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The role of foresight in the selection of research policy priorities
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Conference Proceedings

THE ROLE OF FORESIGHT IN THE SELECTION OF RESEARCH POLICY PRIORITIES

CONFERENCE PROCEEDINGS

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Editor's Note:

The main team in charge of the conference organisation - programme, logistics and secretariat - included Luis Sanz, Maria Ángeles Martínez, Cristina Espa and Cristina González (Spanish Ministry of Science and Technology), Ken Ducatel, James P. Gavigan, Marta Gonzalez, Mario Zappacosta, Fabiana Scapolo, Rafael Castillo, Danae Ortega, Joanne Reynolds, Inmaculada Pizarro, Jesus Vega, Laura Thornton (IPTS - Joint Research Centre, The European Commission), and Paraskevas Caracostas (Research DG - Directorate K, The European Commission).

This conference proceedings was edited by IPTS with input from James P Gavigan, Ken Ducatel, Fabiana Scapolo, Mario Zappacosta, Mark Boden, Tibor Dory, Olivier Da Costa, Anton Geyer, Rafael Castillo and Danae Ortega.

Prefacio

La prospectiva constituye un intento sistemático de observar a largo plazo el futuro de la ciencia, la tecnología, la sociedad, la economía, y sus interacciones, para identificar conocimientos que puedan producir mejoras sociales, económicas y medioambientales sobre la base de predicciones sólidamente fundamentadas. Sin embargo, no basta con establecer una metodología clara y eficiente para el ejercicio de la Prospectiva, sino que es de vital importancia asegurar que los resultados de esta actividad se tengan en cuenta en el debate y en la toma de decisiones políticas. Solamente así podrá obtenerse el máximo beneficio.

El desarrollo del Espacio Europeo de la Investigación supone una gran oportunidad para la colaboración transnacional en materia de prospectiva, y con ello aprovechar las sinergias entre las actividades nacionales y de nivel europeo, aumentando la eficiencia y evitando duplicidades y solapamientos. La Conferencia de Sevilla sobre el papel de la prospectiva en la selección de prioridades de las políticas de investigación fue un foro de intercambio de ideas que ha aportado una valiosa contribución a este fin.

Con el fin de reforzar la relación entre la ***prospectiva estratégica*** *y la* ***planificación política****, especialmente en el ámbito de la Ciencia y la Tecnología, especialistas en prospectiva, usuarios, planificadores y responsables políticos han debatido, conjuntamente en esta conferencia, los requisitos para incrementar en la práctica la sinergia entre ambas actividades. Asimismo, se ha puesto de relieve el papel fundamental que la prospectiva debe jugar en en el desarrollo del Espacio Europeo de Investigación y de la Innovación y en el horizonte de una Unión Europea ampliada.*

Este libro de actas es testigo de los debates, las ponencias y los mensajes principales que surgieron. Su producción poco despues de la conferencia es coherente con algunos de los mensajes y los atributos de la prospectiva – la necesidad de involucrar y llegar a un publico más amplio, y la criticalidad del factor 'tiempo' en el valor y relevancia de un mensaje o conocimiento con implicación para la toma de decisiones.

Ramon Marimon
Secretario de Estado de Política Científica y Tecnológica
Ministerio de Ciencia y Tecnología

Preface

Foresight constitutes a systematic attempt to observe the long-term future of science, technology, society, the economy and their mutual interactions in order to generate knowledge with which to effect social, economic and environmental improvements based on well founded projections. However, it is not enough to establish a clear and efficient methodology to conduct foresight. It is also vitally important to ensure that foresight outcomes are taken into consideration in policy debates and decision making. Only in this way can its maximum benefits be obtained.

The development of the European Research Area (ERA) provides a major opportunity for transnational foresight collaboration, through which to take advantage of synergies between national activities and with those at European level, thus increasing efficiency and avoiding duplication and overlaps. The Seville Foresight Conference constituted a forum for exchange of ideas and made a valuable contribution to meeting this objective.

In order to reinforce the relation between ***strategic foresight*** *and* ***policy planning****, especially for science and technology, specialists in foresight, users, policy planners and decision-makers together debated in this conference the requirements to increase in practice the synergy between both activities. In so doing, much hope and expectation has been placed in the role which foresight must play in the development of the European Research and Innovation, and in view of the enlargement of the European Union.*

This Proceedings bears witness to the debates, the speeches and presentations, and the main messages which arose. Its appearance soon after the conference is coherent with some of the messages and attributes of foresight itself – the necessity to involve and reach a wide audience, and the criticality of the timing factor to the value and relevance of a message or piece of knowledge which has implications for decision-making.

Ramon Marimon
Secretary of State for Science and Technology Policy
Spanish Ministry of Science and Technology

TABLE OF CONTENTS

CONFERENCE PROGRAMMME

13 May 2002

OPENING PLENARY SESSION

• Dr. Jean - Marie Cadiou, Director of the Institute for Prospective Technological Studies, DG Joint Research Centre, European Commission.
• Dr. Alejandro Herrero, Director for Science Strategy, DG Joint Research Centre, European Commission - Representing Commissioner Philippe Busquin.
• Prof. Ramon Marimon, Secretary of State for Science and Technology, Spanish Ministry of Science and Technology.

Keynote Speaker: Prof. Geoff Mulgan, Performance and Innovation Unit, UK Government Cabinet Office. "Governing in Time: Long-termism and the Role of Futures Thinking in the UK Government".

FIRST SET OF PARALLEL SESSIONS

1. EUROPEAN LEVEL FORESIGHT

Moderator:
• Prof. Enric Banda, European Science Foundation.
Speaker:
• Dr. Luk Van Langenhove, United Nations University, Belgium.
Paper presented by: Mr. François Farhi, CM, France
Discussants:
• Prof. Luke Georghiou, PREST, University of Manchester, UK.
• Ms. Kornelia Haugg, Federal Ministry of Education and Research, Germany.
• Dr. Barend van der Meulen, University of Twente, The Netherlands.
• Prof. Emmanuel G. Koukios, National Technical University of Athens, Greece.
Rapporteur:
• Ms. Helena Acheson, Forfás, Ireland.

2. FORESIGHT AND MULTI-LEVEL GOVERNANCE

Moderator:
• Dr. Arturo Garía Arroyo, Spanish Foundation for Science and Technology, Spain.
Speaker:
• Prof. Ortwin Renn, TA-Akademie, Germany.
Discussants:
• Dr. Matthias Weber, ARC Seibersdorf Research, Austria.
• Mr. Gordon Ollivere, RTC North Ltd., UK.
• Prof. Luis Valadares Tavares, IST, University of Lisbon, Portugal.
• Dr. Luis Sanz Menéndez, Ministry of Science and Technology, Spain.
Rapporteur:
• Prof. Joyce Tait, SUPRA, The University of Edinburgh, UK.

SECOND SET OF PARALLEL SESSIONS

3. INTERNATIONAL LEVEL FORESIGHT

Moderator:
• Mr. Jesús Rodríguez Cortezo, Observatorio de Prospectiva Tecnológica e Industrial, OPTI, Spain.
Speaker:
• Prof. Ron Johnston, Australian Centre for Innovation and International Competitiveness, University of Sydney, Australia.
Discussants:
• Dr. Daniel Malkin, Directorate for Science, Technology and Industry, OECD.
• Dr. Tamás Balogh, Ministry of Education, Hungary.
• Dr. James P. Gavigan, DG Joint Research Centre, Institute for Prospective Technological Studies, European Commission.
Rapporteur :
• Dr. Jennifer Cassingena-Harper, Council for Science and Technology, Malta.

4. THEMATIC FORESIGHT

Moderator:
• Dr. Lena Torell, Royal Swedish Academy of Engineering Sciences, Sweden.
Speaker:
• Prof. Rémi Barré, CNAM, France.
Discussants:
• Prof. Andrew Webster, SATSU, University of York, UK.
• Dr. Michael Darmer, Ministry of Science, Technology and Development, Denmark.
• Dr. Terttu Luukkonen, ETLA, Finland.
• Prof. Claudio Roveda, Fondazione Rosselli, Italy.
Rapporteur:
• Dr. Veronique Timmerhuis, Advisory Council for Science and Technology Policy, The Netherlands.

14 May 2002

GENERAL CONCLUSION OF THE PARALLEL SESSIONS

Moderator:
• Prof. Manuel de Hermenegildo. Ministry of science and technology, Spain.
Speakers:
• Ms. Helena Acheson, Forfás, Ireland.
• Dr. Jennifer Cassingena-Harper. Council for science and technology, Malta.
• Dr. Veronique Timmerhuis, Advisory Council for science and technology Policy, The Netherlands.
• Prof. Joyce Tait, SUPRA, The University of Edinburgh, UK.

DEBATE: PRIORITIES FOR THE FUTURE

Moderator:
• Dr. Jean - Marie Cadiou, DG Joint Research Centre, Institute for Prospective Technological Studies, European Commission.
Panellists:
• Dr. Erkki Ormala, NOKIA, Finland.
• Dr. Paraskevas Caracostas, DG Research, European Commission.
• Prof. Jerzy Langer, Academy of Sciences, Poland.
• Mr. John Travers, Forfás, Ireland.

CLOSING SESSION

• Prof. Manuel Hermenegildo, Ministry of science and technology, Spain.

Keynote Speaker: Prof. Dr. Richard Ernst (Nobel Prize - Chemistry 1991), ETH Zurich, Switzerland. "The Role of Academics in our Time"

I. OPENING PLENARY SESSION

SESSION OVERVIEW

Prof. **Ramon Marimon**, Spanish Secretary of State for Science and Technology opened the conference with a warm welcome to all the speakers and participants on behalf of the Spanish Presidency of the European Union. He acknowledged the key, supporting role played by the European Commission in organising the conference, especially the Institute for Prospective Technological Studies of the Commission's Joint Research Centre. He then passed the floor to Dr. Cadiou, Director of IPTS.

Dr. **Jean-Marie Cadiou**, in turn, welcomed all the participants and acknowledged the honour it had been to assist the Spanish Ministry for Science and Technology in organising the conference. He emphasised the increasing necessity of foresight as a key early awareness system to support decisions on the problems of tomorrow. Within this context, he described the role of IPTS in providing foresight in the areas where a European dimension is given or required. Directly referring to the main focal theme of the conference, he stressed that foresight must evolve by building closer links between policy needs and foresight outputs, as well as between the users and the practitioners of foresight.

Dr **Alejandro Herrero**, Director for Science Strategy at the Joint Research Centre Directorate General of the European Commission, apologised on behalf of European Commissioner Mr. **Philippe Busquin**, for not being able to attend to the conference. In delivering a speech on behalf of Commissioner Busquin, he acknowledged Europe's long-standing excellence in research and innovation but stressed some major shortcomings due to the lack of synergies between the national activities. The envisioning of an enlarged Europe capable of competing with other leading economies and being the most competitive and dynamic knowledge-based economy in the world provides a compelling context for the creation of the European Research Area (ERA). He looked forward to the setting-up of a platform for information-sharing for foresight practitioners and users as part of this effort to build the ERA. He also stressed the utmost need to bring science closer to society. He concluded his speech by emphasising the major role foresight must play in tackling major societal challenges.

Taking again the floor, Prof **Ramon Marimon**, Secretary of State for Science and Technology, Spanish Ministry of Science and Technology, delivered his speech in Spanish.

He emphasised the needs for enhanced co-operation in science and technology policies and foresight, more especially within the frame of the coming European Research Area. In this regard, he acknowledged the role played in Spain by the Foundation for Technological and Industrial Foresight OPTI (Observatorio de Prospectiva Tecnológica e Industrial -OPTI-), and of the IPTS in developing a strong foresight co-operative basis EU-wide.

He also mentioned some achievements of the Spanish Presidency of the European Union, such as those accomplished in the first *Informal Seminar of Industry and Research Ministers (Gerona on 1-2 February 2002)*, in which an ambitious and quantitative target was set: The European average R&D expenditure should reach 3% of GDP by 2010, with an increasing role to be played by the privatesector.

Besides, in pointing out that the scope of S&T cooperation must not to be restricted to Europe, he cited the foresight programme for Latin America and the Caribbean initiated by UNIDO with the collaboration of Spain and the IPTS. In fact, scientific and technological co-operation was a central theme of the *EU - Latin America & Caribbean Summit in Madrid* taking place the same week as the Foresight conference. Prof Marimon also stressed the needs for deeper Euro-Mediterranean collaboration in S&T.

With regard to the foresight dimension of the ERA, he underlined the important contribution made by IPTS in selecting thematic priorities during the preparation of Framework Programme 6, and he looked forward to a smooth transition between Framework 5 and 6. However, he remarked that Framework Programme 6 is just one of the collaboration instruments needed. In this context, he underlined the need to make national programmes more open and co-operative.

He also emphasised the necessity of tightening the link between foresight and policy. To illustrate some achievements which co-operation has enabled, he mentioned the recent agreements reached in Airbus, which will make Seville the third most important aeronautic industry location in Europe. He suggested that foresight could very much contribute to support policy decisions aiming at objectives of the kind. However, he admitted that a lot of work had still to be done.

In relation to EU enlargement, he said that foresight is needed to provide global visions and to inform long-term plans.

Prof Marimon concluded with a reference to ethical issues. Society should be involved in Science and Technology, he said. Therefore, it is essential that society understands what the scientific community is doing. Only if Society is able to understand complex issues and what potential societal benefits may result from S&T developments, could the necessary support for the S&T policies be obtained.

Prof **Geoff Mulgan**, Head of the Performance and Innovation Unit of the UK Government Cabinet Office gave a keynote speech on the subject *'Governing in Time: Long-Termism and the Role of Futures Thinking in the UK Government'*. He stressed the difficulties for governments to balance day to day realities and pressures with ethical duties and long-term vision thereby setting out the case for doing strategic work as an input to policy making. He presented the institutions responsible for providing this strategic intelligence to the UK government, the Performance and Innovation Unit playing a major role in this respect. He concluded his speech by drawing out the key lessons of doing future work oriented towards policy-making.

The full text of the introductory speeches and the keynote paper follow.

DR. JEAN-MARIE CADIOU
Director IPTS-JRC, European Commission

Señor Secretario de Estado,
Distinguidos Delegados y Colegas,
Señoras y señores,
Como Director del IPTS del Centro Común de Investigación de la Comisión Europea, quisiera darles igualamente una calurosa bienvenida a Sevilla, y a esta Conferencia de la Presidencia española de la Unión Europea sobre "El papel de la prospectiva en la selección de prioridades de las políticas de investigación".

It is an honour for me to do so in the presence of our Spanish hosts represented by the Spanish Secretary of State for Science and Technology Mr. Marimon, and in this building where, as guests of the Spanish State, our institute is located.

It has also been an honour for us to be called upon by the Spanish Ministry to assist them over the past several months in setting up the programme and organising this event. We have done this on behalf of the Commission with the co-operation of the Science and Technology Foresight Unit of the Commission's Research Directorate General in Brussels.

In the past decade there has been a strong growth in Foresight activities. I believe that this is not just a passing fashion but that there are deep rooted reasons which drive the need for prospective support to policy making.

For instance:

- The accelerating pace of change + uncertainty [the faster the pace, the further ahead you need to look]
- Increased complexity of problems (cross-impacts)
- Increased scale of issues (international and/or global systems)
- Rising pervasiveness of technology dependence (ICTs and Biotech).

Among the main drivers of change for Europe, come to mind:

- The increased needs for energy security and sustainability for a more mobile and enlarging Europe
- The Enlargement process itself [and I take this opportunity to extend a special welcome to the many delegates from Candidate Countries here present]
- The emerging knowledge society and need to compete in the digital economy
- The rising demands for a long and healthy life at a time of demographic ageing.

These issues imply that there should be more efforts to assess the opportunities and risks arising from S&T progress, taking into account:

- The needs for precautionary research to assess, to avoid and to mitigate risks of new S&T. [GMOs is a case in point]
- The increasing reliance of public policy on scientific expertise

- The demands for wider and better-informed public debate, based on the shared responsibilities of scientists, the media, industry, citizens and public authorities.

The acceleration of S&T, when combined with these rising demands to give adequate time for full and open public debate, creates a greater need than ever before for policy to operate in anticipatory mode.

Indeed, I wish to stress the point that the rise of foresight should be seen as a step towards better early warning systems to support decisions on the problems of tomorrow not reactions to the problems of yesterday.

The major challenges that I have just outlined are explicitly recognised by the Joint Research Centre. In fact they are central to the mission of the JRC both at corporate level and for IPTS.

The corporate mission of the JRC is to provide customer-driven scientific and technical support for EU policy making:

> *Currently 20% of all EU legislation is science-based. We can see this very clearly in policy areas such as GMOs, Food, Chemicals, Environment. The main focus of JRC work is to provide S&T support to policy in these areas.*
>
> *In fact the JRC is increasingly a reference centre of science and technology (S&T) for the EU, and one that is independent of special interests, whether private or national.*

Within that context the early warning function is the prime role of IPTS, whose mission is:

> *To provide prospective techno-economic analysis in support of the European Union's policy-making process.*

To carry out its task, IPTS monitors and analyses S&T related developments, their cross-sectorial impact, the inter-relationships between technology and society, and their future policy implications. As a small institute, we obviously cannot do all this ourselves, so we operate in network mode drawing on the expertise of the leading prospective and S&T support institutions from across Europe, mainly our ESTO network.

The role of IPTS is rather special in the foresight scene. Most foresight is aimed at national level and addresses national problems. But, there are now many areas of policy where action takes place at European level. There are many shared issues that are inherently transborder. And there are many challenges that we can face better on a joint basis rather by than acting alone. Thus IPTS essentially provides foresight in these areas where a European dimension is required.

In the past few years we have made some major contributions to providing cross-cutting foresight at a European level including:

- The "Futures" Project, which ran from 1998-2000, and which can be seen as a first attempt at EU-wide Foresight.
- A wide ranging report on "Emerging Thematic Priorities for European Research", as a contribution to the elaboration of the new EU Framework Programme for RDT.
- The "Enlargement Futures" Project - A prospective look at enlargement particularly from the viewpoint of the candidate countries.

In addition we have completed European level prospective studies in numerous sectorial areas. I could name :

- The 2001 Scenarios on "Ambient Intelligence", for the Information Society Technologies Advisory Group.
- The emerging set of Best Available Techniques Reference Documents that is being produced by the IPTS-based European Integrated Pollution Prevention and Control Bureau
- The 2001 Study on "Impacts of Technology on Employment in 2020", produced for the European Parliament's Committee for Employment and Social Affairs.

To conclude I would like to stress that the challenge for foresight is to show its capacity to meet the needs of policy makers. That was the focus chosen by the Spanish Ministry and Spanish Presidency for this conference, and perhaps makes it different from previous foresight conferences. We need to build a closer link between policy needs and what foresight actually delivers. The set up of this conference has tried to seek a balance between the users and practitioners of foresight and we certainly hope that users and their concerns will be paramount in this conference. I look forward to two days of lively and fruitful discussion on these important themes of foresight and policy priority setting.

Thank you for your attention.

DR. ALEJANDRO HERRERO [1]
on behalf of
MR. PHILIPPE BUSQUIN
European Commissioner for Research

THE FORESIGHT DIMENSION OF THE EUROPEAN RESEARCH AREA

Mr. Secretary of State and President in office of the Council,
Distinguished Delegates,
Ladies and Gentlemen,

I am very pleased to open this Conference on "The Role of Foresight in the Selection of Research Policy Priorities". I am glad that the conference takes place in this beautiful city of Sevilla, and under the Spanish Presidency. Mr. Secretary of State, thank you for your initiative and support.

I would like to share with you now, by way of a few introductory remarks, my views on foresight and its relationship with the Commission initiative to build a European Research Area.

Europe has a long-standing tradition of excellence in research and innovation, and European teams continue to lead progress in many fields of science and technology. However our centres of excellence are scattered across the continent, and all too often their efforts fail to add-up in the absence of adequate networking and co-operation. During the past Community Framework Programmmes, many collaborative actions have been initiated at European level, but now is the time to bring our endeavours together, and to build a space for research and innovation equivalent of the "common market" for goods and services. We call such a structure the European Research Area, or ERA, for short. And the development of the ERA, which has already started and will intensify during the years of our new Framework Programme, will seek to give a full step ahead in exploiting all the synergies of research and innovation policies, at regional, national and EU levels.

ERA and foresight

I would like to say to you that our policy proposal for the European Research Area, when we made it in early 2000, had itself some of the key features of an exercise in foresight; and I would like to tell you why I think so.

Foresight is about thinking, debating and shaping the future. This involves, ***first***, the *building and sharing of a vision*, that is to say, developing future scenarios on the basis of which we can shape the policy decisions we are to take today. ***Second,*** the

[1] Dr. Alejandro Herrero (Director for Science Strategy, Joint Research Centre, European Commission), delivered this speech on behalf of Commissioner Busquin.

debate of our vision with all stakeholders, including the policy makers themselves, who often are left just at the "receiving end" of the foresight process. And ***third***, *proposing new instruments for action*, in order to underpin our vision with a sound strategy showing, in essence, that our conclusions can give way to a well planned policy that can actually be implemented to achieve our goals.
If you agree with me in that these are acknowledged attributes of foresight, let me tell you that these were the precise steps that we followed in launching the ERA initiative.

Once the Commission proposal (the "vision") had been endorsed by the Lisbon European Council, we launched a widely open consultation, calling all interested parties, and in particular, the scientific community, to tell us how they saw our initiative. This allowed us to understand better the difficulties ahead, to realise that not all can be achieved in the first go and to plan carefully our policy instrument, the new Framework Programme, as the main means to furthering the European Research Area.

The new Framework Programme will mark a new departure for European research programmes. As many of you are aware, there will be new instruments, especially "Integrated Projects" and "Networks of Excellence". We have designed these instruments to promote innovation and to foster the process for integration of European research, that is, as I said before, in pursuance of our long-term ERA objectives. But please, allow me to say more about these objectives, and about what they mean for European research.

A Vision for the Future of Research Policy in Europe

The Commission proposal for the ERA entails a vision of the future Europe, whereby the present fragmentation in research, and the present barriers for innovation and the flow of knowledge, will have been overcome. This means that, sometime in the not so distant future, our Member States, including the enlargement countries, will have gone beyond the current collaborative research work and will have integrated (that is to say, they will be sharing) their R&D capacities in some areas of excellence. Some Member States will be also launching joint research programmes in selected areas of science and, in still other areas, a better co-ordination of regional and national research activities will be already normal practice and part of the *"acquis communautaire"*. In sum, we envision an enlarged European Union capable of endowing itself with the means to compete, better than it does today, with other leading economies such as the US and Japan.

This goal was endorsed by the fifteen European Heads of State or Government in Lisbon. The Lisbon Summit identified research and innovation as an integral part of the social and economic policy framework of the EU, and launched the well known "Lisbon Strategy", asking that the Union becomes "*the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth, with more and better jobs and greater social cohesion"*. More recently in Barcelona, under Spanish Presidency, the European Council again emphasised the role of knowledge on competitiveness and placed it at the heart of this strategy. The Summit set a target of 3% of EU GNP as the amount of resources to be devoted for research and technological development by all Member States. Again, research

policy has been recognised as a crucial element in our common vision for economic and social development in Europe, central in the political agenda of the Union and relevant to many other policies.

Open Method of Co-ordination: a European Area for Foresight

The ERA is a joint effort between Member States and the Union. This is needed in order to identify excellence, to strengthen pan-European collaboration and to strengthen the interaction and coherence among research policies in Europe. This is why the ERA strategy is also aiming at promoting the *"open method of co-ordination"* in the field of research and innovation policies. If these policies in Europe are to be made more inter-linked, more supportive of each other and will enter progressively into a process of mutual learning, the visions on which they are constructed will gain from being shared and made accessible to all. The process of European integration has led to the development of common policies that need constant monitoring and rethinking and co-operative foresight is mostly needed to inform the policy debates concerning the future developments of those policies.

But if foresight is important for "open co-ordination" of research and innovation policies, it is also true that the "open co-ordination" method is an interesting approach for promoting a true European area for foresight. There is a need to set up a platform for the foresight community of practitioners and users in order to exchange knowledge and experiences at European level. But most initiatives of co-operation will come from the actors themselves. This issue will be thoroughly discussed during this conference, and I am really looking forward to your conclusions.

European Foresight in the New Framework Programme

The Stockholm Conference in March 2001, organised under the Swedish Presidency, was an important step in fostering European co-operation in foresight. The outstanding group that met at Stockholm pointed to the main weaknesses of European foresight: fragmentation, duplication of efforts and, as key deficit, the lack of involvement of the policy makers in foresight exercises. The need for co-operation among national programmes – essentially, the need for foresight at a European level - was clearly identified.

In consequence, the Commission has set up two high level expert groups, one on the European dimension of foresight (the report of which will be presented in this conference) and another on regional foresight. We are helping the development of the European foresight Area by building "foresight bridges" with Eastern Europe and our Mediterranean partners, and also by promoting inter-regional co-operation in foresight.

We need to continue working to identify and mobilise all the relevant actors. But, no doubt, much remains to be done for the development of a supportive framework for foresight, to create platforms for knowledge sharing and to ensure a more systematic use of foresight for policy making. And, no doubt, the new Framework Programme will provide new opportunities to continue and strengthen these multi-dimensional co-operation frameworks: foresight will be an integral part of all priority thematic

areas, as well as in the support to policies and anticipating their scientific and technological needs.

I hope that this conference will bring new impetus to ensuring a more systematic use of foresight in all of the relevant areas, specially, for the setting of priorities for future European research.

Science and Society: a New Contract for the Scientific Community

The new Framework Programme has given to foresight a prominent role. But another important feature of the new Framework Programme is that such an increased emphasis on looking forward is complemented by a higher attention to the relationship between science and society.

There is a need to bring science closer to our society. To say it very clear: the scientific community should, as a matter of priority, also devote efforts to investigate and shed light to those issues of high concern for our citizens. Because while, on the one hand, science delivers higher standards for health and the environment, sustainable economic growth and employment, on the other hand, many products of science also worry deeply our society. Indeed, modern research policies incorporate as a new priority the relations between science and society. As was first pointed out by Jane Lubchenko, President of the International Council for Science, research policies should be built on a new (or expanded) contract between the public authorities who fund research and the scientific community. The notion of this "expanded" contract means that, while the traditional deliverables of science should continue, a stronger priority should be given to the research tackling the issues of societal concern.

A clear driver of S&T funding already is whether societal relevance can be demonstrated. But there is as well a large communication problem – society does not always see the contributions of S&T. Instead, society is often impatient with S&T. It does not understand why scientists take so long to resolve major problems – why is there no AIDS vaccine, why cannot contaminated blood be detected, or why dangerous substances enter our food chain? Citizens also sometimes feel that scientists are not on their side. There are concerns that the dominant voice comes from 'scientists for hire' that are boosting the application of new technologies just to generate profits. *We need to communicate better*, to talk of the success stories from the many labs, of course… but also to say clearly that modern research cares as well for the matters that afflict our society.

An Action Plan for Science and Society

You are aware that, as part of our efforts to develop the ERA, the Commission has adopted an Action Plan on Science and Society. It proposes a range of initiatives, including the promotion of an education and science culture in Europe; bringing science closer to the citizens; and, developing responsible science for policy-making. And, if you allow me, it is this last point that I want to develop in a bit more detail because it relates both to the positioning of the European Commission's Joint Research Centre within the ERA and to foresight itself. The mission of the JRC is to provide S&T support to EU policies. This involves networking with competent MS

laboratories, ensuring that scientific input to EU policy making is based on the best available science. The ERA offers a unique opportunity to reunite research capacities to tackle problems faced by policy makers; and the JRC will fully take advantage of this opportunity. But the process must not just look to the problems of today: it must look forward to the needs of policy makers during the next decade.

This is the challenge that I am giving to our JRC. We need to identify both, the challenges for society brought about by new technology and the future needs for qualified scientific support that new policies will have for their development and implementation.

Now, to sum up, let me give you a few concluding remarks:

Foresight is an important component of the toolbox for policy-making and more European co-operation is needed in this field. Foresight at EU level will have to tackle priorities such as economic competitiveness and innovation in the knowledge based economy; societal developments affecting all our societies, for example, demography, changing living conditions, gender equality, social exclusion, etcetera; and, science and technology developments and science-society relations. It is here where you may find the relevance of our envisaged platform of users and practitioners that we intend to set up for the foresight community. This platform will be a tool to provide a consistent supportive framework for knowledge sharing. Many foresights are actually professionalised debates between scientists, technologists, specialised bureaucrats and lobbyists. Is this actually the wider science and society debate that we need or do we need to go beyond such schemas? Such a platform needs to be built at regional, national and international levels; I trust this conference will contribute ideas to achieve the best articulation among these different levels of governance

We need to ensure that the policy makers themselves are involved in the foresight exercises, and that they act on their results. The wider participation of the public will be key to rebuild public confidence in science. In this regard, foresight is undoubtedly a key contribution to the new contract with the scientific community for which I have advocated earlier.

And to conclude, I would like to say that, over the last two decades Europe has taken a number of remarkable steps towards the integration of its economies. The most recent manifestation of this is of course the single currency, the Euro, which has become a fact of everyday life for most countries of the European Union. The future enlargement will bring membership of the Union to several more countries in a few years. This in itself represents a proof of what we can achieve at Union level when we are able to set clearly defined targets and share a common vision.

Ladies and Gentlemen, I wish you a fruitful work in Seville and look forward to hearing about the result of this important conference.

I thank you for your attention.

PROF. RAMON MARIMON
Secretario de Estado de Política Científica y Tecnológica
Ministerio Español de Ciencia y Tecnología

Es una satisfacción para mí celebrar aquí, en Sevilla, esta conferencia, que va totalmente en línea con las actividades que hemos venido desarrollando dentro de la Presidencia Española de la Unión Europea.

Uno de los primeros eventos de la Presidencia fue la celebración de un Seminario Informal de Ministros de Investigación y de Industria. Era la primera vez que se reunían conjuntamente los ministros de investigación y de industria de la Unión Europea. El tema central de la discusión fue el Espacio Europeo de Investigación y de Innovación.

Allí surgió la iniciativa, recogida posteriormente en la Cumbre de Jefes de Estado y de Gobierno de Barcelona, de marcarnos un ambicioso objetivo en el contexto de la estrategia de Lisboa, como es lograr que la media de gasto en I+D en la Unión Europea alcance en el año 2010 el 3% del PIB, teniendo claro que para ello es preciso conseguir una mayor involucración del sector privado. Pero no sólo de la industria, sino también del sector financiero y de la sociedad en conjunto. Sólo así se puede plantear un objetivo de este tipo.

Lo importante no es la cifra, sino entender que, en general, esta magnitud agregada ha permanecido estable en Europa en el 2% durante estos diez últimos años. Y que para elevarla es necesario involucrar a toda la sociedad en conjunto. Sólo cuando se ven los frutos de la investigación básica y aplicada es cuando toda la sociedad y la industria se vuelcan. Y, evidentemente, para ello se requiere el apoyo de las políticas públicas. Pero con políticas públicas exclusivamente no se puede conseguir el propósito de construir una sociedad altamente competitiva basada en el conocimiento y a la vez respetuosa con el medio ambiente, con las consiguientes mejoras en la calidad de vida.

Es en la perspectiva del Espacio Europeo de Investigación e Innovación donde nos parece crucial que se engloben los ejercicios de prospectiva científica y tecnológica, pues, como señalaba el Comisario Busquin (en las palabras que el Dr. Herrero nos leía), la cooperación en estas tareas es absolutamente necesaria.

Afortunadamente, partimos de una buena base. En particular, el trabajo que ha venido desarrollando el IPTS, y los estudios en cooperación en que muchos de ustedes están involucrados, así como la labor de la Fundación para la Prospectiva Tecnológica Industrial (OPTI) en España, resultado de una decidida apuesta por la Prospectiva que ha hecho el gobierno español.

Gracias a ello, hoy disponemos de 26 estudios de prospectiva tecnológica en ocho sectores de actividad claves para nuestra economía (química, energía, medio ambiente industrial, agroalimentación, transporte, tecnologías de diseño y producción y tecnologías de la información), y tenemos equipos de trabajo altamente especializados, que involucran a casi 2.000 expertos.

La prospectiva también tiene ejemplos de cooperación más allá de Europa, con Latinoamérica y con otros países, que nos parecen muy importantes en nuestra política científica y tecnológica en general, y cómo no, en prospectiva, en particular. Así, el programa de prospectiva para América Latina, promovido por ONUDI, ha sido también una iniciativa que hemos apoyado y en la que también ha colaborado IPTS.

También durante nuestra presidencia nos hemos centrado en temas de dimensión internacional de este Espacio Europeo, resaltando la colaboración con los países de Latinoamérica, con cuyas prioridades científicas coincidimos ampliamente. En este contexto, hemos celebrado en Brasilia una Conferencia de Ministros de Ciencia y Tecnología de países de la Unión Europea y de América Latina y Caribe, para profundizar en el diseño de actividades de cooperación científica y tecnológica. Allí hemos acordado unos principios de actuación que discutirán esta semana en Madrid los Jefes de Estado y de Gobierno en la Cumbre de la Unión Europea - América Latina y Caribe. Precisamente, un tema central de la Cumbre va a ser el de la cooperación científica y tecnológica.

Evidentemente, los países de la ampliación, que ya están formando parte del Programa Marco, también ocupan nuestra principal atención. Por ello, agradezco especialmente el interés y la presencia de estos países en esta Conferencia, en particular, por ejemplo, la del Secretario de Estado de Eslovenia.

También en nuestra Presidencia hemos intentado avanzar en un aspecto internacional especialmente delicado, como es el área euro-mediterránea. Han sido momentos difíciles, pero hemos hecho progresos tanto en colaboración industrial como en temas científicos y tecnológicos, para los cuales hemos encontrado una buena disposición.

Con esto he intentado darles en unas pinceladas una visión más global del Espacio Europeo de Investigación, que me parece importante en una Conferencia de este tipo.

Como decía, el IPTS y los trabajos que se han venido realizando han jugado y juegan un papel importante a la hora de perfilar las políticas de I+D. Ciertamente, en los trabajos preliminares, que ya parecen muy lejanos, de preparación y presentación del Sexto Programa Marco, la prospectiva ha tenido un papel importante y casi todos los campos sugeridos por el IPTS están presentes en el Programa Marco.

Abogaría, sin embargo, por un proceso algo más evolutivo en forma y contenido:

En forma, porque el ejercicio de prospectiva debe ser continuo, y no debe concebirse como un gran trabajo que se realiza de forma puntual con el propósito de diseñar un gran programa marco o un programa nacional y que se retoma al cabo de cinco años para hacer otro plan nacional o regional.

Estamos inmersos en un modelo evolutivo, donde las cosas van cambiando, a veces con gran rapidez. Esto no quiere decir que no haya que hacer prospectiva a largo plazo, sino que, como todo buen navegante, debemos tener un punto de referencia en el horizonte, pero hay que saber reaccionar también en lo inmediato. Y es en esta dimensión donde entiendo que la prospectiva tiene un gran papel que jugar, donde la

relación entre la prospectiva y las políticas debería profundizarse, y donde todos tenemos aún mucho que aprender.

Por esto, aunque ahora empecemos el Sexto Programa Marco, habrá mucho trabajo en estos próximos años. No para preparar el Séptimo, sino precisamente para continuar el desarrollo de este Espacio Europeo de Investigación.

También requerirá los trabajos de prospectiva otra iniciativa de nuestra presidencia, la de avanzar en la apertura de los programas nacionales, tarea esencial para alcanzar el Espacio Europeo de la Investigación y la Innovación. Todos los países de la Unión coincidimos en que es posible avanzar en la apertura y la coordinación de programas nacionales sin necesidad de que se produzcan transferencias de fondos. Se requiere, eso sí, llegar a un acuerdo sobre las prioridades, y aquí también son importantes la importancia los trabajos de prospectiva. Se requiere, también, tener una voluntad política de coordinar efectivamente nuestras políticas e iniciativas. Pero creemos que es primordial avanzar en este sentido.

También he mencionado que abogaría por un proceso algo más evolutivo en contenido, porque es necesario que la prospectiva se realimente a sí misma en el medio plazo, con el fin de que sea de utilidad para otras actuaciones de política tecnológica. Es cierto que cualquier sistema tiene elementos de lo que se llama "self-organisation", de organización propia. Este fin de semana, también dentro de nuestra presidencia, tuvimos una conferencia sobre biodiversidad en Almería, de donde vengo. En los sistemas naturales está muy claro que es preciso entender que éstos tienen solución propia, pero también cómo y cuando se puede incidir sobre ellos de forma efectiva, respetando siempre la capacidad de todo sistema ecológico de desarrollar su propia vida. Algo semejante pasa también en ciencia y tecnología. La comunidad científica tiene sus dinámicas propias como las tiene la industria en sus iniciativas de innovación. Nos corresponde a los responsables de política científica y tecnológica ver en qué momento y cómo se puede ser más efectivo en impulsar una dinámica que ya existe.

No estoy defendiendo, ni mucho menos, que nos quedemos simplemente contemplando cómo va cambiando el paisaje. Esto no es cierto cuando nos planteamos políticas medioambientales y tampoco lo es en políticas científicas.

Ahora mismo, por ejemplo, Sevilla se está convirtiendo en el tercer gran núcleo aerospacial de Europa. Esto era impensable hace algunos años, y ha sido fruto de una política estratégica de apoyo, pero también del esfuerzo de una industria competitiva que ha sabido desarrollar una capacidad tecnológica y desarrollarla aquí mismo, dentro de un gran consorcio europeo como es el proyecto del AIRBUS. AIRBUS es un buen ejemplo de combinación de cooperación, competencia y también de política tecnológica a través de ayudas estratégicas.

Un adecuado enfoque de la prospectiva, bien entroncada en el desarrollo de las políticas en curso, podría prestar una ayuda inestimable a los responsables de política científica y tecnológica a la hora de promover iniciativas de este tipo.

El Espacio Europeo de Investigación e Innovación, en esta Europa que se está ampliando y que tiene una vocación cada vez más internacional, está justo en sus

inicios. El Sexto Programa Marco es un instrumento muy importante para su desarrollo, pero sólo es uno de los posibles. Tenemos mucho que hacer en las políticas internas de los países, por un lado, y en su coordinación, por otro.

Y ya que mencionamos el Sexto Programa Marco, simplemente señalar que me voy rápidamente a Estrasburgo, donde esperamos que el Pleno del Parlamento Europeo emita su dictamen sobre el Programa, y que pueda dar fruto un intenso trabajo de negociación que hemos estado realizando para llegar a un acuerdo entre Consejo y Parlamento que signifique la aprobación.

Esto nos parece importante porque no queremos en ningún modo tener una interrupción entre el Quinto y el Sexto Programa Marco, y nos parece particularmente importante porque el Sexto Programa Marco pone en marcha nuevos instrumentos para el desarrollo de este Espacio Europeo de Investigación.

También quiero mencionar que de cuando en cuando surgen cuestiones de una gran importancia para la sociedad, como la ética en la investigación científica y tecnológica. Es muy difícil para la sociedad abordar estos problemas si no tenemos la capacidad de entender y hacer entender hacia dónde van ciertas tecnologías.

Por ello, no hay que disociar los ejercicios de prospectiva tecnológica de la iniciativa "Ciencia y Sociedad" que mencionaba el Comisario Busquin que intenta involucrar a toda la sociedad. Pero muchas veces, involucrar a una sociedad en conjunto quiere decir también que toda la sociedad entienda lo que estamos haciendo, hacia donde van la ciencia y la tecnología. Sólo si se entienden las ventajas que puede proporcionar, por ejemplo, la biotecnología, sólo si la sociedad comparte que aunque existan ciertos peligros, tendremos la madurez suficiente para no caer en ellos, sólo así se obtendrá el respaldo social para el desarrollo de nuestras políticas científicas y tecnológicas.

Espero que tengan una muy productiva conferencia.

Quiero agradecer una vez más la colaboración del IPTS y me sabe mal tenerme que ir y perderme la Conferencia, en particular la intervención final del Prof. Richard Ernst.

PROF. RAMON MARIMON [1]
Secretary of State for science and technology Policy
Spanish Ministry of science and technology

It is a pleasure for me to celebrate here in Seville this conference which is completely in line with the programme of activities that we have organised as part of the Spanish Presidency of the European Union.

One of the first Presidency events was the celebration of an Informal Seminar of Research and Industry Ministers. It was the first time that the European Union's research and industry ministers met together. The central theme of the discussion was the European Research and Innovation Area.

It was there that the initiative arose - subsequently taken up by the Barcelona Summit of Heads of State and Government - to fix an ambitious objective in the context of the Lisbon strategy, to reach by the year 2010 an average R&D expenditure in the European Union of 3 % of GNP. It was also recognized that this challenge clearly requires a much bigger private-sector commitment, not only from industry, but also from the financial sector and society as a whole. Only in this way is it possible to envisage reaching such an objective.

The number in itself is not as important as the understanding that this aggregate figure has stayed stable at 2 % in Europe for the past 10 years. To raise it requires the involvement of the whole of society. Society and industry only commit themselves when they see the fruits of basic and applied research. Obviously the support of public policy is also required. But it is impossible to build a highly competitive knowledge-based society which also takes account of the environmental dimension and with consequent quality of life improvements, exclusively on the back of public policies.

It appears to us crucial to accommodate science and technology foresight exercises within the ambit of the European Research and Innovation Area, given that, as Commissioner Busquin pointed out (in the words read by Dr. Herrero), co-operation in these endeavours is absolutely necessary.

Fortunately, we have a good starting basis. In particular, the work of IPTS and the co-operative studies in which many of you are involved, as well as the efforts of the Industrial Technology foresight Foundation (OPTI) in Spain – the result of a commitment to foresight which the Spanish government has made.

Thanks to this, to date we have available 26 technology foresight studies in eight key sectors for our economy (chemicals, energy, industrial environment, agri-food, transport, design and production technologies and information technologies), and we have highly specialised working groups involving almost 2,000 experts.

There are also examples of foresight co-operation beyond Europe with Latin America and other countries which we feel are important for our science and technology policy in general, and of course for foresight activities in particular.

[1] This is a translation of the original Spanish speech.

Therefore, we have also supported the foresight programme for Latin America, an initiative promoted by UNIDO in which IPTS has also collaborated.

During our Presidency, we also have focused on European Research Area themes with an international dimension resulting in collaboration with Latin American countries, the scientific priorities of which we largely coincide.

In this context we held in Brasilia a Conference of science and technology Ministers from the European Union and from Latin America and the Caribbean, where we explored in depth the design of S&T co-operation activities. We also agreed a number of principles for action which will be discussed this week in Madrid by the Heads of State and Government in the EU – Latin America and Caribbean summit, with a major focus on scientific and technological co-operation.

Obviously though, the EU enlargement countries, already taking part in the Framework Programme, are our main interest and focus of attention. For this reason, I appreciate the interest and representation from these countries in this Conference, in particular, for example, that of the Secretary of State from Slovenia.

In our Presidency, we have also tried to make progress on a particularly delicate international issue - the Euro-Mediterranean Area. There have been difficult moments, but we have made progress in industrial collaboration and science and technology themes where we found a high interest.

With the above, I have tried to give you a more global vision in broad brushstrokes of what the European Research Area is, which in my view it is important to do in a Conference of this type.

As I mentioned before, the work of IPTS has played an important role in profiling R&D policy. Without a doubt, in the preliminary work, which now appears very remote, leading to the preparation and presentation of the Sixth Framework Programme, foresight played an important role, and nearly all the fields proposed by IPTS are present in the Framework Programme.

I would, however, support a more evolutionary process both in format and content:

In format, because foresight should be continuous, and it should not be conceived of as a major work conducted on a punctual basis with the purpose of designing a big framework programme or a national programme and which repeats itself after five years for another national or regional plan.

We are immersed in an evolutionary model, where things change, sometimes with great speed. This does not mean that we should not do long-term foresight, but rather, as any good navigator, we have to have some reference point on the horizon, but at the same time know how to react to the more immediate. It is on this aspect that I believe that foresight can play an important role, where the relationship between foresight and policy needs to be deepened, and where all of us still have a lot to learn.

For this reason, even though we are now starting the Sixth Framework Programme, there will be much work to do in the coming years, not to prepare the Seventh, but rather to continue the development of the European Research Area.

Foresight is also called for in relation to another of our Presidency initiatives, that of advancing the opening of national programmes, which is an essential task for making progress in developing the ERA.

All EU Member States agree that it is possible to move towards the opening and co-ordination of national programmes without the need for the transfer of funds. What is required is an agreement on the priorities, and hence the need for foresight. Political will is also needed in order to co-ordinate effectively our policies and initiatives. But we believe that it is absolutely essential to make progress in this direction.

I also mentioned that I would support a much more evolutionary process in terms of content, as it is necessary that foresight feeds on itself in the medium term in order to be useful to other on-going technology policy actions.

It is true that any system has what are called *"self-organisation"* elements. Last weekend, also as part of the Presidency Programme, we had a conference on biodiversity in Almeria from where I have just come.

In natural systems, it is very clear that it should be understood that different ecological systems have within them their own solutions, but also how and when it is possible to act upon them, always respecting the capacity of any ecological system to develop its own life.

Something similar happens in science and technology. The scientific community has its own dynamics, as industry does, regarding its innovation initiatives. It falls to those of us who are responsible for science and technology policy to see when and how we can be more effective in providing an impulse to some already existing dynamic.

I am not in any way proposing that we keep watch over how the landscape changes, certainly not when we develop environmental policies, and equally not in science policy.

Presently, for example, Seville is set to become Europe's third biggest aeronautics centre. This was unthinkable a few years ago, and has been the fruit of a strategic policy of support, but also of the effort of a competitive industry which has been capable of developing right here a technological capacity, within a large European consortium – the AIRBUS project. AIRBUS is a good example of a combination of co-operation, competence and also of strategic aid-based technology policy.

An adequate foresight approach, well connected to on-going policy development, could constitute an invaluable aid to those in charge of science and technology policy when it is timely to promote initiatives of this type.

The European Research and Innovation Area in this expanding Europe with an increasing international vocation, is just in its beginnings.

The Sixth Framework Programme is a very important instrument for its development, but it is only one of the possible instruments. We have a lot to do with the internal policies of the countries, on one hand, and in co-ordinating them on the other.

As we now mention the Sixth Framework Programme, I would just like to point out that I will be quickly on my way to Strasbourg where we expect the Plenary of the European Parliament to pronounce a favourable opinion on the Programme, bearing the fruit of intense negotiations realised in order to reach an agreement between the Council and Parliament which is tantamount to its adoption.

This is very important because we in no way want to have an interruption between the Fifth and Sixth Framework Programmes, and this seems to be all the more important given that the Sixth Framework Programme involves new instruments for the development of the European Research Area.

I would also like to mention that, from time to time, very important issues for society are raised such as ethics in scientific and technological research. It is very difficult for society to affront these problems if we do not have the capacity to understand, and to transmit this understanding to others, about where certain technology trends are heading.

For this reason, we must not disconnect foresight exercises from the "Science and Society" initiative mentioned by Commissioner Busquin to involve the whole of society. But very often, involving society means that society understands what we are doing, and where science and technology is heading. Only if one can understand the advantages which can be brought about by, for instance, biotechnology, only if society recognizes that even though certain dangers exist, we will have sufficient maturity not to fall into them - only in this way will we obtain the support of society for the development of our science and technology policies.

I wish you a very productive conference.

I would like to acknowledge once more the collaboration of IPTS and I regret very much that I have to leave and miss the Conference, in particular the final keynote speech by Prof. Richard Ernst.

GOVERNING IN TIME: LONG-TERMISM AND THE ROLE OF FUTURES THINKING IN THE UK GOVERNMENT

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I. BACKGROUND

I want to talk this morning both about why governments should think about the long-term, and about our practical experiences in the UK in trying to shape new institutions and approaches within government.

For anyone with any curiosity about the world thinking about the future is inherently fascinating. But for governments the starting points are both practical and moral.

The practical point is that in order to be effective all Governments need to operate simultaneously in the short term, the medium term and the long term. Inevitably most of the compelling pressures on Government – those from the media, politics, interest groups and an impatient public - are focussed on the short and medium term. But good governments filter some of these out because they know that history is littered with the carcasses of governments that failed to think ahead, focused exclusively on tactics, and assumed the environment would remain stable or that trends would continue in a straight line without deviating.

The moral point is that in any society governments have a duty to act as guardians of the future of the community they serve, and of the interests of future generations, in ways that are simply impossible for individuals, families or businesses to do. As a result one of the tests of the moral quality of leadership in any government is the extent to which it focuses on the long-term, rather than simply addressing today's interests and pressures.

II. WHAT DOES LONG-TERMISM LOOK LIKE?

Let me start by describing what long-termism means in practice. Almost every decision a government takes can be situated in time. Some will have an impact in days or weeks. Others will take effect over decades. Some governments become stuck in an eternal present. Others have a much stronger sense of their position between the past and the future.

The difference between these approaches has been seen very starkly in the UK over the last decade. By the mid-1990s, partly for reasons of politics (a small majority), government in Britain had become remarkably short-termist. These were a few of the symptoms:

- Sharp cuts in public capital expenditure
- Short-term (annual) funding cycles which made planning very difficult
- Low spending on preventive measures in health and crime despite strong evidence on its effectiveness
- Little attention to the long-term environmental impacts of consumption patterns
- Few if any long-term plans for the main parts of government
- Little capacity within the centre of government for doing strategic work

Over the last 5 years there has been a marked shift, partly because we now have a government with a large majority, and partly because there is a broad consensus on the need for change. I will talk later about what this has meant in terms of strategic capacity. But it is worth emphasising from the start the very practical effects that a longer-term perspective has had:

- Public capital spending is rising threefold as a share of GDP
- Departments are now given 3 year spending allocations, and in the cases of transport, health and education, 10 year plans to ensure stability
- Spending on preventative measures has sharply increased, with a particular emphasis on under-3s
- Environmental considerations have moved to the heart of government, including for example a recent review of energy policy which looked out to the key options running to 2050
- The UK has been one of the strongest supporters of Kyoto and more energetic action on climate change
- Science funding has risen sharply – and is now rising by 7% each year in real terms
- Macroeconomic policy – and policy in a number of areas – has been deliberately removed from immediate political pressures to enable a longer-term approach to be taken

Each of these is an indicator of the much longer implicit time horizons that government is working with, and of its effective discount rate.

III. PREDICTABLE AND UNPREDICTABLE TRENDS

Before turning to the detail of institutional structures I want to address how we should think about long-term processes of change. One of the most important tasks for government is to have a sense of which trends are long running and broadly predictable. Many of the trends in demography and economics and infrastructures are broadly predictable – we have a fair idea of how many children will be entering secondary schools in 10 years time (though far less idea of how many of them may be committing crimes or taking drugs). We know a lot about likely patterns of ageing (but less about likely trends in morbidity). We know a lot about linear trends in traffic (but less about whether at some point ICT will substitute rather than complement rising levels of transport use).

We also know a lot about technological trends. Most of the key generic technologies – electricity, the internal combustion engine, IT and biotechnology – diffuse only slowly through society and the economy partly because of the time it takes for

technologies to mature, partly because of the need for appropriate social and organisational innovations. Over 40 years after the invention of the semiconductor, ICT is only now having a big impact on productivity levels, while biotechnology is still some way from having a decisive impact on daily life.

We can predict with some certainty that governments will be concerned about maturing technologies – such as the technologies underpinning the next generation of the Internet (hopefully like the web, originating in Europe), regenerative medicine or proteomics, perhaps even fusion – and that they will be concerned about the associated social innovations – for example, how personal identity should be managed in information rich societies, or how germ line techniques should be regulated.

One of the great advantages of foresight type processes is that they can look in an integrated way both at the technologies and at the associated social and organisational challenges or innovations.

To help us understand these processes we generally use a framework that focuses on 4 key clusters of drivers of change and their interactions:

- the rising centrality of knowledge, which is produced, codified, traded, manipulated, hard-wired into technologies and which is increasingly critical not just to the economy but also to the working of public institutions and society more generally.

- changing values and in particular the rising importance of democracy and of the essential promise of democracy: autonomy, the ability of people to control their own lives.

- the rising importance of connections and the flows of goods, money, ideas and messages around the world.

- the rising importance of the ecology - the physical systems which sustain life, air, water, food and energy

Many of the most important future challenges for governments – ranging from migration to failing states, and from intellectual property rights to organised crime, or from the changing cultures of children raised on screen logic rather than text logic to the handling of new technologies of reproduction, the threat of worsening obesity to return of old infectious diseases - arise from the interaction of these trends.

In some of these cases it is fairly easy for governments to map the trends, apply them and test policies against them, although there are still strong tendencies for compartmentalised thinking – within academic and scientific disciplines – and although holistic, systemic thinking remains rare.

Other trends are non-linear, and it is highly probable that improbable events will occur. Today's conventional wisdom is as likely to be wrong as the conventional wisdoms of the past. Few in the early 1990s expected that the coming decade would bring a civil war in Europe with hundreds of thousands killed, half a billion users of the internet, a long stagnation in Japan and a long boom in the United States, or the

complete mapping of the human genome. Few in the run up to 2000 anticipated thousands killed in a terrorist attack on New York or the partial collapse of the California electricity system.

This is nothing new. It has always been hard to judge the significance of the present, let alone of the future. To take just one example: within a few months of each other in 1969 the first man walked on the moon and the first use was made of an embryonic Internet. One was covered with huge fanfare, but ultimately led to rather little. The other was scarcely noticed but had huge impact.

In relation to non-linear, and less predictable, change of this kind very different approaches are needed:

- Horizon scanning mechanisms to identify coming issues.
- Clarity about leading indicators (governments, like individuals, tend to be poor at understanding exponential processes of change).
- Capacities for rapid response (since even the best mechanisms will miss many events).
- Strategies that are robust against a range of eventualities.
- The use of broad sources of intelligence – including softer types of data – rather than relying on necessarily backward looking statistical information.

IV. COPING WITH COMPLEXITY

The difficulty for government in relation to both linear and non-linear trends is the sheer complexity of the future – the infinite variety of possible events.

After all it is not possible to map out or plan for every eventuality because there are simply too many variables. There is a substantial opportunity cost both in the analysis of the future and in planning for, mitigating, or anticipating possible future events.

The more complex and unpredictable the system, the more this must be true, yet Governments often want the appearance of certainty, even where it is not achievable. The American economist, Kenneth Arrow, tells a nice story about being assigned during WW2 to a weather forecasting unit in the Pacific where, within a few weeks, he realised that their long-term forecasts were no better than simple extrapolations from month to month. He asked his superiors to give him a different task but received the response that, however flawed the methodology, the data was still needed for planning purposes.

In some cases the best response for government is not to plan for a particular future but rather to ensure that it has sufficient capacity to cope with a range of possibilities, and to respond very quickly when things change. Over-rigid plans, and fixed views of the future can be disabling.

Machiavelli quotes Pandolfo Petrucci, lord of Siena on precisely this point: ‘wishing to make as few mistakes as possible,’ he said ‘I conduct my government day by day and arrange my affairs hour by hour; because the times are more powerful than our brains.’

We don't need to be quite so pessimistic – but it is important not to overestimate our capacity to plan.

The other problem for governments is how to link strategy to day to day decisions. Many practical decision makers see long-term strategy as marginal or an indulgent distraction. Our minds are much better suited to dealing with issues in an *ad hoc*, modular way.

V. INSTITUTIONS

The big challenge therefore has been to design structures that bridge the long-term and the everyday. Let me now turn to what these are, and how they work best.

foresight which was launched in the UK in 1994 has been one of these forms and has built up a good track record within the UK, on the interface of government, science and business. It has had a significant impact on technology policy, on a number of sectors and on universities – helping them to forge better links with business in areas like food technology, chemicals, materials and in areas like crime prevention technology.

However, long-termism and foresight go far beyond what has been done so far by foresight panels. Panels are good for building up a shared understanding within sectors. But they have proven less effective as tools for strategic decision-making, and they tend to be rather removed from the day to day business of government.

That was why when Tony Blair came to power in 1997 he decided that there was an urgent need to rebuild strategic capacity at the centre of government.

Early work was done on how governments around the world carried out strategic work and on the what lessons could be learnt from past attempts in the UK (including a high profile Cabinet Office think-tank, the Central Policy Review Staff which lasted from 1970 to the early 1980s), and what lessons could be learnt from businesses and other organisations. Some of these lessons are set out in a report contained on our website (www.piu.gov.uk) which looked at the experience of a wide range of organisations, from the Social and Cultural Planning Office in the Netherlands, to Norway 2030 to Shell, Singapore's Scenario Planning Office, the Hawaii Research Centre to Futuribles in France.

The Performance and Innovation Unit was the first result of this work and was set up in 1998 with a remit to look at long-term, cross-cutting strategic issues. The particular concern was to ensure effective links between strategy work and decisions and implementation (as Henry Mintzberg has written 'every failure of implementation is, by definition, also a failure of formulation'). As a result:

- the unit's work consists primarily of time limited projects, with teams given the time and space to develop forward looking policies rather than reacting to short-term pressures

- the unit is staffed with a roughly equal mix of civil servants and non-civil servants, drawn from business, academia, the voluntary sector to ensure a freshness and breadth of perspective. Civil servants are also included from the departments which will lead on implementation

- there is an emphasis on analytical rigour and analytically driven solutions

- most projects have a sponsor Minister to act as a sounding board and give political steers

- stakeholders are closely involved through advisory groups, consultations and web discussion groups

- for most of the projects there is a time-scale designed to allow serious analysis but avoid the risk of drift: usually this means between 3 and 9 months

- a majority of reports are published as statements of Government policy with clear indications of how conclusions will be taken forward and on what time-scale

- most projects try to design in a learning capacity, rather than being presented rigid plans (reflecting long experience that plans rarely survive intact for more than 2-3 years)

The topics covered by the PIU in its first period included: e-commerce; e-government; trade; adoption; global health; recovery of criminal assets. A broader programme of work was also done on the big strategic challenges facing the UK.

More recently, since the 2001 election, another sister unit has been set up - the Prime Minister's Forward Strategy Unit – which takes a similar approach, but generally on a more confidential basis.

Together these units – which now number up to 100 full-time staff - carry out three main types of work:

i) The first are detailed policy commissions, which are carried out as fairly public projects with the aim of reaching specific conclusions and recommendations. Current projects are reviewing policy on childcare, electronic networks and waste strategy, generally looking 5 to 10 years out with the aim of directly influencing allocations of resources, legislation and public institutions. A recent example was the PIU's review of UK energy policy, which looked out to 2050, using a range of scenarios and detailed modelling, to examine the options for achieving a 60 per cent reduction in C02 emissions. Other examples include work on social mobility and the future of the rural economy. Most of these projects are public with detailed scoping notes, project plans, working papers and online consultations with key stakeholders on the website – a very transparent process which ensures that we can draw on the best intelligence from outside government.

ii) Secondly, more speculative work is done on key potential areas of challenge under the 'strategic futures' heading. This is carried out by a much smaller team along with a virtual network across Government. This is the Strategic Futures Group which

includes the planning units from all departments, as well as foresight. It is linked by an online knowledge pool. An earlier phase of this work in 1999 identified a range of topics or challenges, which Government at that time was not sufficiently preparing for. These included a changed approached to migration, both high skill and low skill, seeing it more as an economic opportunity than as a threat, and work on privacy and data sharing to ensure that there was sufficient safeguards for the use of personal data to maintain public trust during a period when much greater data sharing was becoming possible. We have just started another phase of work of this kind, producing think pieces on topics as varied as geographical mobility and social capital, litigation and biotechnology, to provide tools for Government departments to think in a fresh way about the challenges they are likely to face. Again the great majority of this work is published on the PIU website. This work also links to another recent development – the establishment in 2001 of a civil contingencies secretariat to focus much more rigorously on short to medium term threats to government's business, with particular attention to the resilience of systems, for example, IT systems, energy systems, health systems.

iii) Thirdly, we do more in-depth strategic work bilaterally with departments in areas like transport, thinking 15 years ahead about the key strategic choices which Government needs to make and often using very intensive modelling and system analysis tools. This work tends to be private.

In all of this work we've tried wherever possible to ground projects in strong analysis - of key trends and interdependencies; of lower probability but high impact possibilities; of knowledge of what works, with attention to the reliability of different types of evidence. We make use of a wide range of methods including scenarios, logic trees, formal modelling as well as creativity methods. We try to take as rounded as possible a view of the key factors shaping systems including not only technologies, demographics and economic factors but critically too public values. From that grounding we then make judgements about strategic goals, taking full account of the political dimension of policy. And finally we work with delivery agencies on practical plans of action.

In much of this work the most important aspect is judgement and synthesis, rather than simply amassing data. The American jurist Oliver Wendell Holmes once said: "I would not give a fig for the simplicity this side of complexity… I would, however, give my life for the simplicity on the other side of complexity." Often it the identification of a few key insights that matters most in this work, not its volume.

The importance of judgement is also a feature of another aspect of the emerging institutional landscape. In many of the fields that face the greatest complexities in navigating their way to the future, new types of institution are taking shape which have been designed to make better and more legitimate judgements on complex issues of science and technology.

Instead of being organised as traditional agencies or departments these bodies are attempting to bring together much greater transparency, technical knowledge and judgement. The Food Standards Agency is one example. Others include the human fertilisation and embryology authority (HFEA), the human genetics commission HGC), the agriculture and biotechnology environment council (AEBC). All work in a

much more open and transparent way than was possible in the past to improve understanding of future trends, bringing science together with understanding of ethics and public attitudes. All could be harbingers of a more adult way of dealing with the future – one that is based on evidence but acknowledges unavoidable ambiguities and uncertainties.

VI. KEY LESSONS

I would like to conclude by drawing out some of the key lessons which we have learnt about how futures work can best be done within the constraints of government.

The first is to be clear that there is a tension between the ethical duties of government and day to day realities. Governments are not by nature particularly forward looking. We tend to remember the great leaders who thought hard about their legacy, and built institutions and legal systems to last. But the majority saw their role in a much narrower way, as primarily about surviving in power and balancing competing interests. Indeed hard-nosed realists sometimes find it difficult to understand why any government would spend money on a preventive programme (like Surestart in the UK) that will not deliver results for 10-20 years, or why they might take action now to reduce CO2 emissions in a generation or two's time. Part of the reason why governments do all these things is that some have a sense of their own vocation – their duty to use power responsibly, and their duty to see beyond the day to day pressures of 24/7 media and the clamour of vested interests. But without that drive from leaders themselves it is very hard, if not impossible, to secure the resources and protection that futures work requires.

The second lesson is that the future can be dangerous. Past Governments have often come unstuck when materials about the future leaked to the media and were treated as statements of fact or intent rather than as explorations. One of our predecessors, the Central Policy Review Staff, was closed down in the early 1980s when one of its papers predicting the demise of state pensions was leaked to the press. Part of the answer is to be very strict on security. The other part, paradoxically, is to be open wherever possible, since as a general rule material put on the website is less likely to cause controversy in the media than secret Government papers.

The third lesson is that it is essential to get decision-makers attention by focusing on the immediate steps which link the present to the long term. Even a 50-year strategy needs a year 1 plan. This means having within all of the teams sufficient skills in policy making to demonstrate what needs to be done now in order to achieve a desirable future. It also means looking for early gains which can help to build confidence – and to create the momentum for longer-term strategies.

The fourth lesson is that it is essential to avoid futures, and 'futurology', becoming too specialised a field. There are great benefits in having a substantial flow of people in and out of our units and our teams so that futures work does not become a self contained cult. One of the benefits is that we have an alumni network of several hundred people scattered across government and elsewhere who can act as champions, and who can help to translate concepts and material into forms that make sense to decision-makers and practitioners.

The fifth lesson is that, wherever possible, it is wise to avoid the trap of making forecasts and predictions. As Sam Goldwyn said its unwise to prophesy, especially about the future. We emphasise that futures work is about making better decisions informed by a richer understanding of what might happen rather than setting out what will happen.

And finally, it is vital that the clients of this work – senior ministers and civil servants – are kept in view. Unless they see it as valuable, and unless it is tailored to their needs and provides them with facts and arguments that help them to do their jobs better it is unlikely to survive.

The networked world is in some respects extraordinarily short-term. Events, ideas and crises can spill across the globe with great rapidity. Yet in other respects the long-term is more visible than ever before. In part because people live so much longer, and therefore have more of a stake in the future. In part because of growing awareness of the biosphere and its much longer time horizons. In part because a much more educated population understands better that the present can only be understood with the benefit of a deep understanding not only of history but also of what the future is likely to bring.

Our task is to reflect all of these points in structures of government that meet Italo Calvino's definition of the qualities of the new millennium – that is to say structures which are light, quick, transparent, exact, able to cope with multiplicity, and thus very different from the qualities which governments have so often had in the past when they have been heavy, slow, secretive, vague and homogeneous.

If we can do that, governments will hopefully navigate their way through the 21st century rather better than they did the 20th.

PIU reports can be found on
www.piu.gov.uk

The work of the strategic futures team can be found on
http://www.cabinet-office.gov.uk/innovation/2001/futures/main.shtml.

II. EUROPEAN LEVEL FORESIGHT

Moderator:
• Prof. Enric Banda, European Science Foundation.
Speaker:
• Dr. Luk Van Langenhove, United Nations University, Belgium
Paper presented by: Mr. François Farhi, CM Inno, France
Discussants:
• Prof. Luke Georghiou, PREST, University of Manchester, UK.
• Ms. Kornelia Haugg, Ministry of Education and Research, Germany.
• Dr. Barend van der Meulen, University of Twente, The Netherlands.
• Prof. Emmanuel G. Koukios, National Technical University of Athens, Greece.
Rapporteur:
• Ms. Helena Acheson, Forfás, Ireland.

SESSION OVERVIEW

This session aimed to discuss how European co-operation in foresight should be undertaken and what sorts of issues it should focus on. The context is important, with prospects for more determined transnational collaboration in foresight being given a strong impetus by the European Research Area which calls for national and European-level activities to build-in much more synergies and efficiency, thereby removing redundancies and overlaps. The findings of the recent ETAN/ STRATA high level expert group on European foresight were reported by the main speaker and used as a springboard for the discussants and for the open debate.

Enric Banda (European Science Foundation), the moderator, limited his opening remarks to the introduction of the main session speaker, referring to the fact that, due to personal reasons, **Luk van Langenhove** (Chairman of the High Level Group on European foresight) had not been able to attend the conference. Francois Farhi (rapporteur of the High Level Group) therefore delivered the paper.

Francois Farhi (CM France) provided a synthesis of the main messages and recommendations of the High Level Group on European foresight. He underlined the increased importance of robust priority setting and transparency in the governance of science and technology. foresight with its characteristics of being participative, transparent and forward looking is an increasingly popular tool for setting agendas for science and technology. However, he underline the fragmented position of European foresight, with few links between national exercises, duplication of efforts and the lack of attention to European level challenges and responses. He identified a number of lines of action that could be developed, without affecting the bottom-up diversity of foresight, namely: shared learning on the practice of foresight; monitoring of development of best practices; targeted projects on common problems and wider dissemination and application of results.

In the responses by the discussants a considerable development of complementary positions emerged. **Luke Georghiou** (PREST, University of Manchester, UK) pointed out the difficulty and yet the importance of developing evaluations of foresight. Especially it is important to decide the purpose of the evaluation for instance in terms of predictive performance, affect on general awareness or translation into policy. In addition, clear benchmarks are needed but as yet absent for foresight in the areas of quality, impact and its contribution to network formation in the affected communities. At European level such evaluations could provide the basis for a comparative framework which in the end would be a valuable contribution to ERA.

Kornelia Haugg (Federal Ministry of Education and Research, Germany) raised the issue to what extent we can trust in the foresight processes. foresight represents an advance on traditional priority setting in science and technology by experts behind closed doors. But, the transparency of foresight is not complete, for example how are topics selected and how are participants chosen? Taking these issues to a European level could we end up underlining the mainstream and miss out the surprising and interesting developments. In short, monitoring and enhancement of standards yes, but also a fair discussion of foresights failures.

While agreeing with the majority of the High Level Group's recommendations, **Barend van der Meulen** (University of Twente, The Netherlands) stressed his worries foresight could miss its mark by targeting relatively closed networks, which would give low added value, or policy areas that are so broad that the actor groups are too dispersed for foresight to foster concrete actions. Results show that foresight works best at the medium level where foresight results and processes can support agendas building and network formation. European level foresight exactly risks that it might be at too general a level and so fails to connect to action. Thus, in advancing foresight at European level, it is important that it has a viable contribution to make, for example in building research policy for the European Commission.

The fourth discussant, **Emmanuel Koukios** (National Technical University of Athens, Greece) reminded the audience that although foresight is now widespread, not all regions and even member states have the same capacity to undertake such actions. There is even a foresight paradox: the more you need it the less prepared you are to do it. One advantage of a shared European space for foresight is that the leading areas can certainly provide assistance to the less advanced regions.

Following the formal discussants, the floor was opened to allow a substantial debate to develop. **Helena Acheson** (Forfás, Ireland), whose feedback is in a later section, followed the substance of both the speeches and the comments and provided a concise report on the proceedings.

SCIENCE AND TECHNOLOGY FORESIGHT IN EUROPE; A PROSPECTIVE VIEW…[1]

PROF. LUK VAN LANGENHOVE
United Nations University (UNU/CRIST), Belgium

I. ABOUT SCIENCE AND TECHNOLOGY POLICY AND THE NEED FOR FORESIGHT

Both public authorities and private firms invest considerable amounts of money in science and technology. As such it is not surprisingly that there is an interest in thinking about the future of science and technology in order to strengthen the ability to anticipate science and technology related issues *("where and why do we have to invest money in?"*) and to create a strategic basis for S&T policies.

Meanwhile, governmental S&T policy has dramatically changed in the last decades as we have witnessed an increasing complexity of interactions between the growing number of actors that play a role in S&T processes. Indeed, we are far away from the situation where the only 'players' where the scientists. Today, we have a set of distinct institutions, which jointly and individually contribute to the development of science and to the development and diffusion of new technologies in each country. Usually, this is called a "science system" and/or "innovation system". As noted by Kuhlman et al (1999) the European innovation policymakers have to co-ordinate their interventions with an increasing range of numbers of actors in mind: more governmental actors on the one hand (regions, various national departments, European authorities…) and more stakeholders and civil society groups on the other hand. It follows that policy making can no longer be regarded as a linear process where information is the input and decisions are the output. In stead policy-making can be considered as 'non-linear' as it involves successive stages of both formal and informal consultations and dialogues as well different expert's advice. Perhaps the best way to describe this is by referring to the concept of learning organisation: policy-making as a process of collective learning. And, not to forget, dealing with societal choices also involves ethical and political choices that have to be framed in the dynamics of the social interactions in which they occur. In such non-linear processes, thinking about the future can play an important role in order to capture what already 'lives' in society and in order to make explicit the complex relationship between science and innovation systems and rest of society.

As science and technology are playing an ever more important role in public policies (cf. genetically modified food, nuclear waste management, …), there is a growing

[1] This presentation is based upon the work of the STRATA-ETAN High level expert group (HLEG) to prepare a report on options to support European cooperation in foresight in the 6th Framework and beyond. Luk Van Langenhove has chaired this group. The present document is his own personal interpretation of the work of the HLEG, and do not necessarily reflect the opinions of all members of the group. The full HLEG report is available through the European Commission.

concern about the 'democratic deficit' in science and technology policy as is to a large extent dominated by technical experts. While people are demanding more involvement in decisions that concern them, the answers on scientific issues seem to be given by a scientific 'elite'. Not surprising then that a recent trend in S&T policy is a growing concern with governance issues. As such, plea's for a 'new alliance' between Science, Citizens and Societies are being heard everywhere. The relationship between Science and Society should become a more two-way interaction: involving the science system in listening to and learning to understand public concerns and values. The question is how 'the public' can be brought closer to debates on science and technology and their repercussions on the quality of life. *The organisation of foresight processes offers an opportunity to bridge the gap between citizens and decision-makers and between experts and laypeople.*

II. WHAT CAN FORESIGHT DO?

Foresight can be defined as a systematic, participatory, future intelligence gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilising joint actions. As such, foresight cannot only improve anticipatory intelligence, but also contribute to an increased awareness of knowledge resources and strategic orientations of the actors that participate in the foresight activities.

Foresight can be made by a broad set of methods, ranging from desktop research, over interactive brainstorm processes, to broad participatory arrangements. The scope for foresights can be any issue of societal relevance, in which knowledge, science and/or technology plays a considerable role.

The HLEG that I had the honour to chair, considers foresight to be a policy instrument with a promising potential for understanding the possibility of different futures, and hence the opportunity of shaping our futures, to enhance flexibility in policymaking and implementation, broaden perspectives, encourage thinking outside the box. The increasing number of national foresight programmes suggests that foresight can indeed be a useful policy tool in rather different national innovation systems and relevant to a wide range of societal concerns about technical opportunities, new markets for innovative products or services, risks and their regulation, prosperity and national wealth and how they are generated, public health, education and training, employment, social inclusion, and public perceptions and acceptance of technological innovation.

The HLEG has identified a series of three 'basic statements' about the possible and actual role of foresight in society. These statements are based upon the experiences and beliefs of the members of the group with foresight.

Statement 1: Science and technology policy decisions that take into account foresight tend to be better

It is clear that today's decisions help to form and shape the societies of tomorrow. This is, of course, not new, but - compared to previous eras - the speed, number of interactions, and widespread effects are of a much higher magnitude. The future, beyond the immediate period is much more open. It is possible, therefore, to shape it

to a greater extent than before. The basic condition, here, is that better decisions are made, based on multifaceted and relevant, long-term oriented, facts and visions.
When science and technology actors and decision-makers introduce the future into the present, they are considering not only the possible future trajectories for science and technology developments, but also two dimensions of expectations on the future: the first is on the future consequences of current actions, the second is related to the preferences or interests in future outcomes of the science and technology developments.

Foresight provides a basis for priority discussions and actions; decisions based on foresight tend to be better. Intelligent decisions, however, require society to build a strong awareness and understanding of possible diverging trends. It also implies the need for preparation, and an ability to adapt to unforeseen changes. foresight is an appropriate tool to respond to this requirement for flexibility by integrating socio-economic, technological and scientific aspects, by involving citizens and by focusing on open questions and problems.

Statement 2: Foresight can make a unique strategic contribution to social actors' forward thinking as an element of sound policy-making

As a mechanism for the production and sharing of anticipations and visions by the actors and stakeholders, foresight activities serve as a tool to improve the quality of decisions by political bodies, companies and organisations through the strengthening of a long-term, futures-oriented approach. Foresight activities can therefore contribute positively to strategic intelligence:

- foresight is aimed at producing orientations rather than predictions; it provides guidance to decision makers;
- foresight includes multiple perspectives, multiple actors and multiple disciplines;
- foresight is focused on opportunities and risks alike;
- foresight emphasises the interrelations between the technological, economic, social, political and cultural sector of society.

Statement 3: The societal value of foresight is both in the process and in the products generated.

The Foresight Process typically involves – next to experts - a wide range of different stakeholders from the society, science and technology fields, in long-term structured dialogue. One of the major benefits of this process is that it can open up new opportunities for communication among all stakeholders. In many respects this form of dialogue constitutes a key outcome of the foresight process.

The gathering of visionary and experienced people from multi-disciplinary and multi-sector backgrounds not only helps to build an understanding of the future, the process itself can also have profound effects on the participants themselves, and on their networks. A further benefit of the foresight process is that it can help to balance

the many shortsighted and 'instant' activities of today's media, opinions, shareholders and so on.

On the other hand, foresight provides a basis for sounder policy-making. Thus the production of reports and other communication products allowing decision-makers to discuss and use the results is key to the actual value of such a process.

III. FORESIGHT ACTIVITIES AT EUROPEAN LEVEL

1. What is Europe doing?

With its broad variety of foresight activities (often related to technology assessment activities), Europe is now probably more advanced than the US and Japan in this field. Nevertheless, it is remarkable that, in spite of this increased importance for policy making, foresight activities and foresight supporting policies have not yet reached the same state of integration, or complementarity's and relatedness, at EU level as many other policy fields have achieved during the last decades. The following examples might be given:

- Foresight activities are non-existent or remain relatively weak in some Member States;
- Important players do often network only loosely at EU level, if at all;
- European policies and issues are not systematically taken into account in national and regional foresight studies.

In fact, many foresight exercises are simply repeating and duplicating efforts already made by others, more advanced in the foresight process, without exploiting possible synergies, and thus missing the advantages of co-operation at European level, e.g. in the form of economies of scale, cost-efficiency and shared knowledge gains.
In the medium to long term, this situation could impact negatively on the implementation of the 'Lisbon Strategy'.

The European Commission has already undertaken several actions to stimulate a European Area of S&T foresight. At institutional level one can refer to:

- DG Research (DG RTD) where a foresight Unit (K1) has been established in 2001 within the Directorate K (Technology foresight and socio-economic research); the main functions of this unit are:
  - Act as DG RTD think tank: Provide input to EU research and innovation (RTDI) policy development;
  - Promote a European Area for TA/TF: Interconnect and support TA/TF activities at European, national and regional level, in close co-operation with all related actors in Europe;
  - Support development of different types of institutions and methodologies, promote dissemination, and use of results;
  - Implement projects in support of RTDI policies development

- Joint Research Centre (JRC), where the Institute for Prospective Technological Studies (IPTS) in Seville is one of its eight research institutes. IPTS has been established in 1994 as the Commission's pole

> of competence in the field of foresight and prospective studies with the mission to provide techno-economic analysis to support European decision-makers. It monitors and analyses S&T related developments, their cross-sectoral impacts, interrelationships and implications for future policy development.

IPTS/JRC and Directorate K/DG RTD, each in their respective and complementary roles, have begun to co-operate closely to realise the development of European foresight. Under the Swedish presidency, a foresight conference was organised in March 2001, followed the Belgian Presidency that organised a foresight seminar at the Presidency Conference on Social Sciences in October 2001. And today, we are here at a major event organised by the Spanish Presidency.

2. Why should Europe do more?

Europe has many common goals and priorities relating to areas such as knowledge-based competitiveness; innovation, establishing the ERA, cohesion, crisis prevention and so on. Europe also faces many common and complex challenges, such as environmental issues, unemployment, infectious deceases, disaster prevention, transport, energy and so on.

These goals and challenges can only be addressed by co-operative action, across national borders and cultures. The same can also be said for the foresight approach. Here, programmes have traditionally taken place at national or regional level. Some issues, however, require a consistent position perhaps between neighbouring countries or regions, at EU level or even global level. Examples include common security threats, averting environmental damage, the management of water resources, tractability of foodstuffs and global climate change. Foresight could also address emerging requirements for common approaches to regulations, standards, measurement and testing.

Individuals increasingly make transactions that transcend the jurisdiction of nation states. Food products, environmental pollution, transmissible diseases, global computer networks, international web-retail, personal security, crime, illicit and performance-enhancing drugs, privacy intrusions are just a sampling of issues where EU-level foresight initiatives may be justified – for example to *understand, regulate and mitigate* the risks and threats that affect individual citizens.

foresight activities contribute to raising awareness and participation in political development. At the EU level, foresight can have a role in building solidarity and shared agendas by giving stakeholders a chance to contribute creatively to shaping a new Europe. Such vision creating and goal setting for Europe should be based on joint efforts and take into account different perspectives. As a long-range process, foresight also needs to be the subject of continuity in policies that will have continuity through changing national political administrations. European foresight processes are in a strong position, therefore, to make such joint vision and goal setting possible.

foresight can make an important contribution towards the promotion of the European Research Area (ERA). Indeed, foresight is precisely about identifying leading edge technologies, mapping positions and then identifying priorities for investment. EU level foresight can help to identify those areas of emerging and strategic technologies

where there is a requirement for pre-competitive joint responses to global developments in science and technologies, such as:

- common investments and exploitation of economies of scale in costly, large-scale facilities and infrastructures;
- the building-up of critical mass (in research expertise, approaches, learning effects) especially in emerging or fragmented research fields;
- co-ordinated approaches to complex issues such as environmental threats, individual privacy protection, food labelling or nuclear safeguards.

Foresight is also frequently orientated towards identifying strategies to build a competitive position for the future. In this respect European Member States, as well as regions within Member States, might be seen as entities in a competition with each other. But, even if member states are competitors, a joint, co-ordinated foresight could help identify areas of industrial strength and research excellence that are based on common training infrastructures, market systems, regulatory structures. It could also help to raise awareness of areas of emerging technological opportunity in which the EU could become a leader e.g. by building interdependencies between existing areas of strength (for example in knowledge management, soft technologies or between embedded hardware and software technologies and mobile communications).

In short, foresight processes in Europe can help to:

- Develop a more strategic & co-ordinated approach in the EU;
- Bring research closer to society;
- Improve communication and co-operation between actors from different sectors of society and between different policy levels on EU-wide issues;
- Contribute to the democratisation of EU policy making.

3. What could Europe do more?

The HLEG that I have chaired recommends that two strands of activities should be developed at European level:

1. Activities to tackle European wide issues;
2. The development of co-operation between foresight activities implemented at the various levels in Europe.

Tackling European wide issues

The HLEG recommends that in order to be successful, foresight processes at European level, should be targeted at specific issues. Main recommendations of the HLEG, therefore, are that foresight processes at a European level, should:

- **be targeted at specific issues with room for synthesis actions on commonly defined and co-ordinated national and regional foresight activities.** This could include, for example, actors/regions that are transborder, twinning, and special interests. European level foresight processes should address issues and competencies that have a direct link to new or existing EU policy areas.
    - **identify and address appropriate issues that are inherently transborder and/or particularly complex** – as noted above some issues require a

consistent position between neighbouring countries or regions, at EU level or even global level. Examples include common security threats, averting environmental damage, the management of water resources, tractability of foodstuffs and approaches to regulations, standards, measurement and testing.

As the focus of a foresight exercise will be on different sectors or territories, European foresights can only be based on an appropriate procedure for selecting topics. A European approach therefore implies that the topics to be chosen should fulfil criteria such as:

a. targeted
b. particularly complex
c. concerning a "missing" field i.e. an issue which does not lie into existing scientific, technologic or thematic boudaries
d. right timing (including quick identification of emerging issues)
e. effect on European dimension or in need of European dimension.

- **involve key stakeholders in an open and interactive foresight process** - In the process of a foresight, different actors should intervene producing different types of discourses. First there are epistemological discourses where experts and scientists discuss the potential opportunities and risks based on a common vision and the likely developments that one can foresee. Secondly, there are reflective discourses that involve stakeholders and interest groups and aim at bringing information on different types of uncertainties into a deliberative arena. Thirdly, there are participative discourses, focussing on resolving ambiguities and differences about values. Here citizens at large can bring in reviews on desirable futures and value conflicts. foresight participants can include: policy actors, experts from science, companies, etc, managers from SMEs, as well as large and multinational enterprises, citizens, as individuals or NGO-drivers.

The HLEG recommends that foresight at a European level should be encouraged through a series of targeted projects. Example of relevant issues are :

- Quality services for an ageing population;
- Issues of knowledge society;
- Development of education market;
- Value creation potential in environmental services;

Developing co-operation in Europe

Currently the wide diversity of foresight efforts indicates that Europeans are embracing the possibilities for engaging in various forms of foresight. This diversity is certainly an asset for Europe. However, across all these efforts there is an absence of cooperation and of exchanging best practice results. Thus it seems appropriate to think that networking foresight activities is the most effective way to build synergies and learning effects across the different efforts.

Despite the progress made by foresight programmes in recent years, the HLEG also recognises the need to develop a European wide foresight community and to contribute to its professionalisation. These will need to be addressed if foresight is to

succeed in the European context. Therefore the HLEG suggests following actions to be taken:

(i) Articulation between S&T oriented foresights and societal oriented foresights.

Methods are needed, for example, that will help address both science and technology oriented foresights and societal oriented foresights: a good example of the challenges faced by such 'integrated' programmes can be found in the UK foresight Programme. Here, the broadening of the 1999-2000 programme into socio-economic issues worked well – the panels examining the implications of an ageing population and the future of crime prevention were probably two of the most successful, both in the applicability of their visions and the engagement of the wider public. However, because they were embedded within what is effectively a scientific programme, they were not able to engage policy makers at the centre of Government as quickly as would otherwise be possible. This suggests that the time needed for such influence should be recognised when instigating such projects.

(ii) Development of evaluation instruments of foresights.

Because of their characteristics foresight activities are difficult to evaluate, but this does not necessarily mean that it is impossible, and therefore it should certainly be attempted. As any activity in which scientific methods are used, a foresight should be evaluated according criteria for good scientific practice: *validity, credibility, quality assurance and ethical norms*

Without the support of evaluation evidence it is hard to justify the continuation of a programme, and the assertion that the networks created by foresight are the main tangible, and most valuable, output cannot sustain a programme indefinitely. Evaluation procedures should be built into the programme before its launch. It is clearly impossible to wait for (say) 20 years to evaluate the impact that foresight might ultimately have. Therefore foresight exercises and their methods should be assessed in terms of:

- *external criteria*: the fulfilment of users needs and objectives
- *internal operational criteria*: their quality, actors involvement, diversity, credibility and alternatives produced;
- *internal conceptual criteria*: meaning and interpretation in terms of learning processes, of 'dialogic' democracy, of new forms of knowledge production, positioning in the dynamics of policy making.

Such evaluation of the quality of foresights could best be organised at a European level.

(iii) Assessing and maximising knowledge generation and transfer.

This action is vital to the progress of foresight in Europe. An essential aspect of foresight is the shared learning of how to conduct and how to use foresight. In particular, one of the main challenges is how to ensure lessons from one exercise are successfully transferred to the next one. Very often experiences are lost between one programme and the next. There is a great deal of tacit knowledge involved in

managing these processes and very little chance that a recipe book approach can ensure effective learning. Given that many of the foresight exercises are national there is no basis for a purely national level build up of foresight expertise – it has to be undertaken by transferring know-how between national programmes. Here there may be a need to support formal and informal learning processes. For example, postgraduate courses, certification of practitioners, shared peer review and evaluation processes, registered consultancy services might be developed at European level. Informal learning can come through running joint events or funding secondments from one programme to another.

To achieve this co-ordination objective, there is a strong need for the development of a Knowledge Sharing Platform. This could provide a vehicle for managing access to the cumulative work done on the experiments and exercises that have taken place to date. In this way, the Platform could provide access to accumulated know-how, and data such as sectoral background reports, ICT tools and so on. A website would be a valuable component of such a Knowledge Sharing Platform, providing access to data, as well as a platform for discussion and exchange.

IV. TO CONCLUDE: SOME CONCRETE PROPOSALS

It is clear from the above that for implementing foresight in Europe, competencies are needed at all levels (including the Commission). Next to that there are functions such as stimulating foresght activities that can profit from an economy of scale. **The HLEG has identified the following five functions that can profit from being organised at a trans-national European level:**

i) Creating a learning space for foresight

An essential aspect of European foresight would be shared learning on how to conduct and how to use foresight. One of the main challenges facing foresight is how to ensure that lessons from one exercise are successfully transferred to the next one.

ii) Parallel and co-ordinated foresight exercises could further enhance tacit learning and sharing of results

This could permit economies of scale in terms of recruiting experts to run workshops, developing shared resources such as formal modelling capacity or background literature. In the case of smaller countries it could raise the critical mass of experts available. For all countries it would increase the cross-fertilisation and possibilities for creativity. It provides scope for greater experimentation with different ways to tackle particular topics. It also introduces an interesting element of comparative experience.

iii) Monitoring the landscape of foresight in Europe

A complement to the foresight portal would be a continuous monitoring activity to map the landscape of foresight activities and actors[1]. This would be a useful resource for practitioners, helping them to develop a common sense of identity and awareness of other exercises. This would contribute to the spirit and purpose of the

[1] Again there are already activities launched in this area. On top of the annex to this report, IPTS has started such a monitoring project.

ERA policy. In addition, it could provide a profile of expertise that would be useful for users of foresight. It would give transparency on the location of experienced foresight practitioners as well as providing a possibility for policy makers to identify examples of good practice in the use of foresight.

iv) Running common European foresight projects to develop strategic intelligence on common European drivers and trends

It is desirable to have common foresight projects to develop strategic intelligence outputs (i.e. products) on common drivers and trends. For example there will not be too much difference in the analysis of main trends in the evolution of generic technologies such as nanotechnologies, ICT or biotech. But there are major differences at the stage of interpreting the significance of these issues at domestic level. Common analysis of main generic issues and trends therefore can be very useful, again particularly for smaller countries that do not necessarily have a sufficiently diversified expert mix to be able to assess the full range of such trends.

v) Dissemination:

Foresight is mostly process orientated but products are clearly of wide interest and value – not everyone can be involved in the processes. The large number of foresight exercises (and other future orientated & participatory processes) that has been undertaken or launched in recent years indicates that much might be gained from improving the accessibility of the outputs. A centralised resource such as a foresight portal might be useful to provide links to these efforts[1]. However, in addition it will be necessary to add value to the reports by providing secondary analysis of the results. This could take place through seminars, working groups, dissemination activities and separate publications.

Collaborative European level foresight processes should be considered where relevant to support policy competencies that are actually exercised at Community level. For instance in research policy, food safety, environmental protection or enlargement there is an actual need to develop European visions that are developed in a more holistic way than is possible through democratic representation (e.g. at the negotiating table of Member States). This is important not least because sometimes these decisions affect stakeholders that have no voice in such arenas. EU-level foresight might therefore complement existing representation structures and therefore go some way to tackling the democratic deficit identified in the recent White Paper on Governance.

Short term recommendations to the European Commission

The HLEG has not tried to develop the terms of reference of a foresight Knowledge Sharing Platform as mentioned above. But the above listed functions can be regarded as the main tasks to be performed by such a Knowledge Sharing Platform.

A feasibility study on the Knowledge Sharing Platform is regarded as a major step forward by the HLEG and thus highly recommended to the Commission. Such a Platform would provide practitioners and other stakeholder across Europe, access to the large volume of foresight related data, as well as the reflexive, evaluative and

[1] This portal could be based on the web site already developed by DG Research of the EC.

cumulative learning associated with existing experiments and exercises. Creating a European foresight Website would be a valuable mechanism for disseminating this data to a wide audience, as well as providing a platform for discussion and exchange.

Next to this, the HLEG also recommends to the Commission the following actions with regard to the 6° Framework Programme:

- **Networks of excellence on foresight in Europe should be supported under FP6.** This network would provide a mechanism for interchange between practitioners of foresight on state of the art methods, quality, and impact evaluation. It would also provide a clearinghouse function for developing a shared infrastructure for collecting and synthesising results and mapping and measuring the European foresight landscape.

- **A limited number of demonstrator projects on European Futures should be supported** in order to stimulate a wide and open debate on issues of crosscutting concern. These 'Great Debate foresight' could be large-scale pitched towards Europe's societal evolution (e.g. Europe in the Global Society or the knowledge society in the service of the citizen). They could also be more targeted (e.g. The Future of Science as a Career). Some could be aimed at particular social groups (e.g. "Life begins at 40 - Europe in 2025 as seen by 15 years olds).

- **An infrastructure for cross-connecting regional or transborder foresight projects should be found**. This might link together the growing efforts at regional and local foresight in order to increase their ability to develop a vision of the region in Europe as well as to increase the visibility of the regional viewpoint on Europe. Ways to do this through co-ordinated actions between FP6 and the Anticipatory Actions ('article 10') of the European Regional Development Fund.

In implementing all of the above, it should be noted that European foresight efforts are not an exclusive task for the Commission, but can and should be initiated and driven by other organisations as well. No institution should have monopoly on foresight; multiplicity and competition should be encouraged. Realising the ERA will need as substantial amount of visionary thinking as well as efforts to relate the many different aspects of RTDI policy. Here foresight can play an enormous catalyst role and the European Commission has a big potential to realise a truly foresight area in Europe. After all, as it often said: the best way to predict the future is to invent it.

COMMENTARY ON "SCIENCE AND TECHNOLOGY IN EUROPE: A PROSPECTIVE VIEW…" BY LUK VAN LANGENHOVE

PROF. LUKE GEORGHIOU
PREST, University of Manchester, UK

The paper, and the work of the High Level Expert Group it represents, makes important statements about the role of foresight in science and technology policy generally and in the promotion of the European Research Area in particular. In this short commentary I will focus upon only one of the aspects raised, the evaluation of foresight and its link to policy rationales.

Beginning with those most basic of evaluation questions, we may ask: what difference did it make and what have we learned? The paper rightly points out that it is not practical to wait until the time frame of future visions has expired to seek the answers. This is not to say that lessons cannot be learned by examination of historic foresight activities. Many are aware of the retrospective analyses of the accuracy of the early predictions made in the Japanese 30-year technology forecasts. These are fascinating and to some extent encouraging but learning is inhibited because there is little documentation about the process and techno-social assumptions which produced those early forecasts.

Nonetheless, from these and from almost any other forecast from an earlier period (what can be termed First Generation foresight) it may observed that technology forecasts are more convincing than forecasts of socio-economic change. This does not generate comfort for those working only with science and technology because the most common source of error in S&T forecasting arises from an inability to properly account for the social dimension.

If we move away from the issue of accuracy and instead consider the broader objectives of foresight in identifying priorities for investment and building networks able to realise those priorities we can begin to assemble a policy rationale and hence a framework for evaluation. What I have previously termed "Second Generation foresight"[1] – in which technological development is understood in relation to its contribution to and influence from markets – is founded in a rationale of market failure. Firms have excessively short horizons because of asymmetrical information or because actions aimed at the long term may more easily be appropriated by rivals entering at a later stage. Society loses because valuable technological opportunities are missed or delayed. Hence public foresight programmes are justifiable to persuade firms to take a longer view and consequently to afford a higher priority to research.

By contrast, "Third Generation Foresight" enhances the market perspective with the inclusion of the social dimension, and in particular the concerns and inputs of social

[1] Georghiou L, Third Generation foresight – Integrating the Socio-economic Dimension, in Proceedings of the International Conference on Technology foresight – the approach to and potential for New technology foresight, NISTEP Research Material 77, March 2001

actors. This latter vision is central to the foresight agenda put forward by Van Langenhove. It sits much more comfortably with the policy rationale of systems failure, whereby there are insufficient bridging institutions in the socio-economic system. Keith Smith's articulation of systems failure[1] cites failure to achieve transitions to new technological regimes and failure from lock-in to existing technological paradigms. These are clearly the territory of foresight which seeks to connect visions and hence to loosen these barriers. More generally, the process emphasis we see stressed in many foresight activities demonstrates its status as a technology policy which displays behavioural additionality – it offers the opportunity to give innovation actors new capabilities which persist after the intervention has terminated. These fall into three categories: an entry point to new technological and socio-economic knowledge; new networks with the opportunity to generate further new knowledge and to apply it; and capability to continue carrying out foresight. In reality all foresight programmes to date have exhibited both second and third generation characteristics and are justified from a mixture of market and systems failure rationales.

At European level there is the opportunity to use evaluation as a means of knowledge sharing as envisaged by the HLEG. There has been a substantial multi-directional transfer of foresight policy between countries but generally the basis for these transfers has been study rounds or interviews by representatives of new countries without the benefit of the level of evidence demanded by an evaluation. In most cases the evaluations have been dominated by the short-term policy interests of the operators and other policy actors. They have consisted mainly of operational feedback of the central administration of foresight rather than a full and rigorous appraisal of the rationale and impacts of the programme. There is an important aspect of policy transfer which has been neglected thus far, being the need to understand the interaction of each programme with a particular national socio-cultural and administrative setting. Not only does this embody many of the factors which explain success or failure to have an impact but also the setting disguises some key preconditions of the programme concerned which make transfer liable to failure unless they are somehow replicated. A good example of the importance of the setting is the Australian ASTEC foresight programme which was exemplary in terms of participation and quality but which lacked commitment from stakeholders at the highest political level and hence lost much of its potential impact.

The second aspect for Europe is that of how we should evaluate foresight carried out at a European level. A parallel to R&D evaluation would direct us to questions of implementation, impact and quality, and appropriateness. The first is one where performance indicators function reasonably well – measures of participation, communication and awareness can all be constructed so long as there are clear objectives or benchmarks to allow them to be interpreted. Quality in foresight is probably an issue of peer review and is well-described by Van Langenhove.

The scarcity of national foresight expertise makes international peer review almost a foregone conclusion. When we come to impact, in the public sector an obvious question is that of the degree to which spending and priorities are influenced? The problem is the counterfactual – how much would have happened anyway, with or

[1] Smith K, Innovation as a Systemic Phenomenon: Rethinking the Role of Policy, Enterprise and Innovation management Studies, Vol.1, No.1, 73-102

without foresight? Only dedicated follow-on funds can be fully attributed. In any case, it is unreasonable to expect that foresight and those involved in it would be disconnected from other thinking on prioritisation. The issue is what value-added does it provide? A very practical question could be whether it helps to create a frame of reference against which the strategic selection of major projects such as Networks of Excellence or Integrated Projects can take place.

Formation of new networks is an equally diffuse concept. Metrics can be built which describe the degree of connectivity in networks, whether partnerships are new and what kinds of transaction take place within them. They might miss the main point of new combinations of disciplines or actors being created around a common vision.

With the need to measure sometimes rather subtle or cognitive changes, actors who are often volunteers, and issues which are by definition obscure, evaluation of foresight needs to be an integral but non-intrusive part of the process which runs alongside it from the earliest stages.

SCIENCE AND TECHNOLOGY FORESIGHT IN EUROPE COULD FORESIGHT ALSO BE A MISLEADING PROCESS?

MS. KORNELIA HAUGG
Federal Ministry of Education and Research, Germany

Luk van Langenhove's position paper on science and technology policy and the need for foresight stresses the benefit of foresight in Europe. He more or less summarises the common understanding of the **values of foresight programs** seen by the European foresight community as there are

- require society to build a strong awareness and understanding of possible diverging trends
- increase awareness of knowledge resources and strategic orientations of the actors that participated in foresight activities
- bridge the gap between citizens and decision-makers and between experts and laymen
- open up the perspectives of stakeholders and includes multiple stakeholders in the policy process.

I agree, but in order to stimulate a **fruitful discussion** in our working group I would like to **focus** my statement on the following issues: What do we still not know about foresight? What kind of risks do we take into account? Could foresight also be a misleading process?

What do we not know about foresight?

A lot of research on foresight has already been done but there are still a lot of questions and so we can not be sure about the output and benefit of foresight programs.

A few examples:
Since not everybody can be involved, how can we identify the right people who should be involved in a foresight program? Is the result of a foresight activity a result of an accidental "mixture" of people and so unintended?

What kind of "products" could / should foresight produce? Is it really enough if foresight creates new networks and makes us aware of the importance of working with others to think creatively about the future?

Do we take sufficiently into consideration that a national foresight program fits into a broader national approach of decentralised strategies to identify new developments and technologies and to set priorities? Probably the measurable results of foresight programs are only a duplication of conclusions and decisions already made somewhere else.

What kind of risks do we take into account?

If we all agree that foresight should be a process which

- brings together experts and laymen from different disciplinary and sectoral backgrounds and thus includes multiple perspectives, multiple actors and multiple disciplines and
- dialogue and networking should be in the centre of the process
- we should also think about the risks which might be involved.

From my personal experience in the German *Futur* project I would like to stress the following two examples:

An interdisciplinary discourse is very ambitious. One of the risks seems to be that we reduce the discussions about the future (to reduce the conflicts in the working groups) to a common denominator, that we underline the mainstream and that we exclude thinking out of the box. So we might focus research activities on more ore less well-known areas and leave not enough opportunities for outsiders to develop new ideas and solutions.

The incentive for the participants to invest work, ideas and sometimes also money in national foresight activities is not only a general interest in shaping the future. Very often there are strong interests of lobbyists to influence political decisions in their own direction, e.g. to ensure a special amount of the budget for their own interests. There is a great deal of tactics involved. In traditional procedures of decision-making (e.g. at the negotiating table of the Member States) we are aware of these influences. Are we able to identify specific interests in a dialogue across multiple perspectives, multiple actors and multiple disciplines and to avoid misleading advice?

Focusing on the long- and medium- term priorities of the Union, the Head of State or Government and the European Commission agreed on a common vision for economic and social development in Europe, the so-called Lisbon-Strategy. It aims to make the European Union by 2010 the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion through open methods of co-ordination and benchmarking. Science and technology are amongst the main drivers for these developments. To move towards this ambitious target effectively, we need methods to identify new technologies, developments, their chances and risks very quickly and we have to make up our minds about priorities.

If foresight is to play a dominant role in the selection of research policy priorities we must be able to rely on a reviewed, robust set of methods. To implement formal and informal learning processes – including different target projects, evaluation, monitoring, and knowledge sharing platform - seems to be the most important task on the European Level. And we do need a fair and open discussion also about the failures and malfunctions of foresight activities.

SCIENCE AND TECHNOLOGY FORESIGHT IN EUROPE: A REACTION

DR. BAREND VAN DER MEULEN
Twente University, The Netherlands

Luk Van Langenhove's position paper on the development of foresight in Europe summarises in a few statements the value of foresight, analyses the necessary and possible role of 'Europe' in foresight and concludes with five concrete proposals. Reflecting on the statements and proposals, I am inclined to two different responses. One part of me tends to agree with foresight's possible values and the proposal to increase the role of Europe within foresight. Another part tends to a more sceptical attitude, because the document takes to easy for granted that foresight will help policymakers and stakeholders and seems to neglect the dependency of foresights success on its context.

The background of this ambiguous position results from recent research on foresight dynamics and European RTD policy. The few systematic studies of the impact of foresight do not univocal support the claims on foresight values. Studies on European RTD policy show that it is unclear yet what constitutes the 'Europe' that should profit from foresight. In this short reaction on Van Langenhove's position paper, I elaborate both points.

The value of foresight

Foresight literature usually takes a positive side towards foresight and praises it as a reflexive tool for science and technology policy, especially because it opens up the perspectives of stakeholders and includes multiple stakeholders in the policy process. In a TSER funded study on the impact of Medical Technology foresight activities on strategies of public and private organisations in the medical sector (FORMAKIN), we had difficulties to find any of such impact. Among the multiple actors in three countries (Netherlands, Spain, UK) we interviewed almost none thought that the foresight activity had considerably impacted the own organisational strategy. foresight reports were less known as we expected. Other evaluations of foresight activities rarely find concrete examples of strategic decisions and policies that are directly related to foresight. foresight results easily become part of a pool of strategic information from which stakeholders can take what they like. Up till now, foresight has not established a state of the art that within this pool it can claim a privileged role.

foresight literature tends to evade this problem by emphasising the process instead of the product. Impacts of the process are as difficult to measure as those of the product, but indeed the FORMAKIN project showed that actors found the foresight activities useful, precisely because these activities created an interaction space were they could meet other stakeholders. An evaluative study of an agricultural foresight process in the Netherlands organised by the then NRLO even found stronger effects of the process: building of new visions and commitment to new strategies. But these effects occur especially if actors feel that changes were needed but were uncertain about the

direction of change and if actors the success of their strategy was depending on strategies of others. These results cannot be generalised simply to all foresight activities and RTD policy contexts.

Europe

The context dependency has consequences for thinking about foresight in "Europe". In relation to governance of science and technology Europe is an ambiguous term. The position paper mentions Europe in the headings, but actually means the Commission with Directorate K and JRC/IPTS. Europe is seen as an emerging level of *governance* equated with the Commission as a new *government* level, that develops its own RTD policies and which takes up responsibility for the health of the European RTD system, like national governments have done earlier for their national systems. For other actors involved in the governance of science and technology at European level, Europe has other meanings. A comparative PhD study of national science policies shows that up to now national science policies have hardly been influenced by European RTD policy. National science policies are used by national representatives as an input for European RTD policy formulation, but the national policies do not depend on the European. For researchers, 'Europe' has developed into a new funding opportunity for international collaborations and mobility. But the Commission is not considered as the one responsible for the health of the *science base*. Including industrial and societal actors makes the picture even more complicated as geographic frames of reference shift from very local orientations to global. Only for some actors in some sectors and policy fields Europe's RTD policy is crucial for their own research and innovation strategy.

The result of these different positions and interests is that European RTD sector is a moving mosaic in which actors sometimes can govern certain moves and patterns, but there is no actor and no policy instrument that has a key position in all moves and patterns. That implies that sweeping statements about foresight in Europe have to be specified towards specific actors and objectives in order to be realistic and meaningful.

Foresight in Europe

If foresight is not as effective in every context as the position paper suggests, it is necessary to look for possible roles of foresight in the mosaic pattern of governance in Europe. One possible role is given in the paper by its concentration on the Commission as main client of foresight. It can use foresight to develop its RTD policy in interaction with stakeholders. Similarly, one might expect that research councils and other RTD agencies and funding bodies could use foresight studies to structure their coordination activities. But because of the scale of Europe's RTD sector these foresight activities are not likely to have a great impact on other actors than the direct clients. It is unlikely that these activities will replace other ongoing foresight activities at regional, national and sector level. Within the mosaic overlap and duplication of foresight activities is not only inevitable, but also necessary to create effective patterns at different places in the mosaic.

FASHION OR FUNCTION? QUESTIONS ON FORESIGHT AS AN S&T POLICY TOOL IN EUROPE

PROF. EMMANUEL G. KOUKIOS
National Technical University of Athens, Greece

The End of a Paradox?

Greece is, I guess, one of the EU Member States where, according to Luk Van Langenhove's position paper "foresight activities are relatively weak" (p. 4). This means that, based on the same paper's prospective views, countries in this category cannot harvest the fruits of the "foresight Tree" so colourfully described by that author, but so urgently in demand in such contexts: i.e., improving anticipatory intelligence, building solidarity among critical actors, and balancing short-sighted attitudes. If that is their predicament, then how can such Member States effectively mobilise their research policy forces in order to meet the targets of the Lisbon Strategy? In other words, should they look for some special "eggs" (e.g., that of foresight) or the special "hens" of the knowledge economy?

In the early 90s, during a preparatory stage of discussions within the - even "weaker" then - Greek community interested (for their own, strange reasons…) in technological strategic intelligence issues, I have proposed the term of *"latent social demand"* for TF/TA actions in order to explain this apparent paradox.

Since those days, certain things have changed on our national TA/TF scene, including:
- A Technology Evaluation Committee in the National Parliament;
- A multidisciplinary scientific association of persons active in Technology Assessment and Evaluation (ELETAS);
- Various initiatives in the national research and academic communities, among which the *"Technoscope"* advanced course offering technological strategic intelligence elements to business executives.

Last but not least, the first ever National Technology foresight Programme was launched a few months ago by the General Secretariat of Research and Technology (GSRT) and - also paradoxically - this amateur theorist of "latent demand" has found himself in charge of the "active supply," i.e., as the co-ordinator of the exercise carried out by a consortium of 3 Universities and 2 Companies for GSRT.

Learning from Europe?

There is more than mere timing in the parallel deployment of the Greek foresight exercise and the discussions on European foresight. Actually, one of the early triggers of this national action was the institutionalisation of foresight within the European Commission's DG Research. More recently, leading members of the national project team took part in European expert groups and other fora dedicated to the emerging European foresight issues.

But even more importantly, the new exercise itself can be considered as a more-or-less systematic effort to apply at the national level several ideas and tools already "hatched" at the European - more specifically the European Commission's - level. Major examples, drawn from the position paper and its background information of the "High Level Expert Group on European foresight" final report, follow:

- Emphasis on the *role of foresight in society*, e.g., through a dual, process *and* product orientation of the work;
- *Special care on participatory aspects*: an open Call for panel participants of a variety of backgrounds and expertise is currently in progress;
- *Monitoring interfaces and managing complexity*: linking a dozen of "vertical" panels with four "horizontal" activities (human resources, financing, regional dimension, innovation);
- *Focus on the emerging technology/governance interactions*: a special panel on these issues;
- *Innovative use of the Internet*: a dedicated web site will serve as the main vehicle of the project, thus constituting a *knowledge sharing platform* within the exercise ("an egg within an egg");
- *Early dissemination*: built-in dissemination elements at all stages of the work, starting with a political announcement/press conference, and continuing with members of the press joining foresight panels;
- *Links with Europe*: European scenarios as part of the "lunch box" (starting material) of the Greek panels; also, putting together of an International Advisory Board dominated by persons with recent responsibilities in European foresight projects;
- *Follow-up concerns*: the exercise deliverables include the feasibility plan for a *virtual centre* of foresight studies that will take over the task of follow up activities for GSRT.

Teaching Newcomers?

Besides providing an early test bed for the emerging discussions at European level, the now taking off Greek experience could have a growing learning value for other Member States of the same ("weak") category, European regions, as well as candidate countries.

An early example[1] is offered by Cyprus. This candidate country is a participant in the EC-funded research project eFORESEE, in the frame of which foresight is to be used as a policy-making tool; in the Cypriot case, agricultural policy. Well, experts from the Greek foresight team took part in the eFORESEE meeting in Cyprus, and systematic, learning links are being developed between the Greek exercise and the application of foresight by Cypriot colleagues.

In its turn, the case of Cyprus can be used as model for future transfers of the Greek experience to other countries of the Balkan and/or Mediterranean region, of an obvious critical interest to an enlarging Europe.

[1] It seems that "early" is becoming a key word of this forward thinking note …

OPEN DEBATE SUMMARY

The debate from the floor centred on the three issues. Some speakers were concerned to understand one star feature of the High Level Group Report: the idea of a 'Knowledge Sharing Platform.' There was also a debate on the implications of foresight processes, especially as it moves to European scale. Finally, some speakers sought to underline the importance of clearly defined agendas for any targeted foresight on European issues.

The Knowledge Sharing Platform proposed in the High Level Group Report raised considerable interested, with some speakers showing fear of its potential centralising effect, while others saw it as an open resource that can be used by the whole community. In general, the exact shape of this new initiative is not yet defined, but it will not be an organisation that does foresight but a way to stimulate co-operation. It is not imagined as a centralised single resource but something that is open and networked - a common property. It might help to promote methodologies and good practices in areas such as evaluation. It might be a place to share results and enhance learning. It was also hoped that the Knowledge Sharing Platform should also enhance dissemination of results. It should not only be a place where scientific discussion takes place, but a way to permit wide participation and to produce outputs that are very accessible to read.

A second theme concerned the extent to which foresight processes are really open. It is important that foresight processes are not seen as simple substitutes for democracy. Although foresight is a symptom of a more open approach to priority setting in science and technology, decision making still resides in a distinct sphere. In the past, it was completely unsure who set the priorities. But foresight introduces new uncertainties such as whether all the stakeholders are properly consulted in foresight efforts? For example, what privilege is given to the voice of the scientific community through institutions such as the European Science Foundation or CERN? Also, is foresight focused on public policy needs to exclusion of corporate actors, SMEs, NGOs? Are young people properly consulted? Are such issues are amplified at European level? Is foresight, in fact, scaleable? Perhaps, it was suggested foresight at European level would have to seek legitimacy through multiple targeted and locally relevant activities. This would be important also to deliver believable results, as work by the OECD shows the prime importance of institutional settings in affecting outcomes.

Finally to what extent can we identify the big challenges as focus areas for European foresight? Directly on science and technology there is a need for high S&T expenditure and greater national co-operation on S&T and how to move towards a, still absent, European research policy. Some other issues are not 'scaled-up' to European level immediately but are inherently European such as the implications of enlargement of the EU (which will be the subject of the Greek foresight Conference in 2003). There are also major transborder societal challenges such as rising nationalism.

The contributors to the debate, in addition to the discussants, speaker and moderator, included: **Karel Aim** (Academy of Science, Czech Republic), **David Broster** (DG Information Society, Brussels), **Paraskevas Caracostas** (DG Research, Brussels),

Attila Havas (UNU/INTECH, The Netherlands and Hungarian foresight Programme), **Peter Keet** (Ministry of Agriculture, Nature Management and Fisheries, Netherlands) **Timo Kauppinen** (European Foundation, Dublin), **Jerzy Langer** (Acadmy of Sciences, Poland), **Daniel Malkin** (OECD, Paris), **Markku Markkula** (Member of Parliament, Finland), **Camilla Modéer** (Confederation of Swedish Enterprises, Sweden) and **Andrejs Silins** (Latvian Academy of Sciences) **Ronald Pohoryles** (The Interdisciplinary Centre for Comparative Research in the Social Sciences, Austria) and **Erik Fellenius** (Swedish Environmental Protection Agency).

III. FORESIGHT AND MULTI-LEVEL GOVERNANCE

Moderator:
• Dr. Arturo Garía Arroyo, Spanish Foundation for Science and Technology, Spain.
Speaker:
• Prof. Ortwin Renn, TA-Akademie, Germany.
Discussants:
• Dr. Matthias Weber, ARC Seibersdorf Research, Austria.
• Mr. Gordon Ollivere, RTC North Ltd., UK.
• Prof. Luis Valadares Tavares, IST, University of Lisbon, Portugal.
• Dr. Luis Sanz Menéndez, Ministry of Science and Technology, Spain.
Rapporteur:
• Prof. Joyce Tait, SUPRA, The University of Edinburgh, UK.

SESSION OVERVIEW

The aim of the session was to examine how foresight- and strategic futures-type of activities can best be undertaken in relation to the multiplicity of territorial (locality/ municipality, region, national to trans-national level), and stakeholder-grouping levels (from reduced groups of expert elites, to representative and civil society groupings) at which decisions are taken or have impact. Policy, strategy and their impacts at different levels, can give rise to different requirements in terms of the type of future intelligence needed as well as the type of process by which it is generated.

Arturo Garcia Arroyo (Spanish Foundation for Science and Technology, Spain) chaired the session which was divided in three stages. A keynote presentation was given by **Ortwin Renn** (Centre of Technology Assessment in Baden-Württemberg, Germany). He started with an account of the philosophy, features, evolution and the challenges of foresight. The main focus of his presentation was the challenges to foresight in dealing with the complexity of Multi-level governance. Multi-level governance may be viewed as combining both Vertical (different territorial levels) and Horizontal (public, private, civil-society and mixed domains) dimensions. The major task for foresight and Multi-level governance is to provide links between horizontal and vertical issues, and to offer solutions for three main challenges: *complexity*, *uncertainty* and *ambiguity*. The presentation illustrated approaches and methods on how to deal with these three challenges. The concluding remarks outlined that, in the future, in order to be effective there should be contingency on actions by each governance level. This would be a challenge since decentralisation on one hand, and globalisation on the other hand, are going to increase the level of complexity, and as a result, integration of complexity, uncertainty and ambiguity will be more difficult.

The second stage of the session was a series of presentations by the invited discussants. **Matthias Weber** (ARC Seibersdorf Research, Austria) made three main points. The first was related to the -emphasis of regional development issues in exploring and developing the notion and feasibility of multi-level foresight. It was stressed the importance of participative oriented discourse also for higher-level of governance. In fact, it is at the European level that key decisions are taken in S&T and regulatory fields. Then, multi-level foresight is certainly useful but it should not aim at a single regime, and should rather aim to maintain diversity, especially for cross-border foresight studies.. The second point was on how to bring participatory elements closer to the EU level where in selected sectoral and thematic areas, there is a clear need for participatory discourses. However, due to the limited experiences with participation at EU level so far, experimentation with new approaches should be encouraged. The third point was related to the use of foresight results to make them more effective in decision making. A possible option would be to combine foresight-type activities with the development of adaptive policy-strategies. These strategies imply maintaining a portfolio of policy options in order to be able to react and adapt to changing circumstances. **Gordon Ollivere** (RTC-North Ltd., UK) comments drew on the substantial practical experience and results of a foresight Programme undertaken at regional level in North East of England, in terms of both themes and methodologies applied. Since 1996 there is an operating unit on foresight and 5000 people have been involved in foresight activities, with different types of actors and actions from industries and technology clusters, to education and social issues

including foresight actions in schools involving young people. **Luis Valadares Tavares** (Instituto Superior Tecnico and President of OPET - Portuguese Technology and foresight Observatory, Portugal) made the point of the importance of foresight as a tool for closer relationships between Government, Science and Society to support the process of long-term vision for strategic options and planning. foresight can be used as a tool to meet the challenge set at European level by the Lisbon Strategy. In addition foresight can be used to develop medium to long term scenarios for multiple levels and sectors. **Luis Sanz Menéndez** (Ministry of science and technology, Spain) argued that foresight and Multi-level governance future is still very much dependent on the evolution and trends of the current governance system, especially in relation to its contribution for priority setting actions for innovation, science and technology policies.

The third stage of the session was devoted to over an hour-long discussion and debate involving many of the session attendees. The presentations and discussions were monitored by the rapporteur **Joyce Tait** (SUPRA, University of Edinburgh, UK) whose feedback report is provided in a later section together with the reports on the other parallel sessions.

The papers by the speaker and the discussants as well as a summary of the open debate follow below in this section.

FORESIGHT AND MULTI-LEVEL GOVERNANCE

PROF. ORTWIN RENN
Centre of Technology Assessment in Baden-Württemberg, Germany

I. THE NEED FOR COMPREHENSIVE FORESIGHT ACTIVITIES

Technology Foresight (TF) and Technology Assessment (TA) activities play an important role for the development and management of future-oriented innovation systems in Europe and beyond. These activities are important for giving guidance to policy makers from the public and private sector on all levels of governance. Although technological and social changes are not predictable in the long run, TF/TA activities provide robust orientations that assist decision makers in detecting and identifying opportunities for further development, point our networks of actors necessary to take advantage of these opportunities, and identifying the barriers, risks and obstacles that they need to address these problems in advance.

"Foresight" has been defined as "a mechanism for the production and sharing of anticipations and visions by the actors and stakeholders, knowledge which is key for them to shape their behaviour and decisions in a knowledge society" (contribution by Barre, July 2001). Based on this definition, one can distinguish five central characteristics of foresight activities:

- foresight is based on the philosophy that future developments are contingent on human actions and decisions; that is why foresight is not a process of forecasting the future but rather an attempt to explore the space for human actions and interventions to shape the future;

- foresight is aimed at producing orientations rather than predictions; it provides guidance to all actors and reduces uncertainty;

- foresight includes multiple perspectives, multiple actors and multiple disciplines on different levels of governance;

- foresight is focused on opportunities and risks alike;

- foresight emphasises the interrelations between the technological, economic, social, political and cultural sector of society.

Foresight activities provide guidance to policy makers from the public and private sector. They point towards networks of actors necessary to take advantage of these opportunities, and identifying the barriers, risks, and obstacles that they need to address in advance. foresight analysis requires a holistic approach to understanding the complex systems of technological change. Investigating technological developments goes beyond the usual agent-consequence analysis and focuses on the

mutual interdependencies and spill-overs between different societal clusters. The following sections will focus on the strategic prospective opportunities for policy prioritisation and planning in a multi-level governance structure.

II. TOOLS FOR DISCURSIVE APPROACHES TO FORESIGHT ACTIVITIES

Most concepts of foresight have in common that a network approach is required in order to detect opportunities and risks before they manifest themselves openly. This network approach includes several crucial elements:

- multi-disciplinarity (if not transdisciplinarity)
- inclusion of stakeholder groups
- reliance on network interactions rather than individual research activities
- integration of visions, values, and facts (without sacrificing the distinction between descriptive, analytical and normative statements)
- emphasis on connections between research, policies, and social actions

Foresight activities have evolved over time from focusing on narrow technological issues to organizational questions of development and further to the analysis of social innovation networks. This expansion of the scope has been accompanied by a continuous development of new methods and tools of how to accomplish the increasingly complex goals of foresight studies. It has become evident that foresight cannot be accomplished by scientific reasoning and research alone but necessitates the involvement of those whose decisions shape the future. In the past, the involvement of different groups and stakeholders in constructing scenarios and evaluating different trends or policy options were done on an ad hoc basis. More and more, foresight activities include more comprehensive and structured forms of stakeholder involvement.

As a means to foster a more multi-level but structurally cohesive approach to foresight, three different types of discourse activities need to be distinguished. These discourse activities relate to the major challenges of foresight activities: complexity, uncertainty, and ambiguity. Complexity refers to the difficulty of identifying and quantifying causal links between a multitude of potential candidates for and consequences of technological changes. The nature of this difficulty may be traced back to interactive effects among causal factors (synergism and antagonisms), long delay periods between cause and effect, inter-societal variation, intervening variables, and others. It is precisely these complexities that make sophisticated scientific investigations necessary since the cause-effect relationships are neither obvious nor directly observable. Complexity requires systemic assessment procedures and the incorporation of new mathematical tools such as non-linear regression and fuzzy set theory.

Coping with complexity may be one of the essential keys for improving one's position in a competitive global world. It may provide knowledge that helps to defend or even occupy markets and technological niches. It is based on the systematic knowledge of scientists and policy analysts as well as the anecdotal and experiential knowledge of practioners in business and social networks.

Uncertainty is different from complexity. It comprises different and distinct components that have one feature in common: uncertainty reduces the strength of confidence in the estimated cause and effect chain. If complexity cannot be resolved by scientific methods, uncertainty increases. Even simple relationships, however, may be associated with high uncertainty if either the knowledge base is missing or the effect is stochastic by its own nature. If uncertainty plays a large role, in particular indeterminacy or lack of knowledge, the scientific search for cause-effect chains may even counter-productive because it suggests more certainty and robustness than justified. Judging the probability of certain developments based on uncertain parameters, does not make much sense. Under these circumstances, assessment strategies based on resilience are required. Resilience means to navigate on the cautious side rather than trying to maximise one's utility. Keywords here are enhancement of diversity, redundancy, flexibility, and reversibility of action. The main strategy is to activate process knowledge that helps all actors to navigate safely in the dark fog of an uncertain path.

The last term in this context is ambiguity or ambivalence. This term denotes the variability of (legitimate) interpretations based on identical observations or data assessments. Many disputes in technology developments do nor refer to differences in methodology, measurements of likely impacts, or the balance between risks and benefits, but to the question of what all of this means for the values, visions and lifestyles that are generated and mediated through societal communication. The recent debate on biotechnology and genetic engineering is a good illustration of the experience of ambiguities. High complexity and uncertainty favour the emergence of ambiguity, but there are also quite a few simple and almost certain technological developments that can cause controversy and thus ambiguity.

III. APPLICATION TO MULTI-LEVEL GOVERNANCE STRUCTURES

In a multi-level governance structure, these three challenges need different arenas in which the problems and conflicts are resolved. This governance structure is independent of the political or geographic level in which the foresight activity is embedded. This multi-level structure refers to the type and function of actors involved in the foresight activity. foresight needs different arenas which provide the adequate means to deal with complexity, uncertainty and ambiguity.

First, resolving complexity requires deliberation among experts. We have given this type of deliberation the title "epistemological discourse"[1]. Within an e*pistemological discourse* experts (not necessarily scientists) argue over the potential opportunities and risks based on a common vision and the likely developments that we can foresee without relying on pure speculation. The objective of such a discourse is the most adequate description or explanation of a development that provides opportunities for the affected actors. The more complex, the more multi-disciplinary and the more

[1] The following classification of discourse types has first been published in: Renn, O., "Diskursive Verfahren der Technikfolgenabschätzung," in: Th. Petermann und R. Coenen (eds.), *Technikfolgenabschätzung in Deutschland. Bilanz und Perspektiven*, (Campus: Frankfurt am Main 1999), pp. 115-130

fuzzy a phenomenon appears to be, the more necessary is a communicative exchange of arguments among experts. The goal is to achieve a homogeneous and consistent definition and explanation of the phenomenon in question as well as a clarification of dissenting views. The discourse produces a profile of technological opportunities in question. Tools for epistemological discourses are Delphi, Group-Delphi, meta-analysis, open space conferences or consensus conferences. An epistemological discourse may also reveal that there is more uncertainty and ambiguity hidden in the case than one had anticipated.. The results of these considerations should then be communicated to the respective ministries, to other experts, to the science community, to industry, to stakeholders and to the public at large.

Epistemological discourse activities can be organized in different countries simultaneously. It may even be a specific outcome of the process to see how different science communities evaluate the same problem or data sets. It may also be useful to distinguish the results according to regional strength and weaknesses. Comparative studies on regional innovation systems may help decision makers to see the commonalities and differences between regions. On the other hand, it makes sense to organize epistemological discourses directly on a European level. The procedural rules for conducting Delphis or to engage in meta-analytical studies are similar or even identical in the carious science communities in different countries. The claim of science to become more universal and globalized could also serve as an opportunity to organize this type of discourse on a European level with inputs from different countries, disciplines, and viewpoints.

If technological changes are associated with high uncertainty, which is typical for technologies in their very early phase of market penetration, scientific input is only the first step of a more complex foresight procedure. It is still essential to compile the relevant data and the various arguments for the positions of the different science camps. Procedures such as using the 'Pedigree Scheme' by Funtowicz and Ravetz might be helpful to organize the existing knowledge[1]. In the second step, the information about the different types of uncertainties has to be collected and brought into a deliberative arena. This type of discourse requires the inclusion of stakeholders and public interest groups[2]. The objective here is to find the right balance between courage and precaution. There is no scientific answer to this question and even economic balancing procedures are of limited value, since they stakes are uncertain. We have coined this type of deliberation "reflective discourse". *Reflective discourse* deals with the clarification of knowledge (similar to the epistemological) and the assessment of trade-offs between the competing extremes of rejection and embracement. Reflective discourses are mainly appropriate as means to decide on risk-averse or risk-prone approaches to innovations. This discourse provides answers to the question of how much uncertainty one is willing to accept for some future opportunity. Is taken the risk worth the potential benefit?

We recommend inviting policy makers, representatives of major stakeholder groups, and scientists to play an active role in this type of discourse. Political or economic consulting committees, who propose or evaluate political options, could also be

[1] S.O. Funtowicz and J.R. Ravetz, *Uncertainty and Quality in Science for Policy* (Kluwer, Dordrecht 1990).

[2] T.F. Yosie and T.D. Herbst, "Managing and Communicating Stakeholder-Based Decision Making," *Human and Ecological Risk Assessment,* 4 (1998), 643-646

established to advise this core-group. Multi-level participation here means that beyond the regional political actors stakeholders need to be included as they are important knowledge carriers but also decisions agents for providing the level-specific balance between being over-catious and over-courageous.
Again one could try to make reflective discourse a common activity among European nations. Different from epistemological discourses, one would not expect common or even universal solutions to cope with uncertainty among different nations and regions. It depends on the level of economic prosperity, the amount of equally accessible options, the character of the population and other factors whether one decides for a more risky or more cautious approach to innovation and development. Yet the procedures to arrive at such a decision can be made in similar fashions among all constituencies of the complex governance structure. European foresight policy could foster these methods and parallel approaches without prescribing the outcome of the deliberation process.

The last type of deliberation, which we have called *participatory discourse,* is focused on resolving ambiguities and differences about values. Established procedures of legal decision making, but also novel procedures such as mediation and direct citizen participation belong to this category. Participatory discourses are mainly appropriate as means to search for solutions that are compatible with the interests and values of the people affected and to resolve conflicts among them. This discourse involves weighting of the criteria and an interpretation of the results. Issues of fairness and environmental justice, visions on future technological developments (such as sustainability) and societal change and preferences about desirable lifestyles and community life play a major role in these debates. It is possible to use citizen panels or juries (randomly selected), voluntary advisory groups, consensus conferences and other participatory techniques in order to resolve ambiguities and value conflicts[1]. The main objective here is to mobilize regional actors to from a network of innovation that promotes the desired changes and reduces the respective risks.

It is obvious that participatory discourses need to be local or regional. They rely on the success of organizing regional networks of actors and motivate them to bring their expertise, values and visions. Each outcome of such a process will lead to a different result; yet similar to the reflective discourse, these results may be based on similar procedures and processes.

It is clear that these different types of discourse need to be integrated into one major deliberative process when dealing with foresight. It should be the task of the foresight organizers within each country to develop a protocol for such an integrated model and to provide a guidance document for implementing foresight activities on different political and geographic levels. Multi-level foresight would then provide a structure in which the appropriate levels for organizing epistemological, reflective and participatory discourses on a specific problem. In a nutshell, epistemological discourse should be organized on a European level or, in using the exact same protocol, to be run in parallel in different countries. Reflective discourses should be concentrated on different regions, which could be transboundary for specific purposes.

[1] Schneider, E, Oppermann, B. and Renn, O., "Implementing Structured Participation for Regional Level Waste Management Planning," *Risk: Health, Safety & Environment*, 9 (Fall 1998), 379-395

These regional discourses could still add to a European strategy by providing similar tools and techniques to conduct such discourses in all of Europe, although the result may differ from each other. Lastly, participatory discourses need to be conducted on the local level where foresight activities are implemented or modified. Although common tools are available and innovative forms such as citizen juries, consensus conferences and planning cells have been developed, it should be left to the local organizer hoe the participatory discourse should be structured. The choice of method here depends on the political culture and the issue in question.

IV. INTEGRATION IN MULTI-LEVEL GOVERNANCE REGIMES

Is there any opportunity that such a multi-level foresight vision could become a European reality given the differences in political culture and the feeling of being competitors among each other. We believe that such a vision can only become reality if the various actors for the three types of discourses organise themselves. The European Community or even national governments can facilitate this process, but they can neither generate them nor make them mandatory by law. One of the essential results of game theoretical research is that actors with egoistic interests can develop cooperation without referring to a central authority.

This basic knowledge forms one of the crucial assumptions for analysing the formation of international regimes. Regimes constitute an institutionalised, normative framework of cooperation by which actors, on account of collective interests and converging expectations, act and behave according to a set of implicit or explicit principles, norms, rules and decision-making procedures. The experiences in international relations have shown that the majority of problems do not represent zero-sum-games where damages or losses of one party imply benefits or advantages of the others. Most international and transboundary relations can be characterised as conflicts about controversial interests or controversial means to reach common interests.

The relevant prerequisites of regime creation are voluntary participation, the willingness to engage in a compromise or consensus, the prospect of reaching mutual gains and, if necessary, the acceptance of an autonomous decision-making institution. Cooperation is easier to accomplish if all participants can sustain their status of a nation-state without establishing a kind of "international government". foresight activities across nations would match the conditions for a successful international regime as long as the cooperation among stakeholders and public groups can be institutionalised as a regular consultation process and not as a governmentally ordered activity.

An important advantage concerning foresight undertaken by participatory regimes lies in the reduction of social costs and transaction costs. Without an agreement each side will try to maximise its own benefits on the expense of each other side. It can be shown that such a partial maximisation effort will lead to high transaction as well as social costs for all parties involved provided none of the actors is powerful enough to implement his or her maximising strategy unchanged by the strategies of all the

others (in this case we have one winner and several losers). If all actors strive to maximise their own benefits and each strategy impedes the realisation of all the other strategies, the overall costs of the combined effects tend to be higher than in the case of a mutual settlement. In addition, transaction costs can be reduced in negotiated agreements by means of centralising monitoring and control of outcomes. In this sense, regimes can reduce transaction costs for all participants.

The role stakeholders can play within an international regime of cooperation depends first on the interest and potential commitment of the stakeholder groups with respect to the goal and objective of the foresight activity. If the addressed audiences are not interested in the subject, the foresight community may utilise the conventional platforms of scientific cooperation. This is sufficient to generate interest in epistemological discourse activities. If a clear stakeholder interest is present, public participation provides a meaningful contribution and enhancement to the foresight process. At least, there will be an opportunity to have stakeholders participate in reflective discourse activities. Involving stakeholders on all governance levels do not only increase the legitimacy of the foresight outcome, it can also help to include the anecdotal knowledge about regional conditions and particularities in the deliberation process. Furthermore, stakeholder involvement may serve the overarching goal of strengthening ties between neighbours and foster further forms of transboundary cooperation.

Lastly, if there is public pressure on shaping regional development, there is also a common motive for developing participatory discourse activities. Again many participants of these discourses will demand to have a European element represented in the discourse even if the topic is local. The organisation of participatory activities on a local scale could be a basic input to higher-level democratic decision-making structures on the regional, national and European level.

V. IMPLEMENTATION OF MULTI-LEVEL FORESIGHT

The idea of the European research area is based on the concept of exploring unity in diversity. The major advantage of the European Union is the evolution of space-adapted strategies for regional economies. The process of globalization has often obscured the necessity to develop regional resources and regional niches as a means to be or become a serious competitor in the global market place. Europe will always lose the competition on the basis of price-driven mass products. What is needed is a competitive edge on knowledge and the intelligent combination of local or regional resources, including natural, social and cultural resources. One of the main objectives of foresight is therefore to encourage the different regions in Europe to assess their specific potentials, develop their resources and market them locally as well as globally.

The parallel organization of epistemological, reflective and participatory discourse activities representing the transnational-national, regional and local level respectively provide a viable compromise between the centralists and the decentralists within the foresight community. It is essential to forge a link between “bottom-up” activities of local initiatives and a “top-down” activity of the EU. The EU should provide professional assistance, guidance, and encouragement to local and regional initiatives

to search for their specific path to technological progress and economic development. At the same time, these initiatives need the epistemological base for building regional scenarios or to assess market potentials. Integrating the results of centralized epistemological discourses in to specific regional development plans could provide a viable answer to making best use of the European dimension without sacrificing the regional identity. Regional foresight and supra-national assessments can play a catalytic role for establishing successful innovation initiatives, monitor their performance and suggest improvements and changes in the course of implementation.

Currently the wide diversity of foresight efforts indicates that Europeans are embracing the possibilities for engaging in regional innovation forms of foresight and TA. However, across all these efforts there is an absence of cooperation and of exchanging best practice results among the various regions and local foresight initiatives. Thus it seems appropriate to think that networking regional foresight activities is the most effective way to build synergies and learning effects across the different regional efforts. These networks should provide a common knowledge base, a best practice data collection, a benchmarking activity to ensure quality control and strong expertise in structuring the right form of discourse depending on purpose and issue.

VI. CONTRIBUTION TO THE EUROPEAN RESEARCH AREA

One of the major opportunities is therefore the potential contributions of multi-level foresight and TA activities to the creation of a European Consortium of Regional foresight Initiatives. Such a consortium can be seen as *a strategic precursor to the realisation of the European Research Area (ERA),* which itself will be a major focus of European research policy in the coming years. Multi-level foresight activities could support the ERA by reinforcing and widening European unity through *coordinated diversity.* The strength of Europe, its diversity and multi-cultural tradition, can be made a driving force for technological and organizational innovation starting from the contributions of each region within the Research Area. For this purpose, future foresight efforts should be designed to provide a platform for all actors on the different levels as a means to collect and evaluate the experiences at these levels and feed them into the respective discourse type. The main tasks here are to stimulate an exchange of best practices, to compare case studies, to establish a common network for mutual learning and to foster a common understanding of unity amidst diversity within the European Research Area.

FORESIGHT IN A MULTI-LEVEL AND MULTI-DOMAIN DECISION SPACE

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Is a multi-level foresight approach necessary and feasible?

The integrated multi-level foresight approach outlined by Renn represents a tempting and consistent vision. I agree that the networking of foresight activities at regional level could indeed become one of the cornerstones for the realisation of the European Research Area. However, there are also many other motivations for conducting technology foresight than supporting regional development which is at the focus on Renn's paper. So, technology foresight can also be conducted at sectoral level,. In fact, in some sectors there may be a great need even for participatory foresight discourses at EU-level. For example, a European approach may be appropriate in cases where the future development of EU-scale industries is at stake (e.g. aeronautics, telecommunications, etc.), or infrastructure issues of a European scale (e.g. Trans-European Networks). In such domains, multi-level foresight approaches may be necessary as well, but possibly the emphasis should then be put rather on higher levels of governance. In other words, apart from different levels of discourses we should also differentiate foresight activities by the domains to which they apply.

As regards feasibility, a multi-level technology foresight requires a certain degree of cooperation, coordination and maybe even standardisation of foresight activities at different levels, which could at least in principle be realised under the umbrella of a multi-level governance regime. We should nevertheless be clear what this implies in detail. Multi-level foresight would apply to a range of countries and regions that are characterised by a very high degree of diversity. Many problems and concerns are specific to individual regions and countries and should - also in line with the principle of subsidiarity - be addressed at regional level. Policy structures, styles and processes are not necessarily compatible with the same kind of foresight approach. Even under a common regime, foresight activities need to be geared towards the specificities of the national or regional political systems. This obviously raises scepticism about the scope for homogeneity of a multi-level foresight approach or protocol to be applied in different countries or regions. Due to the context-dependency of foresight exercises, comparisons, benchmarking and the standardisation of practices should be treated with great caution. Nevertheless, there is certainly scope for some kind of co-ordination and mutual learning. It can be ensured by the exchange of experiences and findings, by cross-participation of experts and stakeholders at events at different levels, by the creation of stable networks of practitioners in different domains, and by creating awareness of the potentials and the limitations of foresight, especially in those countries where it is not yet rooted in the political culture.

The multi-level approach suggested by Renn provides an orientation for the future of foresight. However, his argument is rooted in a regional development perspective and should be expanded to comprise also activities of a sectoral or thematic nature.

We would then end up with a multi-level and multi-domain perspective on foresight activities, that could be described by the metaphore of a "patchwork" or "network" of activities. Together they may still build on a common foresight regime that is based on the networking of activities and the exchange of experiences, but there are serious arguments against any attempt to establish standardised practices or benchmarks.

What division of labour between different levels of foresight Discourses?

In his paper Renn distinguishes between epistemological, reflective and participatory discourses as elements of foresight activities. The epistemological discourse is the one he suggests in the first place for the EU- or multi-country level. It is focused on developing a common definition of the problem in question and the resulting risks and opportunities.

Reflective discourses aim at reducing uncertainties and balancing of sometimes diverging assessments. While these balances may indeed differ from country to country, there is still a role for the EU to play with respect to reflective foresight, namely in areas where there are common concerns and debates about an issue in all countries. The importance of an issue in the national political debates may differ, but the balance of arguments brought forward in favour or against different options with respect an issue can still be essentially the same. Moreover, there are issues where important decisions regarding the issue have to be taken at EU–level.

Finally, participatory discourse is clearly of major importance at the regional and local level. As far as decision-making in support of regional development is concerned, I share the viewpoint that participatory discourses should be conducted at regional level. However, I am wondering whether this argument excludes them from being conducted at EU-level. Isn't there also a need for participatory discourses at higher levels of governance? The definition of participatory discourse states that it is focused on resolving ambiguities and differences about values in order to search for solutions compatible with peoples' interests and values. As already mentioned, there are many issues for which important decisions need to be taken at national and European level, involving also debates about values, such as for example in genetic engineering or in public health. Moreover, EU-level decisions are increasingly affecting also local and regional actors in many domains. At higher policy levels, the opportunities and the levers for shaping the future are of often stronger than at lower levels, thus underlining the need for participation. In other words, there is scope for these debates to be informed by a participatory discourse at these higher levels of decision-making as well.

So far, decision processes at EU-level have been based only to a very a limited extent on wider participation, and for important practical reasons. We are still missing the appropriate mechanisms and methodologies to achieve it. So far, organisations like the IPTS have conducted their foresight exercises mainly by bringing together a rather limited range of national and regional experts. There is thus a clear need to start thinking about how to bring participatory elements closer to the EU level. This involvement could be achieved either by conducting value- and solution-oriented participatory discourses at EU-level or by creating a mechanism to transfer the key findings regional or sectoral participatory discourses debates to higher levels of

governance. These activities should be limited to areas with a particular EU-relevance, i.e. where the key decisions are taken at EU level. Beyond the ones already mentioned, examples of this kind can be found in areas related to enlargement, agriculture, transport or energy.

In selected sectoral and thematic areas, participatory discourses are also needed at EU-level. However, due to the limited experiences with participation at this level so far, experimentation with new approaches should be encouraged.

Moving beyond foresight?

foresight has several benefits, especially in process terms. It often entails building joint visions and orientations, it clarifies conflicting views and values. However, it is often unclear where foresight ends and where decision-making starts, and how the two processes are linked to each other. There is a gap between the two, implying that foresight processes often remain untapped as a source of strategic input. In other words, we need to make a step beyond foresight in order to link it more closely to decision-making, and also at EU level.

foresight is about discourse, shared vision-building, creating a common viewpoint on disputed issues for the future under conditions of uncertainty, complexity and ambiguity. It is dealing with future challenges, but it should certainly not be confounded with forecasting. However, forecasting had one major "advantage", namely that it was much easier to draw clear conclusions for decision-making, even if we know today that this was a false promise. As regards linking foresight to decision-making, the experiences made so far have been ambivalent. In many cases, there has been very limited impact on decision-making in S&T policy, in others the link was made in a far too mechanistic way.

An interesting option would be to combine foresight-type of activities with the development of adaptive policy-strategies. The concept of adaptive policy-strategy is based on the recognition that while we may be in a position to influence future developments, the actual realisation of the future is contingent on many external factors as well, outside the scope of national or even European decision-makers. In other words, there is a need to be prepared for the unexpected, undesired or uncontrollable by thinking early on about decisions and choices for a range of different future scenarios. Adaptive policy strategies imply to maintain a portfolio of policy options in order to be able to react and adapt to changing circumstances while trying to consciously shape future development paths. In brief, adaptive policy strategies could be characterised as follows:

- Thinking about challenges and options, as well as the risks and opportunities attached to them;
- Orientating your decision towards guiding visions ("Leitbilder");
- Assuming that things will not necessarily happen as you expected, and adapting to and preparing for contingencies.
- Maintaining a portfolio of political, scientific and technological options in order to be able to react to the uncontrollable developments of the future;

- Setting priorities on the basis of a cautious and robust (or resilient) portfolio management of the risks and opportunities attached to the different options in S&T.

Obviously, adaptive policy strategies are not a one-shot activity, but rather a continuous process of reconsidering scenarios and portfolios of policy options in the light of new assessments results and foresight processes, but also complemented by inputs from policy benchmarking and research in the complex nature of socio-technical change. It should certainly not be misinterpreted as a simple translation of foresight results into policy decisions. Rather it represents an additional element of an interaction process, involving those in charge of taking decisions (in policy as well as in other decision domains) and a wider expert and stakeholder community, but focused on decision options and policy portfolios.

We should start to think about what can actually be done with the results of foresight exercises to make them more effective in decision making. A useful approach to follow in order to bridge the gap could be that of adaptive policy strategies. By complementing foresight exercises with the development of adaptive policy strategies at different levels and in different domains, new ways of combining adaptive and proactive policy elements for shaping the future could be devised.

REGIONAL FORESIGHT GOVERNANCE AND DELIVERY

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Introduction and Purpose

Professor Ortwin Renn raises some interesting questions in his speech about the nature of foresight (non-predictive and consensual) and the need to create a platform for actors and players at different levels. Our experience in the UK supports his argument for linking "bottom-up" activities to national and EU policy making. Indeed it would go further to suggest that early ownership and resource building in the regions is the key to success.

The purpose of this paper is, therefore, to provide informed advice and real life examples of how foresight can be implemented at a local level and then relate these to the current debate about multi-level governance and strategic futures.

Foresight North East

Although, the UK is generally recognized as having a strong national foresight programme, attempts to "roll out" its policy instruments have met with limited success. The North East of England is the principal exception because of its early decision to establish a dedicated foresight unit (1996) responsible for converting policy into action, initially by targeting industrial companies and technology clusters; subsequently by focusing attention on young people, education and social issues.

Impact has been significant and beneficial. Over the past six years, several hundred manufacturing firms have been involved in foresight North East both in consultation and operational activity. Five universities, 15 colleges and 50 secondary schools have taken part in curriculum based activity and/or related product-futures work. Strategic plans have been developed for the Regional Development Agency (ONE North East) in such areas as life long learning, crime prevention and Manufacturing 2020.

Responsibilities of National and Regional foresight

History demonstrates many pitfalls to the top-down approach in which expert wisdom and the evolution of policy instruments become an end in itself. Equally there are dangers in the bottom-up approach which is often obsessed with resolving regional problems and impervious to new opportunities. We believe that the identification of key technologies, observation of global market trends and the creation of foresight tools are valid areas for EU or national intervention. However, responsibility should be taken at the regional level for policy translation, cluster development and social inclusion.

Governance at the Regional Level

The dilemma of governance is as follows. foresight should be inclusive otherwise it cannot significantly impact on economic development or social change. However, trying to include everyone may lead to endless debate about programme content and delivery method. Often the agenda is captured by academics or civil servants that have the time and inclination to pursue foresight for its own sake. Industrialists soon lose interest.

The truth is that foresight should be targeted towards those actors and players that are capable of turning discussion into commercial benefit and/or social improvement. Generally speaking those groups which are tightly specified, cogniscent of targets and subject to timescales are more likely to achieve results. Strong management is essential and the best way to achieve this is to empower a single agency to be responsible for operations, whilst safeguarding the right of stakeholders to set strategic direction.

In North East England, governance is provided by an Executive Board (meeting monthly) and Steering Committee (quarterly) representing industry, higher education, and business support. Other committees are formed to control fixed-term actions. Day to day management and operations are based at the Regional Technology Centre (RTC North) where a full time team of four foresight project managers work alongside a large number of business support and technology transfer personnel.

Developing a Business Plan for Foresight

An effective Regional foresight programme will take several years to develop, perhaps beginning in a limited way with awareness and networking but increasingly moving towards in-depth projects and a greater need for public funding. Components in the plan should address regional actors and players as in the following examples:

- ***Project Management:*** Set-up and maintenance of a central focal point and resource centre. Marketing campaign to highlight the practical benefits of futures thinking. Liaison with EU, national and regional foresight structures.
- ***Interface with Research:*** Global watch service to monitor 'disruptive' technologies and to direct local R&D. Development of graduate coursework and foresight tools in regional universities. Establishment of training and facilitation capability.
- **Interface with Government:** *Support for local policy makers perhaps via a separate Strategic Futures programme. Consultants identify key issues and regional scenarios. Task groups set-up by foresight produce detailed recommendations.*
- ***Interface with Industry:*** Assistance for individual companies to develop their internal foresight capacity. Sector mapping and scenario planning for clusters and networks. Flexible loans to facilitate projects relating to future technologies and markets.
- ***Interface with Citizens:*** Might include 'futures' work with schools exploring products of the future and entrepreneur training. Horizontal projects to explore

matters of public interest including crime prevention, health care, aging population and environment.

Example Methodologies

Professor Ortwin Renn has put the case for an EU-wide exchange of experience. At the practitioner level, RTC North would like to support this view. The following tools and techniques have all proved useful in the North East of England and are described briefly in the interest of exchanging best practice. Further details are available if required.

(a) Scenario Planning: Tools have been developed for anticipating future business environments with individual companies and groups of companies. These include:

- Type A workshops: Offsite sessions with several decision makers from a single company focusing on topics such as long term business planning, product futures, marketing strategy. The technique predicts a future achievement and works backward to the present to define reasons for success.
- Type B workshops: Similar to the above but involving circa 10 participants from 3 companies and allowing SMEs to compare detailed experience. Companies are encouraged to define their identity in terms of core skills rather than products made (e.g. we are experts in inflatable technology / we make life jackets and survival suits).
- Type C workshops: Two-stage tool for working with larger groups of companies. In the first workshop, participants construct a joint or 'default' scenario. Then each company fills in a cross-impact matrix comparing scenario assumptions with individual strengths. In the second workshop results are compared and actions agreed.

(b) Regional Policy Formation: The following technique has been used to produce regional strategies for design, manufacturing and life long learning.

- Organise a major event, with high profile speakers and experts from outside the region Note: sub-groups prepare presentations of key issues before the event.
- Recruit circa 3 sub-groups – each with an issue to carry forward the discussion over a fixed time period – facilitators and recorders to be provided by FNE.
- Receive reports from the task groups and collate findings into a strategy document for further consultation and amendment. Finally submit to regional policy body.

(c) Students Innovation Challenge: An annual three-stage competition for designing products of the future. Every year there is a different theme e.g. fashion, transport and crime. Prizes are sponsored by companies, agencies and universities. This has been a very successful tool which has, so far, attracted the participation of 2,500 schoolchildren and college students.

- Gateway Stage: individual children present a creative business idea
- Semi Final Stage: teams of children engage in problem solving exercise
- Grand Final: teams solve a real life company problem over 12 weeks.

FORESIGHT IN EU: MULTI-CRITERIA PRIORITIES AND MULTI-LEVEL GOVERNANCE

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Public Policies

The scope of public policies and of governmental interventions has grown dramatically during last 40 years in most western societies as it can be shown by the strong increase of governmental expenditure in percentage of GDP (OECD, 2001 and Mueller, 1996):

	1996	**2000**
Portugal	17%	47%
Spain	19%	38%
Finland	27%	45%
Ireland	28%	30%
Netherlands	34%	43%
France	35%	51%
UK	33%	39%
Germany	33%	45%
OECD	27%	42%

This increase shows the importance of public policies (Olson, 1982) despite the general adoption of the paradigms of the market economy. Actually, the main challenge for public policies is the ability to develop a medium and long-term vision of the Society and to carry out sustainable efforts to build up a better future.

This challenge implies closer relations between Government, Science and Society as well as new instruments to support the process of looking at the future, developing alternative scenarios and designing strategic options.

foresight as a source of inspiration and as a methodological framework (Renn, 2002) can give crucial contributions to such challenge.

A New European Policy

The Heads of State and the European Commission have agreed (March 2000) on a common vision for economic and social development in Europe – the so-called Lisbon Strategy – aiming to achieve by 2010 – "the most competitive and dynamic knowledge – based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion".

The European Council meeting in Stockholm (March 2001) has considered the development of a European Research Area (ERA) as one of the key areas for action and the 6th European Community Research Framework Programme (FPG, 2002-

2006) is expected to be adopted by the Council and the Parliament, June 2002, during the Spanish Presidency.

The need to reform the European Governance has become another central issue and several objectives are being underlined (EC, 2001, a), such as:

A – Better relationship between Science and Society
B – Better use of scientific expertise for policy making
C – Further decentralisation schemes and better coordination between national, regional and local levels, according to the White Paper on the European Governance: Enhancing democracy in the European Union, COM (2001) 428, July 2001.

A new policy for Science, Technology (S&T) and Society in EU is required to fulfil these objectives (EC, 2001, b) and such policy implies better systems to set up priorities in S&T and better links between S&T and public policies.

The contribution of foresight methodology to these aims is a central issue for debate and it is the theme of this Conference.

Foresight and S&T priorities: A new model by ET 2000

Setting up priorities for any area of public or private budgeting is inevitable as any allocation of resources implies specific criteria and scales of priorities.

In less developed countries the links between S&T and society are weaker and public policies are less rationalised.

Therefore there is a common temptation pretending that there are no priorities because the goodness of Science is above such type of decision. Obviously, this is just a way of avoiding the debate on priorities and the most common type of priorities in then based on the number of qualified applicants for each scientific domain with quite negative effects as it amplifies existing disparities and distortions.

The debate on S&T priorities has been quite interesting within the Portuguese Technology foresight Project (Engenharia e Tecnologia 2000 – ET 2000) and the degree of priority assigned to each domain should be based on three criteria, according to the obtained conclusions:

I – Potential for future advances.
This potential is estimated in terms of the assessed rate of the number and of the importance of expected results for each domain.

II – Contribution to the development through additional competitiveness.
This criterium is based on the impact of each domain to boost strategic lines of development.

III – Favourable conditions to guarantee the feasibility of the development of each S&T domain

Actually, each region or each country may have comparative advantages to pursue S&T activities in specific domains.

Obviously, these three criteria have to be based on a vision about the future:

a) future evolution of S&T domains;
b) lines of future development;
c) future feasibility conditions.

foresight is the main approach supporting the development of such vision avoiding the mistakes of forecasting techniques and of another approaches more based on the past rather than on the future.

A new model based on Impact Matrices was proposed by ET 2000 and key results were obtained (Tavares, 2000).

Foresight and Multi-level Governance

The White Paper on Governance in the European Union (EU, 2001, a) has considered the questions "what form does the question of multi-level governance take for local and regional players?" which was developed by one of the Working Groups and 5 proposals were presented:

- Promoting the dialogue between the local and regional authorities and EU institutions;
- Involving the Committee of the Regions more effectively;
- Promoting the partnership between the infranational, national and European Union levels to implement EU policies;
- Organising the coordination of Community Policies;
- Creating a Community legal instrument for cross-border, transnational and interregional cooperation.

All of them assume a closer interaction between these three levels of governance.

Actually, European regional policy has led to regionalization and decentralisation and this trend is present also in Objective 1 regions: the majority of funds of the third Community Support Framework is allocated to regional programmes as opposed to the minor budget received during the 1st CSF.

However, there is a general awareness about the need to innovate and to develop new ways to coordinate and to integrate the local, the regional, the national and the Community levels, as it is well expressed the R. Prodi: "I believe we have to stop thinking in terms of hierarchical layers of competence separated by the principle of subsidiariaty and start thinking, instead, of a networking arrangement, with all levels of governance shaping, proposing, implementing and monitoring policy together" (R. Prodi, European Parliament, 15/02/00).

The role to the played by foresight to achieve this aim can include different and important contributions:

- Development of medium and long term scenarios for multiple levels and sectors
- Matrix analysis of interaction between local, regional, national and Community levels.
- Participation of experts and decisions makers of multiple levels of governance in common processes of analysis and decision making to improve the consistency of options.

All these lines of work can benefit not just from the foresight results but also from its process creating general and flexible frameworks where multiple players and decision makers from different areas can interact helping to cope with three major conceptual challenges (Renn, 2002): complexity, uncertainty and ambiguity.

Therefore, promising and important developments of foresight in Europe can be expected to support the development of better governance and S&T policies.

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FORESIGHT AND GOVERNANCE

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On Renn's Vision for Multi-level Foresight

I found Ortwin Renn paper on "foresight and Multi-level governance" very interesting. It attempts to establish a "parsimonious" connection between the challenges that foresight should address (complexity, uncertainty and ambiguity), the types of discourses (epistemological, reflective and participatory) and participants with the diverse levels of governance.

The arguments and statements are conductive to proposals of coordination and networking the different foresight type of activities and future oriented practices that are developed at the different levels of governance. In that sense the final suggestions on the importance of promoting exchanges of information and mutual learning are much welcome.

However what we will comment here is on the analytical unfulfilled potential of the proposal and the need to understand the opportunities, but also the limits that the foresight type activities that we have today show when guiding human decisions and choices; one of those choices refers to alternative policies. Apart from foresight exercises, there is another way through which actors and decision makers introduce the future into the present that is related to the preferences and interest in the outcomes of the future developments.

But where the paper is weaker is on the considerations about the "multilevel governance" and especially on the link between governance and foresight. Governance by definition should be problematic, because it is on constant evolution and change.

Let me start with some considerations of foresight, to go later to some reflections on the issues of "governance", to end with an analysis of the dependence of foresight type activities and dynamics of the evolution of the governance system. The future of foresight activities is very dependent on the dynamics and trends at the "multilevel governance system", but today a foresight exercise could address the "shaping factors and shaping actors" that could make different scenarios of the "governance system" more plausible.

On Foresight

The main focus of Renn's paper is on "foresight activities", however we should be aware that there is not a "single" practice of foresight, not only at this multilevel system, but at any of the single levels of the system. Localities and regions, even those confronting similar challenges, when developing foresight or future oriented activities, have developed very specific practices, nested in policy in very different ways. National governments all over Europe have promoted "foresight exercises"

associated to S&T policies; here in addition to the very diverse S&T policy contexts what we have is a very different impact on policy priorities. Even when the European Commission had developed foresight activities, they do not appear to have a common background.

The reason why there are very diverse practices is that different forces have put pressure on the development of a particular foresight type or future oriented activities in the diverse levels of governance: some could be taken as common to the different practices (e.g. the need for long term scenarios when addressing actual or emerging problems or risk, challenges or opportunities); but others are very specific constraints.

foresight activities, either information production or process interaction, in most of the cases are associated with traditional enlightenment approaches to policy. However enlightenment could also come as a result of other practices and tools, such us "technology assessment", "technology watch", "strategic management", etc.

Organizations, or even individuals, when making choices and selecting a course of action, they assess the future, they require insights on the possible "trends, dynamics or trajectories"; however when they select a course for action, they confront this information with their own resource dependence or capabilities, or even with the past. Human action and organizational action specially is also based on the "past", even when thinking about the "future"; action oriented to future is also based on learning that is, on past experience on similar situations (Sanz-Menéndez and Cabello, 2000).

A significant aspect, underlined in Renn's paper, should be highlighted. In addition to the traditional way of considering foresight activities as methods for producing reports on future trends, there is also a much more valuable foresight role: aligning expectations of actors (Sanz-Menéndez, et al., 2001) through interaction in the foresight type process, then helping to define common goals and common strategies provided that there is not a complete clash of interest and visions.

Thought the interaction process we get not only information on the technological or scientific trends or the emerging challenges and problems, but we also get insights on the "expectations about other actors behaviour"; chances that a technology or a problem evolves is linked to its connection with actors (organizational) behaviour, in that way future is contingent of human actions.

On Governance

There are other puzzling issues not completely covered by Renn's paper that are relevant for considering the link between "foresight and governance". Let me go further on the issue of "multilevel governance" just to try to complete or elaborate on some of the arguments. I should critically comment his underlying vision of a "stable governance system" in which the key level of governance is the regional one.

What do we mean by a "governance" system? We mainly mean a system in which the "public administration" executing political priorities "requires the cooperation in different degrees of the main players". A mechanism in which "expertise" is

exchanged by "legitimation", a mechanism in which the boundaries between what is public and private becomes blurred. Governance has been defined as a process through which a socio-political community achieves binding decisions in the face of conflicting interests; this process of consensus-building, decision-making or even implementation of decisions is not merely determined by state actors or formal governments.

Due to growing complexity and segmentation of modern societies and issue areas, it is the interaction of societal and state actors what defines problems, builds up the necessary degree of consensus on problems and solutions, consolidates conflicting interests and (pre-) determines political decisions. Since state actors need the co-operation of the stakeholders involved in order to come to grips with complexity and fragmentation, they have to trade much of their hierarchical power for access to interest group expertise.

For example in the innovation policy domain (that includes all issues of science, technology, etc.) the governance system has to deal mainly with two types of distributive conflicts on policy reflecting two different cleavages. The first one relates to conflicts among important actors within the system (i.e. scientific or academic versus industrial interests), whereas the second refers to potential conflicts between national states as players in distributive and redistributive games. However there are also constitutional conflicts between the different levels (i.e. national states and regions).

Then what we mean by "multilevel governance system" is just to take into consideration the fact that 25 years ago there were almost only national arenas for S&T policies. All issues on priorities were "decided" on these grounds, actors mobilize and pressured the government to shape their decisions. However, the eighties, a new arena of European action was established and legally structured at the time of the Single Act. Since then, in many countries regional Governments have gained competencies and have developed their strategies and policies that have redefined the overall game. Now, in 2002, there is no doubt that S&T, research and technology innovation have become characterized by a "multi-level governance system". And this is just one single domain of the overall political multilevel governance system.

The White paper on European Governance debates, and the Convention on the "future of Europe" are addressing the appropriate distribution of "competences" between different levels. If institutional reforms of the political system occur, most probably will be very specific to the different policy domains. Then we could imagine that new constitutional agreements could be established on "research", "innovation", "competitiveness", "competition" policies, etc. that could dramatically change the distribution of competencies. Today, the EU in RTD has a "subsidiary" action confronting national States; and in some countries there are shared competences between central and regional governments, while in other there are only "central government" role.

If we think about the "innovation system" or about the "research system" we should be aware that, at the present time, there are many configuration of actors that are shaping the policy arena at the different levels and they influence the trends on the

multilevel governance. foresight should be understood in its policy context (Sanz-Menéndez *et al*, 2001)

Governance Dynamics Constraining Foresight Development

In order to think about the relationship between foresight, as an enlightenment practice, and governance, in any policy domain, we should understand the dynamic of changes in the governance system. Of course "global constitutional redesigns" (such as proposed by the EU Convention or the White Paper on Governance) are key elements, however the dynamics that reshape the way in which actors interact in each of the diverse levels of governance system, still relate more to the specific shaping factors and shaping players of the single policy arena.

The future opportunities of foresight diffusion, the forces that are driving the changes in the "multilevel governance system", especially that referring to innovation, shape extension and impacts.

We could consider broad models of governance in the EU as guidance when speculating about future developments of the "constitutional" shape of the Europe's future (e.g. Schmitter, 1996 or the "Scenarios Europe 2010"), but we will make some considerations on possible scenarios on the area of innovation policy.

- an increasingly transnationally *centralised* and dominating European innovation policy arena, assuming weakened national authorities and (partly) strengthened regional autonomy;
- the opposite, i.e. a progressive *decentralisation* and open competition between partly strengthened, partly weakened national or regional innovation systems and related policy arenas;
- a centrally, mediated" *mixture of competition and co-operation* between diverse national or regional innovation cultures, i.e. a multi-level governance based on a "problem-driven" re-distribution of initiatives and responsibilities across levels.

Any possible scenario on the governance of the innovation system will give foresight a particular and different role, in any of the levels of the system. In their present state, the scenarios are still mainly based on political institutional or constitutional design factors which are just one of the elements of the innovation policy governance.

On a Foresight Exercise on the Multi-level Governance of the Innovation System

Then if we have concluded that foresight future is very dependent of the evolution and trends of the governance system, we should suggest applying foresight to scrutinise the force and factors affecting the governance, at least in the innovation policies and domain.

Of course thinking on possible scenarios or the possible dynamics of the governance system in Europe and their implications is in itself a "foresight exercise issue". Through constructing, characterising and testing on alternative future scenarios, the

exercise will sharpen the identification and analysis of the complex dynamics of European policy-making. The process of scenario building and foresight requires the deconstruction of the policy domain at hand (research and innovation policy) into sets of shaping factors and shaping actors. By constructing different scenarios, assessing their preconditions, likelihood, and possible consequences one better understands the driving factors of possible future modes of governance.

The key issue is to understand what are the key factors and elements that could shape the governance of the innovation system. Through its interactive methodology including very different kinds of European experts and through the identification of shaping factors and driving actors of future innovation policymaking, the exercise will lead to a better understanding of opportunities and threats lying ahead for European governance within the policy domain of innovation policy. Thereby we are aware that one of the dynamic elements of governance is the changing boundary between policy domains (e.g. research and innovation policy vis-à-vis educational or industrial policies) and the learning processes emerging from policy transfers.

In fact we should address what could be the possible future scenarios on governance systems that have included more and more action by the different levels. And how foresight –as normative practice of enlightenments- could help in "selecting the most appropriate not optimal "the best comparative arrangement option". However we should not forget that the choices made by policy makers based on foresight type of activities create a model for S&T policy that is related to "distributive politics". foresight has consequences that vary for the actors since they have different levels of resources and different capabilities in terms of the possible future developments.

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OPEN DEBATE SUMMARY

Following the speakers' contributions, the following issues were raised during the discussion which involved much interaction between members of the audience anf the active participants:

In relation to S&T, there is a need to monitor those technological developments which result from actions at different levels (European, National, etc.). This is necessary to evaluate and assess the impact of outcomes of projects in economic and social terms and to prepare for future research and technology Programmes. From the debate it came out that there is an urgent need to integrate policies and actions/ actors across the different governance levels, both vertically and horizontally.

The debate revealed differences in perception on the meaning of multi-level foresight. The challenge for multi-level foresight is to develop it in a way which can match both European expectations and the subsidiarity principle.

Another point of the debate related to the difficulties to monitor the direct impact of foresight results on policy-making. One solution would be to establish better links between foresight recommendations and policy actions.

One comment in reaction to the main speaker's presentation was that it would be quite difficult/ ambitious to embed in a foresight exercise the three discourses presented and at the same time ensure a successful exercise. For example, the link between science and policy making is not very good (i.e. complexity discourse); it is a difficult exercise to promote a cultural change (e.g. across the board in industry and population); it is necessary to build public confidence in science. However, not all these issues can be easily picked up simultaneously by a foresight exercise and, furthermore, there are also other ways and means for trying to deal with these issues. Finally, when attempting to assess foresight impacts, it should be considered that it is not an easy task to monitor foresight impacts on a target audience which is not only restricted to policy makers.

The contributors to the debate, in addition to the discussants, speaker and moderator, included: **Giannino Bernabei** (European Economic and Social Committee, Belgium), **Miguel Angel Zamarrón Moreno** (UTC-UGT, Spain), **Ferenc Kováts** (Technology foresight Programme, Hungary) **Beatriz Presmanes** (Consejería de Educación. Comunidad de Madrid, Spain), **Alfredo Sandovar** (CARTIF, Spain) **James Gavigan** (JRC-IPTS, Spain), **Ulrik Jørgensen** (IPL-Innovation and Sustainability, Denmark), **Jordi Serra** (Periscopi, Spain), **Clive Grinyer** (Design Council, UK), **Pierre-Yves Mauguen** (Ministry of Research, France) and **Julie Carney** (foresight Programme, UK).

IV. INTERNATIONAL LEVEL FORESIGHT

Moderator:
• Mr. Jesús Rodríguez Cortezo, Observatorio de Prospectiva Tecnológica e Industrial, OPTI, Spain.
Speaker:
• Prof. Ron Johnston, Australian Centre for Innovation and International Competitiveness, University of Sydney, Australia.
Discussants:
• Dr. Daniel Malkin, Directorate for Science, Technology and Industry, OECD.
• Dr. Tamás Balogh, Ministry of Education, Hungary.
• Dr. James P. Gavigan, DG Joint Research Centre, Institute for Prospective Technological Studies, European Commission.
• Mr. Gustavo Aishemberg, UNIDO Latin America and Caribbean Bureau *(in absentia)*
Rapporteur :
• Dr. Jennifer Cassingena-Harper, Council for science and technology, Malta.

SESSION OVERVIEW

The stated aim of this session was to review how foresight is impacting on science and technology policy-related decisions on a broad international front. While foresight has developed very strongly over the past decade in Europe, other parts of the world have also seen a similar rise in interest and activities. The session brought to the fore the case for foresight on issues which by their nature are international (Climate, risk-related topics such as food safety, GMOs, ..), discussing whether or not such supra-national foresight is or should be taking off, what format it should take to be relevant for decision makers, and what the role of the EU and international organisations should be in this regard. It also considered the recurrent theme of the conference – i.e. how foresight and foresight practitioners link up with the day-to-day concerns of policy makers, and what meaning this has in regard to supranational foresight.

In his introductory remarks, the moderator **Jesus Rodríguez Cortezo** (Observatorio de Prospectiva Tecnológica e Industrial, Spain) underlined two particular dimensions to bear in mind. One of these was the general conference theme of the relation between foresight and decision-making and technology planning in both the public and private sectors. The other was the role or potential role which foresight can play in the international arena, either in relations between countries, or in the fields of action of international organisations.

He stressed that, as the use of foresight must always be subordinated to specific contexts and real situations, considering its application internationally obliges a number of questions to be answered:

- Can the same principles that apply to the use of foresight by nationally embedded administrations apply to international organisations?
- Can we speak of supra-national and regional foresights?
- What contributions can supranational foresight bring to national-level decision making?
- What is the role of international organisations in this area?

He pointed to the significance of the fact that a number of prominent international organisations have taken important technology foresight initiatives (OECD, The European Commission through the creation of the Institute for Prospective Technological Studies, UNIDO through its foresight programme for Latin America and the Caribbean, and still expanding, APEC through the creation of its multi-economy foresight centre in Thailand). Experiences from these would be very relevant to the subsequent debate.

The session developed in three different stages. To start, a keynote presentation and review was provided by **Ron Johnston** (University of Sydney). Ron gave an account of world-wide foresight experiences outside of Europe, citing some high-impact examples from Australia and developing arguments on how the foresight-policy links could be improved. He made several proposals on this generic issue as well as on the more international focus of the session.

This was followed by a series of presentations by the invited discussants. **Daniel Malkin** (OECD) set out the history of OECD's involvement in strategic futures and foresight work, in particular its efforts at brokering cross-national learning and exchange of good practice. **Tamás Balogh** (Ministry of Education, Hungary) pointed out some main lessons regarding the effective utility of the process and outputs from the perspective of an interested and involved foresight user. Regarding international foresight, he stressed that its success and viability depends on solid national and local experiences and competencies. **James Gavigan** (European Commission) made some differentiation between different types of international activities. He suggested some themes for supranational foresight, and proposed that the proven power of foresight to mobilise actor networks and incite them to take consequent action could actually compensate for formal institutional and governance gaps at the supranational level. The main points in the paper by the fourth discussant – **Gustavo Aishemberg** (UNIDO) *in absentia* – were reported by the session moderator **Jesus Rodríguez Cortezo**. He gave account of the very pragmatic and practical lessons derived from experiences in Latin America regarding high level commitment and involvement, but also of the enthusiasm with which foresight as a new and fresh approach to informing policy development has been embraced.

The third stage of the session was devoted to over an hour-long discussion and debate involving many of the session attendees. The presentations and discussions were monitored by the rapporteur **Jennifer Cassingena-Harper** (Council for Science and Technology, Malta) whose feedback report is provided in a later section together with the reports on the other parallel sessions. The papers by the speaker and the discussants are included in this section, followed by a summary of the open debate.

THE STATE AND CONTRIBUTION OF INTERNATIONAL FORESIGHT: NEW CHALLENGES

PROF. RON JOHNSTON
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I. THE PROGRESSION OF FORESIGHT AROUND THE WORLD

The application of technology foresight has fairly blossomed over the past 10-12 years. While the Japanese have been carrying out Delphi surveys of the future development of technology at five-yearly intervals since the 1970s, it is Martin and Irvine's landmark publication on Research foresight in 1989[1] which can be considered to have effectively 'launched' the modern foresight era.

In the following decade, many countries conducted national foresight studies. A selected chronology of foresight studies identifying whether they have used a Delphi, a panel- or scenario-based approach, or a mixture of the two, based on Georghiou[2], is shown in Table 1.

This Table indicates the increasing volume of foresight-based studies, and some evidence of a shift away from reliance on the Delphi survey technique. More generally, there has been an increasing shift away from methodology-driven foresight studies, towards recognition of the variety of tools available to conduct foresight studies, each suitable for different purposes and with different strengths and limitations.[3]

The majority of these studies have been conducted at the national level. This reflects a stage in the development of the application of foresight to priority-setting and policy objectives. In general, these studies have been formulated and carried out by organisations with a national responsibility with regard to science and technology matters, be they a government department, or a semi-independent advisory body.

The exceptions are bilateral studies (Germany-Japan) and the recent emergence of multi-country foresight studies, led by IPTS for the European Union and the Center for Technology foresight, for the APEC group.

[1] Martin, B., and Irvine, J., *Research Foresight: Priority-Setting in Science*, Pinter, London, 1989.
[2] Georghiou, L., 'Third Generation foresight: Integrating the Socio-Economic Dimension' in *Proceedings of the International Conference on Technology foresight*, NISTEP, Japan, 2001, available at http://www.nistep.go.jp/achiev/ftx/eng/mat077e/html/mat0771e.html.
[3] Johnston, R., 'Foresight - Refining the Process', *International Journal of Technology Management*, Vol 21 Nos 7/8, 1999.

Table 1 - Selected Chronology of foresight Studies and Methods

Year	Delphi	Mixed	Panel/scenario
1989		Netherlands	
1990	1st German 5th Japan		
1991			1st Critical Technologies USA
1992			New Zealand
1993	1st Korean		2nd Critical Technologies USA German - 21c Technologies
1994	France Japan/Germany	1st UK	Netherlands
1995	6th Japan		France - 100 Key Technologies 3rd Critical Technologies USA
1996	Japan/Germany	Austria Australia-ASTEC	Netherlands (foresight Committee)
1997		Spain - OPTI	Ireland
1998		Hungary - TEP South Africa	New Zealand Sweden 4th Critical Technologies USA IPTS Futures EU
1999	2nd Korea	APEC Multi-economy	2nd UK
2000	7th Japan	Venezuela	Germany - FUTUR China Brazil

A more detailed categorisation of national foresight studies has been made[1] against the objectives pursued, which were identified as:

- national competitiveness
- vision building
- identification of key or emerging technologies
- creation of networks
- information dissemination and education, and
- development of a forward-looking culture.

The authors concluded:
In countries where successive projects have been carried out, one can observe how the evolution in methods employed aims to increase the impact and effectiveness of foresight.

This growth in the number and variety of foresight studies has produced a response, common in all scientific fields, to develop an appropriate typology to categorise them.

[1] Gavigan, J., and Scapolo, F., 'Matching Methods to the Mission; a Comparison of National Foresight Exercises', *Foresight*, Vol.01, No.06, Dec. 1999, pp. 495-517

Barre[1] has applied dimensions of 'extensiveness' - number and variety of persons involved, and 'intensiveness' - quality of the learning cycles involved. This has been used to generate four types of foresight:

- societal foresight - high extensiveness, low intensiveness;
- collective learning and knowledge production - medium extensiveness, medium intensiveness;
- strategic scenario building - low extensiveness, high intensiveness; and
- key technologies/industry-oriented - low extensiveness, medium intensiveness

This typology framework is used to produce an interesting and useful map of 15 European foresight exercises. However it is not obvious that the two dimensions selected - scale and learning, are either the most important or the most useful.

For this paper, a more detailed typology of foresight exercises has been developed which has four distinct dimensions, drawn from various analyses and experience of foresight studies. The first relatively simple dimension addresses the extent of the **evolution**, or experience of, foresight in the country. The two extremes of the continuum are labelled as 'foundational' and 'embedded'.

The second dimension, **level**, is concerned with the whether the focus of the foresight study is national, regional, or sectoral. In many studies, a national perspective is adopted but with a focus on a limited number of sectors (eg Malaysia, Indonesia, Austria). In other cases, the sectoral emphasis is also linked with a regional concern (eg Thailand, Indonesia).

The third dimension is **focus**. This addresses the objective of the study (in a more limited way than Gavigan and Scapolo), with the extremes of the dimension being the conduct of the foresight exercise, with its associated benefits, versus policy and planning purposes.

Finally the fourth dimension, **objectives**, has been developed to address the different outcomes of foresight exercises. Martin and Irvine[2] emphasised the five 'Cs' of foresight - communication, concentration on the longer term, consensus formation, coordination (ie networking) and commitment (to implement outcomes). These have been refined into the five categories of anticipation, participation, networking, vision and action.[3] From these I have selected what I believe are the major elements: *anticipation*, which is concerned with looking to the future and establishing a vision; *networking*, which incorporates participation; and *action* - policy, strategy, planning and decision-making.

[1] Barre, R., 'Synthesis of Technology Foresight', in Tubke, A., Ducatel, K., Gavigan, J., and Moncada-Paterno-Castello, P., *Strategic Policy Intelligence: Current Trends, the State of Play and Perspectives*, IPTS, Seville, 2001.
[2] Martin and Irvine, *op cit*
[3] Proceedings of the EC Conference on Region al Foresight, *Creating and Applying Vision in the Regions*, Dublin 2001; available at http://foren.jrc.es/Docs/Conference/conprog.htm.

This typology has been applied to countries outside Europe[1] engaged in foresight. It provides a summary of their experience up to 2001.[2]

Table 2 - National foresight Activity

Country	State of Evolution*	Level+	Focus#	Objectives~
Oceania				
Australia	*E*	*N, R, Se*	*P*	*A, Ne, Act*
New Zealand	*F, E*	*N, Se*	*F/s, P*	*A, Ne, Act*
Asia				
China	*F*	*R, S*	*F/s, P*	*A, Act*
Japan	*E*	*N, Se*	*F/s, P*	*A, Ne, Act*
Korea	*E*	*N, Se*	*F/s, P*	*A, Ne, Act*
Taiwan	*F, E*	*Se*	*P*	*Ne, Act*
Singapore	*F, E*	*Se*	*P*	*Act*
Malaysia	*F, E*	*N, Se*	*F/s, P*	*A, Ne, Act-P*
Thailand	*F*	*N, R, Se*	*F/s*	*A, Act-P*
Indonesia	*F*	*N, Se*	*F/s*	*Act-P*
Americas				
USA	*F, E*	*N, R, Se*	*P*	*A, Ne, Act*
Canada	*F, E*	*N, R, Se*	*P*	*Ne, Act*
Argentina	*F*	*N*	*F/s*	*A*
Brazil	*F*	*N, Se*	*F/s, P*	*A, Act-P*
Peru	*F*	*N*	*F/s*	*A*
Uruguay	*F*	*N*	*F/s*	*A*

* State of evolution - position of foresight/future activities in the country along a spectrum from 'foundational' [F] efforts, to 'fully embedded in planning processes' [E]

\+ Level - national [N], regional [R], sectoral [Se]

\# Focus - foresight [F/s], policy action [P]

~ Objectives - anticipation [A], networking [Ne], action achieved [Act]
action proposed [Act-P]

These categories inevitably conceal a great deal of variable detail. For example, under 'Objectives' many published studies identify strategy and decision-making as the intention. However, it is apparent that the extent of the action and the effectiveness of the action vary widely, shaped by all the forces that normally affect decision-making. Nevertheless, even at this broad level of categorisation, some useful insights are generated.

[1] On the basis that others at this conference will be better informed about the state of foresight in Europe.

[2] These are the judgements of the author; and inevitably impressionistic, if informed by contact and familiarity with each of these projects.

First, the extent of the adoption of foresight is apparent. All industrialised, and the great majority of industrialising countries have some experience of formal foresight projects. For the former, the majority has reached the stage where foresight is embedded in planning and policy processes at a variety of levels. The exceptions are Canada and particularly the US, where the tradition of expert-panel based judgement, including critical technologies has dominated until recently.

For the latter, industrialising countries, the majority is still at the early foundational stage, some conducting only their first or second project. However, some have begun to embed foresight processes in regular planning and policy formulation.

This stage of development is partly reflected in the *focus* of the foresight. Those countries at the foundational stage are commonly concerned primarily with the challenge of conducting the foresight exercise, even if some broader national objectives have been identified. However in some countries with extensive experience of foresight, as Japan and Korea, the major focus remains the conduct of an independent high-quality foresight study.[1]

With regard to *level*, even when the study is national, a frequent device to reduce the scope and concentrate the effort is to identify a number of key sectors, just as done in the first and second UK exercises. These sectors are selected usually on the basis of their present and future value to the national economy. Regional foresight studies are less common, but growing.

A significant number of foresight exercises are conducted by government departments or agencies at the national and provincial level to address issues specific to the agency, which may not be widely reported even in their own country.

To illustrate, I have drawn on my personal experience of foresight exercises of this type conducted in Australia over the past four years to construct Table 3. The specific examples may be of limited interest. But they do illustrate the great variety of issues to which foresight is being applied. Secondly, that I have been able to identify outcomes of varying significance from theese projects, serves to demonstrate that the use of foresight for policy purposes is much more evident, and practical, at this focussed level.

[1] In some cases, there are other action-focussed foresight exercises conducted by specific government departments eg by MITI in Japan.

Table 3 Some Focussed foresight Exercises in Australia 1999-2002

Initiating Agent	Issue	Objectives	Outcomes
1. Department of Foreign Affairs (Federal)	National policy for the Antarctic	Strong national positioning Research priorities Logistic support	New policy formulated Priorities set and funded Research logistics transformed (from sea-based over-wintering to air-based summer projects).
2. National Research and Technology Transfer funding agency	Irrigated agriculture	Identification of key challenges to irrigated agriculture Research priorities	Targets for achievement based on shared vision Priorities Enhanced networking
3. Department of Industry (Federal)	Renewable energy industry	Technology and market trajectories	Action plan with targets agreed by government and industry
4. State Department, Local Council and Indigenous Land Council	'Arid zone' knowledge based economy	Identification of key competencies Development plan	Consensus Organisation to pursue objectives Plan and substantial funding
5. Regional water supply and management corporations	Water availability	Strategic plan Shareholder acceptance	Agreed objectives and plans (from water deliver to regional investor) Restructured organisations
6. Housing Estate Development Corporation	Environmentally and socially sustainable communities	Effective design principles Community engagement	Effective public consultation Transformed design
7. State Department of Transport and Roads	Transport planning	Parameters for road and public transport development	Approved 20-year objectives and plan
8. Environmental Protection Authority	River health, particularly salinisation	Identification of key drivers of river health and measures to manage	Position document Input to policy consideration
9. National Training Authority	Vocational education needs	Identification of major drivers and scenarios to shape policy making	Major report for national consideration. Establishment of a futures forum

			within vocational education sector
10. Department of Industry (Federal)	Selection of a Biotechnology Centre of Excellence	Improve the quality of proposals Enhance networking	High level of consensus (among competitors) Fewer higher quality proposals
11. Industry Association	Broadband-based services	Identification of scale and trajectory of, and constraints to a growing industry	Submission to Government review
12. State Department of Industry	Commercialisation of public-sector research	Commitment of other Government Departments to establishing a national capability	Partial commitment Research priorities

But, to complete this stocktake, there is a need to go beyond the national and sub-national use of foresight. The pressures for international co-operation in science and technology, the forces of globalisation, and the emergence of global-scope problems have introduced, in various modes, an international dimension to foresight.

At the simplest level, this has taken the form of co-operative imitation, as in the case of the many industrialising nations direct adoption of the Japanese Delphi instrument.

Beyond this, there has been direct bilateral co-operation, as between Germany and Japan, and France and Japan, to develop and refine Delphi instruments, methodology, and interpretation.

A third approach, which is committedly, as opposed to opportunistically multinational in scope, is based on the work of organisations whose remit goes beyond that of the national. For example the European Commission, through the Institute for Prospective Technological Studies (IPTS)[1] has conducted foresight projects with a European scope on a wide range of topics - sectoral, infrastructural and regional, including a major European futures project.

Under the umbrella of Asia-Pacific Economic Cooperation (APEC), a Center for Technology foresight[2] has been established under the aegis of the Thai National science and technology Development Agency (NSTDA). This Center has conducted a number of multi-economy foresight projects, including on mega-cities, water supply and management, smart transport, education and nanotechnology, and is developing networks across the highly disparate APEC countries.

Other international organisations are playing a supportive role. The OECD has established an 'International Futures Programme', promoting forums, projects and networks.[3]

The United Nations Industrial Development Organisation (UNIDO) has established itself as the Latin America and Caribbean regions "depository and distribution engine of accumulated knowledge, expertise and best practices on technology foresight activities."[4]

Another form of internationalisation is being driven by concerns and problems that transcend national boundaries. Examples of these include global warming, to address which the International Panel on Climate Control (IPCC) has been established. Its activities include the construction of a range of scenarios of effects of various factors related to global warming and their consequences. This issue will be examined in more detail later in this paper.

One variant of the global issue, in this case driven more but not exclusively by the private sector, particularly global corporations in the IT industry, has been that of cooperation to establish technology trajectories. In this case, the foresight tool

[1] http://www.jrc.es.
[2] http://www.apectf.nstda.org.th.
[3] http://www.oecd.org.
[4] http://www.foresight.ics.trieste.it.

commonly known as technology roadmapping has attracted considerable interest and investment.[1]

II. IMPACT OF FORESIGHT ON POLICY AND PLANNING

Assessment of the contribution of foresight to policy and planning at the qualitative level would appear to be straightforward, by identification of policy initiatives that directly follow and flow from a foresight exercise. Included would be those projects that have a specific policy goal.

The most common example is the application of foresight to priority setting for research, whether of existing or new funds. The UK foresight exercise is a prime example of this close and direct linkage between foresight and policy, with the establishment of a foresight Fund to support research initiatives in line with the identified priorities. Some studies conducted in Australia, New Zealand and the US fit this model also. In these cases, the contribution is obvious, though its extent may still be difficult to quantify.

Another type of foresight project is linked to fairly specific policy issues, commonly at a sectoral level. In some cases, the implementation of specific recommendations arising from the foresight study can be identified and hence that there has been an effect established. Projects in Australia (Table 3), China, Singapore and Canada fit this model. Again, however, that there has been an effect can be easily established, but determining its extent is much more problematic.

But it must be acknowledged that for a great many foresight projects, particularly those at the foundational stage with an emphasis on learning, creating a stronger future orientation, and building networking, it is extremely difficult to identify any direct policy impact.

In some cases this may be because the studies have little intrinsic value to the policy process. In others, the key policy-makers have not been involved - a problem of communication. In still others, the nature of the product and the process can be best considered as infrastructure in support of policy, rather than a direct contributor, in the same way that the collection of reliable statistics may contribute to improved decision-making.

Hence, it is apparent that in order to assess the contribution of foresight to policy and planning, we need more than a simple empirical measurement. Indeed, the notion that a simple empirical assessment can be conducted has proven illusory. The systems are too complex, the number of intervening variables too many. Rather, we need to establish a framework that will assist in understanding the structures and dynamics of each of the arenas – foresight and policy and planning, and their inter-relationship.

[1] See for example Garcia, M., and Bray, O., *Fundamentals of Technology Roadmapping*, 1998, available at http://www.sandia.gov/Roadmap/home.htm.

In the Blue Corner - Foresight

This thumbnail analysis of the development and characteristics of foresight is inevitably partial. In particular, generalisations across countries at very different stages of economic and foresight development are of limited value.

Moreover, we have seen the adoption by industrialising countries of the models and practices of industrialised nations, regardless of their appropriateness to their particular situation. The experience of observing so many developing nations attempting to conduct a Japanese-style Delphi foresight exercise, with an extremely limited number of 'experts' and dubious relevance of estimated technology realisation times to their economy, serves to emphasise the need to develop foresight appropriate to local conditions.

The chronology of foresight can be regarded as involving five stages. These stages have a degree of historical separation. However, the traditions have also continued in various forms[1].

The first stage, which held strongest sway in the 20 years from 1950-1970, emphasised technology forecasting. The objective was to discover the underlying structures of technology development and thereby be able to predict its future realisation. This ambition, and the associated assumptions, is part of the established tradition of engineering management, with its emphasis on technical and quantitative analysis. This approach, which continues to thrive, has developed significant insights into the factors shaping the development and diffusion of technology. Its major weakness is usually associated with its deterministic assumptions about technology development.

It is important to recognise that until relatively recently, the engineering management tradition operated largely distinctly from the broader management school. Hence, technology forecasting has made barely any entry into or impression on mainstream management thinking, and teaching.

At a similar period, an entirely separate set of people identifying themselves as 'futurists' emerged. Their emphasis, most commonly, was on the spiritual, or values, rather than the technological end of the spectrum, and sought deeper explanations of the evolution of the human purpose and condition.

The third stage, or model, is commonly captured by the label technology foresight, defined as "systematic attempts to look into the longer-term future of science, technology, economy and society with a view to identifying emerging generic technologies likely to yield the greatest economic and social benefits".[2] Most of the studies discussed in the previous section fit in this category. While the canvas may be broad, including economy and society, the focus remains on technology. Under this

[1] This analysis is based on English language terms. 'La prospective' has many useful connotations, particularly as an umbrella term, but its introduction here would only confuse the evolution of English language terminology.
[2] OECD, *STI Review*, No 17, 1996, p.18.

model, policy effects could be expected to be largely where emerging technologies are likely to have a high impact.
Over the past 5-7 years, in part in response to improved understanding of the economic and social processes that shape technology development, and in part due to a clearer picture of the challenges facing policy-makers, the emphasis of foresight has broadened to include technology as just one potentially significant factor. Technology has slipped from the label.

This shift is represented by Georghiou[1] as a "third generation" of foresight in which:
the market perspective is enhanced by inclusion of the social dimension, meaning the concerns and inputs of social actors. A similar concept has emerged in research policy more broadly, notably in the European Union's Fifth Framework Programme.

Parallel to this stage, but with only moderate interaction has been the progressive introduction of scenario planning as a tool for business decision-making.

Most recently, in just the past couple of years, there has been a significant shift in language away from foresight, the tool or method, to 'futures', the objective. At one level this may be little more than a product of fashion. But at another, it may well signal a significant maturing of the field away from its focus on methodology, and the 'foresight study'.

The new approach regards the many tools of foresight as just that - tools for planning and management; its outputs are information, which can be used in many ways. Its use and contribution will be determined primarily by the values, structures and cultures of organisations.

Another perspective can be obtained by looking at the way in which foresight studies have been organised. In the main, they have been led by agencies with responsibility for and an obvious interest in science and technology development. In most countries, such agencies have been fairly marginal to mainstream government, considered as representing just one of the 'special interests'.

As the focus of foresight studies have broadened, they have either failed to engage the interest of those individuals and agencies with direct responsibility for the area, or have been rejected as possible threats to existing arrangements and responsibilities. To illustrate, there have been foresight studies on the future of health involving many bio-scientists, but not Health department officials. Or studies of the future of learning not involving Education Department officials. The challenge of engagement is now upon us.

In the Red Corner - policy and planning

Public administration has found itself under increasing pressure over the past decade in most industrialised countries. Factors responsible for this include:

[1] Georghiou, *op cit*, ref 2

- the general drive to smaller government, to privatisation, and to exposure of remaining government activities to market contestability;

- the drive for higher quality performance particularly through documentation of processes;

- the establishment of the purchaser-provider separation, with possible improvements in efficiency but a decrease in opportunity for shared learning;

- the requirement to establish risk management procedures for all decisions;

- heightened probity requirements to ensure equity in the market-place;

- demands for higher levels of accountability and transparency;

- the shift from the specialist to the generalist public administrator, thereby providing a limited knowledge and experience base for decision-making;

- the requirement to manage increasing interaction between different levels of government, and different governments;

- new challenges arising from the greater permeability of national boundaries, including global corporations, Internet-based activity, etc;

- requirements and pressures of electronic communication, including information overload;

- regulations designed to prevent fraud and corruption;

- increasing public suspicion and rejection of expertise and authority; and

- like everyone else, addressing the complexity and speed of change.

It is against this setting that the issue of achieving a more effective interaction between foresight and public administration needs to be considered. Clearly the first step is to escape the metaphor, and all too often the reality, of the boxing ring, to establish a more cooperative and collaborative mode.

III. LINKING FORESIGHT TO POLICY AND PLANNING

It should thus be apparent that there is no *natural* connection between foresight and policy planning, still less the communities representing each. Neither has access to a moral imperative, or any other irresistible source of power. Their languages of discourse, their objectives and their communities of interest are distinct. Utility would appear to be the only basis for interaction, and that could be in one direction only.

At the same time, foresight has demonstrable achievements. The processes that have been developed have been shown, at least in certain circumstances, to be very powerful in:

- engaging people in thinking constructively about the future
- introducing a stronger 'future orientation' into organisations, and
- bringing together disparate, competitive, and on occasion, antagonistic participants to collectively consider possible and preferred futures.

A by-product, and in some cases the main product, has been the formation and strengthening of networks.

The outputs of information and perspective have contributed directly to priority setting and investment in research and technology development in the public and the private sector. They can also be demonstrated, at least via case studies, to have contributed to shaping agendas, debate and decision-making.

How then to improve the linking of foresight to policy and planning?

It may be appropriate to recognise and portray foresight, beyond its tool qualities, as an 'epistemic community'. This is a:

Network of professionals that share a common worldview… Within this worldview are a number of principles around which the community members inter-subjectively construct a consensus. These principles include agreed methods and models for assessing and understanding causal relationships, common language and jargon, and political values concerning the knowledge's policy implications and what policy choices should be preferred.[1]

Epistemic communities are seen as more than just special interest groups because of their ability to recruit actors to their consensual knowledge-driven ideas:

Epistemic communities have the potential to influence all policy aspects; they are especially crucial in formulating policies and framing issues, diffusing and promoting new ideas and policy innovations, defining the policy solutions that decision-makers select, and working to ensure that the community ideas remain on the agenda.[2]

On this basis it might be concluded that the foresight community is as yet an immature epistemic community, with limited influence but considerable aspirations.

But once foresight is considered not as some uniquely potent concept, process or movement, but as a management and administrative tool with particular advantageous characteristics, much of the analysis applied to other sources of influence based largely on knowledge is relevant also. In this respect, the current

[1] Zito, R., 'Epistemic Communities, European Union Governance and the Public Voice' *Science and Public Policy*, Vol 28, No 6, 2001, p.466.
[2] Ibid.

analysis of the provision, status and impact of scientific advice seems particularly pertinent.[1]

In this light, I propose the following challenges:

- In order to promote greater mutual understanding between the two communities, occasions for dialogue like this Seville conference need to be multiplied, at many levels.

- While there is value for professional objectives to maintain an independent foresight community, it should seek to further develop and apply its capabilities in close consort with public-sector decision-makers and influentials.

- Foresight should be promoted less as a movement, than as a management and public administration tool which should be embedded in a wide range of planning and decision-making processes.

- To this end, training in the tools and processes of foresight should be widely introduced into the curricula of management and public administration courses. The aim is not the production of a cadre of foresight experts, but rather to encourage the acquisition of foresight skills by a wide range of professionals.

- Furthermore, to promote the development of skills at a suitably high level, modes of accreditation and required standards should be pursued.

- There is a need to invest in the development and application of appropriate IT-based tools to increase the efficiency, the information management, and the effectiveness of the use of foresight tools.

- Recognition that it is not an inherent feature of foresight that it be a long time- and resource-consuming process. The tool use needs to be tailored to the specific needs of the occasion. Among other mechanisms, the investment in IT-based tools should assist in developing the capability to conduct 'fast' mini foresight analyses of key current issues.[2]

- Best practice for government departments and agencies should include the preparation and publication of regular, rolling five-year perspectives. This emphasises the need for a two-way process. Decision-makers have to become informed and discriminating users of foresight processes.

[1] See for example *Science and Public Policy* Vol 28, No 6, 2001 - Special issue on democracy in S&T policy advice in Europe, and IPTS Report, No 59, 2001 - Special issue on the provision and impact of scientific advice.

[2] As an example, in the Australian National Training Authority (responsible for vocational education) I have promoted the use of weekly lunchtime meetings to consider a specific current 'what if?'. These exchanges have led on a number of occasions to new projects or studies.

- Recognition that the strengths of foresight allow it to make its greatest contribution to decision-shaping rather than decision-making. Hence it is important to initiate the foresight process well in advance of the need for concrete policies to be formed and decisions made. At the same time, the foresight community should acknowledge that it has no special aptitude to contribute to decision-making.

- Not withstanding, there is a need to foster the development of an independent capacity for foresight, located most appropriately in universities, which can conduct foresight studies on issues of community concern, or in response to other perceived needs and opportunities.

- A benchmarking of national capacity in foresight, and a stronger fostering of international networks, offers considerable prospects.

IV. IS THERE A CASE FOR FORESIGHT DRIVING POLICY AND PLANNING?

I have argued strenuously for an approach that embeds foresight as one of the 'standard' suite of management and public administration tools used in policy and planning.

But *are there circumstances in which the role of foresight might not be subsidiary to policy and planning*? I have already argued that the contribution of foresight is greatest as a decision-shaping, rather than decision-making tool, and therefore should be brought into the planning process at an early stage.

More significantly, in situations where the established mechanisms of policy and planning have little or no competence, or where structure precludes an effective response, it may be that foresight could offer a process to go forward.

Emerging problems with global scope and scale may provide precisely the sort of situations in which existing policy and planning structures and mechanism have limited capacity to lead. This could be a result of the high uncertainty surrounding the issue or that addressing the issue lies outside the terrain of responsibility and action of the policy authorities.

Global warming provides one obvious example, where uncertainties of scientific data, models and theory, of the range of possible consequences, of the appropriate responsive actions and the boundaries of jurisdiction and influence, has clearly shaped and constrained responses (before we get to all the other factors).

One-off mega-conferences have emerged as the mechanism-of-choice. But there is ample evidence that their *ad hoc* nature, and the reshaping of public interest-driven internationalism into economic performance-driven globalisation, have limited their influence.

Is this a policy space, and a planetary need, to which foresight could make a unique contribution?

The list of other possible global scope issues is one to which we could all contribute. It might include:

- achievement of a non-hydrocarbon cycle based energy system

- shaping the bio-science revolution to support the widest range of human and social needs

- international regulation of trade in services and intellectual property

- sources and flows of global human capital - talent pursuit of corporations and nations, immigration and emigration policies

- next-generation patronage - mechanisms for long-term investment to produce the next generation of transforming technologies

- from trickle-down to flooding flow - next generation globalisation

Now that could be a recruiting mechanism for foresight.

FORESIGHT AND S&T POLICY: AN OECD PERSPECTIVE

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The nature OECD interest in foresight

The OECD interest in foresight exercises stems from the mandate of its Committee for Scientific and Technological Policy (CSTP) which, among the areas of responsibilities entrusted to this Committee, highlights the following:

Promoting the exchange of information and discussion on policies for S&T and innovation to facilitate international comparisons and identification of best practices …and to maintain a strong and creative base of scientific research…

Improving the understanding of Member countries both of foreseeable developments of technology and their likely national as well as international economic, social and environmental consequences.

Facilitating international co-operation in S&T among Member countries as well as with non-Member countries …

From the above, we can see that there are broadly two perspectives that underpin OECD's interest in foresight.

The first is linked to its role as information broker and assessment facilitator about practices developed in Member countries to inform the policy debate on S&T through the involvement of government as well as other stakeholders in the identification of research priorities.

The second has more to do with the design and efficient implementation of S&T policies, and the identification of best practices both at national level and in matters of international co-operation. In that case, foresight is seen as but one tool among many others.

Over time, these two perspectives have received different emphasis in the work of the OECD. However, it is fair to say that in recent years, in line with the CSTP work priorities, the second aspect has gained ground at the expense of the former.

Foresight practices: an evolving OECD involvement

1. A pioneering role

The OECD involvement in foresight and prospective studies has a long history that started in the 60s with the publication of Erich Jantsch pioneering book *Technological Forecasting in Perspective* (OECD, 1967) and continued in the 70s

with the work on *Society and the Assessment of Technology* (OECD, 1973) and the systematic use of the scenario methodology in the Interfutures project.[1]

2. Information exchange and assessment

While major work developed in the OECD on the relationships between science, economy and society and their implications for policy making often referred to foresight exercises the OECD actual use of foresight or prospective analyses subsumed after the pioneering period. In the context of its mandate, the CSTP has never been entrusted to undertake or foster an internationally co-ordinated foresight exercise. However fulfilling its role as information broker and assessment facilitator about practices developed in Member countries to inform the policy debate on S&T, the Committee continued to focus its attention on foresight, albeit on an ad hoc basis.

The last systematic effort in this area was conducted in 1994 with the organisation of a workshop aiming at reviewing Member countries technology foresight exercises and drawing their main lessons notably as regards methodology, stakeholders' involvement and policy relevance. It is to be noted that in this workshop a consensus emerged that bilateral arrangements were more appropriate at that stage in the development of technology foresight than multilateral foresight exercises.[2]

Technological foresight: use and limits in the design and implementation of S&T policy

3. S&T policy outcomes: the question of uncertainty

In knowledge-based economies, innovation, rooted in scientific advances and technological change and new patterns of firms' organisation with regard to knowledge management, has become the main driver of economic performance. However, investment in research activities and the development of new technologies by the public and private sectors still remains fraught with large uncertainties.

The economic value of research activities may not be a primary concern of scientists, but it is becoming increasingly important in the process of allocation of public funds to basic and applied science. Uncertainty about the outcomes of R&D activities in terms of innovation leads to risk aversion, compounding the externality effects of such activities that result in levels of private R&D investment lower than social optimum ones. Increased public awareness and concerns of potential risks associated to the wider application of science and the faster diffusion of innovations in a broad spectrum of human activities add to the difficulties of public and private decision-making regarding investment in science and technology.

[1] *Facing the Future: Mastering the Probable and Managing the Unpredictable: Final Report of the OECD Futures Programme*, OECD, Paris, 1979; See also Malkin, D., "*The Interfutures Project: Why and How"*, Futures, 1977

[2] The proceedings of this workshop have been published in *STI Review, No 17*, OECD, Paris, 1996

4. Foresight as a tool of S&T policy

Efforts to reduce the elements of risk and uncertainty in R&D investments are therefore an essential component of S&T policies that aim at strengthening innovative capacities and their contribution to economic performance. Governments' promotion of and involvement in technology foresight can be seen as an important, but limited, element of such efforts on several grounds. One, in the context of tighter budgets devoted to R&D activities and increased accountability requirements foresight facilitates the setting of priorities in resources allocation to public research organisation and support to private R&D. Second, and probably as important in many countries it fosters new participation mechanisms in the governance of the S&T and innovation system which puts a premium on the strengthening of information flows among institutions. This last aspect is particularly important as innovation performance is increasingly determined by the intensity of Industry/Science relationships in which public/private partnerships play a significant role. Third, as emphasised by Luke Georghiou and quoted by Pr. Johnston, the social dimension of technological development is getting a greater emphasis in foresight commensurate with both the more vocal concerns about risk management associated with technological choices, and the involvement of civil society in the S&T policy process.

5. Some limitations

As all policy tools foresight has its limitations that should be recognised. One of these, highlighted by many analysts, refers to the possible ambiguity regarding the main objectives of foresight exercises. While some advocate that the main purpose of foresight lies in its *product* i.e. the identification of "key" or "promising" or "critical" technologies leading to effective priority setting in resources allocation, some others emphasise the *process* that facilitates networking and information flows among actors. In the former case of priority setting caution is required as regards the use of foresight results in terms of the selection of key technologies for the design of S&T policies and actual implementation programmes. In this regard, the most important issues are:

- The risk of inefficient domestic R&D investment (including in highly qualified human resources) in the development of key technologies in the context of international specialisation in S&T areas and increasingly globalised technology markets. In this regard, internationally co-ordinated foresight exercises may be of value to avoid misallocation of domestic resources and to forge cross-country partnerships as a means to foster internal scientific and innovation potential associated to key technologies.

- The increasingly multidisciplinary and cross-sectoral nature of major technological breakthroughs as well as the importance of serendipity in such breakthroughs.

- The respective roles of public research institutions and the private sector R&D in the development of key technologies, notably as regards risk sharing and the attention given to competition issues in public-private partnerships.

- The possible over emphasis that might be given to foresight results as a means to allocate R&D resources with adverse effects on the balance and complementarity between programmes focusing on specific technological areas and innovation policies that are of a more horizontal nature.

SOME ASPECTS AND POINTS ON THE ROLE OF INTERNATIONAL TECHNOLOGY FORESIGHT

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Some Experiences and Tips in Promoting Technology foresight in General

First of all, it is an important issue how to improve co-operation between the different communities participating in a foresight exercise. Human factors are always crucial: the main experience and the best advice that can be given is the careful choice of persons from several spheres (industry, academia, and government advisory groups) simultaneously or subsequently through their career path. These people are the best choice for group leadership, having not only broad views on their area of activity but also a deep understanding and empathy for other opinions. Choosing the members of foresight bodies and committees, it is always useful to utilise the existing professional associations, networks and social groupings. It is especially interesting that, at least in a small country like Hungary, there is a strong convergence: some people are proposed by two or more organisations. It seems to be a right assumption that these people have something valuable, which makes them attractive for different interest groups.

The next question: how far to go and not to go in embedding strategic prospectives that work into the decision-making process? It is necessary to find a fine and sensitive balance here: the foresight exercise has to be embedded somehow in the decision-making but in the meantime it has to remain independent. If the participants of the study feel any pressure due to short-term interests, the seriousness of the exercise will be questionable.

Another aspect is the breadth of strategic prospectives and its correspondence with the time period of analysis. In a long run analysis, the level of uncertainty is high and a wide variety of possibilities and options can be investigated. In a shorter-term analysis, the options are more concrete, clear dichotomies can be prepared for the decision makers, showing the likely consequences of the decisions. In this sense, short-term foresight is converging to technology assessment.

What are the main success factors and barriers to strategic prospectives work impacting on the decision shaping as opposed to the decision-making process? Success factors can include:

1. The presence of creative, open-minded and flexible decision-makers is an absolute requirement to have any direct policy effect.
2. Early involvement of influential personalities in the strategic work makes the process and the outcomes credible.
3. A broad consensus on the main strategic goals is necessary.

The corollary of this is that a lack of consensus in the main strategic goals and short-viewing and rigid decision-makers can be the strongest barriers.

What actions can be useful on the side of policy planners to improve the take-up and effectiveness of a foresight exercise? They have to convince the decision-makers that it is a common a long-term goal to create strategic prospectives. Consensus-building conferences and workshops, and permanent communication - personally and electronically - are also inevitably necessary to improve the effectiveness of the activity. It is true that most foresights have been driven by competitiveness or national-innovation-system rationales, because these rationales are obviously easier to "sell" for the decision makers, feeling the direct feedback and the easy-to-communicate results.

Technology foresight is strategic thinking, just like other policy-orientated analyses like policy evaluation, planning and technology assessment. Their better integration can be promoted by the fact that there is a considerable overlapping both at the stakeholder and the expert side. These activities use similar intellectual values and networking abilities, so it seems to be evident to see a convergence. Unfortunately, I do not have experience of any formal action to promote that.

What are the steps in moving from foresight to implementation? It is a major question, but I do not know institutionalised ways. In our case in Hungary, perhaps due to the lucky human resource policy of the foresight programme, several members of the expert panels became high-level government officials in the meantime, including a minister and several secretaries of state during or after the foresight programme. This personal mobility is obviously not the only way to transfer foresight ideas to government policies, so it cannot be a general solution in the international practice, but perhaps it can serve as an interesting example.

What is special about foresight compared to other forms of intelligence? In my opinion, it is more "artistic" activity than others, needing more creativity and more freedom. Fortunately, there are less borders of policy thinking determined by short-term problems, because the strategic goals are far enough not to disturb decision-makers thinking in political cycles.

On the Relation of National and International Technology foresights

Foresight is a tool for policy preparation, analysis of the future scenarios determined by decisions today. If foresight is a policy tool, international foresight is an international policy tool. Where do we aim at with international policies? International policy making activity has long tradition, such as the co-operation in the frames of OECD, looking for comparable indicators to track the real procedures, to look for the best practices and working out general recommendations for member and non-member countries. These international activities, however, are relatively static, they build on the observation of the present and the recent past, but these are not related to the future, as in an international foresight exercise. In my opinion, OECD remains an extremely important and useful tool for international policy consultation, but not the right forum for common foresight activities. European Union, however, has more common policies, more convergence and more elements of internal cohesion and solidarity, therefore, in accordance with the European Research Area concept and the decisions of the European Council in Lisbon, it is realistic to expect a strong and continuous common foresight activity in the EU.

Is it possible to start with the international dimensions at once? In other words: is it realistic to begin with an international policy making tool without a strong base of national foresights, including the informal channels and fine network of intelligence and consensus search? No. I think international technology foresight is a very refined intellectual activity, which needs the solid bases of local communities having already experience in long-term strategic thinking, consensus search, continuous communication and co-operation, which are absolutely necessary to build up a more sophisticated structure. I do not believe that any country could be a successful participant in an international foresight exercise without own national experience.

In practice, the right way seems to be an upstream approach, beginning with exercises having territorially localised national foresights and development to more synthetic supranational foresight. As the focus changes, some problems and aspects of the regional or national exercises may become irrelevant at the higher abstraction level. In order to keep these aspects, it is evident that high abstraction international foresights cannot substitute further efforts at national level. These strategic thinking activities should live continuously in parallel and should mutually influence each other.

INTERNATIONAL LEVEL FORESIGHT – A VIEW FROM EUROPE

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Introduction

Foresight programmes and analyses in Europe have mainly been conducted nationally, though activity and interest in foresight at other levels has recently grown (especially at regional and European levels[1]). Most foresights have been driven by competitiveness or national-innovation-system rationales, and their outputs aimed at underpinning the prioritisation and selection of strategic long-term goals for nationally-based public and private S&T research.

However, many of the issues tackled by foresight (whether technological e.g. nanotechnology, medicine, materials, ... or problem-oriented e.g. climate change, ageing, mobility, etc.) are inherently international or have significant components which transcend national confines. This is because of the nature of S&T activity, its research communities, and the increasingly open or 'global' nature of business, as well as key aspects of other human activities - culture, leisure, sport, crime, community formation, interest representation, and so on.

Very few foresights explicitly factor in a strong international dimension but deal with it in an implicit contextual sort of a way[2]. Furthermore, while there is a lot of on-going international "futures" research[3], there still is little "foresight"[4] in the sense of strategic futures work which has an effective impact on international-level decisions and which mobilises international actions.

The following Q/A points take their general cue from the background paper for this session prepared by Prof. Ron Johnston.

What sorts of international foresight activities can be envisaged?

These may vary from add-on activities to territorially-localised foresight, to truly supranational foresight. At the lower end, informal cross-border learning and information-exchange already takes place between separate foresights. At a similar level, national/ regional foresights could take more explicit account of the international dimensions of the issues and contexts affecting their territories and interests, in the manner of the global scenarios developed in the Hungarian and New Zealand foresights. An example of something more intense is a recent pilot *ex post*

[1] http://foren.jrc.es; IPTS Report, No. 59, Nov. 2001 Special Issue on Regional foresight
[2] The Hungarian and New Zealand foresights may be exceptions as they developed scenarios regarding the overall international/ global positioning of the country.
[3] E.g. the AC/UNU Millennium Project, the OECD's Futures Programme.
[4] foresight can be defined as a systematic, participatory, future intelligence gathering and medium-to-long-term vision-building process aimed at present-day decisions and mobilising joint actions.

comparison of four national industry-oriented foresights[1]. Apart from the detailed exchange of experiences and codification of much tacit learning, this project also identified the potential value in doing cross-country co-ordinated foresight on areas of common concern (the area of international logistics in particular was cited).

As of yet, very little exists by way of real cross-country co-ordinated foresight work. This, however, is the specific brief of the APEC Centre for Technology foresight in Bangkok[2]. A different one-off example of a cross-border foresight is the STRING project carried out in the Southwestern Baltic Sea area spanning regions of Denmark, Germany and Sweden[3]. The work of the IPTS constitutes a form of European supranational foresight. One can easily imagine that the supranational foresight frontier could be pushed further beyond continental confines to more global issues and engage globally distributed stakholders, communities of actors and decision-makers.

However, the challenge is to match practice with imagination. In all cases, the reasons for taking policy discussions and decision-making above and beyond the local constituency and territorial levels have to do with solving common problems, achieving economies of scale, compensating for lack of knowledge and resources, seizing opportunities to learn more and faster, etc. Given that an essential feature of any foresight is that its output be relevant and usable in planning policy decisions, international foresight therefore has to adjust to the increasing actor and stakeholder complexity with rising levels of policy internationalisation in order to maintain its relevance and usability.

What is the case for international foresight?

When taken to a supranational level, the potential for foresight to have an impact on decisions and actions is, in principle, curtailed by the underdevelopment of international governance[4] regimes and formal institutions which are empowered and endowed with resources to respond to the types of challenges that typically emerge from foresight work. However, this underdevelopment can also be seen as an opportunity, in that the proven power of foresight to mobilise networks of actors and incite them to take consequent action can actually compensate for formal institutional gaps[5]. This is also consistent with the fact that emerging modes of governance and decision-making increasingly involve a much wider range of stakeholder-, special-interest and civil-society groupings than the traditional exercise of public authority. foresight fits naturally into this diffused governance configuration - its proven power to mobilise actor networks and incite them to take consequent action could actually compensate for formal institutional gaps. In methodological terms, the challenge is

[1] Jordi Molas-Gallart, Rémi Barré, Mario Zappacosta & James Gavigan (2001), *A Trans-national Analysis of the Results and Implications of Industrially-oriented Technology foresight Studies (France, Spain, Italy & Portugal*) IPTS Technical Report EUR 20138 EN, Contributors: Cécile Seelinger & Mildred Lacomme (CMI, France), Claudio Roveda (Fondazione Rosselli, Italy), Luís Valadares Tavares (OPET, Portugal), Ana Morato (OPTI, Spain).

[2] http://www.apectf.nstda.or.th/

[3] see Birte Holste Jørgensen (November 2001), foresight in Cross-Border Cooperation, *The IPTS Report*, No. 59, pp. 22-30.

[4] Governance is the capacity to exercise formal and informal authority within or over a given constituency.

[5] The same argument applies both sub-nationally and supra-nationally.

on practitioners to come up innovative and customised approaches to international foresight. Similarly, the challenge is on users/ policy makers to better articulate the type of strategic intelligence needed at international level.

Is it reasonable and timely to push for the development of international foresight?

The case above, in itself, is not sufficient. it is too simple to believe that foresight will alone generate its own means of self-validation by the actions it might give rise to outside formal policy implementation routes. The development of effective international foresight is probably conditional on a more conclusive demonstration of its impact and value nationally. The development of European level foresight, the work of the APEC foresight Centre and UNIDO fostered experiences in Latin America are also very crucial. The promise of a strong impetus to pan-European foresight under the next EU RTD Framework Programme also makes it an opportune moment to push the development of foresight on many fronts – internationally, and other territorial levels, as well as in terms of developing practices, evaluation, utilisation, professionalisation, training, new competences development, etc.

What does it mean to set international S&T priorities, and which types of issues are more amenable to international foresight?

The difficulty of developing meaningful strategy-relevant discussions, as foresight typically involves, increases with the number and diversity of the interests represented. There are quite a number of issues and challenges where one might reasonably expect a wide consensus that their nature is global or planetary – global warming, pollution, demographic ageing, migration, biodiversity conservation, disease and epidemic control, space research, organised crime (drugs/ people trafficking), poverty and illiteracy eradication, food-chain risks, security…. Still, generating such a list of issues is not trivial. Furthermore, the order of priority within such a hypothetical consensual list will vary from constituency to constituency. On top of this, with respect to any given single issue, a diversity of interests and cultures, will give rise to a equally diverse range of visions, even when placing the time horizon beyond the short term strategic time frame[1]. The challenge to foresight applied in such circumstances is to accommodate (in the sense of seeking to harmonise or render compatible) the different sets of futures or visions that emerge from the different worldviews and value sets represented. This may seem like a tall order and one that might frustrate any serious attempt to conduct a truly open and participative international foresight?

An alternative might be to first develop in the international arena the more expert-based 'professional' model of foresight[2]. This would remove some of the complexity mentioned above by constraining participation to globally dispersed, but like-minded informed actors – i.e. members of what academics would refer to as an epistemic community characterised by shared world view, set of values and strategic pursuits.

[1] Key axes of differentiation in this regard include the likes of OECD vs. non-OECD, Europe vs. America vs. Asia; developed vs. under-developed world; belief-system differences such as Christian vs. Muslim vs. Confucian; etc.

[2] Remi Barré (2001), "Synthesis of Technology Foresight" Chapter IV in *Strategic Policy Intelligence: Current Trends, the State of Play and Perspectives* IPTS Technical Report, EUR 20137 EN edited by Alexander Tübke, Ken Ducatel, James P. Gavigan & Pietro Moncada-Paternò-Castello

Even if these methodological, process and instrumental challenges to practitioners can be managed, the issue of utility and impact of international foresight will still depend on and require the existence of a receptive and empowered international polity[1], and a clarification of its specific anticipatory intelligence needs (i.e. specific issues to explore and the format in which it should be delivered).

[1] A polity refers to an organised set of policy-making agents and stakeholders, and the institutions through which they act.

SCOPE AND LIMITATION OF FORESIGHT IN THE DEFINITION OF SCIENCE AND TECHNOLOGY POLICY

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UNIDO Latin America and Caribbean Bureau

Experiences in Latin American Countries in the Application of Technology Foresight

The following commentary on the scope and limitations of foresight in the design of science and technology policies is based on our experience in the UNIDO programme for technology foresight for Latin America and the Caribbean, throught which we launched and participated in programmes in eight countries in the region (Mexico, Venezuela, Colombia, Peru, Brazil, Argentina, Uruguay, Bolivia).

Firstly, we observed that rather than being rejected, the methodology was accepted by the stakeholders involved in the projects as ideal for policy design, in particular in the area of science and technology. In some respects, it can be said that, in some of the countries, in a first instance it proved to be quite captivating and attractive given that it deals with the design of the possible future. This was reinforces by the available knowledge of successful experiences in Europe, Asia and North America.

However, its utilisation per se in no way guarantees that we will achieve the objective proposed at the outset, which is the implementation of the recommendations arrived at.
In this sense, I believe it is important to stress that in order to implement recommendations, the foresight exercise must be designed with this objective, given that it is rather difficult to implement something from an exercise which is not designed with this aim.

It is also important to recognise the foresight has certain characteristics which result in loss of focus of the aforementioned final objective, in the face of other outputs of the foresight process execution. I refer here mainly to achieving consensus and the generation of a long-term common vision in a limited time period and with a multidisciplinary group.

If the process was limited to this, the achievements of foresight would still be significant, particularly in the countries we have been involved where the lack of a medium to long term consensual vision for many factors means that routine economic and social issues constitute a big barrier preventing until now the sustainable development of the respective societies. However, many of these countries view science and technology as the essential factors with which to achieve a significant increase in manufacturing added value and at the same time in the international competitiveness of products and services.

To illustrate, the great majority of the countries in the region have annual per capita exports of between 200-300 Euros, mostly related to primary commodities, and small

internal markets in terms of purchasing power. To take part in and benefit from globalisation, these countries necessarily have to define and implement their S&T policies in order to turn around this situation which is adversely affecting the majority of the society in these countries.

But one must be very precise regarding the knowledge one wishes to develop, and invest in a way that is commensurate with the objectives. Here is where foresight is of great value, given that it constitutes a powerful tool when it comes to prioritising and concentrating human and financial resources in a selective way – something which is absolutely vital in countries where resources are scarce.

Recognition of these potential benefits by the socio-economic and political actors in Latin American countries, in addition to the availability of good practices and accumulated experience, allowed us to achieve rapidly a high level of awareness of foresight.

However, in order for recommendations to be realised, it is not enough to achieve a high level of awareness of the advantages of the methodology, but rather in a first instance the studies must be designed to achieve results, and be of a high technical level, and secondly, that the participants be highly committed to execute the actions identified including mobilising the executive levels of power of the State and the private sector.

Regarding the difference between foresight and other methods, the only comment based on my experience is that in the region concerned, there is a degree of "fatigue" in society - sometimes conscious sometimes not - with elitist methods of designing science and technology policies.

The fact that we have available a methodology that allows for multidisciplinary participation is in some respects a novelty for the countries in the region, which, if administered correctly, has enormous potential.

Regarding limitations, my comments, more than to do with methodology, refer to issues such as available resources, political support, the design capacity, management of the exercises, and the availability of specific knowledge – that is to say the quantity of experts and the independence of their contributions. These aspects are central but not exclusive.

A foresight exercise which is not designed to reach applicable recommendations will never serve this purpose. Without a good manager, with both technical and political recognition, it is impossible to run a successful foresight programme.

Lessons

Do not fix in a very strict manner the foresight framework from the beginning, neither from a chronological nor methodological point of view.

Each country must design its programme in accordance with the objectives it wishes to set out and with the resources available. The selection of the areas must be based on a wide consensus, which does not mean that specific methodologies have to be

developed in each case – on the contrary, I believe that those that exist already are more than enough if they are managed correctly.
The participation of all sectors of society is important, en particular the active participation of the private sector is crucial and of the Government at the highest level, especially when it comes to implementing the recommendations.
It must be made explicit that foresight has to be based on a profound and objective knowledge of the local and international situation in the subject areas chosen.
Do not force the application of foresight until an acceptable level of knowledge of the subject is attained, and until awareness and compromise at a political level exists.
For all countries without previous experience, a continuous "benchmarking" with recognised sources of knowledge on the subject, is vital to maintain all through the process.

Recommendations

Promote through national and supranational organisations, the establishment of standards that can be accepted and recognised internationally.

Establish at global level an ad hoc technical group for monitoring and co-ordination (IPTS, OECD, UNIDO, Universities, specialised institutes, etc.), which could assume the task of managing a reservoir and diffusing knowledge, including the identification of experts and competencies, and in particular, the identification of successful cases of implementation, as well as an annual agenda of international events.

OPEN DEBATE SUMMARY

The debate centred on the issues associated with developing international level foresight. It was noted that the best examples of multinational foresight are occurring in the private sector, such as in the use of technology road-mapping. Also in the case of international scientific collaboration, there is a kind of implicit international foresight occurring in the process of establishing joint scientific facilities. Similarly, there are social and political mechanisms in place to deal with global problems, to which foresight could contribute.

The question was raised of why international foresight can be perceived to be lagging. The main obstacles in moving from national to international level are the differences in national context, both in terms of institutional frameworks and policy needs. The need for harmonisation – in the sense of compatibility / synergy rather than standardisation / homogenisation - between national level foresight exercises was a recurring theme in the discussion. This was seen as essential to developing supra-national foresight activities. EU enlargement, in particular, was seen to be a potential beneficiary of greater harmonisation.

A distinction was introduced between two kinds of international foresight: bilateral foresight, which uses a common methodological approach, and the co-ordination of different national foresights, using methodologies adapted to the context. It was recommended that foresight approaches should be based on learning from experiences in other countries, but not on directly transferring approaches. That the foresight toolbox now contains a significant number of tools was seen as one of its strengths in wider application.

The contributors to the debate, in addition to the discussants, speaker and moderator, included: **Kerstin Cuhls** (Fraunhofer IsI, Germany), **Luke Georghiou** (PREST, UK), **Attila Havas** (UNU/INTECH, The Netherlands), **Ferenc Kováts** (Hungarian foresight Programme), **Jack Smith** (National Research Council, Canada), **Andrejs Silins** (Latvian Academy of Sciences), and **Gordon Ollivere** (RTC North, UK).

V. THEMATIC FORESIGHT

Moderator:
• Dr. Lena Torell, Royal Swedish Academy of Engineering Sciences, Sweden.
Speaker:
• Prof. Rémi Barré, CNAM, France.
Discussants:
• Prof. Andrew Webster, SATSU, University of York, UK.
• Dr. Michael Darmer, Ministry of Science, Technology and Development, Denmark.
• Dr. Terttu Luukkonen, ETLA, Finland.
• Prof. Claudio Roveda, Fondazione Rosselli, Italy.
Rapporteur:
• Dr. Veronique Timmerhuis, Advisory Council for science and technology Policy, The Netherlands.

SESSION OVERVIEW

The stated aim of this session was to consider different approaches to foresight programmes (from all-encompassing formats with thematic sub-components to more selective approaches focusing on one or few specific issues at a time) in order to establish what circumstances determine which option should be preferred. The session aimed to consider comparative studies of foresight results, as well as recurrent themes in foresight exercises (e.g. knowledge society, sustainable development, health and well being, social values and industrial competitiveness), with a view to identifying relevant lessons for future thematic foresight developments.

In her brief introduction, the moderator of the session **Lena Torell** (Royal Swedish Academy of Engineering Sciences), pointed out that the conference especially focuses on different types of foresight to set research priorities, and that the emphasis in this session was the use of ***thematic*** foresight in the policy making process. She raised a number of important questions for the session to address:

- What do we mean by thematic foresight?
- What are the most common methods, tools and techniques used in foresight?
- Who are the users of foresight results and for what purposes?
- What type of foresight is needed at European level?
- What is the role of foresight for the European Commission?

The session developed in three different stages. In the first part to kick-off the session, **Remi Barre** (CNAM, France) made an interesting and challenging attempt to classify existing national foresight exercises by focusing on some characteristics such as categories of themes, relationship between the categories of themes, objectives, methodology, content, organisation and internal coherence. He concluded with some recent trends and suggested orientations for designing foresights fit for addressing EU wide questions.

The keynote presentation was followed by a series of presentations by invited discussants. **Andrew Webster** (SATSU, UK) stressed the more effective implementation of foresight and its usefulness as instrument both on national and international levels, but foresight needed to locate within the distinct national systems of innovation. **Michael Darmer** (Ministry for science and technology, Denmark) reported on the Danish foresight experience presently underway which very much follows a theme-specific approach. He pointed out that the diverse nature of foresight is vital saying that its ability to function as a policy-making instrument precisely depends on the flexibility to organise foresight exercises in accordance to the specific challenges, culture and decision-making processes of the constituency concerned. **Terttu Luukkonen** (ETLA, Finland) pointed out the main characteristics of an embedded and distributed foresight process and how these can lead more easily to implementation than exceptional one-off foresights. **Claudio Roveda** (Fondazione Rosselli, Italy) emphasised how different types of foresight have been used as decision support instruments in four different countries, namely France, Italy, Spain and Portugal. He addressed in particular differences between the adoption of a centralised or decentralised foresight process.

The last part of the session was devoted to over an hour-long discussion and debate involving many of the session attendees. The presentations and discussions were monitored by the rapporteur **Veronique Timmerhuis** (Dutch Advisory Council for science and technology Policy, The Netherlands) whose feedback report is provided in a later section together with the reports on the other parallel sessions. The papers by the speaker and the discussants are included in this section, followed by a summary of the open debate.

FORESIGHTS AND THEIR THEMES: ANALYSIS, TYPOLOGY AND PERSPECTIVES

PROF. RÉMI BARRÉ
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I. INTRODUCTION

By now, almost all EU member states and accession countries have realised national – level foresight exercises dealing one way or another with the 'science – technology – society' issue. Several of them are engaged in a second round of such foresight work. The UK, which has started in 1994, is launching its third exercise.

Even though experience is accumulating, we are still very much in a discovery and exploration stage of foresight as a policy making instrument. There is a need to draw lessons from practice so that we learn how to tailor foresights better to their contexts in order to take full advantage of this promising but complex policy making instrument.

But to transform experience in knowledge through accumulation, we need a conceptual framework in order to structure the discussion and organise the learning process.

The objective of this paper is to make use of this limited, but already significant, experience we now have in order to propose such a conceptual framework. We will do so in a way which highlights one feature of the foresight exercises, which is that they deal with several possible 'thematic classes', namely technologies, sectors, societal functions or issues.

This paper draws some lessons from the analysis of the relationship between the thematic class of a foresight and its other features, such as its objectives, methodology, content and organisation.

Our basic hypothesis is that the thematic class on which a foresight is based is not independent from the other features of a foresight, namely its objectives, methodology, content and organisation. In other words, we assume there is an internal logic relating these various elements which characterise a foresight exercise.

Our objective is thus to understand the internal logic of different types of foresights by identifying the combinations of features which can be observed in recent exercises. From there, we draw some lessons and perspectives for future foresight exercises.

This paper is addressed at the national policy-makers, which are involved in the difficult task to develop sensible science, technology and innovation policies.

As we know, foresight has been identified as one of the major instruments for open co-ordination and facilitation of the building of the European Research Area (ERA). This will undoubtedly require specific breeds of foresights: our paper also aims at giving some clues to what they could be. In this sense, this paper is aimed also at policy makers concerned with the European level, be they from national or European institutions.

In a first paragraph, we discuss the question of how to characterise a foresight, and propose at set of relevant features to do so. In a second paragraph, we present these features with the options existing for each of them. In a third paragraph, we will present the major types of foresight, linked to the various thematic classes. In a fourth paragraph, we will show the variety of the actual foresights and the adaptability of the instrument to a diversity of contexts and objectives. In a fifth paragraph, we outline some recent trends and suggest orientations for designing foresights fit for addressing EU wide questions, which leads us in conclusion, to some recommendations.

II. HOW TO CHARACTERISE A FORESIGHT EXERCISE TAKING INTO ACCOUNT ITS THEMATIC DIMENSION?

1. Characterising foresights – problematique and attempts

a) Some foresight exercises address a number of themes (for example national exercises with their 5 to 12 panels), some are focussed on one sector. This raises the question of what is the unit of analysis.

To overcome such a problem, we take here as our unit of analysis the national scene regarding foresight at one period. It consists in general in one multi-panels national exercise lasting two to three years, but it may consist in a variety of thematic exercises realised by several specialised institutions, in a decentralised and non parallel way. Such is the case of the countries having 'embedded' foresight.

In other words, we analyse here foresight situations at national level. To describe and characterise such situations, we must identify the components of a foresight exercise.

b) A foresight exercise consists in most cases in an organised set of working panels interacting with each others both at the exploration – analysis – hypothesis building stage (extension) and at the selection – convergence – synthesis stage (concentration). foresight is a learning process of sequential steps of tacit to codified knowledge transformation cycles. Its main components are the following:

- A client which is the financing institution (it can be several institutions),
- A steering committee, in charge of monitoring the overall exercise, responsible for the synthesis and recommendations (circle 1),
- A set of thematic panels producing a report (circle 2),
- External participants, making an input to the process in a variety of possible ways (responding to a survey, participating to a conference…) (circle 3),

- Support staff, both for the operations of the steering committee and panels, and for preparing background studies.

c) Beyond the components, we have to identify the features of a foresight exercise. Several attempts have been made to characterise foresights, by listing a number of features considered relevant. We present below three such characterisations performed in recent ESTO-IPTS studies. Boxes 1 & 2 consist in sets of items relevant to describe foresights, addressing the foresight activity itself, but also its institutional context, its methods, products and outcomes. Box 3 shows an example of a synthetic characterisation, along two axes.

Box 1. Characterising foresights in "Strategic policy intelligence: current trends, the state of play and perspectives"[1]

1 - objectives, overall description

Scope, Questions addressed, Geographic and time scale, Duration, Explicit objectives

Actual outputs / impact sought, Overall methodology

2 - institutional design of the exercise,

Ordering body, Steering committee, Implementing agency, Target audience, Target sectors, Number and origin of persons consulted

3 - methods used ('tools and techniques'),

Methods used for: identifying areas and questions, gathering background information, choosing the experts, consulting the experts, identifying driving forces, presenting future developments, identifying priorities, consensus generation

4 - modes of communication

Modes of communication between ordering body and steering committee, steering committee and implementing agency, implementing agency and experts, among experts

5 - awareness rising,

Modes of communication and type of information during Pre-foresight phase, foresight phase, Post-foresight phase; foresight actors - Policy makers - business, research community and public at large

6 - results and their impacts

Modes of presentation of analysis, results, recommendations, measurement and evaluation of impact

Box 2. Characterising foresights in "A transnational analysis of results and implications of industrially oriented technology foresight studies"[2]

1.Time horizon	7. Methodology
2. Project promoter	8. Outputs
3. Project responsible	9. Dissemination
4. Objectives	10. Implementation of results
5. Motivation	11. Indirect results
6. Institutional design	

[1] A. Tubke, K. Ducatel, J. Gavigan, P.Moncada, Strategic policy intelligence: current trends, the state of play and perspectives, JRC-ESTO, EUR 20137 EN, 2001, p.55.

[2] J. Molas-Gallart, R. Barré, M. Zappacosta, J. Gavigan, A transnational analysis of results and implications of industrially oriented technology foresight studies, JRC-ESTO, EUR 20138EN, 2002, p.48.

Box 3. Characterising foresights in "Strategic policy intelligence: current trends, the state of play and perspectives"[1]

Characterisation of S&T foresight activities by positioning them on two axis.
Definition of the axis and measurement of the position of a foresight activities on each one of them.

Axis 1: the extensiveness of the foresight activity
The first axis refers to the 'extensiveness' of the foresight activity, that is, the number and variety of persons or the experts involved.

Axis 2: the intensiveness of the foresight activity
Intensiveness of a foresight activity: quality (completeness) of the learning cycles involved in each of the four phases of a foresight process: kind of work being performed, substance of the activities taking place, what is produced, how, by which methods, what results, what impacts.

The first two characterisations are too detailed to get beyond purely descriptive exercise. The third is, on the contrary, too short to grasp the underlying logic of the foresights. In all cases, the thematic dimension is not highlighted.

2.A proposal for characterising foresights on five features, the first being the 'thematic class'

Our basic assumption is that the thematic dimension is key to characterise and understand foresights. We propose to consider the following thematic classes:

- technology areas (technologies, possibly with their scientific components, underlying capabilities, use function)
- activity sectors (economic or industrial, activity cluster)
- public functions (areas of public action and policy)
- strategic issues (challenges, problems, horizontal questions, societal goals).

Undoubtedly, foresights often address more than one single thematic class, but each foresight has a dominant category for which it is designed. We suggest there is an internal logic and coherence in a foresight design, linking the thematic class it addresses, with its other features.

We propose a characterisation of foresight exercises by the five following features:

- the thematic class which the exercise addresses,
- the main objective of the exercise,
- the mode of involvement of the societal actors,
- the cognitive nature of the work,
- the institutional-temporal architecture of the exercise.

To put this paper in a proper empirical context, we will refer to 14 foresight exercises from 10 EU or accession countries and one from the EC[2]. As mentioned earlier, our unit of analysis is the national scene regarding foresight at one period, which may consists in one large national exercise, or in a variety of focussed exercises realised

[1] Op. cit., p.53-54.
[2] The description of the exercises in terms of the features must be considered tentative.

by several institutions (case of 'embedded' foresight situation). For Germany, we have two generations of foresights and for the UK, we have three.

III. THE FIVE FEATURES CHARACTERISING A FORESIGHT EXERCISE AND THEIR OPTIONS

For each one of the five features, there are different options. We review them in this paragraph.

1. The thematic class

A foresight deals necessarily with themes, which are the elements to be analysed. Themes are the entry points of the process and organise the segmentation of the exercise. A first and major differentiation among foresights is the thematic class which is stated in the terms of references. The choice of a thematic class is defined upstream, along with the basic features of the exercise. There are four basic options about thematic classes (table 1):

- A. technology areas: technological areas and their scientific components, capability, use function. Examples: nanotechnologies, genomics, materials, information and communication technologies…
- B. activity sectors: economic or industrial, activity cluster. Examples: food industry, transport, service industry, chemical sector…
- C. public functions: areas of public action and policy. Examples: health, education, natural environment…
- D. strategic issues: challenges, problems, horizontal questions, societal objectives. Examples: crime prevention, ageing society….

In many foresights, there is more than only one thematic class, but one is usually dominating. For example, there can be 'activity sectors' themes, completed by 'public functions', with even, like in the second UK foresight, some 'strategic issues' themes.

Table 1. The thematic classes

Thematic class	Illustrations	Example of foresights*
A Technology areas	Nanotechnologies, genomics, materials, information and communication technologies	Key technologies study (I) Technology programmes TEKES (Fin) Technologies for the 21st century (D) Key technologies study (F)
B Activity sectors	Food industry, transport, service industry, chemical sector	foresight 1&2 (UK) foresight OPTI (E) ET 2000 foresight (P)
C Public functions	Health, education, natural environment, public infrastructures	foresighted society exercise (S) Futur (D) Research councils & agencies foresight (ND) TEP programme (H)
D Strategic issues	Crime prevention, ageing society	IPTS Futures project (EC) foresight 3 (UK)

* Tentative classification according to their dominant thematic class

2. The objectives

Foresight are usually presented as having three major '*raisons d'être'*:

A. Research priorities agenda: orienting and focussing better the research priorities agenda and investments in the most promising areas in terms of both technology supply potential and demand. The result of the foresight can be presented in terms of new pattern of allocation of resources to S&T areas,

B. Connectivity and efficiency of the innovation system at large or in a new field: increasing the efficiency of the innovation system through co-operations and networking, better framework conditions policies and regulations, and improved infrastructures. This can also be presented as contribution to better self-organisation of a new field of innovation, be it through the connection of dispersed actors or the disruption of too closed networks[1]. In this case, the results are cast in terms of a new public initiative or action, or the set up of a new institutional arrangement,

C. Shared awareness for future technologies, opportunities and strategies: fostering shared awareness for futures technologies, markets and strategies through a debate on future technologies and their impacts on society, with a participation of the civil society, and through a better and shared understanding of the drivers of change. Here, the outcome can be a strategic move, an institutional change, a new set of actions.

Foresights have usually a mix of these objectives, more or less explicitly stated. But each foresight has a dominant objective which can be identified. There are therefore three options about objectives (table 2).

Table 2. The objectives

Objective	Illustrations	Example of foresights*
A Research priority agenda	Identification of most promising and high priority technological areas Harnessing technological opportunities	Key technologies study (I) Technology programmes TEKES & other institutions (Fin) Technologies for the 21st century (D) Key technologies study (F)
B Connectivity and efficiency of the innovation system at large or in a new field	S&T capabilities and structural changes needed to increase competitiveness Attractiveness in a knowledge society	foresight 1 (UK) foresight OPTI (E) ET 2000 foresight (P)
C Shared awareness for future technologies, opportunities and strategies	Strengthen futures – oriented approaches Understanding transformations and their impact Driving change Look collectively at what might happen	foresighted society exercise (S) foresight 2 & 3 (UK) Futur (D) Research councils & agencies foresight (ND) TEP programme (H) IPTS Futures project (EC)

* Tentative classification according to their dominant objective

[1] as suggested by Prof. A. Webster.

3. The involvement of the societal actors

It is one of the key-features of a foresight exercise to involve the societal actors. The notions of diversity of visions, debate, appropriation by the participants, networking are central. In all foresights, representatives from government, industry and research are members of the steering committee and panels (circle 1 and 2 participants). The differentiation is about the involvement of the societal actors: foresights differ in terms of who participates and of what is meant by participation. We identify three options of societal involvement[1] (table 3):

A. No direct implication of societal actors: Social scientists, as well as marketing specialists and public opinion experts are the voice of the societal actors and enrich the work of circle 1 and 2 participants. Possible use of opinion survey, sometimes through the technique of statistically representative panel(s). In this level, there is no implication of the societal actors themselves.

B. Ad-hoc limited implication of societal actors: in addition, there is a contribution, as circle 1 and 2 participants, of spoke-persons of some societal groups, chosen on an ad-hoc basis by the foresight organisers; there are also some open conferences, web-site facilities and provisions for specific input for feed-back and contribution from stake-holders and the general public.

C. systematic implication of societal actors, including institutional representatives: same as above, but with a more systematic implication of societal groups, as well as reaction, comments and inputs from interested parties and stake-holders, which then feed back into the foresight process in an explicit way.

Table 3. The involvement of societal actors

Involvement of societal actors	Illustrations	Example of foresights*
A No direct implication	Industry, administration and research, plus sociologists, economists and political scientists contribution	Key technologies study (I) Technologies for the 21st century (D) Key technologies study (F) IPTS Futures project (EC)
B Ad-hoc limited implication	Industry, administration and research, plus sociologists, economists and political scientists contribution, plus effective contribution of some spoke-persons of societal groups	Technology programmes TEKES & other institutions (Fin) foresight 1 and 3 (UK) foresight OPTI (E) ET 2000 foresight (P) TEP programme (H)
C Systematic implication of societal actors and institutional representatives	Industry, administration and research, plus sociologists, economists and political scientists contribution, plus provision for effective input of a large spectrum of interested organisations, plus representatives from concerned organisations formally involved	foresighted society exercise (S) foresight 2 (UK) Futur (D) Research councils & agencies foresights (ND)

* tentative classification according to their dominant involvement of societal actors

[1] The number and variety of participants increases from A to C. In fact this segmentation in three options parallels our previous 'extensiveness axis' classification, as presented in A. Tubke, K. Ducatel, J. Gavigan, P.Moncada, op.cit., pp. 53-55.

4. The cognitive nature of the exercise

In principle, in foresight, one gives attention to possible changes in a wide spectrum of parameters, to systemic and indirect effects, and has a concern for internal coherence in the evolution of the parameters (notion of scenarios). There is also a concern for the identification and exploration of alternative hypothesis and possible events of significance for the overall dynamics. In fact, all these can be done in a more or less formal and explicit way, so that the 'cognitive loops' are more or less fully completed: the identification of drivers can be done systematically or in an ad-hoc way, the internal coherence of the images of the future can be intuitively or formally checked through explicit linkages with other parts of the exercise.
We identify three options for the cognitive nature of the work[1] (table 4):

A. intensive analytic work: systematic and partial-modelling work on drivers and scenarios, codified knowledge use, formalisation of criteria, documentation of hypothesis, verification of internal coherence of evolutions, qualitative and quantitative detailed descriptions,

B. significant analytic work: significant background studies and analytic work some linkages among stages & topics of the exercise,

C. focus on interactions and consensus building: qualitative clusterisation of items, direct exchanges among participants, relatively limited use of analytic tools and methods.

Table 4. The cognitive nature of the work

Cognitive nature of the work	Illustrations	Example of foresights*
A Intensive analytic work	Detailed background studies Important analytical work by panels Linkages among stages & topics of the exercise	Key technologies study (I) Technology programmes TEKES & other institutions (Fin) Technologies for the 21st century (D) Key technologies study (F) IPTS Futures project (EC) foresight 3 (UK)
B Significant analytic work	Significant background studies and analytic work Some linkages among stages & topics of the exercise	foresight 1 (UK) foresight OPTI (E) ET 2000 foresight (P) Research councils & agencies foresights (ND) TEP programme (H)
C Focus on interactions and consensus building	Ad-hoc identification of drivers Intuitive building of images of the future	foresight 2 (UK) foresighted society exercise (S) Futur (D)

* tentative classification according to their dominant cognitive nature

[1] The number and completeness of learning cycles decreases from A to C. This segmentation in three options parallels our previous 'intensiveness' axis' classification, as presented in A. Tubke, K. Ducatel, J. Gavigan, P.Moncada, op. cit., pp. 53-55

5. The institutional - temporal architecture

Regarding the temporal aspects, foresight exercises consist in several panels, which can be run in parallel, or in a sequential frame. Regarding the institutional set up, foresight exercises can be institutionally focussed, that is centred on one institution or operation, or decentralised, that is realised by several institutions co-ordinated by one unit, in charge of the overall coherence.

We identify four options for the institutional - temporal architecture of the foresight exercises (table 5):

A. Sequential panels, institutionally distributed, ('embedded'): specialised foresight exercises are launched at different times (sequential), by a variety of institutions (distributed), according to their mandate,

B. Sequential panels, institutionally focussed: panels on different topics are launched at different times (sequential), by a unique institution, in charge of the foresight activity (institutionally focussed),

C. Parallel panels, institutionally distributed: all panels launched at the same time (parallel), by a variety of institutions (distributed), according to their mandate, which supposes some sort of co-ordination,

D. Parallel panels, institutionally focussed: all panels launched at the same time (parallel), by a unique institution, in charge of the foresight activity (institutionally focussed).

Table 5. The institutional - temporal architecture

Institutional-temporal architecture	Illustrations	Example of foresights*
A Sequential panels, institutionally distributed ('embedded')	foresight panels / themes launched independently, when needed, based on various institutions or programmes	Research councils & agencies foresights (ND) Technology programmes TEKES & other institutions (Fin)
B Sequential panels, institutionally focussed	foresight panels / themes launched independently, when needed, based on one institution	foresight 3 (UK)
C Parallel panels, institutionally distributed	foresight panels / themes launched in parallel, but based on various institutions or programmes	foresight OPTI (E)
D Parallel panels, institutionally focussed	foresight panels / themes launched in parallel, based on one institution	Key technologies study (I) Technologies for the 21st century (D) Key technologies study (F) foresighted society exercise (S) foresight 1 and 2 (UK) ET 2000 foresight (P) Futur (D) TEP programme (H) IPTS Futures project (EC)

* tentative classification

IV. THE TYPES AND ARCHITECTURE OF FORESIGHTS: THE INTERNAL COHERENCE BETWEEN THE THEMATIC CLASSES AND THE OTHER FEATURES

A foresight is characterised by the combination of a thematic class, an objective, a mode of involvement of the social actors, a given cognitive nature of the work and an institutional-temporal architecture. Given the fact that each feature has 3 or 4 options (see table a in annex for an overview), there are several hundreds conceivable combinations.

What combinations of thematic class, objectives, methodology, content and organisation can we observe in the foresights having taken place during the past years? In this section, we show that in fact we observe only eight of such combinations, which define the options for foresight.

We address this issue in three steps:

- looking first at the coherence between objectives (feature 2), involvement of social actors (feature 3) and cognitive nature of the work (features 4), which defines three 'models' of foresight,
- then analysing the linkage of the three models with the thematic classes (feature 1), defining four 'types' of foresights,
- finally crossing the four types the possible architectures (feature 5), thus defining eight 'options' for foresights.

1. The three Models of foresight: analytic, societal and intermediate

The observed coherence among objectives, involvement of social actors and cognitive nature of the work defines three 'Models' of foresight, which we call 'analytic' and the 'societal' models, plus an intermediate one. The observed broad regularities relate (table 6):

- on one side objectives of research priorities definition, with no direct implication of societal actors and with intensive analytic work (mode A of the three features) and,
- on the other side, objectives of shared awareness, with systematic implication of societal actors and with work focussed on consensus building (mode C of the three features).

Table 6. The analytic and restricted participation and societal Models of foresight

Foresight Model Features	Analytic model (AAA)	Societal model (CCC)
2. Objective	*state of feature: A* Research priorities agenda	*state of feature: C* Shared awareness, strategy
3. Involvement of societal actors	*state of feature: A* No direct implication	*state of feature: C* Systematic implication and institutional representatives
4. Cognitive nature of the work	*state of feature: A* Intensive analytic work	*state of feature: C* Focus on interactions and consensus building

The first set defines the analytic model, the second defines the societal model. It is important to note that a third model exists, somehow in-between the two, defined by a mode 'B' for each one of the three features under consideration. We call it the 'intermediate' model in what follows.

2. The four Types of foresight: technological, sectoral, public function, strategic issues

Adding up the thematic classes (feature 1), we observe a correspondence between the three models of foresight defined above and the thematic classes. The observed regularities are the following:

- Foresights with the thematic class 'technological areas' tend to be of the analytic model,
- Foresights with the thematic classes 'public function' and 'strategic issues' tend to be of the societal model,
- In-between, foresights with thematic class 'activity sectors' tend to be of the 'intermediate' model.

There are reasons for such regularities, since working on technology questions tends naturally to restrict participation to researchers working in almost by definition in an analytic mode, while public functions and strategic issues are directly relevant for societal debate and actors, almost necessarily working in a looser mode, aiming at consensus and networking building.

We have to be clear here that we are not normative, but merely descriptive of the observed main configurations, in an acknowledged stylised and simplified way. As we will see later, one of the major perspectives for future foresight activities, is to break those regularities, and build 'hybrid' foresights, by combining technology class foresights with the societal model or a strategic issues class foresight with the analytic model.

This defines four foresight Types, namely, the technology, sectoral, public function and strategic issues foresight types (table 7).

Table 7. The four foresight types

Foresight type	Technology foresight	Sectoral foresight	Public function foresight	Strategic issues foresight
Thematic class (feature 1)	A Technology areas	B Activity sectors	C Public functions	D Strategic issues
foresight Model *objective, involvement of societal actors, cognitive nature of work* (features 2, 3, 4)	Analytic model (AAA)	Intermediate model (BBB)	Societal model (CCC)	Societal model (CCC)

3. The eight options for foresight

The observed combinations of foresight Types and architecture

In many cases, the architecture consists of parallel panels, in an institutionally focussed organisation of the exercise (mode D of feature 5), which we call the standard architecture. This defines the four foresight Types in their standard architecture.

But we observe that all foresight types can have one other architecture, embedded, sequential focussed or parallel distributed[1], which makes eight possibilities of foresight[2] (table 8).

Table 8 - The observed combinations of foresight Types and architecture

foresight type / Architecture	Technology foresight	Sectoral foresight	Public function foresight	Strategic issues foresight
Standard architecture (D) (parallel panels, institutionally focussed)	Key technologies study (I) Technologies for the 21st century (D) Key technologies study (F)	ET 2000 foresight (P)	foresighted society exercise (S) Futur (D) TEP programme (H)	IPTS Futures project (EC)
Other architectures	Technology programmes (TEKES) (Fin) embedded (A)	foresight OPTI (E) parallel - distributed (C)	research councils and agencies foresights' (ND) embedded (A)	foresight 3 (UK) sequential-focussed (B)

The eight foresight options

Finally, a foresight being characterised by both its type and its architecture - with four types and four possibilities for the architecture, hence eight foresight Options (table 9).

Table 9. The eight Options for foresight

foresight type / Architecture (feature 5)	Technology foresight	Sectoral foresight	Public function foresight	Strategic issues foresight
D Parallel panels, institutionally focussed	Technology foresight with standard architecture	Sectoral foresight with standard architecture	Public function foresight with standard architecture	Strategic issues foresight with standard architecture
Other architectures	Technology foresight with embedded architecture (A)	Sectoral foresight with parallel distributed architecture (C)	Public function foresight with embedded architecture (A)	Strategic issues foresight with sequencial – focussd architecture (B)

[1] This shows the relative independence between a foresight type and a foresight architecture.
[2] We repeat here that our classifications are tentative and simplified.

V. FORESIGHT OPTIONS: THE EXTERNAL COHERENCE WITH THE SOCIO-INSTITUTIONAL CONTEXT

We have presented above a purely descriptive analysis of what kinds of foresight we can observe, in other words we have identified a number of coherent combinations of modes of the five features which characterise a foresight.

In this section, we show that the types of foresight with their architecture that we observe correspond to specific goals and contexts.

To do this, we begin by discussing the significance of the foresight models and the foresight architecture, which will then allow us to relate the specific characteristics of foresight exercises to their goals and socio-institutional context.

1. Towards an understanding of the significance of the foresight options possibilities

1.1. Discussion of the analytic versus societal models

a) The analytic model of foresight

In this model, there is a important knowledge production activity, leading to data, modelling and formalisation challenges. It involves few people directly, having interactions only with technology and a few social sciences experts. The central focus is the internal coherence and plausibility quality of the analysis and, eventually, of the scenarios
These represent a more classical view of foresight: S&T aspects are seen quite independently from societal aspects, in the sense that they are no explicit feedback loop between the two categories of parameters.
Such technology foresights are analytic and focused, and can bring very valuable information for technology programme setting. They are typical of industrially oriented technology promotion foresights.

The risk is one of foresight becoming a classical study, not questioning existing views, or institutional frontiers. The risk is also to be unable to build real interactions and systemic view of the questions at stake.

b) The societal model of foresight

The central focus here is on whom participates and the outcome is expressed in terms of the creation of new networks and circulation of information. The actors themselves participate (and not only their representatives) and this participation is meant to be on substance, including the S&T substance. Such societal model is rooted in the tradition of public participation, and extended technology assessment. The societal exercises are socio-political processes, which make them a new breed of decision-making instruments in tune with the 'dialogic' democracy.

The risks are those of political and practical unfeasibility: there may be too great a role for users, thus shifting objectives to short term and potentially damaging basic research. When all opinions are legitimate, the risks of inconsistency and downright factual errors are high. If foresight is just for anyone to present the pieces 'on the table' for whoever wants to use them, what is the real value added?

In terms of the learning cycles, it appears that such widely spread exercises often end up in rather loose exchange of opinions among participants. The challenge for societal foresight is to know how to ensure the internal consistency of the debate, the risk being one of non-relevance for the 'real' economy and society.

Another concern is to know whether societal foresights put at risk the normal channels of the political decision-making, de-legitimising the political arena.

The scope, complexity, cost and political risks involved in a societal model of foresight are real limitations.

Finally, there appears to be a trade-off between the societal and the analytic model, each one having its advantages and limitations.

c) Linking the choice of a model and the socio-political context

The feasibility of societal types of foresight will be higher in the following cases:

- the size of the population concerned is not too large,
- there is a culture of participation of NGOs and a large variety of stake-holders in the public policies decision-making process.

This is why foresights based on the societal model are mostly small countries exercises[1], and even more so, they are regional level exercises[2]. Furthermore, the Anglo-saxon and Nordic cultures, with their tradition of public participation, provide favourable contexts for societal exercises. There are nevertheless reasons to turn also towards the analytic model in order to deepen the analysis[3].

In other cultures, for example the Latin cultures, the model chosen will tend to be the analytic one, which has its own values. The challenge is to get the specific benefits of a more societal foresight, without loosing sight of the associated political and practical difficulties.

1.2. Discussion of the thematic class of a foresight

Foresights which are structured upon technology areas tend to be relevant for rather technologically advanced countries, where cutting edge scientific and technological research takes place at a large scale, resulting in major questions regarding the research agenda for both the public and industrial sectors[4].

[1] with of course the notable exception of the UK
[2] as shown in the FOREN and FOMOFO STRATA studies.
[3] such is the trend in Sweden and the UK, where more focussed and restricted foresights are advocated after very broad exercises had been conducted these last years
[4] the foresights of France and Italy can be interpreted along these lines

Activity sectors based foresights can be relevant for two types of situations:

- either when issues of improvement and adaptation to the new competitive or regulatory context are raised at industry sector levels, with challenges regarding best practices identification and diffusion[1],
- or when a sector may be confronted with potentially large changes, technological innovation posing significant threats and opportunities for a whole industry[2].

Public function focussed foresights are relevant for establishing a platform for the redefinition of a public policy area, in areas like health, environment or education, with questions regarding the re-assessment of the role of the state and of its mode of action, questions about the infrastructures and institutional changes needed.

Strategic issues foresight are relevant in cases where quite a few specific analysis exist, but when there is a need to overcome institutional barriers through raising cross cutting questions. Strategic issues can have a mobilising effect able to impact the behaviour and strategy of actors in the direction of better co-ordination and coherence.

1.3. Discussion of the architecture of a foresight

There are direct relations between the institutional context in a country and the architecture of its national foresight activities.

In countries where there is an established tradition of foresight-type activities, the architecture ill tend to be of the 'embedded' mode[3] (mode A): each institution having a public policy responsibility will conduct foresight activities as a normal part of its duties, when needed. This is why foresight activities will be institutionally distributed and sequential.

At the opposite, countries which are setting up the stage for foresight as an instrument for public policy-making, will tend to focus the exercise on one ad-hoc institution or set up, and launch the panel in parallel in order to get quickly a critical mass of results and impact (mode D). This is what we have called the standard mode.

In between, we have the sequential panels, institutionally focussed mode (mode B) which may be the next stage after the standard mode, when the objective may be to concentrate resources on specific issues, in a sequential mode[4].

There is also the "parallel panels", institutionally distributed mode (mode C), which may appear to be a good way to involve from the start the institutions which will have to implement the foresight recommendations[5].

[1] case of Spain with the Chemical sector
[2] case of several segments of the service sector in the UK foresight
[3] such is the case of Finland and the Netherlands
[4] such is the architecture of the foresight 3 exercise in the UK
[5] such as in the case of Spain

2. Examples of the internal and external coherence of foresight options in their socio-political context

It appears that the foresight model, thematic class and architecture can be related to specific contextual aspects: they have both an internal coherence (the eight foresight options) and an external coherence, to their socio-political context.

We present below four cases, corresponding to the specific situation of different countries (table 10). The aim of those four cases is to show the correspondence between the features of the foresights and their socio-political context.

Table 10. Four examples of foresights adapted to their specific national context

Type / Features	Technology foresight	Sectoral foresight	Sectoral foresight	Public function Foresight
1. Thematic class	Technologies	Activity sectors	Activity sectors	Public functions
2. Objective	Research agenda	Efficiency of innovation system	Efficiency of innovation system	Shared awareness, strategy
3. Involvement of societal actors	No direct implication	Ad-hoc limited implication	Ad-hoc limited implication	Systematic implication
4. Cognitive nature of the work	Intensive analytic work	Significant analytic work	Significant analytic work	Consensus seeking analytic work
5. Institutional-temporal architecture	Sequential, distributed (embedded)	Parallel, distributed	Parallel, focussed (standard)	Sequential, distributed (embedded)
Example of foresights*	Technology programmes TEKES & other institutions (Fin)	foresight OPTI (E)	ET-2000 foresight (P)	Research councils and agencies foresights (ND)

2.1. The case of Finland

In Finland[1], there are a variety of parliamentary, governmental, institutional and regional practices that contribute to forward-thinking in technology policy making and industrial strategy processes. An explanation is the scale-advantage of a small country: key-people often know each other or they have at least common contact networks, so that information on technological developments and their conditions can be exchanged quite effectively through informal channels without any organised procedures. Fostering continuous forward-thinking close to decision-makers and development communities has also been seen more important than establishing separate foresight institutions. Forward-thinking has been integrated in planning and decision-making processes at industrial, governmental, regional and local levels through a diversity of smaller-scale activities. Forward-thinking is embedded in the preparation of research programs of the National Technology Agency and the Academy of Finland: future orientation and user involvement have been considered as central programme elements. Foresight-related activities include production of

[1] from Annele Eerola (VTT), chapter 'Finland', in Part 1 – deepening of foresight exercises having taken place in six countries (non published ESTO-IPTS Report)

vision statements on technological trends and associated opportunities, as well as organised workshops and seminars supporting networking and identification of research challenges that call for concerted efforts.

2.2. The case of Spain

The Spanish study[1] was launched by the Ministry of Industry in 1997 (today incorporated into the Ministry of Science and Technology) and it was completed in three reporting phases – to 1999, 2000 and 2001. Its objective was to identify the emerging technologies necessary for an adequate Spanish industrial development and a proper orientation of technical research centers in this respect. The Spanish study followed a decentralised approach, each sectoral component employing a common methodology defined by OPTI. Responsibility for each sectoral studies was assigned to a corresponding independent technology centre (eight centres in total were involved), under the co-ordination and direction of OPTI, acting as the central body. Each technology centre was in fact responsible for preparing, handling and processing the survey and, beyond, the whole sectoral component of the study.

2.3. The case of Portugal

The Portuguese study[2] (2000) stemmed from concerns in the industrial sector and among professional associations that the future of the country depended on improving technological knowledge, combined with the fact that there was no clear strategy on how Science, Engineering and Technology (SE&T) capabilities can be boosted and how they can be made to contribute to industrial competitiveness. The major motivation for the Portuguese project was finding ways to make a better use of SE&T to improve the competitiveness of Portuguese firms, within the context of the EU market. The Portuguese initiative was specifically targeted at political decision-makers and high-level private managers. One of the central topics in the Portuguese foresight is the link between research and innovation, as this is an area where institutional arrangements are very important. After its completion, an independent non-profit Observatory (OPET – Observatório de Prospectiva da Engenharia e da Tecnologia) was set up with the objective of giving continuity to the dissemination of results.

2.4. The case of the Netherlands

In the Netherlands[3] there are several parallel foresight initiatives, with different orientations and driven by different stakeholders. For instance, the Royal Academy of Sciences develops a science-driven exercise, while the Ministry of Economic Affairs organises a "technology radar" study, which is mostly a technology foresight. The research councils have to give advice on the research priorities in their fields and, to assist them in the selection of research priorities, organise their own foresight

[1] From A trans-national analysis of results and implications of industrially oriented technology foresight studies (France, Spain, Italy, Portugal), ESTO-IPTS report, 2002.
[2] ibid.
[3] From Nabila Chehab (TNO), Jan de Wilt (NRLO) and Hans Rutten (Ministry of agriculture), chapter' The Netherlands', in Part 1 – deepening of foresight exercises having taken place in six countries, Monitoring foresight activities, ESTO-IPTS report, 2001

exercises at a sectoral level. For example, one of these sectoral studies was the carried out by the Council for Agricultural Research and was structured as a social learning process: starting from social challenges it systematically tried to widen the exploration of alternative possibilities through the use of techniques like visioning and *backcasting*. From here alternatives were narrowed following a "funnelling" process leading first to the identification of possible paradigm shifts, the definition of strategic and action conferences, and the identification of technological areas in need of attention. The guiding principles in this approach were its long-term scope, and the effort to deal with uncertainty and with multiple values and multiple stakeholders, and to transcend disciplinary boundaries.
The approach taken was "societal" in at least two senses:

- the emphasis on social dynamics and issues (both as a starting point in the identification and definition of challenges and in the development of discussions and proposals);
- the broad participation in the workshops –about 1000 people.

The main concern in this study was not so much with the identification of exact key technologies but about collective learning and facilitating the free exchange of ideas. The process is seen as a social learning process, in which new ideas have to be brought in. So there is first a broadening of horizons at the start (participants writing first essays, doing scenario exercises, doing visioning and backcasting exercises leading to the identification of possible paradigm shifts), and from here moving to a conclusion through strategy and action conferences culminating into foresight reports.
Once the exercise was completed the organisation carrying it out was transformed – and enlarged - and given the remit for developing and applying policies based on the results of the study. In other words, the organisation evolved to tackle implementation issues.

VI. RECENT TRENDS AND PERSPECTIVES

The characterisation of the foresight activities and their relationship to their context should be seen neither as mechanistic or as static. Three major evolutions can be identified:

- one within the existing framework of the options of foresight which we have identified: certain combinations tend to gain in importance,
- one consisting in the emergence of un-conventional options of foresight by hybridisation of the features,
- one linked to the emergence of European public policy relevant foresight activities.

1. Evolutions of foresight within the existing options framework

1.1. A first trend: the emergence of strategic issue foresights

During a first period, most national foresight exercises had their themes expressed in terms of technological areas or activity sectors. Such an expression of the themes is

understandable for somehow setting the stage. It appears that some recent exercises tend to express their themes in terms of strategic issues, which can be interpreted as a logical next step after a broad overview (table 11).

Table 11. Two examples of strategic issues oriented foresights

Foresight type / Features	Strategic issues foresight National issues	Strategic issues foresight European-wide issues
1. Thematic class	Strategic issues	Strategic issues
2. Objective	Shared awareness, strategy	Shared awareness, strategy
3. Involvement of societal actors	Ad-hoc limited implication	Ad-hoc limited implication
4. Cognitive nature of the work	Intensive analytic work	Intensive analytic work
5. Institutional-temporal architecture	Sequential focussed	Parallel focussed
Example of foresights*	UK foresight 3	IPTS futures

* tentative classification

This trend raises a major challenge in terms of the identification and definition of what are the challenges relevant for a foresight. Another question is the accumulation of experience to identify the best practices to address strategic issues foresights, which have not been numerous.

1.2. A second trend: institutionally distributed and/or sequential foresight exercises

Along with this first trend, it appears that the institutional architecture of the foresights might become more diverse than the classical multi-panel exercises, all taking place in parallel and being based on one single institution (the standard mode).

The 'embedded foresight' option is typical of countries having a long experience of foresight (The Netherlands, Finland, maybe France), and this model may develop as countries gain experience. The Spanish model of decentralised sectoral foresight is worth noticing, as well as the evolution of the UK foresight into a sequential model, even keeping its focus on one institution (the OST within the DTI).
There are several variants in such an institutionally de-centralised model (table 12).

Table 12. Four examples of institutionally distributed or sequential foresight exercises.

Type / Features	Technology foresight	Activity sectors foresight	Public functions foresight	Strategic issues foresight
1. Thematic class	Technology areas	Activity sectors	Public functions	Strategic issues
5. Institutional-temporal architecture	Sequential, distributed	Parallel, distributed	Sequential, distributed	Sequential focussed
Example of foresights*	Technology programmes TEKES & other institutions (Fin)	foresight OPTI (E)	Research councils and agencies foresights (ND)	UK foresight 3 (UK)

* tentative classification

This trend points towards an increased diversity of the foresights, which is positive in the sense that foresight processes, being systematically adapted to the context, have a better chance of being efficient.
But this also raises questions of the proper handling of such a variety of possibilities, which is a challenge of accumulation and codification of experiences so that an effective learning process is at play.
A risk linked to this trend is that each exercise will have less visibility, increasing the difficulties to follow and benefit from the experiences.

2. The emergence of new types of foresight through hybridisation of the features

Another evolution relates to the emergence of new types of foresight, not observed so far (at least in our sample). The major aspect of such potential hybridisation is the one consisting in new combinations between the foresight thematic classes and foresight models.

So far, we had basically the combination between technological and activity sector thematic classes with the analytic model, on one side ; between the public function and strategic issues thematic classes with the societal model, on the other.

Table 13. Combination of thematic classes and foresight models: existing and new types of foresight

Thematic class (feature 1) / Foresight model (features 2, 3, 4)	Technological class	Activity sector class	Public function class	Strategic issues class
Analytic model	Technology type foresight	Sectoral type foresight	*Deepening more analytic?*	*Deepening more analytic?*
Societal model	*Societal technol. foresight? New TA?*	*Societal sectoral foresight?*	Public function type foresight	Strategic issues type foresight

Other combinations of thematic classes with foresight models can be imagined. This opens possibilities for new types such as technology and sector oriented societal foresights, as well as public function and strategic issues foresights, with the analytic model.

Such possibilities may increase the range of relevant adaptations of the foresight instrument to a wider diversity of contexts and objectives. Regional and European levels foresight are here particularly concerned.

3. The challenge of inventing EU-relevant types of foresights

A major challenge for foresight is to become relevant for both member-state government and EC decision-making processes in the European Research Area

(ERA). Will foresight become an operational open co-ordination instrument? At what conditions? What type of foresight & architecture can be best suited?

There are obvious pitfalls and risks if the features of the foresight put in place are not tuned to the specificities of the EU context. There is a need of an organisational design of EU – relevant issues foresight exercises. The following features seem adapted to the EU policy-making scene (table 14):

- strategic issues oriented,
- objectives of shared awareness and strategy,
- no direct implication of societal actors,
- significant analytic work
- institutionally distributed, parallel foresights.

In any case, it also seems reasonable to suggest that such EU-relevant foresights would greatly benefit from building on the results and networks of existing foresights at national level.

Table 14. Towards a foresight design fit for addressing EU policy issues

Features	EU policy relevant foresight
1. Thematic class	Strategic issues
2. Objective	Shared awareness, strategy
3. Involvement of societal actors	Indirect implication
4. Cognitive nature of the work	Significant analytic work
5. Institutional architecture	Parallel, distributed

It is suggested that such a specific type of foresight be methodological elaborated and then tested, in order to get at a viable option for EU-relevant foresight options for policy making.

VII. CONCLUSION

There is recognition of the sensitiveness of the design of foresight to different cultures, to different rationales of decision-making scenes. foresight must be a flexible and adaptable instrument. The major result of this paper is to have brought elements of demonstration in this respect. So, the instrument 'foresight' has a real potential for further and new policy challenges, in particular at EU level.

It seems to us that such challenges can be addressed with reasonable chances of success, but at the following conditions:

- the conduct of systematic reflexive, evaluative and cumulative work on the experiments and exercises that have taken place these last years in the member states,
- the building of the infrastructures needed for access to background studies and previous results of foresights, the mechanisms for the capitalisation of results, methodologies and experiences. This is the issue of inter-operability of the national practices and methods,
- the emergence of an open professional community concerned with foresight, with a variety of background and competencies,
- addressing seriously the problems of the evaluation of foresights - their validity, credibility, quality control, criteria and ethical norms. This would go along training and research activities in the field.

The European scale is a proper one for addressing these conditions, which would enable us to invent the 'European-relevant' type of foresight activity.

Foresight is indeed a new instrument, with original features which may be related to the 'social European model' of development, embedding S&T issues in a broader political framework: in this sense, foresight may well be a key instrument for the building of the European Research Area.

ANNEX – OVERVIEW TABLE

Table a. Overview: the five features of a foresight and their possible state

1. Thematic class	2. Objective	3. Involvement of societal actors	4. Cognitive nature of the work	5. Institutional-temporal architecture
A Technology areas	A Research priority agenda	A No direct implication	A Intensive analytic work	A Sequential panels, institutionally distributed ('embedded')
B Activity sectors	B Connectivity and efficiency of the innovation system at large or in a new field	B Ad-hoc limited implication	B Significant analytic work	B Sequential panels, institutionally focussed
C Public functions	C Shared awareness for futures technologies, opportunities and strategies	C Systematic implication of societal actors and institutional representatives	C Focus on interactions and consensus building	C Parallel panels, institutionally distributed,
D Strategic issues				D Parallel panels, institutionally focussed

RESPONSE TO PROF. RÉMI BARRÉ'S 'FORESIGHT AND THEIR THEMES'

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Professor Barré's paper has three main objectives: to describe and determine the implications of the different 'internal logics' that various types of foresight exercise have; to ask what particular forms of foresight might be most 'sensibly' deployed by policy-makers given different national settings? and finally, to ask what the broad characteristics of a foresight activity might be that is specifically geared towards the ERA?

The paper provides a very useful, schematic outline of types of foresight according to distinct overarching themes, objectives, type of participation, the 'cognitive' aspect of the exercise, and the wider institutional 'architecture' it involves. The value of these typologies is that they should, in theory, provide for some form of deductive approach whereby a specific type of foresight can be shown to be more appropriate to a given set of circumstances prevailing in one country compared with another. This is indeed what Professor Barré seeks to do towards the end of his paper with brief commentaries on foresight in Finland, Netherlands, Spain and Portugal.

However, there are a number of points that need to be explored in order to move towards more effective implementation:

- how does context determine what option is to be chosen?
- how does the 'internal logic' that is said to define different foresight types shape actual exercise? does variation from the logic imply sub-optimal deployment of foresight?
- how does foresight itself have any capacity to shape aspects of the national setting and are some of the foresight types more able to do this than others?
- how does an ERA-driven foresight accommodate sensitivity to different cultures while still adding value to local contexts through its specifically European dimension(s)?

In regard to the first of these, for example, we need to locate foresight within distinct national systems of innovation. While the four cases describe the broad dimensions of foresight deployed in each country, further analysis is needed to show how the type of foresight used was contingent to the actual context of use. In the case of Portugal there is an explicit link made, whereby professional associations in the industrial sector sought to strengthen their S&T knowledge base in a situation of limited knowledge about what capacity they actually had. Here foresight was optimally sectoral and requiring of extended analytical work. In the other cases, however, we find more than one type being used - as in the Dutch case. This diversity is sometimes explicable in terms of the different priorities, capacities and networks operating at regional compared with national levels.

In considering the implementation of foresight, much depends on whether we have business or more social priorities in mind. In terms of *business* innovation we would need to consider the following:

- The targeting of foresight on either established or emergent innovation (often sectorally based) networks that require either *disruption* or *aggregation* to be opened up to, conversely, enabled to engage with new innovation opportunities respectively. The most intelligent foresight is that which has best intelligence of the configuration of relationships between companies, professionals, existing and potential markets and so on.
- The differentiation of foresight from more conventional forms of strategic planning, but must be seen to add value to that: the best way of doing so is by demonstrating through foresight how innovation works *at a distance* and accordingly to time frames (and innovation 'spaces') that are not with the normal horizon of business planning.
- Foresight is a wasted resource when it simply duplicates horizon scanning undertaken by the much larger private firms that now use localised foresight on a routine basis. Typically such planning can make gross assumptions about a natural, evolutionary progression of technologies and their markets - as happened, for example, with overinflated foresight predictions about WAP phones. Consumers may have a rather different set of priorities - such as control over costs, or how new systems relate to contexts of use (the home in contrast to work environments for example).
- The objectives of foresight are often couched in broad terms in regard to fostering future-oriented networking (the process of foresight). This is important, but what it might mean in practice is considerably varied: it might include the repositioning of a new field under threat; the fostering of new social markets and the undermining of entrenched interests in a specific area. Each of these will require different types of method, and this means that methods are *not* 'situation-neutral' in their effects. In addition we need to consider new methodologies for foresight - perhaps based on the *archetypes* of Professor Barré's paper, or based on the parallel work on the *social framing of risk futures* that has been undertaken by sociologists and economists.
- It would be possible to learn from previous foresight exercises their impact only if we can retrospectively construct their deployment and use. Little if any work of this type has been undertaken. Evaluation is however possible through moving foresight into a more experimental mode through undertaking more controlled use in specific sectors, regions or social constituencies, comparing that use against data on equivalent 'foresight-free' contexts in the same country.

In the Spanish context, it is clear that there are significant regional differences in the S&T infrastructure and the industrial base. Foresight should not be used as a horizontal tool across these geographical and sectoral variations as though it were uniform. Moreover, it should foster an investment in a range of high tech, intermediate and traditional industries for the future – as was said in the FOREN project in relation to craft industries in Andalucia – a foresight that 'builds tomorrow's traditions'. Such an inclusive strategy is likely to be received more positively by a much wider range of socio-economic groups. At the same time, the national agencies in such areas as the health service have the opportunity to use

trans-regional institutional structures as a vehicle for more directed change from the centre.

FROM A PROMISING BUT COMPLEX POLICY-MAKING INSTRUMENT TO AN INTEGRATED DECISION-MAKING TOOL

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First of all, I would like to thank Professor Rémi Barré for a well-structured and clear paper, which brings clarity to a rather unclear area. It has not been an easy task due to the linguistic, cultural and structural differences in the fourteen studies investigated. Nevertheless, Prof. Barré has managed to identify significant characteristics for this promising, but complex policy-making instrument.

Firstly, Prof. Barré identifies a common *set-up*, which characterise foresight studies. The main components are a client, a steering committee, a set of thematic panels, external participants and support staff. Secondly, Prof. Barré proposes a *model* for characterisation of foresights exercise. The model consists of the following five features: 1) The category of themes which the exercise addresses, 2) The main objective of the exercise, 3) The mode of involvement of the societal actors, 4) The cognitive nature of the work, 5) The institutional-temporal architecture of the exercise. Thirdly, Prof. Barré identifies *new trends*. The trends are the emergence of more issue-oriented foresights and a more diverse institutional architecture than the classical multi-panel exercises. Fourth and finally, Prof. Barré *recommends* further studies on foresight policy-making instruments to be carried out at European level addressing especially their validity, credibility, quality control, criteria and ethical norms.

The Danish Foresight Programme

The findings of Prof. Barré are based on fourteen foresight exercises from all around Europe. The Danish foresight Programme is for obvious reasons not part of this data material. The Danish foresight Programme began in May 2001 and will run until the end of 2004, and no final results have yet been obtained.

As Prof. Barré points out, the foresight exercises are very different and I think the Danish foresight Programme will turn out to be another variant. The Danish foresight Programme is a four-year pilot project with limited financial and human resources compared to other European programmes. The idea is to test the potential of foresights as a policy-making instrument in a Danish context. In this respect it is interesting to look into how the Danish foresight Programme fits into the four main findings of Prof. Barré mentioned above

Set-up

The set-up of the Danish foresight Programme follows the one described by Prof. Barré. We identify the client as the ministries mainly responsible for the innovation system in a broad sense (primarily the Ministry of Science, Technology and Innovation, the Ministry of Education and the Ministry of Economy, Trade and Industry). Besides that, we have a steering committee, thematic panels, external participants and a support staff.

Model

Partly because of the limited financial and human resources in the Danish foresight Programme, we have decided to have a very flexible structure on most features. During the four-year period of the programme, we expect to carry out 10-12 foresight studies. Each study is organised around a panel. Due to financial restrictions, only 2-3 studies can start up each year. The flexible structure also means that we do not decide for one theme or a category of a theme a priori. One study could be technology specific another could be sector oriented and yet another could focus on a social function. As a matter of fact, I believe that the three studies we until now have started are within three of the four different categories of themes mentioned by Prof. Barré.

The same flexibility in the Danish foresight Programme goes for the objectives. The three foresight studies so far have three different objectives. One has a research priority agenda, another has connectivity and efficiency of the innovation system as the objective and the third falls into the category of shared awareness for futures technologies, markets and strategies.

As for the involvement of social actors, I believe that the three Danish studies so far are within the two first categories: Indirect implication and Ad-hoc limited implication.

As for the cognitive nature of the work, I believe that all of the Danish studies so far fall within the category of significant analytic work.

For the institutional-temporal architecture, the Danish foresight Programme is organised in the category called sequential panels, institutional distributed.

New trends

Prof. Barré identifies two new trends. One is the change in themes, typically expressed in terms of technologies or sectors toward themes in terms of issues. So far, we have not started up foresight studies, which express their themes in terms of issues. But it is certainly an interesting thought for further consideration.

The second new trend relates to the fact, that the institutional architecture of the foresights have become more diverse than the classical multi-panel exercise, all taking place in parallel. The Danish model is already, as described, a much more flexible and sequential model.

Recommendations

Prof. Barré points at the diverse nature of the different foresight exercises and recognises the sensitiveness of the design of foresights to different culture, to different rationales and decision-making scenes. In my opinion the diverse nature of the foresight exercises are absolutely vital. If you cannot organise your foresight exercise in accordance to your own challenges, culture and decision-making process, the foresight exercise losses its ability to function as a policy-making instrument, because policy-making is different in different Member States. But because of this diversity, it is even more important to carry out cross national foresight exercise as the one Prof. Barré has carried out, and I fully support his recommendation of further studies to be carried out at a European level. To identify common characteristics, problems and best practices is of vital important in order to further develop foresights from a promising but complex policy-making instrument to an integrated decision making tool.

COMMENTING "FORESIGHTS AND THEIR THEMES: ANALYSIS, TYPOLOGY AND PERSPECTIVES"

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The keynote paper by Rémi Barré, entitled "foresights and Their Themes: Analysis, Typology and Perspectives", is a step forward in understanding and analysing different foresight exercises in the EU countries. Barré's paper provides useful analytical schemes for the classification of such activities. In order to convince policy-makers of the utility of foresight exercises, we will need, however, more information about their uses and impacts.

Drawing on Finnish experiences, this paper will discuss some of the questions our hosts have posed to us, particularly those related to the uses and implementation of foresight. Different types of foresight exercise have varying degrees of integration in the decision-making processes and therefore, the circumstances of their implementation differ.

Finnish Foresight – Embedded and Distributed

In Finland, no nation-level foresight exercises have been carried out. So far the only effort in this direction was the project entitled "On the road to Technology Vision" by the Ministry of Trade and Industry in 1996-1997, intended to prepare the way for more extensive nation-level foresight exercises. Foreword-looking exercises are embedded in the research policy process and are distributed widely in different parts of the system. Such limited exercises are usually confined to research policy or industrial sectors and often concern specific technologies. Foresight-related activities are carried out by industrial associations (co-financed by Tekes in its wish to support forward-thinking in industry), research funding organisations, Ministries, and the National Technology Agency, Tekes, to mention the most important forums. In Tekes' own activities, foresight exercises are mainly carried out at the technology programme level to help formulate new technology programmes and the overall technology strategy of the organisation. At the programme level, this means in practice that, e.g. a group consisting of high-level industrial R&D people and top researchers, gathered for the steering of a programme, is requested to formulate visions of the future, needs and opportunities, in their technological area. In many instances, foresight or visionary exercises do not employ formal foresight methods but are rather based on brainstorming sessions by groups of qualified experts. Scenarios and the findings of forecast activities carried out in other countries are often used. The time-spans of these kinds of exercises differ, but often range within the middle term.

Advantages and Drawbacks

The fact that such informal foresight is carried out at different levels and is distributed in different organisations implies that it utilises available expertise, perhaps originally gathered for other purposes. It effectively mobilises national resources for vision-making and foresight types of activities.
It also means that awareness of a need for forward-thinking is spread widely at different levels of decision-making.
Further, it means that vision-building is an integral part of the preparatory and decision-making process and is taken into account in decisions. The steps from foresight to implementation are easier to take if foresight is a normal part of the decision process than when it is institutionally separate or something that is extraordinary.

The system thus has many advantages, particularly those related to implementation. It also has drawbacks. The foresight exercises described above do not advance networking and interactions across different groups or sectors. Foresight building is done by experts whose expertise mainly lies in the technical area or in the commercial utilisation of technological innovations. It does not normally include experts from other fields or societal sectors or lay people representing interest groups or various standpoints. Such exercises may, however, achieve the objective of building consensus within the expert groups and the technology areas and have limited impact on interactions and consensus building within the sector. To summarise,

- the system lacks transparency, since foresight is carried out within the decision-making process
- foresight is technology-driven
- it tends to reinforce current thinking and current structures
- it does not advance cross-sector collaboration, particularly that across ministries, and
- it does not involve the public and tends to avoid interest conflicts

When distributed and embedded, thematically (sector) oriented foresights are usually well integrated in the decision-making process and are taken into account in the decision process. However, integration in the decision-process is not the only concern. Such foresight exercises lack features important for new thinking and for breaking the sector-related and other boundaries.

We may claim that the more integrated foresight is in the decision process, the shorter its time-span and the less path-breaking its thinking. In order to develop path-breaking visions and new perspectives, we need to question our current thinking and cut across existing institutional and knowledge boundaries. Therefore in addition, we need exercises, which strengthen long-term thinking and bring something really new to our systems. Nation-level exercises can help in this function.

Nation-Level Foresight – Aiming at Advancing Important National Objectives

It is often pointed out that the process of foresight, rather than its outcome, is important. A major advantage of a national level foresight is the fact that, if well planned, it promotes interactions and consensus building across administrative and industrial sectors and other boundaries. There is a hazard that a foresight exercise follows the current sector-related policy areas and does not promote cross-boundary thinking. A national-level foresight exercise can help commit important groups to joint objectives and would ideally lead to funding decisions to further the joint objectives. This is not automatic, and obviously requires a great deal of effort. A nation-level foresight could be an effective means *to advance new, important national projects, new national initiatives, which require the collaboration of many sectors and many types of actor*. To achieve this objective, one does not necessarily need a full-scale, costly foresight exercise, but the process can be more limited and focused. Here there is room for being innovative in designing foresight processes.

To summarise, it is useful to commission foresight exercises which are embedded in the research policy process, and these lead more easily to implementation than when they are exceptional activities. It is also useful to carry out foresight exercises which cut across current institutional and sector boundaries, raise new issues and help build consensus around new national projects. Implementation is not the only important factor to consider when judging the usefulness of foresight exercises. Exercises that question current thinking can have indirect or longer-term impacts through their ability to pose new questions, to bring different types of partner together, to further interactions and to present new types of solutions to problems. Perhaps the most important thing in striving to endorse foresight with major impacts is a high-level commitment to foresight and to furthering important nation-level projects through it.

CONTRIBUTION TO THEMATIC FORESIGHT

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Up to now only a small amount of information and of analytical and systematic work is available on the effectiveness of links between foresight and policy making and on the impact that the outputs of foresight exercises have created in government, research sector, industry and society at a large.
This lack of evaluations is largely due to the fact that there is a broad variety of ways, often unforeseen, in which the impact of a foresight exercise materialize, in many cases long after the end of the study.
As most national foresight exercises are quite recent, our actual limited understanding of how a foresight exercise can be effective as a tool for policy making (which is claimed to be its basis goal) is quite expected and should stimulate more investigation and comparative work.

In any case, one can draw some preliminary hypothesis regarding the effectiveness of foresight for policy making and its dependence from the features, as categorised by Rémi Barré, first of all, category of themes and objective.

As pointed out in Barré's presentation and learnt from the Futur project in Germany, the societal type of foresight may end up just in a mixture of opinions, very differentiated and with a low factual basis, relating to (sometimes very complex) societal problems and issues. These outputs are of little value for designing future oriented strategies and policies and have no relevant impact of the "real" problems of economy and society.

The technology type of foresight, being usually focussed on more specific issues, pursuing well defined objectives and using more analytical methods, is capable of providing more reliable informative outputs, useful for setting up policies and programs even if in more restricted problems areas, such as R&D policy. Societal themes can be dealt with in technology oriented exercises through appropriate methodologies, even if explicit feedbacks between societal and technological issues are difficult to analyse and to master.

It is worth reporting some results on the link between foresight and policy planning, gained in a comparative JRC-IPTS/ESTO study recently completed on the national foresight exercises of France, Italy, Spain and Portugal.[1]

All these exercise showed a clear connection between technology foresight and decision-makers. Yet, the type of decision-makers targeted by the foresight initiatives varied. While in Italy the study was primarily oriented to scientific and research authorities, in France the study was oriented to the wider public, that is organisations, individuals, enterprises, etc, for their own use in their strategic

[1] J. Molas-Gallart, R. Barré, M. Zappacosta & J. Gavigan (2001), *A Trans-national Analysis of the Results and Implications of Industrially-oriented Technology foresight Studies (France, Spain, Italy & Portugal*) IPTS Technical Report EUR 20138 EN, Seville.

thinking and decision-making process. On the other hand, in Portugal and Spain the main customers resided in economic authorities and other public bodies like ministries of industry, and in private firms.

The different "customer base" for the foresight studies affected the type of links with policy-makers and industry during the different phases of the study, and particularly during the "post-foresight" dissemination and implementation phase. For instance, while in the Spanish case there is an organised attempt at further linking the studies to policy decision-making, this is not the case in France where there is no formal dissemination of the "key technologies" study. In Italy, an exercise that was initially an industrial initiative has later evolved into an effort receiving public funding and feeding directly into policy definition.

The institutional set-up in which the foresight exercises were carried out, is different among the four countries, which is related to their positioning vis-à-vis policy making:

In Portugal and Spain newly created organisations (OPET in Portugal and OPTI in Spain) are taking responsibility to establish policy links, while continuing to manage further foresight studies:

In Italy it is an existing private organisation (Fondazione Rosselli) that is mainly responsible for managing the studies and establishing formal links with policy-makers. Fondazione Rosselli carried the initial studies funded exclusively by industry, but now it is receiving funds from the Ministry of science and technology to carry out a new foresight exercise. The Ministry is planning to use the results to develop the national science and technology plan.

In France, the exercise took simply the form of a contract between private consultants and the Ministry of industry, which is in tune with the objective of producing information for the public, without any objective of follow up in the policy making processes.

The policy role of foresight initiatives may also evolve with the changing political or institutional environment in which the foresight exercises take place. For example, in France, the first key technologies study, funded by the Ministry of Industry, identified specific areas in need of policy support and was translated into a set of policy actions. The technologies were segmented into different groups depending on the degree and type of public support needed. Yet the second study, commissioned by the Ministry of Industry after it had been integrated in the Ministry of Finance, has not been so specific and has not classified technologies in this manner. So the direct connection with government policy measures is now more tenuous.

In all countries there has been an evolution in the recognition of foresight as tool to inform the development of science and technology strategies. In Italy, Portugal and Spain, foresight has progressively become a part of the national landscape. New institutional forms have developed by which non-profit organisations have been set up to work with industry, government and research establishments.

Now some of these organisations are involved in a much wider range of policy-oriented activities well beyond the organisation of studies.

In general, as is the case in all foresights, the outcomes derived from the *process* are at least as useful as the specific technical results and policy recommendations of the study. The information exchanges, networking activities, and policy debates have resulted in new avenues of communication across different societal groups, and have to be considered in themselves an important outcome of the studies. Attitudes towards innovation and the importance of planning for the future have also changed.

OPEN DEBATE SUMMARY

Following the contributions of the discussants, the following issues were raised in the debate:

- ***Involvement of the public***, especially citizens and younger generations as well as different stakeholders into the foresight process. It is not easy to involve the public, citizens, industry or representatives of industry in foresight processes, in panel discussions and achieve consensus on socio-economic challenges. But positive examples from the UK, Finland and Denmark were mentioned. The key question seems to be how to engage the public and citizens, and have their views and knowledge articulated in a way that is relevant to the formulation of strategic and prospective policy intelligence.
- ***Launching European foresight***: It seems that there is a significant need for European foresight, but questions such as its organisation, co-ordination and regulation should be analysed and discussed in detail. It is also not self-evident whether European-level foresight should be a centralised or a decentralised process.
- ***Construction of a knowledge/information sharing platform***: As a benchmarking instrument and information source, such a platform could inform about foresight activities and reports, the activities carried out in different countries, sharing the results achieved and (both good and bad) experiences these countries have had with foresight.
- ***Addressing different needs of users***: There was a discussion - mostly related to the quality and assessment of foresight - on how to accommodate user needs. One should take into account the different interests of participants taking part in foresight process.

At the end of the session, the moderator summed up the discussion stressing the importance of ethics, evaluation and assessment of foresight, and of raising the questions for what purposes and why we need foresight. It was clear in the discussion that there is a need for having some kind of benchmarking approach to monitoring foresight, which is consistent with the proposed idea of having a foresight knowledge or information-sharing platform. Many contributors addressed the important role of foresight in setting priorities in science and technology strategy and the issue of involvement of the society: the citizens, the youth and the industry. However concerning the involvement of different groups in the foresight process one should be aware and better understand who should take part, as well as why and how they should take part.

The participants in the discussion included: **Victor Van Rij** (Royal Dutch Academy of Science), **Göran A. Persson** (Royal Swedish Academy of Engineering Sciences), **Barend Van der Mulen** (University of Twente), **Vassilios Laopodis** (Greek Ministry for Development), and **Lars Klüver** (The Danish Board of Technology) with intensive involvement of the active participants (speaker, discussants and moderator).

VI. General Conclusions of the Parallel Sessions

SESSION OVERVIEW

This session was moderated by **Manuel de Hermenegildo,** (Spanish Ministry for science and technology). It consisted of four presentations - one for each of the parallel sessions, which took place on the first day of the conference.

The rapporteurs making the presentations were:

- **Helena Acheson** (Forfás, Ireland) for the *European Level foresight* session
- **Jennifer Cassingena-Harper** (Council for science and technology, Malta) for the *International Level foresight* session
- **Veronique Timmerhuis** (Advisory Council for science and technology Policy, The Netherlands) for the *Thematic foresight* session, and
- **Joyce Tait** (SUPRA, University of Edinburgh, UK) for the *foresight and Multi-level Governance* session.

Each aimed to capture the session highlights, covering in a synthetic manner the set contributions by speaker and discussants, and the subsequent open debates. Following the presentations, there was time for a short discussion involving the audience.

The individual session reports plus a summary of the issued raised in the discussion follow below.

REPORT FROM THE EUROPEAN LEVEL FORESIGHT SESSION

MS. HELENA ACHESON
Forfás, Ireland

This session, primed by interesting and thought-provoking papers, resulted in a number of important questions being raised that should usefully guide **future actions** in other fora regarding European level foresight.

Francois Farhi opened the session with a presentation, of the report of the High Level Group (HLG), set up by DG Research (Directorate K), to prepare options for developing foresight to strengthen the strategic basis of the European Research Area (ERA). The report, for which Francois was the rapporteur, is entitled *Thinking, Debating and Shaping the Future: Foresight for Europe.* In reflecting on the implications for S&T policy decision-makers, in light of the changing governance of science, the report points out that:

- there is a need for greater co-ordination of public interventions, both at national and EU level, given the increasing number and diversity of stakeholders (scientists, government funders, civil society) now involved in the innovation system, and
- as science and technology now play an important role in public policies there should, therefore, be concern about a democratic deficit developing.

Consequent to this, the report contends that a better strategic basis for S&T policy decision-making is needed. The potential contribution of foresight in this context lies in a number of characteristics particular to a foresight process – it is systematic, participatory, future looking, enhances flexibility in policymaking and thus informs better present-day decisions. The scope for a foresight exercise can be any issue of societal relevance, in which knowledge, science and/or technology plays a role.

The report also points out that:

- there is fragmentation of foresight activities in Europe – and many exercises are simply repeating and duplicating efforts already made by others

and highlights:

- the need to explore the feasibility of developing a Knowledge Sharing Platform – there is real potential for shared learning at the European level of how to conduct and to use foresight.

The following points, made by the four discussants, warrant highlighting:

In considering the role of foresight **evaluation** and its link to policy rationales in a European context, **Luke Georghiou** alluded to the need to be alert to the

counterfactual. How much would have happened anyway and what is the real added-value that foresight provides? Importantly, there is an opportunity to use evaluation as a means of knowledge-sharing, as envisaged by the HLG in its recommendation regarding a Knowledge Sharing Platform. Based on the Irish foresight experience, this rapporteur found resonance with the point made about the need to understand the interaction of each programme [and its subsequent implementation] with a particular national socio-cultural and administrative setting.

That foresight might be **a misleading process** was the provocative question posed by **Kornelia Haugg**. Participation is an important characteristic of a foresight exercise, but from a practical perspective, not everyone can be involved. Therefore, the challenge (and the risk) is to ensure that the *right* people are involved and thereby ensure that decision-makers have more confidence in the advice they are receiving. At this point, and later during the discussion phase of this session, the importance of *involving young people* in foresight consultations was strongly stressed.

That **foresight 'success' is context dependent** was the key point in **Barend van der Meulen**'s contribution. He suggests that the emphasis in the foresight literature on the process benefits over and above any concrete outcomes arises because it has been particularly difficult to point to concrete examples of strategic decisions and policies that are the directly related to foresight. He posits that 'Europe' is an ambiguous term in relation to the governance of science and technology – national science policies are used by national representatives as input for European RTD policy formulation.

Emmanuel Koukios spoke of the parallels between the **Greek foresight experience** and discussions on European foresight. He highlighted the latter's potential to catalyse foresight activities in countries which might typically be regarded as 'lagging behind'. Importantly, these countries can employ directly the foresight ideas and 'tools' developed at the European Commission level. He noted the further domino effect as the foresight experience now growing in Greece can be harvested through systematic learning links with other Mediterranean/Balkan regions such as Cyprus.

General Conclusions from the Session

The leitmotif throughout the discussion in this session was that the most important task at the European level is to pioneer and facilitate formal and informal learning processes.

The proposal to develop a Knowledge-Sharing Platform attracted much comment – ranging from concern about the potentially closed nature of such an entity or that it could become a centralised management or co-ordination unit. Ideally, it should be an intellectual infrastructure that would stimulate experience-exchange and discussion for the different actors, at the different levels (regional/national/sectoral). It should be a service provider in terms of advice about foresight processes and methodology, the use of foresight outputs and the development of foresight evaluation capability. Its main objective should be to support the development of an EU-wide foresight community through real knowledge sharing.

Even though national foresights are not usually linked in any formal way, the priorities that emerge are often the same from country to country. This replication should not necessarily be viewed as a problem. The stakeholders are different in each case and particularly so where the institutional and structural differences of the national innovation system are specifically taken into account when identifying the stakeholders.

The session stressed that foresight is not a panacea for all difficult policy decisions, neither is it a substitute for politics or the democratic process. However, it can and should contribute to improving democracy in science.

Some doubts were expressed about the feasibility of 'scaling up' to a European level foresight – the process could become too obscure for most stakeholders, particularly civil society. The point was made that in order to contribute to the sustainability of economic development policies, European level foresight should focus on complex or trans-border issues.

If the ambitious targets set by the Lisbon-strategy (March 2000), and reinforced at the Barcelona Summit (March 2002) are to be achieved, there is a need for a robust set of methods to quickly identify new technologies, identify their potential and to make decisions quickly about priority S&T investments. That a pan-European foresight exercise could achieve this remains in doubt.

REPORT FROM THE INTERNATIONAL LEVEL FORESIGHT SESSION

DR. JENNIFER CASSINGENA-HARPER
Council for science and technology, Malta

Introduction

This report is an attempt to synthesise the most salient points emerging from the papers and ensuing discussion in the International Level foresight session. This synthesis aims to organise these points into a preliminary framework from which some conclusions and recommendations for future action could emerge. In this sense, the report reflects the author's particular interpretation and understanding of the issues emerging from the session and therefore the views presented in this report, whilst drawing on the invaluable insights of the session participants, are the sole responsibility of the author.

Defining International Level Foresight

The report takes the keynote paper presented by Professor Ron Johnston as its point of departure. From this paper, it becomes apparent that international level foresight has a number of different, yet complementary facets which have started to emerge in recent years. It is important to identify them and to be clear what we are referring to when we speak of international level foresight.

International level foresight could refer to:

- ***International trends in foresight*** – the study of how foresight is being used by governments and other players around the world, tracing common or divergent trends in foresight (and its use) which are emerging from an international perspective. International evolutionary trends in the application of foresight at different levels (national, regional and local), mapped in time, space and content, provide important insights into how to maximise its utility and impact within a particular context. The emphasis here is primarily on a comparative review of the use of foresight tied to p*articular geographical locations.* This work has started but needs further consolidation – it will provide an important building block to the internationalisation of foresight.

- ***The internationalisation of foresight*** - the focus here is on the actual process through which foresight is becoming internationalised and a number of questions come to mind:

    - How are we defining the internationalisation of foresight?
    - Can we trace increasing levels of internationalisation?
    - Is the internationalisation of foresight necessarily a positive/useful development? Is there a rationale for it? Could there be differing rationales and how can agreement be reached on them?

- Is the time ripe for it? What about other constraints relating to space and context?
- Who are the key players promoting the internationalisation of foresight? governments, MNC (multinational corporations), international organisations ?
- How effective is this process?
- What are the challenges of taking this process forward?

The emphasis here is on the use of foresight *beyond the geographical confines of the state*.

Whereas the first facet of international level foresight (international trends in foresight) is primarily descriptive, the second facet (the internationalisation of foresight) borders on the prescriptive. These two facets of international level foresight highlight the fact that foresight as a concept, methodology and culture is undergoing constant change, as it is being shaped and refined by the contexts within which it is being applied. The internationalisation of foresight and its application to a wide diversity of contexts, is bound to increase the range of definitions and approaches. Arguably, however, the internationalisation of foresight could also help to bring some coherence to the process of defining the concept, or at least agreement on its core elements.

Next we draw on some examples of the two facets of international level foresight.

International Trends in Foresight

In reviewing a number of studies on the application of foresight as well as a range of actual foresight exercises, Professor Johnston traced certain overall patterns and trends in its application in different countries emerging in recent years:

- there has been a marked shift away from the use of the Delphi technique towards panel- or scenario-based approaches;

- this is linked to a growing awareness of the diversity of foresight tools available and their use has become more context-specific;

- foresight is primarily being used for priority-setting and policy development;

- Johnston's typology of foresight exercises based on evolution, level, focus and objectives highlights the fact that, with the exception of Australia, Japan and Korea, the majority of countries in Oceania, Asia and Americas are at the foundational stage of foresight and have still to fully embed foresight in their planning processes. Most of these exercises are pitched at the national level (rather than regional or sectoral) and give priority to anticipation rather than networking or action. It would be interesting to compare in more detail these findings with experiences in Europe.

Internationalisation of Foresight

Professor Johnston's stock-take of the international dimension of foresight identifies varying levels of internationalisation:

- In embarking on their foresight exercises, states tend to study and copy (and hopefully adapt) the foresight approaches of more experienced states. This results in the international transfer of foresight practices and approaches.

- Beyond cooperative imitation, states may engage in bilateral cooperation e.g. German-Japan and France-Japan, in relation to refining foresight methodology and tools. This results in the international development of foresight practices.

    - International organisations have a potentially pivotal role to play in driving the internationalisation of foresight, by sponsoring studies and projects, promoting dialogue through conferences and workshops and agenda-setting for member states. UNIDO, the EU Commission and IPTS, APEC, and OECD (among others) are already engaged in these types of activities. This is leading to a more strategic orientation or steering of foresight, particularly in response to the challenge of international governance.

    - Non-state international players, in particular multinational corporations, and to some extent NGOs, are also contributing to the internationalisation of foresight - e.g. the use of technology road-mapping by global IT corporations. This is bringing about the strategic deployment of foresight in response to the competitive challenge of the globalising economy and trans-national concerns relating to sustainable development.

The Rationale for International Level foresight

At this point, it is worth pausing and focusing on why international level foresight is needed and should be developed and promoted further. There are a number of factors which point to its utility:

- The growing number of internationally co-authored papers would seem to indicate the utility of and interest in knowledge-sharing and international collaboration in research on issues of common concern.

- There is a range of transnational (and trans-sectoral) problems (e.g. global warming, migration and mobility flows, crime and terrorism, trade, …) requiring supranational governance solutions.

- Tackling these transnational challenges effectively is dependent on international co-operation in order to ensure critical mass and sustainable use of resources through economies of scale/use.

The internationalisation of foresight through information- and knowledge-sharing between foresight practitioners could provide a potentially vital input in the development of appropriate policy responses to these transnational governance concerns. Is there however a limit to the utility of international level foresight as a policy tool?

Levels of Internationalisation of foresight

In addressing this question, it is worth considering how foresight is being or could be internationalised:

- At the lower end of the scale, internationalisation could start through the involvement of international experts in national or regional foresight exercises.

- International level foresight could also play a role in the international coordination of national research activities.

- Moving beyond the mere introduction of an international dimension to national or sub-national foresight activity, supranational foresight could focus on the development and use of international/global scenarios. These and other foresight tools may be used to tackle global issues and international governance concerns, in the absence of relevant institutions at the global level.

The Challenges of International Level Foresight: Complexity

If the rationale for international level foresight is becoming increasingly evident, the way forward in terms of further promoting and embedding foresight on an international scale is less straightforward. There are certain challenges that have to be faced. These include:

- The need for international foresight is arguably not something new – international foresight was possibly needed in the past just as much as we need it today. Yet arguably the time may not be right for the strategic use of international level foresight, in terms of the current international system. At the national level, experience shows that the more successful or effective foresight activity in terms of policy impact, has been in response to a formulated or implicit demand for such activity. How can this be achieved at the international level? Can a formulated or implicit demand for such activity be generated? Alternatively could international level foresight focus on needs-anticipation to start with?

- The lack of institutions at the international level (already referred to above) could present both an obstacle and an opportunity in this respect. International foresight could play an important role in redressing the institutional gap, however this task should not be underestimated.

- In terms of implementing an international level foresight, the challenges encountered at the national and sub-national levels, of rendering the foresight process effective and meaningful are multiplied. For example, the process of agreeing on objectives and approaches and the stakeholder mapping become more complex at the international level with the sheer increase in numbers of potential stakeholders and related opinions.

- At the international level, foresight is in danger of being captured by diplomatic and/or competitive interests and pressures. Consensus-building may therefore prove particularly complex and time-consuming.

- The challenges outlined above highlight the need for the delivery of training in particular foresight skills at the international level. Yet, whilst involving the development of generic skills, foresight training needs also to focus on context-specific skills. How can an appropriate balance be retained between generic and context-specific training?

The Focus of International Efforts toEembed Foresight

The challenges, outlined above, highlight the need for more international dialogue and research on appropriate strategies for embedding foresight at the international level. These could aim:

- To bring about a formulated or implicit demand for international level foresight by encouraging and supporting the international foresight "community" to act as an informal international "lobby";

- To support research on needs anticipation and embedding foresight in international governance structures, focusing in particular on how foresight can help to overcome the lack of institutions at the international level;

- To launch a strategic/high-level international dialogue (involving key international organisations) on possible objectives and approaches of international level foresight and how it can be used for consensus-building;

- To promote foresight as a (knowledge) management tool and decision-shaper and to provide accreditation for foresight training and skills.

REPORT FROM THE THEMATIC FORESIGHT SESSION

DR. VÉRONIQUE TIMMERHUIS
AWT, The Netherlands

Main issues in the discussion paper by Rémi Barré

As the discussion in this session focussed on the input delivered by Prof. Rémi Barré in his paper *foresight and their themes: analysis, typology and perspectives*, it is useful to highlight very briefly the main points he made.

Barré's main goal with his paper is to shed light on the overwhelming variety of thematic foresight. His 'problem' when preparing his contribution, was what to say about the abundance of types, forms and methods of thematic foresight. His solution was to make sense of all this variety through some sort of classification. He started with grouping thematic foresight in 4 classes:

- foresight on technologies areas (e.g. nanotechnologies);
- sectoral foresights (e.g. agriculture, chemical sector);
- foresight on public functions (e.g. health, education);
- foresight on strategic issues (e.g. crime prevention, ageing).

His main statement in the paper is that there is a relationship between the thematic class of a foresight and its other features, such as its objectives, nature of involvement societal actors, the cognitive nature of the work and the institutional form (embedded or one central organisation which conducts the foresights). In this sense there is a clear *internal coherence* of several features of foresight. Additionally, there is also *external coherence* with the socio-institutional context in which the foresights take place. All in all, Barré brings the overwhelming variety of thematic foresights back to (only) eight different types. Barré concludes with the message that the design of foresight is sensitive to different cultures, rationales or decision making scenes. This means that foresight is flexible and adaptable; it leaves room for differences within and between countries.

It is important to note that Barré's classification aims at an analysis of foresight activities in different countries, with the 'national scene' as unit of analysis. It also needs to be stressed that the nature of the classification is inductive, based on 'after the fact' descriptions. The eight types of foresights that he comes up with are meant as archetypes, as basic points of reference, and in no way as blueprints or straightjackets.

Comments and discussion

'Interesting classification, very insightful, many useful details' - these were some of the compliments Barré could harvest. All four discussants, as well as most of the audience agreed on the usefulness of the classification-exercise. It offers a useful 'benchmark', a typology to consider when developing a foresight exercise.

There was by and large agreement that in doing foresight, there is 'not one best way of doing':

- there is a need for diversity and flexibility, to be able to accommodate different contexts and settings;
- diversity and flexibility not only between countries, but also within countries, at the national scene;
- it is also not a question of 'either/or' – it is important to realise that all the different types of foresight are relevant and needed, depending on context or contingencies.

A note from the rapporteur: Barré's classification has strong resemblance to classical contingency theory in organisational studies and its associate debate on 'strategic choice'. This revolves around the questions of imposed constraints and the strictness of relationships between variables (if contingency x, then type foresight y). How much room is there for making one's own strategic choices, how much is determined by context, what is the area of tolerance for action?

Part of the comments brought up by the discussants, revolved around the descriptive character of Barré's classification.

A descriptive classification of foresights is not enough to be useful for implementation and making choices. What is needed perhaps is a more prescriptive approach: to make clear what type of foresight is best suited in a particular situation (if --> then). The next question after description is therefore: what are useful patterns and in which situation? This also links to the question whether the diversity in types of foresight is accidental or the result of purposeful design.

Some discussants also stressed the need to go beyond description to explanation: from the 'what' question (what types of foresight can one discern), to the how and why questions. For example:

- How does context determine the type of foresight? foresight is seen here as a dependent variable.
- How does the internal logic of foresight shape the actual foresight exercise? Does variation lead to sub-optimisation? How much room for strategic choice and manoeuvring?
- What if several types of foresight co-exist in one country? Does this lead to tensions?
- Can foresight shape its national context? foresight is here seen as an independent variable, driving change itself.

Guiding questions for discussion

The chair (Dr. Lena Torell) put forward three questions, linked to the main focus of the whole conference, namely 'the role of foresight in the selection of research policy priorities'.

1. *What type of thematic foresight is most relevant for research policy?*
   The discussion with the audience did not lead to a real answer to this question. There appeared to be consensus that there is not just one type of foresight best suitable for research priorities, although the more focussed foresights on technology areas tend to come up with clearer answers than the broader foresights on public functions or strategic issues.

2. *What kind of foresight process is most relevant and useful for setting research policy priorities?*
   This question has to do with timing (ad hoc or continuous processes of foresight) and with different institutional settings (independent agencies or embedded, close to policy). Some remarks made were:
   - General agreement that all kinds of different foresight processes are needed; flexibility and diversity are very important. Some experimentation with different forms and types is called for.
   - foresight is not an innocent game. Important things are at stake. Therefore it is of crucial importance *who* is invited to participate. This will determine to a large extent what will come out of the foresight exercise ('what you put in, you get out'). Several people from the audience stressed the need to include and involve the younger generations, as well as representatives of industry and society at large. This led to discussion on the role of experts versus 'lay people' who are nonetheless important stakeholders in the future to come. One of the underlying questions was *how does participation in foresight relate to democratic processes?*
   - One discussiant (Dr. Terttu Luukkonen) stressed that a close link to policy and implementation of results is not the only point to consider. What is also needed sometimes is foresight exercises to break consensus, to go through boundaries. Therefore, is is not self-evident that foresights closely linked to policy (embedded foresight) is better geared to research policy.
   - With a lot of attention and time spent discussing foresight processes, some people pointed out the hazard of too much focus on methods and 'how to do foresight'. What is needed first is a clear vision on what do we need foresight for, what will we use it for? Only then does one choose the appropriate method and process.

3. *When taking foresight to the European level, which types of foresight are most relevant and useful?*
   As for this question, there was quite some concern about the perceived tendency to co-ordinate at EU-level. Several discussants from the audience clearly said 'no' to such co-ordination. What is above all needed is diversity and room for different choices. No EU-jacket. Others discussants made it clear that at the EU-level such 'straight jacket' co-ordination is not an issue.
   Then what would be useful at EU-level?
   The loud and clear answer from this parallel session is the need for a 'platform' to share information and experiences. Such a platform could also act as a sort of clearinghouse: to observe and assess the quality of foresights. Several people mentioned that such a platform should not only be aimed at practitioners conducting foresights as they already participate in some kind of international network. What is perhaps above all needed is a platform and meeting place/network of policy makers and people involved with foresight in intermediary organisations. They do not yet participate in the existing networks, while they change places quite often. Therefore knowledge and experience does not build up, every new person to the job has to start at the beginning. A platform could in some way help.

REPORT FROM THE FORESIGHT AND MULTI-LEVEL GOVERNANCE SESSION

PROF. JOYCE TAIT
SUPRA, University of Edinburgh, UK

Major Themes Emerging in this Session

The conference papers on foresight and Multi-level Governance and the subsequent discussions, focused on the potential complexity and uncertainty of the issues and interactions raised by foresight, and the ambiguity of interpretation that arises from different human interests and values.
A further layer of complexity was added by the differing professional perspectives to be found among conference participants - academics, policy makers, those involved in promoting regional development, and scientists and technologists themselves. As the practice of foresight extends more widely at European, national and regional levels of governance, the need for both vertical and horizontal integration of policies and actors becomes increasingly urgent. In this context, the danger to the vision of Europe as *the most competitive knowledge-based society in the world* is three-fold:

- the weight of the European and national foresight policy hierarchy superimposed on regional development initiatives, which are the source of this competitiveness, will stifle rather than stimulate innovation;
- the academic community will over-indulge its tendencies to focus on theory and discourse, rather than the development of practical instruments and solutions; and
- the current fashion for 'stakeholder engagement' in foresight processes will delay decision making to such an extent that opportunities for innovation are exploited by Europe's competitors.

However, this is not to advocate unrestrained freedom for innovators. The experience of agricultural biotechnology in Europe in the past few years has made all groups represented at the conference acutely aware of the need for public acceptance of innovation and of the sophistication and effectiveness of public groups in opposing innovations that they consider unacceptable or undesirable. The challenge, at all levels of governance in Europe is thus to provide a policy and public environment for science and technology that enables decisions and technology choices to be made rapidly and that is compatible with European value systems. The latter is a much bigger challenge than the former. At the moment in some areas we seem to be allowing the interests and values of minority groups, ranging from industry lobby groups to public campaigning groups, to dictate the range of technology options that will be available to Europeans in the future.

The Nature of Multi-level Foresight Systems

One of the most interesting aspects of the debate in this session of the conference was the tension between the accepted role for academic theory and debate (including the recognition that academic books and theories have on several occasions changed the world) and the perceived need among regional development agencies and

innovators for policies to support their ability to compete on a global scale and to move rapidly in response to changing innovation opportunities. In many European countries there is a 'policy gap' between the top-down European/national hierarchy which is often dominated by academic and high level policy debates, and bottom-up regional innovation systems dominated by more local policy issues and the needs of entrepreneurs. On the other hand, even in this latter context, it would be a mistake to think too much in local terms when the economies of scale are global.

Closing this policy gap to provide effective vertical integration across governance levels is a major challenge. If our efforts in this area undermine the remaining degrees of freedom vital to European innovators then the vision of Europe as a competitive knowledge-based society will not be achieved. This was expressed by one participant as a plea that practice should have a greater influence on policy.

We are in the early stages of this enterprise and the discussions in this session provided some useful points for the development of future guidelines, based on both theoretical and practical insights.

- There is a need to select appropriate methods and appropriate stakeholders to be involved at each governance level, to have a range of interacting parallel discourses, each of which should avoid patronising the others. This implies a stronger emphasis on constructive selection – how to select better rather than how to include more.
- These discourses at different governance levels should fit with the alternative hierarchy of social and technical engagement.
- We should not assume that all expertise is equal – effective foresight will need to select reasonable from unreasonable knowledge and predictions.
- One key, and uncontroversial, requirement for effective innovation is the provision of a good supply of educated scientists and engineers and also of scientifically literate members of supporting professions including lawyers, accountants and policy makers.
- Participatory discourse has greatest value in the generation of new options – policy makers and academics are not good at this.
- Particularly in the context of the accession countries, there is a need for better European cross-border integration.
- We should stop talking about foresight in abstract terms and look for cases where it has been implemented successfully as a way of generating enthusiasm at regional levels.
- foresight requires better horizontal as well as vertical integration, for example linking the various disciplines involved in innovation - design was specifically mentioned in this context.
- One aspect not mentioned in this session, but which seems central to many of the issues raised, is the role of science and innovation in mitigating the negative social, health and environmental impacts of existing technology and planned innovations, and the corresponding role of policy in guiding innovation systems in publicly desired directions.

Implications for the Role of Foresight in the Selection of Research Priorities

A theme in this and some of the other conference sessions was the view that there was a lack of evidence for foresight having influenced government policy so far. However, the one area where it has undoubtedly had an influence is in the selection of research policy priorities, the primary theme of this conference. However, this

leads us then to question whether an exclusive focus on science policy as the driver of innovation implies too linear a progression from laboratory research to new processes and products - a view which goes against the findings of social science research in this area. Commercial advantage often comes from the interactions between sectors rather than from within single sectors so we need to pay attention to issues which cut across administrative and disciplinary boundaries. Also, we should not underestimate the amount of research and innovation needed to support the development of new products and processes beyond the confines of the laboratory.
This is where the need for horizontal integration comes in again. Geoff Mulgan, in his keynote address, pointed to the need for better integration across a range of policy functions to create a foresight and innovation system appropriate to the needs of the 21st Century.

The foresight systems we are in the process of designing thus need to be better integrated, both vertically and horizontally. To improve the fit between the needs and desires of European citizens and the technology available to satisfy them, to be enabling rather than constraining of innovators, and to make Europe more competitive on a global scale.

Above all such systems need to be adaptive, to respond rapidly to changing circumstances and opportunities, to learn from their own mistakes and from the mistakes and experience of other nations. Every system contains within it the seeds of its own destruction. In some cases this relates to excessive constraint and lack of flexibility. In others to lack of appropriate constraint. We no longer look to the Japanese economy for lessons in foresight. And the current paragon, the USA, may experience a similar fate if it adheres too rigidly to a model which ignores the new realities of the 21st Century. The opportunities for Europe, as is always the case, may arise as much through the failure of competitors as through the success of its own foresight systems. However, we will only achieve our vision if we have in place our own systems to enable us to grasp such opportunities when they arise.
A quote from the Scottish designer, Charles Rennie Mackintosh, in 1901 still seems apposite here –

> "There is hope in honest error, none in the icy perfections of the mere stylist'"

OPEN DEBATE SUMMARY

Following feedback by the rapporteurs, the moderator Prof. Manuel de Hermenegildo opened the floor for reflection on the presentations and cross-session themes. The short ensuing discussion centred on the relationship between national and international level foresight activity, and the role and nature of foresight in the policy process.

An emphasis on interest in national level foresight was noted, but given the European policy context of integration, more attention to European foresight was seen to be a key issue. The need for international co-operation in foresight was recognised, as certain cross-border issues can not be dealt with either by national or regional policy tools. Foresight is relevant for promoting socially responsible technology at both national and international levels.

However, there are still uncertainties as to how this can actually occur, particularly in terms of centralised action. Following the vote of approval on the Sixth EU Research Framework Programme by the European Parliament, there is still lack of understanding of how it will be implemented, particularly in terms of the management of integrated projects and networks of excellence. There is therefore a need for continuous monitoring, evaluation, assessment and forecasting. Such a framework for foresight, monitoring and assessment will be particularly necessary for the governance of research in Europe, when there are 25+ member states.

With the devolution of responsibility to regions, co-ordination between regions could occur quickly and play a role in bridging national governments. There was also felt to be a need to look beyond Europe, to the global level, as this is where companies operate. Also, it was observed that the debate should be extended from research policy priorities to policy priorities more generally.

Given the current base of experience in Europe, a need for work on developing typologies of foresight was signalled. There are arguments for embedding foresight more effectively in policy and decision making, but there is also a need to retain its independence and not to forget that it is a simply tool with inherent limitations.

The contributors to the discussion from the audience included: **Eric Banda** (European Science Foundation), **David Broster** (European Commission), **Josephine Green** (Philips Design), **Attila Havas** (UNU/INTECH) and **Ron Johnston** (University of Sydney).

VII. DEBATE: PRIORITIES FOR THE FUTURE

Moderator:
• Dr. Jean - Marie Cadiou, DG Joint Research Centre, Institute for Prospective Technological Studies, European Commission.
Panellists:
• Dr. Erkki Ormala, NOKIA, Finland.
• Dr. Paraskevas Caracostas, DG Research, European Commission.
• Prof. Jerzy Langer, Academy of Sciences, Poland.
• Mr. John Travers, Forfás, Ireland.

SESSION OVERVIEW

This session opened with some introductory remarks by the Session Moderator, **Jean-Marie Cadiou** – Director of IPTS. This was followed by a statement from each of the four panel members in which they set out their views on where the future priorities lie regarding the development of foresight and its relevance to policy and strategy. After this, a half-hour long open debate and discussion took place.

Errki Ormala - Director of Technology Policy for Nokia, began with strong endorsement of foresight and its high importance for all companies in the knowledge economy. He stressed three roles that foresight plays for companies in providing important business intelligence type of information – – I) in relation to technology (predictable and unexpected developments), II) in relation to business development (changes to the value chain), and III) in relation to the economic and regulatory environment (to anticipate and understand impediments to business). Dr. Ormala underlined how important it is to Nokia to co-operate in such foresight work with competitors, clients, customers and the public sector, to compensate for individual companies' inability to maintain the full spectrum of knowledge and competencies they need. He stressed the strong commitment of Nokia to face the European challenge – of making Europe the most competitive knowledge-based economy in the world by 2010. He drew attention to some of the knowledge gaps and negative trends that lie between us and reaching that objective. He concluded with a wish to see European foresight as an instrument to make Europe an attractive location for investment.

In recalling the theme of the conference, **John Travers** - Chief Executive of Forfás (the Irish agency for industrial development and S&T policy), stressed that technology foresight can and has played a powerful role in informing R&D funding priorities. He cited the Irish example where technology foresight priorities have received R&D funding of €700 million administered through a new organisation - Science Foundation Ireland. However, recognising that foresight is still under trial, the main theme he developed in his remarks was how to better embed foresight and get a much broader acceptance of it in public administrations. He listed some of the ways in which the tools and methods of foresight need to evolve. He also described a number of other factors which could contribute to its evolution and, in particular, to its use and deployment at EU and other supra-national levels. Among these he included the importance of stressing *outputs* as well as *process*, and the need for good evaluation of foresight to be carried out.

Paraskevas Caracostas - Head of the European Commission's science and technology foresight Unit (Directorate K, DG Research), highlighted the various activities of the European Commission to catalyse European foresight co-operation, to support the development of tools for foresight practitioners, and to raise awareness in the foresight community of funding opportunities for networking which the European Commission can offer. He drew attention to the recently established High-Level Expert Group on the European dimension of foresight and mentioned ongoing co-operation projects supported through the STRATA programme. These activities will contribute to the emergence and the structuring of a European Area for foresight. In addition the Commission have been supporting the development and dissemination of practical guides to foresight. To raise the awareness of the foresight

community for funding and networking opportunities at European level, the Commission is preparing a Guide to foresight in FP6. Stating that now is time to act, Dr Caracostas presented his vision of a European Research Area that includes a strong foresight dimension based on increased trans-national, interregional and thematic co-operation activities by 2010. To attain this goal the Commission will set up a *Knowledge Sharing Platform* that will serve as knowledge infrastructure to collect and disseminate information and good practices on foresight in Europe. In his concluding remarks Dr Caracostas drew attention to the complexity of the European decision-making process that involves several decision-making bodies (Commission, the European Parliament and the Councils of ministers) setting limits to the impact of foresight processes on identifying policy priorities on European level. He called for a stronger role of joint foresight activities in the preparation of EU policy decisions and stressed the need for new co-operations in foresight in Europe as well as methodological exchange.

Jerzy Langer, Professor at the Polish Academy of Sciences, identified three groups that actually need foresight - decision makers, society at large, and science itself. He pointed to the increasing lack of understanding of science and the need for a sound basis for setting R&D priorities in the sciences. He recommended devoting another meeting of similar format to this issue. At European level, the European Science Foundation (ESF) has recently introduced the “Forward Looks” instrument. It should enable Europe's scientific community to develop medium to long term views and analyses of future research developments in multidisciplinary topics, and interact with policy makers from member organisations. He suggested to broaden the involvement of pan-European science organisations in this process to have a larger spectrum of opinions represented. Policy advisors involved in foresight activities should be able to point out the trends and potential trend breaks that may lead to major transitions. Instead of providing solutions, foresight should present and assess alternative options that can be used by decision-makers to make their choices. To ensure and improve the quality of European foresight exercises, Prof. Langer stressed the need for a Code of Good Practice. Science-based foresight could be among the objectives of a future European Research Council. foresight should play a pivotal role in the identification of the priorities of European Science Policy. Prof. Langer concluded with the recommendation to place learning from approaches with the highest success rate at the centre of the prioritisation process.

PRIORITIES FOR THE FUTURE

DR. ERKKI ORMALA
Director of Technology Policy, Nokia, Finland

Let me address the issue of foresight from a company perspective. Nokia is a global company. We spent about € 3 billion on R&D in 2001. Nokia has R&D sites in 14 countries in five continents. Strategy formulation requires a continuous evaluation, bench marking and foresight.

The future oriented activities are called **'future watch'** covering three main areas: *technology*, *business* and *economic and political environment*. Future watch is conducted as a process. Each main area has its own separate sub processes, but the interaction between these sub processes is an essential part of the overall future watch.

- Technology issues involve both long-term trends with high predictability and short-term disruptive technologies, which may require immediate and rapid response. A process, which identifies weak signals, supports technology future watch.

- The business future watch is integrated into the strategy process covering the market/customer behavior, changes in the business environment, new business models and the changes in the whole value chain.

- Finally, economic, political and regulatory future watch identifies the changes in the framework conditions and potential impediment to business development.

The ICT sector is a very dynamic and rapidly changing business. Speed and agility combined with economies of scale create competitive advantage in the market place. Flexibility in organization and management is required to facilitate adaptation to changing conditions. Future-oriented activities are aimed at creating a winning foresight – a vision, which paves the way towards future business opportunities. The vision needs to be implemented swiftly and effectively in practical operations and execution. The combination of winning foresight and excellence in execution constitute the foundation for competitiveness.

The technology options in ICTs are growing exponentially. No organization alone can master the variety of relevant technologies and competencies in the future market place. Nokia, like all the other global ICT companies, is increasingly co-operating in foresight activities. Co-operation takes place in industrial consortia where partners in the same value change including many competitors are involved. Public/private partnerships are playing an increasing role in these co-operations. Universities and public research institutes collaborate extensively with private business in order to create a better understanding about the future opportunities. Our experience suggests that this interaction can become an important knowledge-sharing activity, in which both parties – companies and public partners – can benefit significantly through mutual interaction. Business can bring to the joint effort understanding about the markets and about product and process technologies, while public research representatives can reflect new unexpected technology opportunities or innovative

combinations of technologies. Learning the best practices of public/private co-operation is one of the main challenges for the development of foresight in the future.

The Lisbon process set a target to make Europe the most competitive knowledge-based economy by 2010. The subsequent Barcelona Summit added the ambition to raise the R&D input to 3 % of the GDP by 2010. Two thirds of the increase should take place in industry. These two decisions set a clear and ambitious target for European foresight:

- Firstly, the foresight activities should be able to identify the gaps in the European knowledge base, which creates barriers to industrial R&D investments in Europe. The ICT sector is a good example of areas where Europe is lagging behind its main competitors both in terms of R&D investment and competence.

- Secondly, foresight exercises should look at the economic, political and regulatory environments and the framework conditions, which, to a large extent, influence the allocation of private R&D investments. For example skill shortage in the ICT sector is a major hurdle to R&D investments in Europe. These kinds of concerns weaken significantly any attempt to strengthen the competence base in Europe.

- Thirdly, foresight should address the issue of implementation. A rapid and effective response to identified barriers is an indispensable part of any attempt to reach the Lisbon and Barcelona targets. From experience we know that the ICT skill shortage was identified more than five years ago, but besides some smaller countries (e.g. Finland and Ireland), no major revisions in the higher education systems has occurred. Another example could be the relatively weak tradition in private/public partnerships compared the US situation. The rigidities of the European economic, political and regulatory framework conditions are a severe threat to European industrial competitiveness in the longer-term.

It seems to me that European companies would welcome both national and European level foresight initiatives, in particular, if they could address the kinds of issues raised above. Companies would certainly be interested to contribute when appropriate forums and platforms are available. Our experience suggests that company participation may require somewhat different working procedures that are usually applied in the academic environment. However, private contributions, when organized appropriately, can be very valuable for the success of foresight exercises at all levels.

THE ROLE OF TECHNOLOGY FORESIGHT IN PUBLIC SECTOR STRATEGY FORMULATION AND DECISION-MAKING AT SUB-NATIONAL, SUPRA-NATIONAL AND EUROPEAN UNION LEVELS: PRACTICE AND PROSPECTS

MR. JOHN TRAVERS
Chief Executive, Forfás, Ireland

Introduction

I think that this has been a highly valuable conference. Our thanks are due to the Spanish Ministry of science & technology, to the Commission, the Joint Research Centre and I.P.T.S. for the excellence of the program and the arrangements. The papers have been of high quality and the discussions full of useful insights and practical lessons drawn from the actual experience of many of the participants at this Conference in being engaged in Technology foresight exercises at different levels.

My observations and contribution at this Conference are based on my experience as both an economic industrial development and science policy strategy formulator and decision-maker in Ireland and as Chief Executive of an organisation which undertook at the request of the Government a Technology foresight exercise in 1998 to establish priorities for investment in R&D in Ireland. Arising from that exercise the Government allocated some €700 billion to my organisation to invest in basic research in information and communications technology and in biotechnology over the period 2001-2006 and to establish a new organisation to manage this process – *Science Foundation Ireland.*

Conference Objectives

Let us remember, at this final debating session, the objectives of the conference. These are to identify the requirements which are needed to increase, in a practical way, the synergy which exists between strategic foresight exercises and policy planning and decision-making, and, in particular, to identify the prospects and opportunities for Technology foresight in helping to achieve better decisions in a number of areas at EU level and, with a special focus on the proposals of the commission to create a European Research Area.

The papers presented, and the debate that they have engendered, have already identified a number of practical steps through which these objectives can be achieved.

Overview: Technology foresight has made significant progress as a tool of public policy strategy formulation and decision-making

If I can draw some kind of overview and conclusions from the papers and discussions that have taken place, it is quite clear that Technology foresight has already made significant progress as an important tool of strategy planning and formulation in the public policy making decision process. A number of points may be cited in support of this view:

1. Firstly, Technology foresight has generated wide-spread interest among decision-makers as an important tool in the larger tool-kit which they apply to strategy formulation and decisions. It is a fact that Technology foresight is being used for strategy development purposes in an increasing number of countries in Europe and around the world.

2. Secondly, Technology foresight has moved on, in two directions, in the public policy/strategy formulation process, evolved from being an approach to strategic decision making at national level to its use for such decision-making at regional level and, increasingly so, at supra-national level.

3. Thirdly, the scope of Technology foresight has widened considerably over the past 10 years to encompass public policy formulation dealing with multi-issue as well as single issue themes.

4. Finally, Technology foresight has become an increasingly adaptable and flexible instrument of strategy formulation and decision-making based on the more sophisticated methodologies that have emerged as the experience of using Technology foresight has increased.

These are all positive signs of an increasing recognition of the potential which Technology foresight holds to improve strategy formulation and decisions.

Despite significant progress, Technology foresight struggles for wide-spread acceptance in Public Policy Formulation

But it is also clear that Technology foresight remains on trial: the jury is still out on its contribution. While Technology foresight is increasingly becoming part of the strategy formulation and decision-making process in many areas, it is not yet strongly embedded in that process. It is struggling for wide-spread acceptance.

Looking forward: How will technology foresight evolve?

So, it is useful to pose the question: where does Technology foresight go from here? What are its prospects as a practical and useful tool of strategy formulation and decision-making at regional, national and supra-national levels? What should the priorities be in developing the potential which Technology foresight holds for better decision-making at these different levels?

The answers are unclear. Perhaps we should apply a Technology foresight analysis to the future of Technology foresight!

Six Factors which can improve the contribution of Technology Foresight to Public Policy, Strategy Formulation and Decision-Making

More seriously, I think that the answer depends on a range of factors which might form the basis for establishing a number of operational priorities in helping to shape the evolution of Technology foresight to become a more useful tool of strategy formulation and decision-making in the years ahead.

Firstly, it needs to be stated, without apology, that Technology foresight is fundamentally a sound concept. Who can deny the essential validity of attempting, in a systematic way, to map out the long-term evolution and possibilities of developments in science, technology, society, the economy in general and in specific economic sectors – all at regional, national and supra-national levels – in order to provide at least part of the information that decision-makers need to make better strategic decisions. Strategic decision-making without such an input is likely to be highly deficient.

Secondly, while it is important to stake out the potentially strong role that Technology foresight can make to better decision-making, it is essential that the process is not exaggerated or over-sold. Technology foresight is *part* of a more comprehensive kit of tools available to decision-makers. Any attempt to present it, in some way, as the only basis for good decision-making is not credible. For many public policy decisions Technology foresight may have little to offer. But for others, it can make a major contribution to good decision-making. Matching Technology foresight with appropriate areas of decision-making is a major challenge for both advisors and decision-makers. Research which helps to do this, should be another priority.

Thirdly, it needs to be more strongly recognised that Technology foresight is not a "one-size fits all" concept. The nature and scope of Technology foresight requires to be designed, shaped and fitted to the specific needs of the decision area to which it is applied. The use of Technology foresight to deal, say, with sustainable development issues at regional level will be very different to its application to this issue at national or supra-national levels.

Fourthly, there needs to be a greater emphasis in Technology foresight work on the output or results which it achieves or can achieve and not just on the *process* of Technology foresight – important as this *process* may be. An over-emphasis on *process* at the expense of *outputs* and *results* makes Technology foresight an unconvincing tool to decision-makers, given the resources that good Technology foresight requires in terms of time, people and money.

Fifthly, Technology foresight should not be allowed to become an excuse for inaction. Many decision-makers may be tempted to do this – to apply Technology foresight to areas where they wish to postpone the taking of decisions. The misuse

of Technology foresight for such purposes may be one of the reasons why Technology foresight is under-rated as a decision-making tool.

Sixthly, good *evaluation* of Technology foresight is essential. It needs to be clearly recognised and accepted that not all Technology foresight exercises will be successful. But it must also be acknowledged and clearly demonstrated by good evaluation techniques that Technology foresight does result in better decisions in many areas. It is important to log both the successes and the failures, to widely disseminate information on the successes, and to learn, in particular, from the failures. Each Technology foresight exercise should specify the decision-making area to which it is addressed and should also establish the metrics and means through which its impact can be assessed and measured. *Ex-post* evaluation and conclusions should be an essential component of each Technology foresight exercise.

Prospects for the use of Technology Foresight at EU Level

Chairman, there are many other points I would like to raise but the time is not available. There is no inherent reason why Technology foresight, which has been mainly a tool of strategy formulation and decision-making at national level, cannot be equally used at supra-national and EU levels. To do so, is mainly a challenge of carefully identifying the decision-areas where Technology foresight can support better decision-making and designing a process of Technology foresight appropriate to these specific areas. In order to gain some early wins these areas should be chosen extremely carefully and driven forward by decision-makers rather than the technical analysts. In this context the six factors I have listed above are relevant.

Conclusion

Finally, can I say that the Commission Directorates for Research, and the IPTS in particular, have made a major contribution to establishing the part which Technology foresight can make to good strategy formulation and decision-making. This conference has added further and substantially to that contribution. I congratulate you, Dr Jean-Marie Cadiou, as Chairman and your colleagues on what you have achieved.

NOW IT'S TIME TO ACT!

DR. PARASKEVAS CARACOSTAS
Head of the "Science and Technology Foresight" Unit,
Directorate K, DG Research, European Commission

Ladies and Gentlemen, I will start by saying that Europe is a world leader in foresight. We should not forget that the richness and variety of experiments in the field of foresight, technology assessment and participative approaches is a key asset for Europe.

Secondly, a lot of progress has been achieved since the last foresight Conference in Stockholm in March last year (2001). In the Commission, we have tried to act as catalysts for more European co-operation, to support the development of tools for practitioners and to raise awareness about possibilities for getting EU support for launching new joint activities.

Catalysts:

- We have set up a High Level Expert Group on the European dimension of foresight (you discussed its Final Report extensively yesterday and the debates initiated here will continue in a number of appropriate fora) and another one on Regional foresight the conclusions of which will be discussed in Brussels in a Conference on 24-25 September 2002;
- We are supporting through the STRATA programme a number of co-operation projects (e.g. eForesee, TAMI, DFFN, etc.[1]) which will contribute to the emergence and structuring of a European Area for foresight, with a special focus on linking experiments in candidate countries with actors and networks in and between Member States.

Support to the development of tools:

Most of you are aware of the production by the FOREN-STRATA network of a Guide to Regional foresight[2]. We are supporting at the moment the translation of this Guide in all EU languages and its adaptation to the various national contexts in order to make it available to all actors in Europe that, we hope, will use it and adapt it to their specific context.

The EPUB « toolkit » is another example. This STRATA project has made an extensive review of methodologies used in evaluation of research projects and programmes.

[1] see http://www.cordis.lu/improving/strata/selected.htm for a complete list of STRATA projects.
[2] See http://foren.jrc.es/Docs/eur20128en.pdf

Awareness raising:

We sent to all of you an early warning about the Expression of Interest published by the Commission to stimulate new network and project proposal ideas for thematic priority areas in the Sixth EU Framework Programme. We are also preparing a Guide to foresight in FP6 to help the foresight community to find its way in the various relevant parts.

Thirdly, what about the next steps?

I will use Martin Luther King's expression "I have a dream!" I hope that by 2010 we will have progressed substantially towards the goal of a stronger foresight dimension in the European Research Area:

- A number of national foresight initiatives will have opened up to each other and started to manage joint foresight processes (e.g. using a commonly agreed methodology);

- Regional foresight initiatives will be interconnected via a number of trans-regional co-operation networks;

- For each thematic priority are (e.g. genomics, nanotech, environmental research…), there will be one or more foresight project or foresight components in large networks of excellence or integrated projects;

- Co-operation between various participative approaches to science and technology policy will have started.

These developments are likely if all of us mobilise the actors, sponsors and users of foresight at all levels.

This Conference has been a great success but to all of those who still ask questions like "What is Europe? or "What is foresight?", I tend to answer: "now it is time to act!" We will try to support all those who want to co-operate across borders with good projects and my unit will focus on setting up a **Knowledge Sharing Platform** to collect and disseminate information and good practices on the basis of a diversity of co-operation projects initiated under various parts of FP6, as well as good practice exercises outside the EU-funding framework. Such a platform will be a knowledge infrastructure at the service of a *self-organising but networked* foresight community as well as of the users of foresight for decision-making at all levels.

Finally, I would like to go back to the central theme of the Conference and share with you some reflections about the relations between foresight and decision-making at EU level. We cannot pretend that we have reached the same level of political commitment to foresight than the one achieved in the UK Government or the Finnish Parliament. We should bear in mind that the decision-making process at European level is much more complex than at national level.

The example of the Framework Programme can be illustrative here. Even if the Commission were to use extensively foresight processes to identify its policy priorities, these would then be presented as proposals for co-decision by the European Parliament and the Council of Ministers. The co-decision process might then change substantially what was initially proposed by the Commission. That is why I think we should stress the distinction between activities like foresight that inform the decision-making process and this democratic process itself.

What we should aim at is at a stronger role of joint foresight activities in the preparation of EU policy decisions, in particular in areas where there are strong EU competencies (e.g. research policy, sustainable development strategy).

There are questions that concern all of our countries or the EU as a whole like, for example:

- What are the scenarios for the future governance of the European Research Area (the EUROPOLIS-STRATA project[1] has developed some but there is still prospective work to be done)?

- What if the Framework Programme funds (the famous 5-6 % of total civil public R&D spending in the EU) leverage - through its new instruments - much more national funds than in the past? Don't you think that more joint foresight would be needed to prepare the next debates on priorities as well as to permanently inform the evolution of EU research and innovation activities?

- What will be the consequences for the ERA of the September 11 events? What are the new *geopolitics of knowledge* that emerge and what can Europe do?

These examples show that new co-operations in foresight in Europe are needed as well as methodological exchanges to develop the creativity, independence and robustness of such processes.

Thank you very much.

[1] see http://www.obs-ost.fr/pub/lt_022.pdf

FORESIGHT: SOME PROBLEMS WORTH REFLECTION

PROF. JERZY LANGER
Polish Academy of Science, Warsaw, Poland

Who needs foresight?

The quite simplistic, but I believe, pragmatically correct answer is threefold:

1. DECISION MAKERS,
2. SOCIETY AT LARGE,
3. SCIENCE ITSELF.

I have been surprised to notice that at this meeting except for a few discussants, foresight was mainly dealt with as an advisory tool for setting up medium and long-term policies, which means governance.

Indeed foresight originates from this community, but I want to stress its societal value, as well as its linkage to science itself. It looks to me as a somewhat unexplored avenue, so my first recommendation for future activity, maybe under the next Presidency, is to make again foresight a key subject for a meeting of similar format but mainly devoted just to the other two targets (2. and 3. above).

The reason is very simple. Society at large understands less and less science, the need for pursuing science and the scientific approach. It is enough to go to any newspaper stand to see what sells best. Other media are no better. The amount of scientology and popularity of healers already became a social problem. Catastrophic prognoses sell best. Nostradamus is still with us!

And politicians are humans and they are being elected by such a society. We, scientists, must be aware of this and leave the ivory tower as quick as we can. Otherwise not only nuclear physicists or molecular-biologists, not to mention those who love cloning, but also foresighters will be blamed for all troubles of the world.

I believe Professor Ernst intends to touch this aspect in his concluding talk.

But I would like to go even further. Some years ago the Greenpeace movement became quite popular and influential. Forgetting all politics and underlying manipulation, public awareness of the environment has already become a big societal asset. But recalling again all that we can witness with parascience, scientology, futurology and intellectual garbage in the media I would like to think about another colour – GREY – the dominant colour of our brain.

Maybe then a similar movement to the GREENPEACE should be initiated, but with our brain on the flag!

The need for foresight in science itself

My old Professor used to say quite often: *it is much more important to know what not to do than to know what to do*. Now this personal dilemma becomes the key issue for everybody responsible for distributing money for R&D. And a proper assessment may save not only money, but first of all limited human resources. This is also why we need some sort of foresight in science itself.

foresight, by definition, is an interdisciplinary activity. And as any borderline endeavour it requires very special and very unique mentality of the pursuers. Unfortunately it is not so easy for top specialists to leave their fields and seclusions and to do what Alexander Graham Bell once said: *occasionally it is necessary to leave the beaten track and dive into woods.* So this is also why quite often those who land at the borderline are not necessary those worth listening to.

However there is hope given that the ESF has started such an activity at the European level. Here, the foresight exercises have been nicknamed "forward looks". They are still in an early phase, but at least the ESF constituency assures seriousness and high intellectual and professional level of the pursuit and very importantly – objectivity. A closer collaboration between the European Commission and the ESF in this endeavour could bring unexpectedly good results, and also could save a lot of public money. Maybe other pan-European science oriented organization, such as EUROSCIENCE, should be invited to these debates to have a larger spectrum of opinions. I appeal very much to the high representatives of the Commission present here to think about it. This is in fact my second recommendation for this meeting.

I would like to go even further. Many of you may be aware of a discussion about the need to create in Europe a European Research Council. In the autumn, a meeting devoted to this issue is planned under the Danish Presidency. There are several suggestions for what this new body could and should do. Many see it as a new pan-European funding agency for basic research. Well, there is a need for this, but I believe that science-based foresight addressing both science and society could well be speciality of the ERC.

If we wish to treat foresight as a scientific tool for a decision-making, then we cannot escape a problem of methodology and procedures.

Foresight and science – issue of methodology

Doing research we have to admit that in most cases we just do not know. In fact there is even more we have to say, namely that science is not a rosy path from success to success. Failure is the essence of research and the right to failure is one of its major assets. But thanks to solid procedures, sooner or later the errors are filtered out: at least in exact sciences.

What does this mean for foresight?

If it is to be based on a scientific methodology (i.e. taking all known facts properly weighted and applying proper analytical tools and knowing the limits of justifiable extrapolation), then it means that errors are inevitable. We must accept this, but all

measures should be undertaken for not letting errors accumulate, otherwise we may receive instead of a valuable prognosis, just dangerous rubbish, although most likely nicely packed with all modern multimedia and word-processor tools.

And here comes the next recommendation: The "10 commandments" of foresight or better to say a code of good practice is absolutely needed.

This does not imply appeal for the "uravnilovka[1]" of methodology, but my observation from the side and taking into account my professional background (physics) says that the amount of shallow and unjustified outputs is unacceptable, especially if the consequences are being considered.

Advisors vs. decision makers relationship

Apparently the major driving forces for foresight are decision makers, not scientists. This is quite optimistic, as it seems not to be just a fashion. It also constitutes a real challenge for true scientists who must give up some of their time to provide counsel to the politicians and to stop the crooks and pure lobbyists who are so plentiful. The messages provided by our Scandinavian colleagues raise my optimism even higher.

So let me address now the fourth issue, namely the relationship between advisors and decision-makers.

Paradoxically, good advisors do not provide advice, but only professional assessment. In terms of providing solutions, only alternatives should be allowed, but with a fair account of possible consequences and risks involved.

And I think that in a foresight activity quite important is the identification of trends, but even more important is a proper prediction of future trends. Putting it in other words it is a problem of spotting weak signals that either indicate a likely change of the current trend, not to say the signals that come from the real triggers of a "phase" transition – which is a very formidable task, and very hard to codify. This is why good foresight resembles more of an art than an exact science.

And one more general comment about those who should be involved in foresight debates. Diversity among the participants is a must. It also means that both young and hopefully "angry" and contesting people should be invited on par with more mature, presumably calmer and more knowledgeable participants. By definition: in foresight the prime tool must be discussion, not a computer analysis by lonely analysts.

Advisors are not prophets. And they must not be prophets, neither wishful thinkers. And most importantly, they must not participate in the decision-making, a very hard restriction to many scientists with well-developed egos.

Good decision-makers are those who are mentally prepared to listen and make a final choice and take responsibility. Again the feeling and joy of power very often kills the modesty needed in accepting knowledge limitations among the politicians.

[1] Editors note: an abusive term for egalitarianism

It is a very idealistic picture, but the closer we are to such a situation, the better.

It has been quite a dense meeting, so let me diverge for a moment.

A friend of mine, a Polish economist, Professor Stefan Kwiatkowski, who participates at this meeting, told me once a story of an ultimately perfect decision-maker. It was a Red-Army general who was put in charge of one important department in the *nomen omen* Commission of Planning of the Polish government in the early 1950s. He spoke no Polish, but he was responsible for quite many strategic decisions. Asked how he arrived at them he once revealed his methodology of decision-making. He used to ask only whether he was the addressee or the sender of a document. If the latter, then he signed below the text, but if the document was sent to his department, then he signed above it. It was a real alternative. I wish to know who were the advisers in his department.

This nostalgic story brings me to the last issue I was expected to raise, namely:

R&D Policy in Central and Eastern Europe

Our science ministers and governments are facing an almost insoluble puzzle. They have quite a legacy of the past - good and bad. They also generally have a problem of shrinking public money for research. There is also a rising problem of demography and unemployment, which eats up an enormous amount of public money. So without proper assessment and decent advice, the next crisis is almost in sight.

Then we arrive at the most serious problem faced by our governments, namely:

What science policy?

Foresight, whatever the form, should play a pivotal role in answering this question. And in fact it does. Despite numerous statements that only in very few accession countries foresight activities have taken place, my observation is not that pessimistic. It is being done usually under a different name and with different formal arrangement, at least in Poland.

And we have plenty of examples of what happened when wrong or insufficient foresight had been done. Just recall the collapse of the once mighty Soviet Union and why? It is up to the historians to make a detailed assessment, but I think that pumping enormous resources into the star wars programme was much more than just a trigger. Such heavy bets are acceptable in a casino but a poker game must not be played on the international scale. However, observing the today scene, I am not so sure that anybody listens.

Should then our research councils just copy the EU or say the USA set of priorities? My simple and somewhat cautionary five pieces of advice would be:

1. Be careful in exerting discipline priorities (*look at who your customer is and what the country really needs? Also what are the intellectual resources?).*

2. Think not only about the brain drain, but also the money drain (*lobbies of large research facilities outside the CEEs such as CERN, ESRS, EMBL…*) in assigning public money for R&D.

3. What are the institutions to be financed and developed? Here proper BENCHMARKING must be used as guidance.

4. Until quality becomes a prime feature in a given field/community, pouring and streamlining money into it is dangerous and may result in heavy losses and frustrations. At the end, developing a scientific environment needs much more time than buying a license, taking credits from a bank and setting up a factory.

5. Observe the experience of others, but learn only from those with highest success rate. And not only for courtesy reasons I wish to say that in the context of foresight exercise our host IPTS under Dr Cadiou's directorship is quite high on my recommendation list.

But most importantly behave as the students of medicine are being taught to behave:

PRIMUM NON NOCERE

OPEN DEBATE SUMMARY

A number of different subjects were raised in the short discussion which followed the panellists' presentations. These included:

- the relationship between industrial foresight experiences and public policy oriented foresight,
- the conduct of more systematic and more systemic European level foresight, and
- bridging the gap between science and society.

Most of the discussion, however, centred on the industry-foresight issue.

The need for stronger links with industry in the area of foresight - either with firms themselves, or through industrial federations and associations - was emphasised in light of the fact that most R&D decisions are made in companies. The willingness of industry to co-operate and share knowledge in public foresight exercises was seen, from the side of industry representatives to be of mutual benefit to all involved, but not necessarily having a direct bearing on corporate decisions. Although different cultures and thoughts may prevail in government and industry mutual respect can enable learning. The experience of Nokia in implementing its web-based knowledge-sharing platform Forum Nokia with 600,000 subscribers world-wide was reported as a very valuable and efficient means of detecting so-called weak signals, with equal potential value for public foresight. This example indicates that industry is willing to share knowledge in the pre-competitive research realm.

The desired creation of a critical mass of foresight capability at EU level should involve utilising national experiences and company experiences. This was also related to the industrial debate in the sense that the horizons of most private business with foresight competence are international if not global. It was clear, though, that industry often requires very specific technology foresight activities that are usually outside the scope of public exercises.

The importance and potential of foresight as a means of engaging citizens and regional actors in science - society debates and bridging the gaps between these two worlds was mentioned, though it should be remembered that there are other ways and means of engaging the public and promoting a better public understanding of science.

Jean-Marie Cadiou closed the debate with a number of summarising remarks and additional comments.

He firstly reiterated the particular need to take forward concrete foresight actions in many specific areas and at different levels, as well as emphasising the paramount importance of the link with decision-makers, in line with the overall theme of the conference.

By way or response to some doubts about the rationale for European level foresight, he stated that the need for such foresight analysis and input to inform policy making at EU level is quite explicit. Several major policy decisions of principle have been made at the highest level by The European Council which require very careful and

intelligent specific policies to be developed, if the larger policy goals are to be realised. Some of the current major EU policy processes which need to be informed include the *enlargement process*, the *Lisbon process* and the *European sustainable development strategy*. EU-level foresight without a doubt, is required to inform these policy processes.

He also stressed the following:

- Technology foresight must be embedded into a broader societal context.

- Stakeholder involvement is absolutely crucial to the success of foresight. At European level this raises the question how to effectively involve high-level decision-makers in foresight activities. However, high-level decision-makers will only get involved if they feel that the process is really useful to them and if the timing is right.

- The process side of foresight is important but the content and outputs are critical. foresight must deliver clear and insightful messages on which the decision makers and stakeholders can act.

- As far as industry is concerned, we have to find better ways of getting it involved in public policy oriented foresight activities.

- Finally, a large unresolved challenge is how to get a good representation of public opinion in foresight activities.

The contributors to the debate in addition to the panellists and moderator included: **Torsti Loikkanen** (VTT, Finland), **James Gavigan** (JRC/ IPTS), **Geoff Woodling** (Hutchison 3G, UK), **Gordon Ollivere** (RTC North, UK), **Josephine Green** (Philips Design, The Netherlands) and **Daniel Malkin** (OECD).

VIII. CLOSING SESSION

THE RESPONSIBILITY OF ACADEMICS IN OUR TIME

PROF. DR. RICHARD R. ERNST
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Abstract

In this lecture, it is stressed that the responsibilities of academics and academic institutions are not limited to research and teaching. Today, where short-term and self-centered thinking prevail in politics and economics, a third, independent authority with a long-term vision and global responsibility is needed to prevent that our world goes fully astray. There can hardly be any doubt that this is a primary function of universities and of academics, a function that is today painfully neglected. The universities are called for developing again into cultural centers where ethical, cultural, and scientific guidelines for the peaceful and sustainable future development are formulated.

I would like to speak about responsibilities of academics and of academic institutions that are particularly relevant in our time. Since centuries, each generation thinks to live in a unique time with unparalleled challenges, opportunities, and problems. Later, however, historians find usually numerous parallels and relativate the subjective uniqueness. Nevertheless, I am convinced, our time has more than ever characteristics with no parallels in earlier periods, and we can no longer argue by historical analogies. We have to invent our future ourselves. Historical knowledge might inspire, but it is more important to grasp the particularities of our time.

I think our time is characterised by:

- *nearly unlimited technological means*
    - We are strong believers of unlimited technological progress.
    - Within a modern hospital it is easy to get convinced that any decease can be cured in time.
    - But also at home in front of the laptop or in a modern vehicle' the same conviction prevails.
- *limits of growth set by limited resources of all kinds*
    - Energy is a major calamity.
    - A healthy environment is in many places just wishful thinking.
- *an increasing gap between rich and poor*
    - A too large gradient between rich and poor causes instability.
    - Terror is not a cause but a consequence of injustice.
- *unlimited faith in free market economy*
    - Our pension plan depends on gains at the stock exchange
- *loss of an accepted ethical foundation*
    - Perhaps we even go regularly to church, but this has rather limited consequences in international politics.
- *governance by a single super power*
    - a power whose success we admire
    - a power which we envy
    - and a power which we sometimes dislike.

I will come back later to some of these points.

What are the driving forces in our global society today? I see three distinct players that influence the course of its development, each in its particular manner: Politics, economy, and academic institutions.

Politics pursues today predominantly national interests. This is true for small states, such as Switzerland, as well as for the large and super strong ones.

Switzerland is known for its independence and pretended neutrality, hiding behind strong border walls. Until very recently, we felt no need to join the UN, and surely, we will not join the European Union for several decades to come. You know the famous bank secrecy and our inglorious past during the Second World War. Swiss have a dubious reputation for their money mindedness. But you know, there are people in other countries having become much richer by much more dubious methods.

Selfishness seems to be a universal property, and not only of men, also of animals, at least of those who have survived so far! Take, for example the USA where, indeed, national interests have today absolute priority. Surely, any kind of short-term thinking will be self-defeating in the longer run; for example a careless misuse of resources after banishing the Kyoto Protocol: *"We will not accept a plan that will harm our economy!"(G.W.Bush).*

The unilateral withdrawal of the ABM treaty is another of too many examples, like the all too frequent vetoing in the Security Council, questioning of the authority of the International Court of Justice, disregarding decisions by WTO, and storing away nuclear weapons instead of destroying them.

International collaboration and solidarity are in the longer run more beneficial than short-term national profits. International agreements are indeed the most valuable treasures of mankind. Unilateral breaking of them leads to lawlessness and moral decline. The strive for power on an international platform explains much of the hypocritical arguments which are often far from being honest. International agreements are disregarded whenever one feels sufficiently strong to getting away with the loss of face. The goal justifies all means.

I am impressed by the sentences which Martha C. Nussbaum (Univ.of Chicago) published in Daedalus just a few weeks ago: *"The world is moving on, with of without US participation, to find creative solutions to pressing problems of human inequality. Usually US citizens don't know anything much about these developments, and some of our politicians encourage disdain for what is happening elsewhere. We need to learn new habits of curiosity and respect if we are to be productive members of an increasingly interdependent global community."*

Oscar Arias, the former President of Costa Rica, speaks in the same direction when he says: *"Children of the world need schools and health clinics, not F-16c and rocket launchers."*

Sometimes, one can understand the anger building up in a knowledgeable and compassionate person, such as Noam Chomsky, leading to such awful books, like *'Rogue States, The Rule of Force in World Affairs'*, awful but true, when he defines on the first page the '*Rogues' Gallery' and who qualifies, concentrating then on the major rogue state: the one he is living in*. And he said recently on the bombing: *"Again, we have a choice: we may try to understand, or refuse to do so, contributing to the likelihood that much worse lies ahead."* I do not want to comment on the American foreign policy which is full of crimes and atrocities, still today.

You can certainly guess what sort of academic responsibilities I have in mind. But I will come to it later. For the moment, I would like to continue to sketch my, perhaps distorted, view of the situation.

Dishonesty and injustice you can find almost anywhere, for example in Germany, in Turkey, or in Chile. And all too often politicians do not promote *justice* but use their grey matter for finding *justifications* for what they initiated.

It is remarkable how the social product of Switzerland increased during the past century. But it is even more remarkable how little we have left for development aid: 0.29% of the social product! All the rest, we are eating up ourselves. But we are in good company, the US spends just 0.10%. And we all know that without food children have no future. Generous support of FAO and the World Food Program would be essential.

Let us turn to economy.

Economy is governed today by free market economy. Free market economy is a simple and efficient principle for optimising the efficiency of industry and trade. No ethics, no moral, and no global responsibility are required. One just has to select a suitable optimisation criterion, which is today profits and share holder value. And then one lets the market freely run. We all became passionate stock market gamblers - having lost a lot of money. But thank God, it is going up again! The steeper the better, as long as it is going uphill! Smaller catastrophes are to be expected. I am not the only one who lost significantly with the bankruptcy of Swissair, similar to the losses others had to digest with the crash of ENRON. At least a few employees seem to have enjoyed their sex-drenched employment!

And Adam Smith is still our God Father, whose *'invisible hand'* guarantees that after all everything will turn out to be beneficial for his believers. *"By pursuing his own interests he frequently promotes that of society more effectually than when he really intends to promote it."* Let us be egoists, we will be blessed by Adam Smith!

And the constitutional system is also on our side, following James Madison, the 4th President of the USA, it will "*protect the minority of the opulent from the majority"*, ensuring that "*the country is governed by those who own it.*"

The wealth of the rich may create jobs for the poor. And the richer the rich, the more garbage to feed the poor, or the more garbage to kill the poor! Free market economy leads to a marginalization of the weakest. And indeed, we are living on the account of the disfavoured, the third world, and the future generations. Perhaps, you have

read the book *'Nickel and Dimed. On (not) getting by in America'* by Barbara Ehrenreich.

James K Galbraith has recently shown in *'A perfect crime: Inequality in the age of globalization' (Daedalus, 2002)* how inequality has increased drastically in the age of globalization, mentioning that "*the developed countries have abandoned the pretence of attempting to foster development in a world at large, preferring to substitute the rhetoric of ungoverned markets for the hard work of stabilising regulation. The prognosis is grim: a descent into apathy, despair, disease, ecological disaster, and wars of separatism and survival in many of the poorest parts of the world."*

Free market economy has much to do with Charles Darwin's '*Natural Selection*' where the fittest survives. Clearly, this principle proved to be enormously successful in the hands of nature. Otherwise, we would not be here. But nature can be very cruel. Just put yourself into the skin of a dinosaur, and you know what I am speaking about. But I doubt whether this is the appropriate principle for economics. Perhaps we will turn out to be on the side of the dinosaurs, and history will be repeating, eliminating, by their own fault, another species! The feedback loop can not be stable on a short time scale, and the corrections that concern damages of the nature will happen too late, much after all the profits have been happily spent on the account of those coming later.

'Luxury fever' is affecting many of us, as Robert H. Frank describes eloquently, a truly contagious illness! An economy which depends on sales promotion for creating desires instead fulfilling needs is not worth being supported. Economical growth, expansion, and progress can not be goals in themselves. The fulfilling of life-supporting needs, only can justify growth.

We are truly living in a world bare of idealistic concepts! Let us turn, finally to academia.

Academia: No question the major obligations of academic institutions are teaching and research. Research we like, and teaching provides a living! You know, everybody is a researcher, and "*satisfaction of one's curiosity is one of the greatest sources of happiness in life*", as Linus Pauling has discovered! Science may truly be gripping!

Innovators were not always associated with universities or academic institutions. At first, they were strictly controlled by the church. Then they found support by the more wealthy rulers, having a few scientists at their court. Later, many came from rich families and did not need external support. Only after 1600, famous scientists can be found at universities, and in the 19th and particularly 20th century also in industry. But this luxury has ended during the past decade, and industry is short-sightedly concentrating on seemingly more profitable activities. The entire research obligation is from now on completely on the shoulders of the universities, which correspondingly need appropriate support.

Quo vadis homo? - Quo vadis terra?
Who shall provide long-term guidance?

You know the answer that I will be giving. Before, I would like to mention another current tendency, the almost universal quest for Autonomy by academic institutions. It is usually claimed that only in complete freedom original, creative research can be done. Joshua Lederberg said: *"You rarely find the most important thing by deliberately looking for them,"* meaning that you never find what you are told by politicians to find.

Autonomy of universities is being sought-after in Asian countries, and particularly in Europe, such as in Austria, where autonomy is defined as follows: *"Autonomy of Universities means that they are not governed by bureaucratic regulations, but have to organise themselves in the frame of the state laws."*

Also in Switzerland, a new university article is prepared for the Swiss Constitution which includes a guarantee for autonomy. The International Association of Universities has also published a statement on Academic Freedom, University Autonomy and Social Responsibility.

It is not unexpected that the autonomy at US universities is relatively high, only being beaten by Ireland, UK, and Canada. And American scientists have the least desire for more government control! There is much concern that seeking for external funds might limit autonomy.

But Freedom and Autonomy imply to do voluntarily what has to be done. *"Liberty means responsibility. That is why most men dread it,"* George Bernhard Shaw has said.

We have to recognise that there are two worlds, the world of science and the rest, profiting from science or being squeezed more and more by the technological achievements for which it has never asked. Sometimes, I feel that the public is on a *'vol de nuit',* seeking a few bright stars which are out of reach, having no clear goal, and heading for an almost sure crash landing.

Clearly, it is up to us academics to prevent such crash landings. And indeed, in addition to research and teaching, we have a third obligation in the form of societal responsibility. It comprises
- Continuing education of professionals in industry or another job,
- Life-long learning for everybody
- Providing rational and ethical guidelines for the global future.

I see our system consisting of three worlds that form a vehicle moving forward. Society is the passengers, entertained by the politicians. Industry forms the drive wheel that pushes the vehicle with full power forward, irrespective of the direction. Finally, a steering wheel seems indispensable. The academic community is called to take its function.

Researchers should learn to operate on two levels: On the basic research level where fundamental research seeks to lift the inner most secrets of nature by digging as deep as possible into the ground, and on a societal and global level where the urgent

questions of humanity are to be addressed. *Work locally and think globally* should be our moto.

In principle, scientists have much to offer for solving societal problems. Their approach is based on unrestricted honesty, on self-critics, and as far as possible on 'objectivity'.

But are we really capable? Are we still forming an elite, capable of guiding society? To a large extent, we became extremely skilful super-technicians, who have lost the wisdom and foresight to conceive guidelines for the global development.

Frank H.T. Rhodes has characterised the situation quite well in his book *"The Creation of the Future"*: *"The sciences have become powerful, but increasingly unintelligible to nonscientists. The social sciences, entranced by microanalysis and quantification, have become increasingly irrelevant to social issues and public policy. The humanities, embracing fragmentation, otherness, and unreality, have neglected the great overarching issues of human commonalitiy."* Sometimes, I have the feeling that scientists are working in deep shafts remote from any sunshine.

What can we do? We know that *"who understands nothing but chemistry, does not understand chemistry either"* (Georg Christoph Lichtenberg), and *"for being an engineer, it is insufficient to be just an engineer"* (José Ortega y Gasset). We are asked to break barriers!

We have to break barriers

- between the scientific disciplines
- between the sciences and the humanities
- between science and the public
- between science and industry.

The universities and academic institutions should grow into agoras where the interdisciplinary dialogue is stimulated for broadening the scope of all academics so that they become, after all, 'human beings' again. For example at ETH in Zurich, an old observatory has been converted into such a lively meeting place under the name *Collegium Helveticum*. Here, very diverse faculties and disciplines meet for mutual stimulation.

What can we do?

- Appoint professors with a broad scope and a critical sense for global accountability. Of course, they need to be scientifically at the very forefront, but this is not enough!
- Stimulate the formation of interdisciplinary discussion groups (think tanks) within academic institutions.
- Organise reflection weeks at the university or at a secluded place to reflect on ethical, societal, and long-term development prospects.
- Invite 'profound thinkers' and 'field workers' to institute and university seminars.
- Discuss regularly in group seminars the general context and the relevance of the ongoing work and of the long-term goals.

- Organise pair lectures together with a lecturer from the humanities, or in the humanities with a scientist.
- Invite to your lecture courses a representative 'from the other side' for occasional comments.
- Invite a representative from 'the other side' to PhD-examinations for general questioning.
- Put into evidence regularly the societal context of the contents of your lectures.
- Summarise regularly the contents in words which everybody can understand.
- Acquire the skill to present 'popular' lectures that fascinate also non-experts.

Questions to be addressed:

- Establishing a novel, universal ethical foundation, combining science, compassion, respect and culture.
- Develop novel concepts for supernational structures for international governance.
- Rethink the concepts of free market economy, benefits and dangers, with a long-term scope.
- Work out proposals for restructuring universities for enhancing interdisciplinary interaction and for mastering the future challenges.
- Work out ways to continually inform and educate the general public.
- Work out ways to improve the fate of the disfavoured, in our countries, in the third world and tomorrow.

Frank H.T.Rhodes formulates the goals well: *"In an era of broken families, dwindling religious congregations, decaying communities, our nation needs a new model of community - knowledgeable but compassionate, critical but concerned, sceptical but affirming - that will serve the clamoring needs of our fragmented society and respond to the nobler, unuttered aspiration of our deeper selves. This emerging community will be the New University."*

We have to provide our ethical and foresightful input into a modified economical feedback system.

An example is the *Alliance for Global Sustainability* formed between Chalmers University of Technology in Göteborg, MIT, ETH Zürich, and the University of Tokyo. This alliance explores, for example, about how to cope with the global warming. An initiative coming out of this group is CLIPP, Climate Protection Partership, selling CLIPP flight tickets that include a surcharge financing ecological projects. The surcharge will be partially subsidised by sponsors.

We should also be reminded of the proposal of the *'Tobin Tax'*, suggested by James Tobin (N.P.1981), as an excise tax on cross-border currency transactions. The revenue should go to global priorities such as basic environmental and human needs. Such taxes will help to tame the currency market volatility and restore national economical sovereignty, an important measure as long as we do not have a world government.

A very negative example of academic activity is the *'Anti-Global Warming Petition'*, where academics and other citizens act as grooms for the oil industry and an

irresponsible government. Fortunately, I found among the 17000 signatories only one of my friends!

Many ways to fulfil our obligation for public teaching are conceivable: Public lectures, adult education classes, popular publications, radio, tv, internet, political activities, and personal contacts. We should remember Paul M. Kennedy: *" Global society is in a race between education and catastrophe."* Knowledge opens avenues into a brighter future for everybody.

Universities, in general, severely underestimate the importance of life-long-learning, especially in Europe. We should educate not only the very best specialists but also responsible leaders and devoted science ambassadors who can carry the knowledge into the broad society.

Let as recall that science alone can not solve global problems. We also need wisdom and compassion. We owe respect to other cultures that might not be sufficiently resistant against our ruthless economical aggressivity. Just try to imagine who needs Coca-Cola and McDonald's hamburgers for survival in Africa or in the Himalayas? Contributing to the destruction of alien cultures is as criminal as murder.

Be reminded that exemplary universities that fulfil a public function facilitate the recruitment of motivated students, who desire more than just working on a fascinating but seemingly irrelevant detail. Also public support will be enhanced.

David R. Gardner says *"We should be reminded that others before us in the Western world, from the twelfth century on, somehow managed in the face of complacency, indifference, ignorance, and despair to raise the university lamp high enough to illuminate not only the university's future but also to link to a more broadly civilised and cultured society."*

Let us become pathfinders and helpers for society. Perhaps we can help to convert the *free* market economy into a *responsible* market economy. Let us be reminded by François Rabelais (1494-1553) that *"Science sans conscience n'est que ruine de l'âme."*

CURRICULA VITAE

OPENING PLENARY SESSION

Dr. JEAN – MARIE CADIOU

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Previous activities: Civil servant in the French Ministry of Industry, working on environmental issues.Scientific Director at INRIA (France), Manager of the IBM France Scientific Centre in Paris and Responsible for for Programming Technology Research at the IBM San Jose Laboratory; Director of Information Technologies in the Commission of the European Communities and of the ESPRIT Programme at its inception in 1984; Assistant Secretary General at NATO, in charge of Scientific and Environmental Affairs.
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EUROPEAN LEVEL FORESIGHT

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Previous activities: On leave from his post as Deputy Secretary-General of the Belgian Federal Ministry of Science Policy.
Areas of Expertise: Social sciences, RTD management
Publications: *Science, technology and Change* (with D.Aerts, S. Smets and S. Gutwirth; Kluwer, 1999); *Positioning Theory: the moral context of intentional behaviour* (with R. Harré; Blackwell, 1999); *Rethinking Psychology* and *Rethinking Methods in Psychology* (with R. Harré and J. Smith; Sage, 1995).
Other: He currently chairs a STRATA High Level Expert Group of the European Commission on Science and Technology Foresight. He also chaired the Steering Committee of the OECD workshops on Rethinking the Social Sciences.
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MR. FRANÇOIS FARHI

Current Post: Vice President of CM Inno. Rapporteur of a High Level Expert Group set up by the Commission to propose ways to support the development of foresight in the 6th FP
Previous activities: Consultant for more than fifteen years. Conductor of many projects for the European Commission to develop, implement and/or assess Innovation Policies and Regional Development programs in the E.U. Responsible of the Network of RIS-Ritts regions. He has participated to the update of the french Technology Foresight project and is one of the responsible of the Foren network.
Consultant for the regions of Aachen (Germany) and Yorkshire & Humberside (UK).
Areas of expertise: Technology management, innovation policies and regional development.
Others: He has directed several projects for companies including Business Plans for technology-based start ups, and major re-engineering projects. Assistant Professor at INSTN and PARIS IX University, Member of the Scientific board of DESS "Technology and Innovation Management". Founding member of the Institute for Research and Innovation Management (IMRI), Paris IX University
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DR. LUKE GEORGHIOU

Current Post: Professor of Science & Technology Policy and Managemen. Executive Director of PREST
Areas of expertise: Evaluation of R&D and innovation policy, foresight, national and international science policy, and management of science and technology.
Previous activities: Chair of the Strategic Review of the EUREKA Initiative and during 1996 he chaired the evaluation of the European Union's Framework Biotechnology Programmes.
Publications: Georghiou L and Roessner JD, "Evaluating Technology Programs: Tools and Methods", *Research Policy* Vol.29 Nos.4-5 April 2000 657-677; Georghiou L, "Socio-economic effects of collaborative R&D - European Experiences", April 1999, *Journal of Technology Transfer* Vol 24 pp69-79 (Winner Lang Rosen Best Paper Silver Award).
Others: He is a consultant to several Ministries in the UK, to the OECD, the European Commission, several foreign governments and major companies. Member of the Finnish Public Research Funding Evaluation Committee, the Swedish KK Foundation International Advisory Committee on Evaluation of Research Doctorates and the Executive Board Save British Science Society.
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MS. KORNELIA HAUGG

Current Post: Head of the Division "Strategy and Planning; Research Co-ordination", Federal Ministry of Education and Research, Germany
Previous activities: Ministry of Education, Science, Research and Technology; Ministry for Youth, Family, Women and Health; Assistant Lecturer at the University Gießen
Areas of Expertise: Strategy and Planning; Vocational Education and Training; Higher Education; International Affairs and Co-operation
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Current Post: Assistant professor at the Centre for Studies of Science, Technology and Society, University of Twente, The Netherlands.
Previous activities: Involved in the implementation of the Dutch Research Budget 1993 and has been seconded to the Dutch Foresight Steering Committee from 1993-1996.
Areas of Expertise: Science policy studies and dynamics of technology, especially the development of institutional and national research strategies; dynamics and evaluation of (technology) foresight activities; evaluation of socio-economic relevance of research, Europeanisation of research and the role of research councils in research systems, technology policy and citizenship.
Publications: Foresight as a Tool for the Management of Knowledge Flows and Innovation: Final Report, Nik Brown, Brian Rappert, Andrew Webster, Cecilia Cabello, Luis Sanz-Menéndez, Femke Merkx, Barend van der Meulen Report for the European Commission, January 2001.
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Prof. EMMANUEL G. KOUKIOS

Current Post: Professor at the School of Chemical Engineering, Section Synthesis & Development of Industrial Processing, National Technical University of Athens.
Areas of expertise: Simulation and modelling of European agro-industrial production systems making possible the assessment of their potential for non-food uses; Development of "intelligent" characterisation methods; R&D on appropriate pretreatment processes to upgrade agricultural biomass; Optimisation of biofuel (bioethanol, biohydrogen) production systems; and
Evaluation of socio-economic aspects of technological change.
Publications: Diamantidis, N.D., and Koukios, E.G., "Agricultural crops and residues as feedstocks for nonfood products in Western Europe," *Industrial Crops and Products*, 11, 97-106 (2000).
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MS. HELENA ACHESON

Current Post: Head of Department, International RTD Programmes, Science,Technology & Innovation Division, FORFÁS, Ireland.
Previous activities: Manager, Technology Transfer Programme (East Region), Enterprise Ireland; Project Manager, SERTEC Programme, Office of Science and Technology (Department of Enterprise, Trade & Employment); Technical Manager, Food, Drink & Tobacco Federation, Irish Business and Employers Confederation (IBEC).
Areas of expertise: STI Policy
Others: Irish Delegate, EU CREST Committee; National Co-ordinator,Technology Foresight Ireland (1999); Irish member of EU Commission HLG for *Developing Foresight to strengthen the strategic basis of the European Research Area*
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FORESIGHT AND MULTI-LEVEL GOVERNANCE

DR. ARTURO GARCÍA ARROYO

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Previous activities: Under director general of Co-ordination and Promotion of Research and Information, Direction General of Science Policy, Ministry of Education. Researcher at the Consejo Superior de Investigaciones Científicas (CSIC), Researcher at various Institutes in Rome, Naples, Padua, University of Cincinnati and the Building Research Station Techion of Haifa.
Areas of Expertise: Industrial and Material Technology, Technologial Research, Competitive and sustainable development, heat transmision, Science Policy.
Publications: La formación de investigadores. Hechos y omisiones. Mundo Científico n° 43, vol. 5. 1984. Building a science and technology system. Priorities in Spain's R+D". International Journal of Technology Management n° 3 and 4, vol. 1. 1986.
Others: PhD in Physic Science, Universidad Complutense. Advisor to the UE, Member of the European Academy of Sicences and Arts, awarded "The Best International Paper Award" de la American Society of Heating, Refrigerating and Air Conditioning de Atlanta, 1977.
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Prof. ORTWIN RENN

Current Post: Chair of the Board of Directors at the Centre of Technology Assessment in Baden-Württemberg. Since 1993, he directs one of the Technology, Society and Environmental Economics Department. He also serves as full professor at the University of Stuttgart and chairs the department of Environmental Sociology.
Previous activities: Director of Clark University‘s Center for Technology, Environment, and Development (CENTED). Prior to joining Clark, he directed a research unit for technology assessment at the National Research Center KFA at Jülich (Germany).
Areas of expertise: Risk perception, risk management, citizen participation in risk management, risk analysis and risk communication, conflict resolution, technology assessment, energy planning, environmental economics and sociology, regional concepts of sustainable development, attitudes towards technology, and social movements.
Others: Chair of the German Government's Risk Commission; Former member of the Prime Minister's Future Commission in the State of Baden-Württemberg. Co-editor of the Journal GAIA and of the Kluwer book series on technology and risk. Ordinary member of the European Academy of Sciences in Vienna (Austria).
Publications: Author/co-author and editor/co-editor of more than 30 books and more than 250 articles in journals or chapters in books.
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Dr. MATTHIAS K. WEBER

Current Post: Head of Department Technology Policy at Seibersdorf Research, which is part of Austrian Research Centers ARC in Vienna.
Previous activities: Researcher at the European Commission's JRC-IPTS. Among others, he was a core member of the IPTS Futures project.
Areas of expertise: Prospective studies and policy advice at national and European level focusing on a variety of aspects relevant to the management of innovation systems and processes: the role of intangible assets in the knowledge-based society, science-industry relations and technology transfer strategies, sustainability and research policy, mobility and transport innovations, and the impact of ICT on production systems, working patterns and space.
Publications: *Experimenting with Sustainable Transport Technologies. A workbook for Strategic Niche Management*, University of Twente/IPTS: Enschede/Sevilla (1999); *Innovation Diffusion and Political Control of Energy Technologies*, Springer/Physica: Heidelberg (1999)
Others: Member of the Scientific Advisory Board of the German Research Initiative on Sustainability and Innovation; lecturer at the University of Stuttgart and the University of Economics in Vienna
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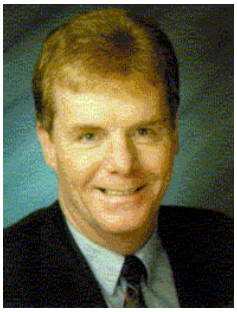
Mr. GORDON OLLIVERE



Current Post: Managing director of RTC North and president of TII, a European network of over 300 organisations involved in research, innovation and technology commercialisation.
Previous activities: Over the past ten years he has developed RTC North into its present position in four key areas – manufacturing, business growth, R&D exploitation and cultural innovation. Gordon Ollivere has a strong personal interest in futures thinking and, since 1996, has taken a leading role in building a comprehensive and practical Foresight programme for North East England.
Areas of expertise: Technology transfer infrastructure - advising on national and regional strategy, International best practice – projects in USA, EU, Indonesia, Iceland, Hungary, Science and society – design of programmes for industry, education and policy bodies
Publications: European Directory of Regional Technology Advisory Centres: SPRINT (1996); Approaches to Technology Scan: Asean Secretariat (1998); UNESCO-UNISPAR Toolkit on Technology Advistory Centres (1999)
Others: Co-Chair (European) of the USA-EU Transatlantic Technology Forum
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Prof. LUIS VALADARES TAVARES

Current Post: Professor of Operational Research at IST, Area: Management Sciences and Systems, Technical University of Lisbon.
Previous activities: General Director of Planning of Education in Portugal, President of the Education Committee (OECD), Head of the Portuguese Project of Technology Foresight - ET 2000 (99-01).
Areas of expertise: Models to support processes of communication, decision making and negotiation, E-Business, project management and evaluation, planning, design and assessment of social systems (namely educational systems).
Publications: Author of 8 books and more than 100 papers on Public Decision, Project Management and Foresight. Editor of the European Journal of Operational Research and of The International Transactions of Operational Research.
Others: Founder and first President of the Portuguese Observatory for Prospective Engineering (OPET), Advisor on Foresight, Science and Technology for several international institutions.
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DR. LUIS SANZ-MENÉNDEZ

Current Post: Deputy Director General for Research Planning and Monitoring at the Spanish Ministry of Science and Technology in Madrid since 2001.
Previous activities: On leave from his post as Senior Research Fellow at the Spanish CSIC- Consejo Superior de Investigaciones Científicas, in the Research Unit on Comparative Politics and Policy.
Areas of Expertise: Organizational aspects of research systems and the constraints that political and administrative capabilities impose on policy strategies. Comparative studies on S&T policies at European and Spanish levels, with especial attention to the role of Evaluation and Foresight, S&T indicators and new ways of measurement and representation.
Publications: "Understanding Technology Foresight: the relevance of its S&T policy context", (with C. Cabello & C. E. Garcia) in *International Journal of Technology Management*, vol 21, nº 7/8, 2001, pp. 661-679. ; "Interdisciplinarity as a multidimensional concept: its measure in three different research areas", (with M. Bordons & M. A. Zulueta) in *Research Evaluation*, vol. 10, nº 1, april, 2001, pp. 39-50. Other publications can be found at: http://www.iesam.csic.es
Others: Involved in numerous international panels in the European Union, the OECD, UNESCO, NSF, etc. Involved in S&T policy evaluations such us the COST framework or the UNESCO networks in Latin America.
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PROF. JOYCE TAIT

Current Post: Director, SUPRA Scottish Universities Policy Research and Advice Network, University of Edinburgh.
Previous activities: Chair in Strathclyde Graduate Business School in 1991 and then spent four years as Deputy Director of Research and Advisory Services in Scottish Natural Heritage (SNH).
Areas of expertise: Risk assessment and regulation; policy analysis; technology management in the agrochemical and biotechnology industries; sustainable development; public attitudes and communication; strategic and operational decision making in companies and public bodies; land use and crop protection.
Publications: Tait, J. and Bruce, A. Global Change and Transboundary Risks. (Commissioned by Society for Risk Analysis for the International Symposium on Risk and Governance, Warrenton, VA, USA, June 2000.) To be published by Cambridge University Press (abailable on www.supra.ed.ac.uk).
Others: UK Government Sustainable Development Research Network Advisory Group; EC High Level Expert Group on Mobilising Regional Foresight Potential; UK European Commission Fifth Framework Programme External Advisory Group for Key Action 5.
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INTERNATIONAL LEVEL FORESIGHT

Mr. JESÚS RODRIGUEZ CORTEZO

Current Post: Director General of the Foundation Observatorio de Prospectiva Tecnológica Industrial (OPTI)
Previous activities: Director General of Industrial Technology and of New Technologies, Ministry of Industry. Executive Chairman of technological companies ERIA and ISEL. Vice-director for Informatics of the National Institute for Industry. Professor at the Universidad Politécnica de Madrid, Universidad Internacional Menéndez y Pelayo and Escuela de Organización Industrial (EOI).
Areas of expertise: Information Technologies, Technological Policy, Business Administration.
Publications: *Tecnología e Industria: Realidades alcanzables,* y *La Sociedad de la Información. Introducción a la convergencia tecnológica y empresarial.*
Others: Advisor to UNO for prospective programs in South America, private advisor and Academic Director of the Escuela de Organización Industrial (EOI).
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Prof. RON JOHNSTON

Current Post: Executive Director of the Australian Centre for Innovation and International Competitiveness (ACIIC).
Previous activities: He worked as a professional chemist in industry and universities in the USA and UK before turning to science and technology policy. Through his career, he has been employed by, or carried out major contracts for a wide range of private sector and public organisations.
Areas of expertise: Technology foresight and strategy, innovation, priority-setting, research-evaluation, research management, technology assessment, science and technology indicators, intellectual property management, technology transfer, impacts of technological change on employment, technology and regional development, economics of innovation, the knowledge economy, and electronic commerce.
Publications: More than 200 books, articles and reports.
Others: Fellowship of the Australian Academy of Technological Sciences and Engineering, former Deputy Chair of the Australian Science and Technolgy Council, Member of Australian Manufacturing Council, Advisory Board Member, APEC Center for Technology Foresight.
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MR. DANIEL MALKIN

Current Post: Head of the Science and Technology Policy Division of the OECD Directorate for Science, Technology and Industry (DSTI) since 1999. He was previously heading the Industry and the Economic Analysis Divisions in the same Directorate.
Previous Activities: Prior to his joining the OECD, Mr. Malkin held several posts in the French Administration, the last one as Head of the Industry and Technology Department of the Planning Commission. He developed prospective studies in the Industry Ministry and the Regional Planning Commission (DATAR).
Areas of Expertise: Assessment of OECD Member countries' S&T and innovation policies and public support to R&D. Contribution of science and technology to productivity and economic growth. Performance and governance of Science and Innovation systems. Public/private relationships in R&D and innovation.
Publications: Russia: Declining S&T in Need of Reform, in Economic Trends, Helsinki, 2001
Others: Daniel Malkin graduated from the "École Polytechnique" in Paris. He completed his post-graduate studies at the University of California (Berkeley) and at the University of Pennsylvania (Wharton School). Member of the editorial board of the review "Futuribles".
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MR. GUSTAVO AISHEMBERG

Current Post: Director Latin America and the Caribean Bureau, Programme Coordination and Field Operations Division, UNIDO, since 1995.
Previous activities: General Manager, Laboratorio Tecnologico del Uruguay (LATU). Industrial Engineer, Agro-Industry Food Branch, LATU.
Areas of Expertise: Development of Technology Foresight Programming in Latin America.
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Dr. TAMAS BALOGH

Current Post: Senior Head of R&D Strategy Department, Ministry of Education, Hungary.
Previous activities: Associate Professor at Budapest Technical University, researcher at Stuttgart University, at the University of Illinois at Urbana/Champaign and at the Hungarian Institute for Building Research.
Areas of Expertise: Science and technology policy, design and evaluation of R&D programmes, technology foresight, innovation related regional and structural policies, business R&D incentives, R&D statistics and indicators.
Publications: 50 papers (articles and book chapters), 25 papers in conference proceedings.
Others: OECD Committee on Science and Technology Policy, CREST Evaluation Subcommittee, EU Benchmarking and Mapping of Excellence group, DG Research Evaluation Network, Programme Committee member in EU 5th Framework Programme, IHP Programme.
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Dr. JAMES P. GAVIGAN

Current Post: James has worked at the IPTS, Seville since 1995. He presently co-ordinates several Foresight-related activities of the IPTS *Futures* project.
Previous activities: He worked in the Research Directorate General of the European Commission on SME research policy actions (1992-95), and was in charge of electromagnetic materials research (1990-92). Before that (1985-90) he worked as a research physicist in France, Ireland, Italy and the UK.
Areas of expertise: Technology foresight. Prospective methodologies. Policy impact analysis of S&Ts. Participative studies / network-based research.
Publications: *A Practical Guide to Regional Foresight* – FOREN Network Dec. 2001. *A Trans-national Analysis of the Results and Implications of Industrially-oriented Technology Foresight* - IPTS Technical Report Dec. 2001. *Strategic Policy Intelligence: Current Trends, the State of Play and Perspectives* - IPTS Technical Report Dec. 2001. *Future-proofing and Validating Development Strategies* IPTS Report Nov. 2001. *Challenges and Priorities for European Research* Foresight Journal 3/04 Aug. 2001.
Other: He holds both a BA and a PhD in Physics from Trinity College Dublin, Ireland.
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DR. JENNIFER CASSINGENA HARPER

Current Post: Head of the Policy Development Unit within the Malta Council for Science and Technology where she is responsible for two major Cabinet-approved projects, the National Research and Development Audit and the Technology Foresight Exercise. She is the Malta partner of the EU IHP STRATA project eFORESEE (Exchange of Foresight Relevant Experiences among Small Enlargement Countries) and a member of the EU High Level Group on Regional Foresight.
Previous activities: Responsible for the National Screening of the EU's Science and Research legislation and formed part of the Maltese delegation to Brussels for related bilateral screening talks.
Areas of expertise:
Publications: The Internationalisation of Science and Technology Policy: Malta Case Study (1988-1996), paper to be published in "The Innovation Paradigm: Economic ideas in the re-framing of research and technology policy." (UK) (forthcoming)
Others: Member, Maltese National Commission for UNESCO. Deputy Chairperson of the National Contact Point Organisation for the EU's Fifth Framework Programme.
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THEMATIC FORESIGHT

Dr. LENA M. TORELL

Current Post: President of the Royal Swedish Academy of Engineering Sciences
Previous activities: Professor in Solid State Physics at the University of Uppsala, Professor in Materials Physics at Chalmers University of Technology (CTH), Vice President at CTH, Director of Programmes, Joint Research Centre of the European Commission.
Others: Albert Wallin's prize (for achievements in Solid State Physics) Member of the Board of European Council of Applied Sciences and Engineering, Euro-CASE, Member of the Board of Institute for Research and Competence Holding AB, IRECO, Member of the Board of Foundation for Strategic Environmental Research, MISTRA, Member of the Board of Telefonaktiebolaget L M Ericsson.
Publications: More than 120 papers in international scientific journals of high repute.
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PROF. RÉMI BARRÉ

Current Post: Rémi Barré is Associate Professor at CNAM (Paris), in charge of the program 'prospective and evaluation of research and technology' and Project director at Futuribles (Paris).
Previous activities: Director of the Observatoire des Sciences et des Techniques (OST). Coordinator of the ESTO study on 'Monitoring Foresights in Europe' (2000 – 2001) and coordinator of the ESTO study on 'Industrially Oriented Foresights Comparison' (2001-2002).
Areas of expertise: Political and economic analysis, public economy, technology analysis and strategic management, scientometrics.
Publications: Science & Technology indicators Report 2002 (co-Editor, with Laurence Esterle), Economica, Paris, 2002
Others: Chairman of the 'prospective club' of the ECRIN Industry – Research Linkages Association, in France (since 2001). Member of the High Level Group on the Development of Foresight for the ERA (2001-2002), of the Expert Group on Benchmarking research productivity (2001-2002).
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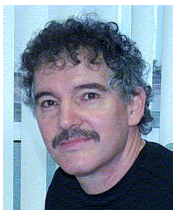
Prof. ANDREW WEBSTER



Current Post: Professor of Sociology, University of York, UK. He is Director of the Science & Technology Studies Unit (SATSU), and Director of a national UK research programme on Innovative Health Technologies, currently involving 31 projects.
Previous activities: He has conducted studies for the UK ESRC, the European Commission, European Parliament, various reserch Charities and private consultancies.
Areas of expertise: Sociology of science and technology, science policy studies, foresight and innovation studies, health technologies and policy especially in relation to genetics and health informatics, intellectual property and the commercialisation of research.
Publications: A Sociology of New Medical Technology (Cambridge, Polity Press) forthcoming 2002,, Contested Futures: A sociology of prospective techno-science (Ashgate: Aldershot) co-editor, 2000 and Valuing Technology: Organisations, Culture and Change, (London: Routledge) 1999 (co-author).
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Mr. MICHAEL DARMER

Current Post: Since 2001, Head of Division in the newly formed Danish Ministry of Science, Technology and Innovation, responsible for the Danish Technology Foresight Programme.
Previous activities: Head of Division in the Danish Agency for Trade and Industry, Industry and Trade Counsellor at the Danish Permanent Representation to the European Union in Brussels and Counsellor in the Ministry of Industry.
Areas of Expertise: Analysis of the use of ICT in industry and various instruments/schemes for promoting co-operation between universities and industry
Publications: *Industry and the European Union. Analysing Policies for Business* by Darmer, Michael and Kuyper, Laurens (eds), published by Edward Elgar Publishing, Cheltenham, UK – Northampton, MA, USA.
Others: Lecturer at Copenhagen Business School.
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Dr. TERTTU LUUKKONEN

Current Post: Head of Unit at the Research Institute of the Finnish Economy.
Previous activities: Director of VTT Group for Technology Studies. Member of the European thematic network, ASTPP, which dealt with advanced strategic intelligence tools for technology policy, among others, technology foresight, and has contributed to evaluation and benchmarking exercises at the European level.
Areas of expertise: Technology and innovation policy and its influence on technical change, quantitative performance measures in science and technology, and strategic decision-making tools for technology policy.
Selected publications: Research Policy 31,3, 2002, 437-455; Science and Public Policy, 28, 3, 2001, 205-218; Innovative Networks: Co-operation in National Innovation Systems, OECD Proceedings, OECD, Paris, 2001, 193-208; Research Policy, 29, 6, 2000, 711-724; Scientometrics 28 (1993) No. 1, 15-36; Science, Technology & Human Values 17 (1992) 1, 101-126.
Others: She has also been involved in the evaluation of major technology programmes in ICT in Finland and is currently carrying out research in biotechnology.
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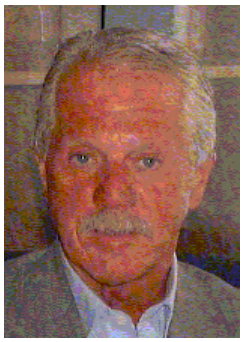
PROF. CLAUDIO ROVEDA



Current Post: Professor of Industrial Economics and Business Administration at the Politecnico di Milano, he is President of "Politecnico Innovazione", the Centre for technology transfer of this university.
Previous activities: Hise whole academic career has been developed at the Politecnico di Milano
Areas of expertise: S&T policy; Foresight; Economic impact of S&T; Technological innovation and local development.
Publications: More than 100 publications in scientific journals, books, conference proceedings.
Others: Founding member of Rosselli Foundation, he is member of its Executive Committee and Director of its CeS&T, Centre for Science and Technology Policy. In July 2001 he has been appointed member of the Technical Secretariat for Planning of the Ministry of Education, University and Research. He holds positions in many scientific institutions and knowledge based firms.
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Dr. V.C.M. TIMMERHUIS

Current Post: Since 1998 she works for the AWT, the Dutch Advisory Council for Science and Technology Policy. In 2001 she became secretary general of the Council and director of the AWT-secretariat.
Previous activities: She worked for 9 years at IVA, a research institute at Tilburg University, The Netherlands.
Areas of expertise: Management and organisation of professional organisations, specifically universities and research institutes, innovation policy, knowledge transfer and knowledge management.
Publications:
Others: Dr. Timmerhuis studied history and sociology at the Erasmus University in Rotterdam, the Netherlands. In 1997 she got a Phd-degree in social sciences (thesis: *Science organisations in flux: choices in organisational devevolopment en Human Resource Management*).
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GENERAL CONCLUSIONS OF THE PARALLEL SESSIONS

PROF. MANUEL DE HERMENEGILDO

Current Post: General Director for Research at the Spanish Ministry of Science and Technology. Full Professor of Computer Science at the Technical University of Madrid.
Previous activities: Coordinator or principal investigator of several collaborative basic and applied research projects and networks of excellence funded by the E.U., U.S., and Spanish funding agencies and industry. Leader of the Computational Logic, Implementation, and Parallelism group at the Technical University of Madrid. Previously he was project leader at the. Microelectronics and Computer Technology Corporation (MCC) research center and Adjunct Professor at the CS Department of the University of Texas at Austin, in the US.
Areas of Expertise: Science and technology policy, computer languages, advanced compilation techniques, abstract interpretation, parallelizing compilers, logic programming, constraint programming, high-performance and distributed computing, program execution visualization, automatic documentation, and parallel computer architecture
Publications: Over 100 refereed publications, in addition to books and reports.
Others: Area editor of ACM Transactions on Programming Languages and Systems and Theory and Practice of Logic Programming and editorial advisor of the Journal of New Generation Computing. Elected Member of the Executive Council of the European Association for Programming Languages and Systems and the International Association for Logic Programming.
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MS. HELENA ACHESON
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DR. VERONIQUE TIMMERHUIS
PROF. JOYCE TAIT

DEBATE: PRIORITIES FOR THE FUTURE

DR. JEAN-MARIE CADIOU

DR. ERKKI ORMALA

Current Post: Since 1999 he is Director of Technology Policy at Nokia Group. His responsibilities cover technology policy, knowledge management, University co-operation, future watch and issues relating to information society.
Previous activities: He worked as a research engineer at the Technical Research Centre of Finland 1974-1987. In 1967 he was a visiting scholar at Stanford University in the USA and in 1982 at the International Institute of Applied Systems Analysis in Austria. From 1987 to 1999 he was the Secretary of the Science and Technology Policy Council of Finland.
Areas of expertise: Technology policy, knowledge management, University co-operation, future watch and issues relating to information society.
Publications: Dr. Ormala has published over forty papers on evaluation and innovation policies. **Others:** He has been a consultant to a number of industrial companies, international organisations and European governments. Since 1994 he has been a member of the evaluation and monitoring panels of the EU RT&D programmes.
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Dr. PARASKEVAS CARACOSTAS

Current post: Head of the Unit "Science and Technology Foresight" in DG Research, European Commission, in Brussels.
Previous activities: Financial analyst and independent consultant before joining the European Commission in 1984 where he has hold various positions mainly in the field of Research policy.
Areas of expertise: Economics of research and high tech industries, and science and technology policy.
Publications: "Society, the endless frontier", 1997; "Research and Innovation Policies in the New Global Economy", Ed. by Larédo & Mustar, 2001; and "Où va l'économie mondiale ? Scénarios et mesures d'urgence", Ed. by Chevalier & Pastré, 2002.
Others: PhD in International Economics
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PROF. JERZY M. LANGER

Current Post: Professor at the Institute of Physics, Polish Academy of Sciences, since 1978, and since 1999, Adviser to the President of Polish Academy of Science.
Previous activities: Post-doctorate at Stanford University. Visiting professor at Linz University –Austria, and UMIST – Manchester, UK.
Areas of Expertise: Science and science policy
Publications: . Author of about 130 original research papers.
Others: Recipient of Maria Skłodowska-Curie prize – the highest Polish award in physics and chemistry Founding member and Vice-President of EUROSCIENCE. Fellow of American Physical Society for his contributions to physics of defects and recombination phenomena in semiconductors.
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Mr. JOHN TRAVERS

Current Post: Chief Executive of Forfás – the policy and advisory Board for industrial development and science and technology in Ireland.
Previous activities: Chief Executive of Science Foundation Ireland; Chief Economic Advisor in the Government Ministry of Enterprise, Trade & Employment and in senior management posts in the Office of the Taoiseach (Prime Minister), in the Ministry of Finance and in the Industrial Development Authority (IDA). Consultant on United Nations and World Bank projects in the industrial development field. Chairman of the joint public/private sector Consultative Committee for the Government EMU Business Awareness Campaign and of the Management Committee for the Campaign
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PROF. DR. RICHARD ERNST

Nobel Prize in Chemistry in 1991, Dr. Richard Ernst is retired Professor of Physical Chemistry at ETH-Zurich (Switzerland) since 1998 where he taught from 1970.

Areas of expertise: Spectroscopy, Magnetic Resonance, Solid State NMR Methods, Solid State Magnetic Resonance, Biomolecular NMR, Zero Field Resonance, Development of Fourier NMR Tomography for Medical Applications.

Honours: 1962 Silver Medal of ETH-Z for PhD Thesis, 1983 Gold Medal, Society of Magnetic Resonance in Medicine, San Francisco, California, 1986 Benoist Prize (awarded by the President of Switzerland), 1989 John Gamble Kirkwood Medal by Yale University and the New Haven Section of the American Chemical Society, 1991 Nobel Prize in Chemistry, The Royal Swedish Academy of Sciences, Stockholm, 2000 Tadeus Reichstein Medal.

Memberships: American Physical Society, Academia Europea, Schweizerische Chemische Gesellschaft, National Academy of Sciences, Allahabad (India) Foreign Member of the National Academy of Science of the USA, Foreign Member of the Royal Society, London, Foreign Member of the Korean Academy of Science and Technology, Honorary Fellow of the Singapore National Institute of Chemistry, Foreign Member of the Russian Academy of Sciences.

Editorial Board: Journal of Magnetic Resonance, Magnetic Resonance Imaging, Molecular Physics, Magnetic Resonance in Medicine, Chimia, Chemical Physics Letters, Applied Magnetic Resonance, Journal of Biomolecular NMR, Solid State Magnetic Resonance.

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