
- Development of fundamental skills, i.e. cognitive, affective and other skills for individuals for the development of their overall capabilities
- System for knowledge determination and approval
- Multimedia education
- Remote education
- Individual educational account
- Partnership between the government and civil society in the area of education and financing

Medicine: care for the elderly

According to the current demographic trends ageing is the main characteristic of Slovenian population, similarly to the population trends in the rest of EU member states, which represents a potential threat for long-term sustainability of human capital. The people in the working age will be decreasing and senior population will be increasing so fast that in 2020 there will be 35 percent more people older than 65 years (SPD, 2003).

As a result of the survey the following topics were ranked in the first places:
- Prevention, early diagnostics, treating and rehabilitation of patients with lung diseases, for instance COPD
- The role of public media in health educational work
- Prevention, detection and treating of infectious diseases in the old age, hospital infections
- Activities towards removal of risk factors resulting in injuries of the elderly population (prevention and treating of osteoporosis, prevention of falls, medical protective resources for hips, support straps, etc.)
- Technical resources and services for quality life in the old age (for moving, hearing, seeing, robotics, intelligent dwelling etc.)
- Network data and expert systems for diagnostics and treatment directives
- Remote disease follow-up and help (self-monitoring, red button, etc.)
- Palliative nursing, passive euthanasia
- Attitude of the public towards ageing and old age
- Social-health network for complete nursing of chronically ill old people (involvement of health-social institution, daily centres, centres for home nursing, volunteers)
- Prevention, early diagnostics, treating and rehabilitation of cardio-vascular diseases
- Determination of the risk rate for health complications and setting up guidelines for medical treatment on the primary, secondary and tertiary level
- Substitution of organs and tissues with implantation, trans- and auto-transplantation and usage of artificial materials
- Prevention, early diagnostics and treatment of cancer diseases (biomarkers, transplantation tests, etc.
- Care of one's own health and health policy (collaboration with other fields – rural policy – healthy food, sport – body exercise in the old age, etc.

5. PROBLEMS ENCOUNTERED DURING THE CONDUCT OF TF

The final goal of TF is diffusion of the related results in order to allow for social, organizational or technological changes. The most serious critical point is therefore the implementation of the set priorities both in the public administration and in the economy. As mentioned above, it is an imperative to consider forward thinking and its related activities as an indispensable element which must be paid due regard already in the preparatory phase of a company's research programme, it should be an important component of the linkage between its development divisions and should be built into its strategic plans to pave the way towards a higher level of technological development. A notable emphasis on the importance of the implementation of TF has been observed in Spain and Portugal.

The Netherlands[2] have been reported as being very successful in the area of TF implementation. Upon the completion of a project of this kind they reorganised/transformed the institution which had conducted it. The institution was expanded and entrusted with the responsibility for initiating and practicing policies developed on the basis of the study performed. This very institution then conducted and supervised the related implementation in the public administration and the economy. By doing so, the basis for the next TF project – to be conducted at five-year intervals – was provided for.

Trends and perspectives

In the first phase of the TF exercise, the related national tasks were reflected in the form of technological fields or sector activities. For the time when the TF platform began to be set up, such an approach was quite reasonable. The analysis of third generation TF – as currently practiced by some European countries – shows that anticipation of strategic development issues is a common phenomenon.

The next trend that was detected is that the TF project is distributed among various institutions and carried out subsequently, which is not the case with the projects of the classic multi-panel type carried out in parallel and in just one institution. This is the so-called "integrated" TF type which is typical for countries which have several years experience in TF (Finland, the Netherlands). This model is expected to be further developed after the institution implementing the project gains the necessary experience. The issue to be solved hereby is the appropriate use of a great variety of results necessitating an efficient learning process and accumulation of adequate experience.

Proposals have been made at the EU level for TF in order to make it relevant for the EU member countries as well as for decision-making processes of the European Commission within the European Research Area (ERA). Our position with respect to TF becoming an open co-ordination instrument is as follows: Since TF is an element of strategic planning of national activities targeting sustainable development, various types of knowledge and innovation potentials both in the public administration and private companies – which necessitates a specific orientation towards future development issues of national

[2] Foresight Steering Committee, 1996, A vital knowledge system. Dutch research with a view to the future. Amsterdam. It focused on small groups for elaboration of scenarios for 17 thematic fields. It was used as a model for small countries in the EU as well as in Australia.

importance – it is not possible for EU TF to be a relevant instrument for small-sized countries. EU TF is a context for large-sized member countries and absolutely not for the small ones which have attained different development levels and specific business strategies of how to fill up market niches in which they foresee their own specific competitive advantages. This is also the clearly expressed position of the Austrian TF taken in 1999. The Austrian TF is oriented towards the advantages of specialised industrial (service) sectors with which other countries have nothing to do. Similarly, Slovenia will not be able to make use of foreign TF originating from conditions specific for a particular country. TF is in a certain sense a development plan for the particular innovation potential of a certain country. It grows from the current state and tends towards being shifted – in the most rational and fastest way – into the future, trying to catch up with those who are technological leaders in the field.

What can be done is to set up a unique EU TF from the various national TFs so as to allow for the use of results and networks of the existing national TFs.

Implementation

Steps taken towards the implementation of TF are much simpler in cases when TF is a part of the decision-making process than when it is institutionally separated or specialised. Forward thinking should be an integral part of the preparatory and the decision-making processes.

We find the experiences of Finland worth studying. The Finns did not implement TF on their national level but in various sectors in order to meet the demands of their research policy. A group of experts from the industrial R&D and top researchers had set up a vision for the future regarding meeting demand and opportunities in the Finnish research field. For that purpose they organised brainstorming sessions dealing with the issue on a medium-term basis. By doing so they stimulated implementation instead of in-advance networking and interactions among the various cluster groups. Experts participating in the foresight exercise came from technical and natural science fields and from the field of the commercial use of technological innovations. No experts from other fields or public sectors nor lay persons from other interest groups were admitted. The result was a consensus reached within the various groups and technological fields, yet with a limited possibility of influencing interactions and consent within the overall sector. Such TF does not include an instrument important for new ways of thinking and for exceeding sector and other boundaries.

Their conclusion was that the more foresight is integrated in the decision-making process, the shorter the time span. It is solely the national TF that contributes to long-term thinking and assures something new for the S&T system. The fact is that the national TF supports new important national projects, i.e. new national initiatives, necessitating the involvement of a certain number of sectors as well as several kinds of factors.

The Finnish practice suggests that TF integrated into the process of a research policy is simpler to implement and that the usefulness of national TF is beyond institutional and sector boundaries, as it raises new questions and contributes to reaching a consensus about new national technological projects. According to the Finnish experience, the implementation of TF should not be regarded as a unique important factor in the evaluation of TF task utility. Projects departing from the current way of thinking may have an indirect

or long-term influence as a result of their quality of raising new issues, bringing together various types of stakeholders, enhancing interactions and offering new approaches to problem solving.

As confirmed by the JRC report (Tait, 2002), in many European countries and in Slovenia as well, there is a "political gap" between the leading national hierarchy – influenced by academic lobbies and top political institutions – and economic entities dominated by regional and local interests and the needs of individual businesses. It is an important challenge to close this "political gap" by means of an efficient vertical and horizontal integration of the governing levels. If the trends perceived in this area in Slovenia undermine the remaining degree of freedom, which is of utmost importance for innovators, the targeted foresight of a knowledge-based and globally competitive society will not be attained.

When conducting TF, it is important to realise that the most important underlying condition in order to assure efficient dialogue is a sufficient availability of scientists and engineers unavoidably working hand-in-hand with broadly knowledgeable persons from other supporting professions. Such collaboration should include in particular lawyers, the media, financial experts and politicians. Of a decisive value for identifying new priorities are participatory discussions in which politicians and scientists should not be allowed to play a dominating role.

Absence of policy measures

So far no respondents' measures have been identified as necessary to be taken by Slovenia in order to achieve an eventual leading position for a particular technology topic. The reason for the delay was lack of time. The second phase of our investigation (based on a second survey round) has not yet been completed, for which reason no consent has been reached, i.e. no basis for a common assessment has been provided for. The measures should be proposed by experts involved within various technological fields. This should be done for each field separately and not for each topic. It was decided that the smallest possible number of measures of a certain category should be selected for each field. This means that proposals that would be obtained for the various fields would be differentiated among themselves. Thus the proposed measures would then be introduced in the questionnaire. They would be given for each field separately and scored by the selected respondents on a scale from 1 to 5. Following the above, the aggregate analysis cannot be of a small scope. It will undoubtedly be quite complex and the proposed measures will be classified into separate groups. The measures will be decided upon either with regard to R&D, technology, legislation, co-operation, education and training, or society. Measures defined by specific working groups for various areas and fields will differ among themselves considerably despite the fact that they will address the same topic, for instance education and training or legislation.

The project working groups haven't been given enough time to prepare their proposals for the measures they would consider necessary to be taken for Slovenia's achievement of an eventual leading position. Such an inquiry shall be made in a later phase of this project. The same applies also to the study of mega-trends affecting Slovenia.

6. CONCLUSIONS AND RESEARCH TASKS FOR THE FUTURE

The first phase of the second Slovenian research in Technology Foresight was conducted in 2004. Its task was to make a preliminary identification of priority technological topics for eight thematic fields. The research involved 474 respondents. When assessing each of the observed topics, they thoroughly analysed the related situation in Slovenia. The average response rate (almost 22%) was found to be satisfactory. There were areas which provided 40% and areas which provided much less answers. Experts, too, committed themselves in a very efficient way to give their assessment of the identified priority topics. Their list was set up on the basis of computer processing of the responses to the questionnaire. They were classified according to their importance and share of high ratings. The research is quite an accomplishment in the Slovenian technological context as it was the first time that the experts were faced with assessments of individual topics over the various areas in an integrated way, i.e. the individual topics were competing among themselves. This means that they had to study in a more serious and broad way not just their own – more or less restricted – field of expertise, but also that of others. By following the foreseen assessment criteria, centres of importance were finally determined. The selection of the areas was made on the basis of evaluation of the importance of individual areas. This turned out to be a good solution as it permitted all the most outstanding and vitally important areas to be included. We do realise that in the second phase of the investigation it will also be necessary to investigate some other areas (for instance chemistry as well as oncology and cardiovascular diseases in medicine).

The respondents were asked to assess each of the technological topics for eight areas and, moreover, they had to assess their own knowledge of each topic. The areas of evaluation were the following:

- Information and communication technologies
- Advanced materials
- Biotechnology, pharmaceuticals, nutrition
- Environmentally acceptable manufacturing
- Sustainable construction
- Traffic and mobility
- Life-long learning
- Medicine - care for the elderly

The data processing procedure was based on the elimination of technological topics in order to identify among the selected topics 10 - 15 topics which: a) had the highest degree of innovation, b) their development was estimated as being very important for Slovenia, c) their prospects for being realised in the next 10-15 years were the most promising, d) they showed the best possibilities for Slovenia to achieve a leading position world-wide in terms of R&D and their economic utility (in the sense of new products/services), and e) the eagerness to invest in them was felt to be the greatest. With regard to the variable *development stage*, the final selection addressed those topics which are still in their R&D phase. The respondents eliminated first were those who rated their knowledge of individual topics as being below 3. Then we determined the share of answers which assessed the topics differently. The next step was the procedure of gradual elimination of topics made according to the importance of the set criteria. The topics eliminated first were those whose share of scores 4 and 5 was below 50%. In the next step we further eliminated the topics whose share with “yes” was below 60%. We then eliminated topics which are already

available or even already in general use. The topics that were retained are the ones still in the R&D phase. At the end, the experts who are involved with these technologies and who participated in our workshop further eliminated also the topics which they considered inappropriate. It was in no way possible to add in an arbitrary way topics which had not succeeded to pass through all the elimination steps of the respondents.

Judging from the state of the Slovenian economy and with deficiencies having been emphasised by domestic experts as well as foreign observers of Slovenian development, three TF targets have been achieved:

1. The main existing and emerging technologies, (i.e. technological topics), were identified. They might be useful for Slovenian economic development and appropriate guidance of public institutions and enterprises acting in the area of technological innovation.
2. The importance of co-operation between public research institutions and the privatised business enterprise sector and its innovation activities was highlighted and the necessity of institutional changes was emphasised as being a precondition in this regard (increased orientation of the public research sector towards development efforts).
3. Bases were provided for setting preliminary research (technological) priorities destined for political decision makers and top management in the business sector.

The research was conceived in a way that enabled the promotion of collective learning and simplified a free exchange of ideas. The process thus qualified itself as a public learning procedure into which new ideas were initiated. We started by broadening the horizons, then we made a limited selection of the identified topics and ended by shaping preliminary conclusions given in the current phase of TF report (section 4).

The central task of the investigation was accomplished, i.e. the preliminary areas were identified for which Slovenia might be able to become, in a decade or two, the leader of a certain technological topic. Through such achievement, Slovenia will assure itself specific competitive advantages not primarily conditioned by low cost. By grouping the obtained answers according to dimensions regarding R&D, institutional changes and economic evaluation, we also implicitly defined areas for which our respondents believe special difficulties will be faced with in efforts to achieve topic leadership. The result was that we determined the areas that are most likely those for which governmental support would be successfully used and the fostering of research-development institutions efficient.

Following our experiences gained through the completion of the first phase of the project, we came to the conclusion that it is also necessary to carry out the second phase of the project (interactive phase) in order to verify the selected technological topics and to obtain the consensus of all the participating experts and institutions without the considerable dispersion which was characteristic of the first phase. The same position has been taken also by other countries where the second or third phase was regarded as an integral part of the overall project, which for this reason lasted 2-3 years. It was also noted that it would be necessary that the institution that had completed the TF project also co-ordinate the project implementation in the society. It is important that the governmental administration, the Chamber of Commerce and Industry of Slovenia, the public media and non-governmental organisations participate in the second phase of investigation more intensively and in a broader scope.

Research tasks for the future

The task of the second phase of the TF Project is focusing on topics identified for individual thematic fields and reaching – on the basis of the second phase of our investigation – a consensus about the assessments. This will be done after the respondents in the first phase of our investigation obtain an aggregate assessment about each of the topics for their particular elements. In order to avoid the quota of the obtained answers to our questionnaire being too low, it is important that our search for answers be co-ordinated with the Chamber of Commerce and Industry.

In the final phase, an investigation shall have to be carried out regarding the measures to be taken in Slovenia to allow for TF implementation. That is, when assessing individual topics, which was done from the perspective of the various set criteria, respondents had their own particular ideas of what the future development of Slovenia should be like in order to assure implementation of the set topics as well as goals. For each observed socio-political area they proposed their own measures.

It is important that research and technological activities within the Sixth Framework Programme of the EU connected with foresight are closely followed and analysed. They are financed either by a special programme called Integrating and Strengthening of the European Research Area (as an integral part of all priority research thematic areas and support policies for the needs of the technological development or as co-ordination among common research activities, horizontal aspects of TF). A special programme called "Structuring of the European Research Area" supports an inter-regional co-operation and research within the relationship between science and society.

In the last two years (2003-2004) two main TF-related activities were being carried out:
a) informing about the most decisive TF incentives in Europe and over a broader scope
b) mutual learning among the EU members over the internet and through assistance of the JRC/IPTS - Institute for Prospective Technological Studies

Currently there are several related to future research and innovation activities in the following thematic fields:

- Future of R&D in the area of services
- Perspectives of national and regional innovation systems within expanded Europe: specialisation, complementarity and competitiveness
- Scientific and technological priorities within public research policies in European countries, the USA and Japan
- Key questions of the future research and innovation policies in the expanded EU – 2015
- EU research and innovation activities and the future of the common external and safety policy of EU
- Scenarios of the future development in the area of science and technology in progressive countries
- Improvement of the relationship between politics and science through anticipation in the light of the European perspective

7. LITERATURE

Aichholzer G. *Delphi Austria: an example of tailoring foresight to the needs of small country*. In International Practice in Technology Foresight, UNIDO, Vienna, 2002.

Barré, K. *Foresights and their themes: Analysis, typology and perspectives*. (In: The role of foresight in the selection of research policy priorities, p. 123), European Commission, Report EUR 20406 EN Seville, July 2002.

Blueprints for Foresight Actions in the Regions dissemination conference, September 23rd 2004; "Building the Future on Knowledge", DG Research.

Creating futures: scenario planning as a strategic management tool. Paris and London, Economics, 2001.

Cuhls K. *Foresight tools – Delphi Surveys Foresight Methodologies*. UNIDO, Vienna, 2003.

Cuhls, K., C. Uhlhorn and H. Grupp. *Foresight in science and technology – future challenges of the German S&T syste.,* In Meyer-Kramer, F. and W. Krull (eds.), Science and technology in Germany, London, Longmans, 1996.

Eerola, A., B.H. Jørgensen: Technology Foresight in The Nordic Countries, Riso N. Laboratory, Roskilde, 2002.

FOREN. *A practical guide to regional foresight.* FOREN network. European Commission Research Directorate General, STRATA Programme, 2001.

FOR-RIS: *Experiences and ideas for developing foresight in a regional innovation strategy context (RIS/RITTS)*, DG Research, Brussels, 2004.

Gibbons, M., C. Limoges, H. Nowotny, S. Schwartzman, P. Scott and M. Trow. *The new production of knowledge*. London, Sage, 1994.

Godet, M. *From anticipation to action.* A handbook of strategic prospective. UNESCO Publishing, Paris, 1994.

Havas A. *Technology foresight in Hungary: objectives, methods, results and lessons,* Workshop organised by Slovenian Ministry for Science and Technology, Planica, 2000.

High Technology Finland, The Finnish Academies of Technology, TEKES, Finpro, Sitra, Helsinki, 2003.

International Practice in Technology Foresight, UNIDO, Vienna, 2002.

Jud, T., Stern D., Klusacek K. *Technology foresight in the Czech Republic*. Center for technology development, Prague, 2002.

Kautonen, M., Koski P., and Schienstock, G. *From the national industrial heartland toward a node in the global knowledge economy: The case of Tampere Region.* In

Schienstock, G. (ed.) Embracing the Knowledge Economy. The Dynamic Transformation of Finnish Innovation System. Edward Elgar, London 2004.

Kodama, F. *Technology fusion and the new R&D*. Harvard Business Review July-August: 70-78, 1992.

Kos, M. *Razvojno tehnološki načrti slovenske industrije – Razvojne perspektive, kritične tehnologije, sodelovanje z raziskovalno sfero in stopnje tehnološke zahtevnosti.* (Development Programmes of Slovenian Industry – Perspectives, critical technologies, technological levels) Delo – Znanost, 22. 5. 1996, p. 10.

Lundwall, B.-A. (ed). *National innovation systems: towards a theory of innovation and interactive learning.* London, Pinter 1992.

Luukonen T. *Commenting Foresights and their Themes.* In: The Role of Foresight in The Selection Policy Priorities, EC Seville, 2002.

Martin B.R. and H. Etzkowitz. *The origin and evolution of the university species.* Journal for science and technology studies (VEST), 13:9-23, 2001.

Martin B.R. and J. Irvine. *Research foresight: priority-setting in science.* London and New York, Pinter Publishers, 1989.

Martin B.R. and R. Johnston. *Technology foresight for wiring up the national innovation system: experiences in Britain, Australia and New Zealand.* Technological forecasting and social change, 60: 37-54, 1999.

Martin B.R. *Technology foresight in a rapidly globalizing economy.*SPRU, Brighton, 2002.

Matching societal needs and technology capabilities: research foresight and the implications for social sciences. In: Proceedings of the International Workshop on Social Sciences and Innovation, United Nations University, Tokyo, 2000. Paris, Organisation for Economic Cooperation and Development, 2001.

Netherlands, Ministry of Economic Affairs. *Technological foresight studies: an important tool in economic strategy*. Ad hoc meeting of experts, 14 Sep. 1994.

Nordmann A. *Converging Technologies – Shaping the Future of European Societies.* Directorate General for Research, Brussels, 2004.

Single Programming Document 2004-2006, Government of Republic of Slovenia. Ljubljana, April 2003.

Stanovnik P. et al.: *Ključne tehnologije in možnosti ustanavljanja tehnoloških mrež v Sloveniji* (Key technologies and possibilities of establishing technology networks in Slovenia), IER, Ljubljana, 2003.

Tait, J. Report *from the Foresight and Multi-Level Governance Session*. In: The Role of Foresight Priorities), JRC IPTS, Seville, 2002.

TECHTRANS: *Transregional integration and harmonization of technology support mechanism.* DG Research, Brussels, 2004.

The Impact of foresight on environmental science and technology policy in the Netherlands. Futures, 31: 7-23, 1999.

UPGRADE: *Foresight strategy and actions to assist regions of traditional industry towards a more knowledge based community*. DG Research, Brussels, 2004.

Web-sites visited

- Converging Technologies for a Diverse Europe, 14-15 September 2004; Brussels, Belgium http://www.cordis.lu/foresight).
- http://www.prospective–foresight.com
- Innovation regions in Europe – homepage of IRE network http://www.innovation-regions.org/network/regionalstiat/index.cfm
- www.tekno.dk
- www.tekes.fi
- www.mol.fi/esf/eunakointi
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