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Industrial Promotion and Technology Branch
TECHNOLOGY PAPER SERIES 3/05

Instruments for Strategy and Policy:

Modelling the Structure of the Policy-making on Science and Technology

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

INDUSTRIAL PROMOTION AND TECHNOLOGY BRANCH

Instruments for Strategy and Policy: Modelling the Structure of the Policy-making on Science and Technology

TECHNOLOGY PAPER SERIES
TPS 3/05

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Industrial Promotion and Technology Branch

Technology Paper Series

TPS No. 3/05

August 2005

UNIDO's Contribution to Technological Development: Instruments for Strategy and Policy: Modelling the Structure of the Polilcy-Making on Science and Technology

Ricardo Seidl da Fonseca & Ozcan Saritas

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Contributions of articles are invited for the IPT Technology Paper Series (TPS). Articles should be of contemporary economic interest, with special reference to investment and its industrial dynamics in relation to economic development within the UNIDO field of competence. Each article should be between 8,000 and 15, 000 words in length. The presentation should be readable and scholarly. Tables, citations, footnotes, and quotations should be at the minimum essential for the analysis for or description intended. A brief abstract of maximum 500 words must accompany each article. It should be noted that contributions to the TPS are reviewed. Manuscripts should be submitted in typescript, 12-pitch, Garamond font, 1 inch margins all round, 1.5-spaced, along with electronic submission (Microsoft Word). References should be 1.5-spaced and placed in alphabetical order, and should follow the format indicated: Author name(s), initial, date, title, journal (or source of publication), Vol., No., p. (pp.). For example Buckley P. J., Hashai N., 2004, A Global System View of Firm Boundaries, Journal of International Business Studies, Vol. 35, No. 1, pp. 33-45.; and for a book: Author name(s), initial, date, title, publisher: place, page(s) (if quoting). For example Dunning J. H., 1993, Multinational Enterprise and The Global Economy, Wokingham: Addison Wesley. Manuscripts should be submitted to:

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Introduction to the UNIDO Industrial Promotion and Technology Branch

Technology Paper Series

The UNIDO Industrial Promotion and Technology Branch (IPT) Technology Paper Series (TPS) provides a means for: stimulating policy thinking; improving policy orientation among policy makers; assisting in the management of science and technology policy craft in industrialisation; and disseminating current thinking on technology, and its industrial dynamics, in broad relation to the economic development within UNIDO's field of competence. Attention is paid to developing countries (DCs) and transition economies (TEs). The predominant orientation of TPS is Science and Technology (S&T) policy, policy management, co-ordination dynamics of knowledge-based and public-private partnerships in relation to technology in industrialisation.

The effective, and efficient, management of the policy and structural dimensions of technology, broadly encapsulating trends in innovation, R & D and science is increasingly viewed as crucial to economic development. The systemic aspects of national technology management in terms of incentives, institutional generation of knowledge and flows of technology (and investment) present policy challenges to DCs and TEs.

Strategic decisions at government level concerning the articulation of policy instruments, and co-ordination of supporting institutions with respect to economy-wide technological enterprise are vital to creating competitiveness, sustaining total factor productivity growth, and cohering the national system of innovation. Furthermore, the social capital – public sector as well as private sector – dimensions of the S&T intellectual infrastructure of DCs and TEs present opportunities for science and technology to be harnessed more productivity for socio-economic advance.

The Reviewers of TPS welcome papers and work in progress on technological development in DCs and TEs within UNIDO's field of competence. The expectation is that submissions focus on technology policy – craft, analysis, formulation, implementation – in relation to economic development manifest as higher levels of technology intensity in manufacturing industry. TPS will be published electronically on the UNIDO website as well as in hard copy form.

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1. BACKGROUND

UNIDO implements a global initiative on Technology Foresight to enable governments, the research community, enterprises and society to define common future visions and strategies leading to innovations for sustainable industrial growth. UNIDO also assists member countries applying Technology Roadmapping to support strategic decision-making with findings and recommendations to strengthen the national innovation system and enhance the competitiveness of selected productive sectors.

Technology foresight is a relatively new mechanism for strategic decision-making. Its wide application in certain countries dates back to the beginning of the 1990s. It is also highly regarded as a tool for anticipating future market demand and designing development strategies for corporations.

Meanwhile, technology foresight is being increasingly recognized world-wide as a powerful instrument for establishing common views on future development strategies among policy-making bodies, bridging the present with the future. One of its unique features is the participation of a large number of stakeholders, namely, government, science, industry and civil society. The application of technology foresight processes at the national and regional levels have become crucially important for developing countries and countries with economy in transition to narrowing their competitive gap in the global economy.

Technology Roadmapping method is widely used at industry level to support and justify technology strategy and planning. The method can be used both at industry and company level as well as at national sector-level. Technology roadmaps can take many forms, but generally comprise multi-layered time-base charts or tables, together with supporting text, that enable technology decisions and developments consistent with market trends and drivers.

The present paper will concentrate on the incorporation of Technology Foresight in the national policy-making process for science and technology development, modelling an instrument for strategy and policy.

2. INTRODUCTION

This paper attempts to model the structure of the policy making for Science and Technology (S&T) at the national level. The aim is to understand the conventional structure of the decision-making processes and the actors involved at the national policy level and to propose a dynamic and broad mobilization based model.

Firstly are presented the basic structures of decision making processes in this area. A generic model shows the policy framework and the flow of actions during the S&T policy making process. This basic model explains a conventional, linear and top-down policy making process, existent in many countries. Understanding the structure of the conventional policy framework allows making judgements on its effectiveness.

The discussion on the conventional policy structure will be followed by the presentation of the Foresight methodology. As a forward looking tool, Technology Foresight has been employed as a participatory process to address the medium-to-long-term future with the aim of building visions, creating consensus, informing present day decisions and mobilising concerted actions.

As done with the structure of the basic policy framework, it will present the structure of the Foresight method and the actors involved in a foresight process. A model will be developed to show the foresight framework and the flow of actions in foresight process.

Taking participation and active involvement of stakeholders with a widespread dialogue environment as a base, and placing particular emphasis on the dissemination and networking, the Technology Foresight method has introduced various highly desirable strengths to the policy making processes.

The nature of Science and Technology policy-making practice in many advanced and some developing countries has changed in recent years with the inclusion of Foresight activities. Previous decision-making models followed a linear path, whereas the addition of Foresight brought more participative processes.

The contribution of Technology Foresight to policy-making towards more participative processes, represents a more dynamic, systemic and both top-down and bottom-up processes. In order to

understand this new dynamic process the paper re-models the decision making process with the inclusion of foresight.

Modelling the dynamic policy making and implementation process with Foresight can help to improve the instruments for strategy and policy through strengthening functions, tasks and actors involved in this new policy making process.

Finally, the paper will use all the above-mentioned models with a country case. The selected country case of Turkey will demonstrate how the S&T policies were made conventionally and how the processes changed after the inclusion of foresight in decision-making processes.

3. THE STRUCTURE OF POLICY-MAKING

Policy making process for Science and Technology has followed a linear process. This linear structure of conventional policy making framework represents a top-down structure. The structure of the policy-making can be represented with a singular model as shown in the Figure.1.

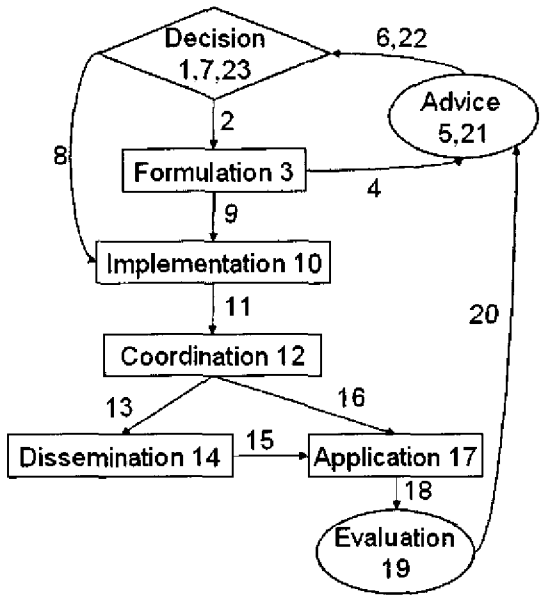

Figure.1: Policy framework and the flow of actions

The actions from 1 to 23 explain the policy making cycle. These actions and the tools for communications are as follows:

1. Identification of needs and priorities (political views and preferences)
2. Requesting policies to be formulated (meetings)
3. Formulation of policies (meetings, draft policy documents)
4. Reports on policy outcomes (final policy documents)
5. Extraction of advises (meetings)
6. Suggesting advices to decision makers (list of advises)
7. Evaluation of advises (meetings)
8. Decision on implementation (meetings, list of policies to be implemented)
9. Formulation of implementation (detailed implementation documents)
10. Development of implementation strategies (strategy and action documents)
11. Decisions on structures required (planning documents)
12. Establishment of organisational structures (coordination documents)
13. Production of dissemination materials (printed and visual media etc.)
14. Announcement of policies to wider stakeholders and society (via printed and visual media etc.)
15. Informing stakeholders on policies (meetings, seminars, workshops)
16. Informing stakeholders on policy implementation (meetings, seminars, workshops)
17. Application of policies (actions)
18. Monitoring of applications (meetings, data analysis)
19. Evaluation of the applications (draft evaluation documents)
20. Presentation of evaluation results (final evaluation documents)
21. Analyses of evaluation documents (meetings)
22. Advise on the policies implemented (advisory documents)
23. Revision of policies (meetings)

4. WHAT IS MISSING IN CONVENTIONAL POLICY-MAKING PROCESSES?

Figure.1 presents a linear and top-down decision making process, where the decisions are taken at the top only with the involvement of relevant governmental bodies. This structure draws on the studies that have been prepared by a small group, sometimes including selected external experts, working for a particular agenda. It is rare for these studies to involve wide participation – they may have drawn on

many knowledge inputs, but the critical work is usually carried out by a small number of people with their own views and methods.

It is inadequate to consider S&T policy issues without taking account of a broad range of other economic and social dimensions. In some cases these dimensions have been mainly identified with factors influencing invention, innovation and diffusion of new technologies, such as entrepreneurship, financial institutions and incentives, scope for formation and growth of small firms, skill needs and educational systems, awareness of market and social demands for innovations, public acceptability of particular lines of advance. Often, these have been framed in terms of barriers and obstacles to technological development, or needs for collaboration or public support. Less often there is recognition of the importance of social conditions more generally as providing the context for the development and use of S&T, and the social implications of such patterns of evolution. [EFL, 2003][1]

Consequently, conventional policy making efforts cannot go beyond simple extrapolative prediction with a narrow pool of expertise and limited networking and dissemination. The outcomes of this type of activities are usually published reports, for example "white papers" or S&T plans. As a result, there is a limited ownership form the wider stakeholders and public. The decisions taken mostly have normative or even coercive characteristic for the stakeholders and public.

5. TECHNOLOGY FORESIGHT METHODS

Efforts to improve decision-making and public debate by thinking about longer-term future and the longer-term implications of short-term decisions have become more crucial in recent years. With this regard the term Technology Foresight has been used increasingly since the late 1980s. This term refers to approaches to informing decision-making, by improving inputs concerning the longer-term future and by drawing on wider social networks than has been the case in much "futures studies" or long-range planning.

During the policy-making processes, Foresight introduces a number of benefits. Visions created during the Foresight exercise provide direction for the decisions of many people and guide their actions. In this content, EFL (2003) enumerate some of the major benefits of Foresight as:

[1] EFL (2003). Handbook of Knowledge Society Foresight, European Foundation for the Improvement of Living and Working Conditions, Dublin.

- To bring together key agents of change and sources of knowledge. This is liable to mean a wide variety of stakeholders - often going well beyond the narrow sets of experts employed in many traditional futures studies and planning exercises.
- These agents are brought together so as to develop strategic visions and what is named anticipatory intelligence. Structured approaches are employed to focus on long-term social, economic and technological developments and the challenges they pose. To realize these visions, feasible and desirable options are explored. The applied methods and analyses are interactive and participative.
- Results of this process can help policy-making and priority setting, relating these strategic visions to present-day decisions. The formal results may include such outputs as scenarios, action plans, priority lists. Although guiding strategic visions are fundamental, the Foresight process – especially in its networking of people – should have helped establishing a shared sense of commitment to these visions. In other words, there will be not only understanding of the issues, but "ownership" of the analysis as to what is feasible and desirable to be implemented.
- Another type of output is more informal, but can equally be part of the explicit objectives of Foresight. It involves the establishment of networks among agents concerned. These networks should allow for members to share awareness of each other's knowledge resources, strategic orientations, and visions of the future. They should provide new knowledge communities that can act to deal with longer-term challenges. Some Foresight programmes use networks merely to develop and disseminate their formal results. Others take network establishments to be an equally, or even more, important achievement of the exercise. The aim may be, for example, to establish better linkages between people active in various areas of social innovation, so as to enable them to share and understand each other's orientation towards longer-term perspectives.

5.1 Structure of Technology Foresight

Foresight activities can often be quite extensive undertakings requiring the appointment of:

- stakeholders,
- steering committee
- working groups of experts, and
- project management team

The structures connecting the different participants are to be organised and monitored, to ensure that the final objectives of the activities are met. The type of the exercise and the organisational structures are closely linked.

Before mentioning the structure of a Foresight exercise, it is worthwhile to understand the systems where Foresight takes place. Because the characteristics of the external systems, the context, effect the content of Foresight, the process of the Foresight exercise will be specifically designed and implemented. [Saritas, 2004][2]

In the Figure.2, the outer circle represents the context and the public outside the border of the Foresight organisation. Foresight communicates with the public by dissemination of the outputs during and after the exercise.

The inner context relates to the stakeholders. These stakeholders include government, industry, academy and NGOs. These stakeholders may not be involved in the exercise, but they have critical importance, since this is the social system where the policies are applied. Therefore, the dialogue during the process and dissemination of results are vital for the ownership and implementation of the decisions. Finally, the circle at the core represents the Foresight system. In terms of Science and Technology policy-making, this system has three main components: Research, Policy making and Stakeholders. Stakeholders include the public and private sectors along with other interest groups such as academy and NGOs, which are involved actively in the process.

[2] Saritas, O. (2004). Systems thinking in Foresight: A systems analysis of British, Irish and Turkish Foresight Programmes, Paper presented at the "EU – US Scientific Seminar on New Technology Foresight, Forecasting and Assessment Methods," EC, IPTS, IAIA, 13-14 May 2004, Seville.

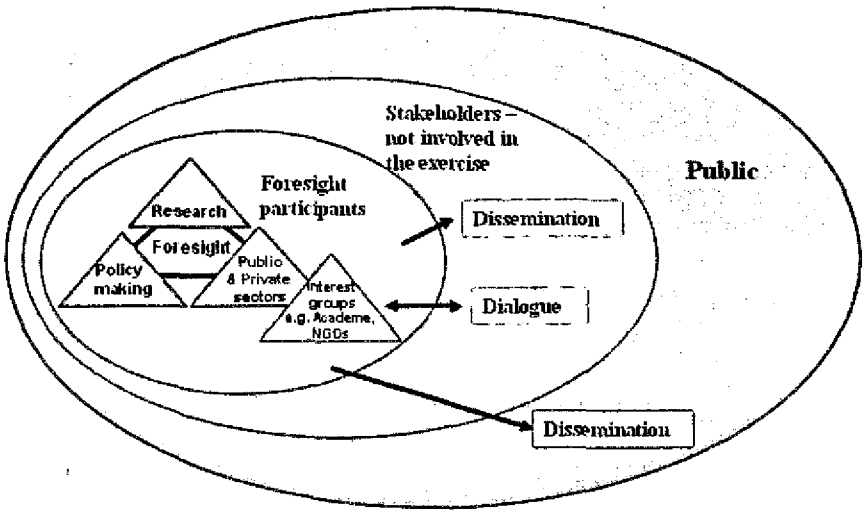

Figure.2: The context of the Foresight process

In terms of organising a Foresight exercise, there are three main dimensions to be considered:

1. Formal structure of the project
2. Decision processes to be implemented
3. Resources procurement

Each of these dimensions is associated with a variety of activities, the importance of which will depend upon the type of the exercise undertaken. Table 1 indicates the relevant relations.

5.1.1 Formal Structure

Whatever the type of Foresight is, identifying the stakeholders is a key step. The players who are interested in, concerned by, and have stakes in the project should be known.

Further there is a need for a structure for the Foresight exercise, to include the assignment of roles to working groups, panels, committees, sponsoring agencies, etc.

Table.1: Structure of Foresight

	Tightly centrally managed autonomous project	Loosely centrally managed autonomous project	Coordination of embedded activities
FORMAL STRUCTURE			
Identify stakeholders	Key	Key	Key
Appoint a steering committee	Key	Necessary	Not real needed
Set up a management team	Key	Key	Just one person might be enough
Recruit a champion	Useful	Useful	No real need
Recruit expertise	Key	Useful	No
DECISION PROCESS			
Define the management style	Key	Useful	No real need
Prepare a blueprint (roadmap)	Key	Just coordination of group plans	No real need
Assign tasks to each group	Key	No	Key
RESOURCES PROCUREMENT			
Identify a sponsor	Key	Key	Useful
Secure resources	Key	Key	Key
Identify existing inputs	Key	Useful	Useful

5.1.2 Decision process

If the project is centrally managed, there is a need to define the management style to be proposed to the groups. For example, if working groups are to be established, they could be given the freedom to make many of the decisions highlighted. Alternatively, **a central project team** or **steering committee** might define the work plan to be followed.

Some of the most frequent tasks associated with Foresight management work are shown below:

- Nominate group members
- Manage process

- Identify existing literature
- Prepare reports on specific issues
- Organise expert hearings
- Employ Foresight methods
- Organise conferences on specific issues
- Prepare synthesis
- Prepare final report
- Organise public debate on specific issues

5.2 The actors included in Foresight and their tasks

The following actors are involved in the Foresight process:

1. Promoters
2. Stakeholders or user/target groups
3. Sponsors
4. Steering committee
5. Project team
6. Champions
7. Political support
8. Experts
9. Process experts
10. Monitoring group

Promoters are the people (or the organisation) supporting the Foresight exercise. At a very early stage of the exercise promoters usually try to identify who are the interested players and what could be the first outline of the work (objectives, focus). They would also start looking for sponsors. Usually promoters become highly involved in the project team.

Stakeholders are those people/organisations that have an interest in the economic & social development of the region. They feel they have something to say in the policy-making process. In this connection, stakeholders should participate actively in the Foresight process. They can become sponsors, provide experts, and/or act as champions. The most important stakeholders should be appointed to a steering committee. Some stakeholders, however, might feel threatened and will oppose

to the Foresight exercise. For this reason, promoters should organise consultations with most stakeholders when drafting an exercise profile. In this way, it can be used as a tool of enrolment that could engender future ownership of Foresight process and results.

A **Steering Committee** would be established to approve the objectives, the focus, the methodology and the work programme, to validate the strategy and tools for communication, and to help disseminating the results. It will define / adjust the assessment criteria and review the deliverables. It will monitor the quality assurance process for the whole exercise. The SC could also be a key actor to raise awareness, mobilise and nominate experts to various panels.

A **Project Team** would be appointed to manage the exercise. Usually its tasks are as follows:

a. Lead the implementation of the exercise
b. Keep regular contacts with the stakeholders and the SC to ensure that the agreed focus and direction are maintained
c. Maintain records of costs, resources and time scales for the project
d. Ensure integration of Management Reports and their presentation to the SC
e. Ensure that the exercise follows its technical objectives
f. Ensure that the exercise keeps its relevance within the eventual regional innovation activities.

Securing high **political support** early on will be helpful to ensure that the exercise receives serious consideration.

Expert work is highly significant in terms of:

a. Gathering of relevant information and knowledge
b. Simulation of new insights and creative views and strategies for the future, as well as new networks
c. Diffusion of the Foresight process and results to much wider constituencies
d. The overall impact of Foresight in terms of follow-up action

Foresight experts can also be mobilised. Their role could be:

a. Mentor/coach the SC and the Project Manager

b. Undertake specific activities (advises on methodology, contribute to SC meetings etc.)

Citizens would also be engaged from the wider community.

The level of involvement of the various actors may vary depending on the type of Foresight and its focus.

Table.2: Actors involved in Foresight

	Autonomous projects	**Embedded activities**
Key actors	Promoters Stakeholders Steering committee Project team	Promoters Stakeholders
Usually involved actors	Champions Experts	Foresight activities coordinator Experts
Actors involved in large scale projects only	Citizens Politicians Monitoring group Foresight experts	Not relevant

5.3 Foresight Project Main Milestones

Main milestones of a Foresight exercise are:

- Engage stakeholders
- Set-up the infrastructure
- Choose focus and methods
- Gather existing inputs
- Produce new knowledge

- Develop a shared vision
- Produce final deliverables
- Disseminate results
- Monitor the activities
- Incorporate the outputs in stakeholders decision processes

5.4 Foresight Information

Two types of information can be mentioned to provide input to the Foresight exercise, such as:

1. **Passive**: Any type of information or data collected on the current state of the sector or issues in play and any data that will allow to construct a retrospective analysis of the main trends (e.g. economic, social, and demographic trends). Other types of passive information are forecasts, scenarios, results of other Foresight exercises, opinion pools, sectoral and regional data sets, market reports, benchmarking data etc.
2. **Active**: Mainly resources that can be used during the course of the exercise (e.g. expertise and network):
    a. The presence of easy-to-access expertise in Foresight tools and methodology in the region
    b. The presence of associative and representative structures of different sectors of society – networks, consumer / citizen groups, business associations, unions, chambers of commerce, leading figures in the community (public, business), participants that can be involved in the exercise as 'experts'.
    c. The presence of latent Foresight potential in the country or region that could be mobilised according to the sensitivity of the various players (business, regional authorities, research- technology-transfer and innovation-support) to Foresight thinking.

5.5 Outputs of Foresight

Each Technology Foresight exercise will produce tangible outputs - in the form of reports, website, press articles - and intangible outputs such as development of new networks. These outputs are presented in formal and informal forms:

- The formal outcomes of Foresight are largely matter of research priorities, and strategic goals, for other aspects of S&T. Typical formal outputs are reports, dissemination activities such as workshops, newsletters, press articles, web sites etc.
- Typical informal outputs are the development of new networks, the integration of Foresight results into the strategy and the projects of national and regional organisations and companies.

The following table proposes a synthesis of the types of output that might be expected:

Table.3: Outputs of Foresight

	Formal outputs	**Informal outputs**
Formalisation	Report, book	Presentations
Dissemination	Workshops, newsletters, press articles, web sites	Results and evaluation circulating within networks
Networking	Institutionalisation of networks	Development of new networks or new links within existing ones
Strategic process	Formal incorporation of results within strategic process	Informal incorporation of results within strategic processes

5.6 Foresight framework and the flow of actions

From the above overview of Foresight produced from Practical Guide to Regional Foresight[3], a generic Foresight framework was drawn in Figure.3. The figure shows the main functions in a Foresight framework and the flow of actions between these functions.

[3] European Commission (2001). A Practical Guide to Regional Foresight, FOREN – Foresight for Regional Development Network. Report EUR 20128 EN

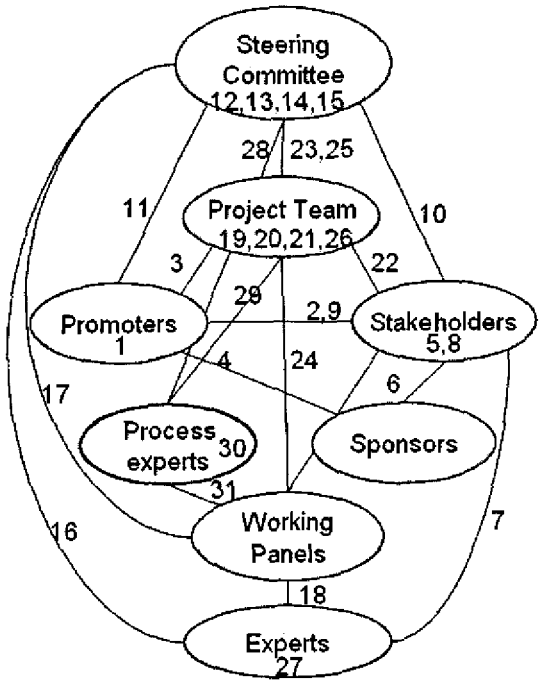

Figure.3: Foresight framework and the flow of actions

The actions from 1 to 31 represent the Foresight cycle:

1. Promotion of Foresight (written, oral and visual presentations)
2. Identification of interested parties
3. Drafting the first outline of the project (objectives and focus)
4. Search for sponsors
5. Involvement of stakeholders[4] (meetings)
6. Identification of sponsors
7. Selection of experts among stakeholders (Nomination)
8. Championing the Foresight process
9. Consultations with stakeholders (to provide future ownership of the process and products)
10. Involvement of stakeholders in SC
11. Approval of the objectives and focus of TF programme
12. Approval of the work programme and validation of strategy and tools for communication and promotion of the results
13. Definition/adjustment of the assessment criteria and reviewing the deliverables
14. Monitoring the quality assurance process for the whole project

[4] Stakeholders are the people and organisations that have an interest in the economic and social development. They have something to say about the process.

15. Raising awareness
16. Mobilising experts
17. Nominating experts to panels
18. Involvement of experts in panels
19. Management of the project on a daily basis
20. Maintaining records of costs, resources and timescales for the project
21. Following the technical objectives of the project
22. Keeping contact with stakeholders to retain the project direction
23. Keeping contact with SC to retain the project direction
24. Meeting WP managers
25. Integration of management reports and their presentation to the SC
26. Ensuring the relevance of the project with other regional innovation activities
27. Gathering relevant information and knowledge, stimulate new insights and creative views and strategies for the future, as well as new networks, diffusing foresight process and results to much wider constituencies, contributing to the follow up actions
28. Mentoring/coaching the SC, providing ideas and external views, highlighting best practices, contributing to the SC meetings
29. Mentoring/coaching the project manager, providing ideas and external views, highlighting best practices
30. Undertaking specific activities such as refining the work programme, giving advices on research methodologies
31. Participation in consensus building activities

6. THE CONTRIBUTION OF FORESIGHT TO POLICY-MAKING PROCESS

As discussed previously, the conventional policy-making process places little stress on interaction. This process is mainly conducted by a small group. Therefore the public acceptability is usually low, so as the implementation of outcomes. However, decision-making process with Foresight places high stress on interaction, opinion gathering and information from a wide range of sources and in principle more legitimacy for, "ownership" of, and networks established around the activity.

Figure.4 shows the policy framework and the inclusion of Foresight in policy-making processes.

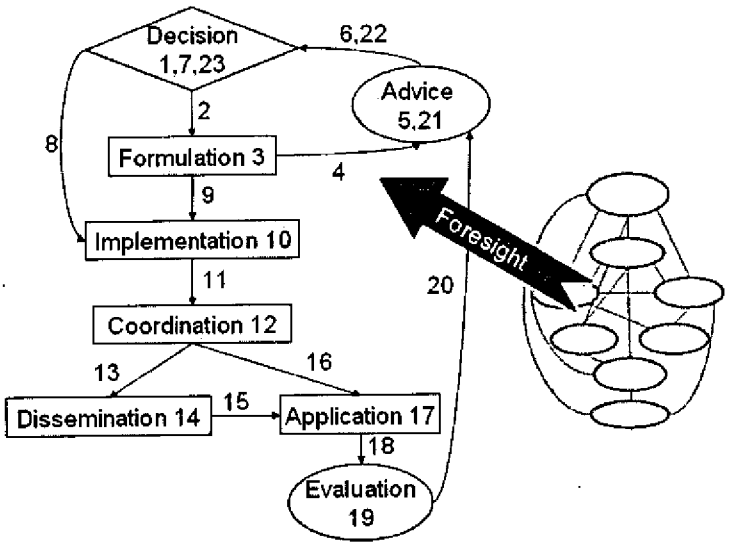

Figure.4: Inclusion of Foresight in policy-making process

The involvement of Foresight in the policy-making changes the conventional structure.[5] Figure.5 presents a decision making model to describe the organisational structure of the S&T policy-making with Foresight.

[5] For the inclusion of Foresight in development planning process and a practical application see Oner and Saritas (2005). A systems approach to policy analysis and development planning: Construction sector in the Turkish 5-year development plans, **Technological Forecasting and Social Change**, Article in Press, Accepted for publication in November, 2004.

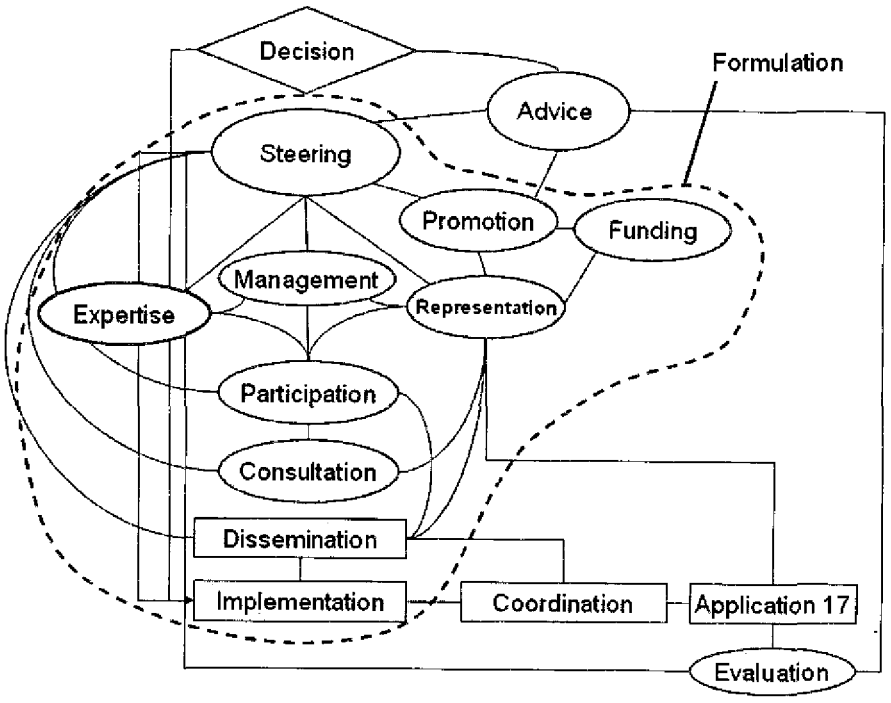

Figure.5: Dynamic policy-making and implementation process with Foresight

Figure.6 shows the actors, who fulfil the above mentioned functions in the policy formulation phase such as steering function is carried out by steering committee, management function is undertaken by the project team and funding is provided by sponsors.

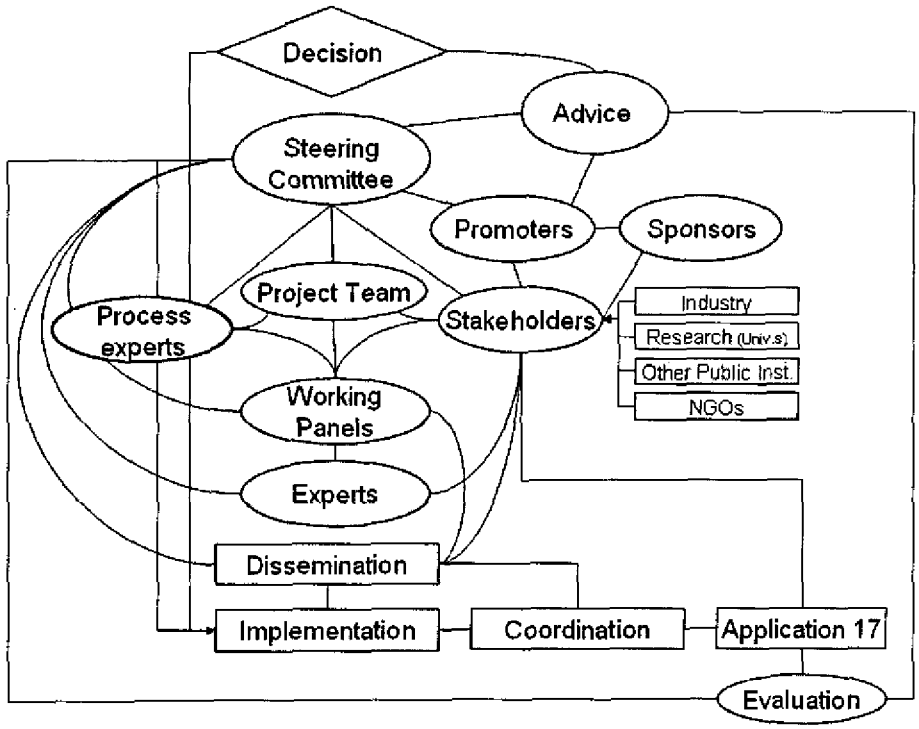

Figure.6: Actors in the dynamic policy making and implementation process with Foresight

As a result of the considerations above, Table.4 indicates policy functions, tasks and actors involved in each function and necessary resources. This table aims to guide policy makers to understand the decision-making process with foresight, the actors involved and necessary resources such as personnel, time and funds.

Table.4: Policy Functions, Tasks, Actors Involved & Necessary Resources

Policy Function	Tasks	Actors	Resources		
			People	Time	Funds
Decision	- Identification of needs and priorities - Request policies to be formulated from the policy advisors - Negotiating policies advised - Decision on implementation - Updating existing policies or requesting new policies	Government Parliament Ministries			
Advice	- Looks for ways and actors for policy formulation - Advises final policies	S&T Council			
Promotion	- Supports the idea of developing Foresight exercise - Identifies the first outline of the project - Usually takes part in the Project Team (PT) - Looks for sponsors - Organise consultations with stakeholders when	This can be a key organisation and/or person			

Policy Function	Tasks	Actors	Resources		
			People	Time	Funds
	drafting the Foresight project to provide future ownership of the process and products.				
Coordination	- Coordinates the policy formulation process - Hosts the activities	Ministries S&T Council			
Representation	- People and organisations that have an interest in the economic and social development. They have something to say about the process. - Can act as champions - Provide experts for the project	Stakeholders including - Industry - Research - Public institutions - NGOs			
Funding	- Financially support of the project	Stakeholders can be sponsors			
Steering	- Approval of the objectives and focus of the project - Approval of the work programme, - validation of strategy and tools for communication	Steering Committee (formed by the key stakeholders)			

Policy Function	Tasks	Actors	Resources		
			People	Time	Funds
	- help to promote the results - Definition/adjustment of the assessment criteria - Review of deliverables - Monitoring of the quality assurance process for the whole project - Awareness raising - Mobilisation of experts - Nomination of experts to various panels				
Management	- Management of the project on daily basis - Records costs, resources and timescales for the project - Ensures that the project maintains its technical objectives - Keeping contact with the stakeholders to ensure that the project direction is maintained - Keeping regular contact with SC to ensure that the project direction is maintained	Project management office (usually takes place in the host organisation) Promoters are also involved			

Policy Function	Tasks	Actors	Resources		
			People	Time	Funds
	- Holding regular meetings with panel managers - Ensuring integration of management reports and their presentation to SC - Ensuring that the project maintains its relevance within the other regional innovation activities				
Expertise	- Representation of the views of stakeholders - Presenting and gathering relevant information and knowledge - Stimulate new insights and creative views and strategies for the future as well as new networks - Diffusing Foresight process and results to much wider constituencies - Taking active part in the follow-up actions	People from stakeholders			
Participation	- Involvement of nominated experts actively in the project activities	People from stakeholders			

Policy Function	Tasks	Actors	Resources		
			People	Time	Funds
Consultation	- Mentoring/coaching the SC and project managers - Providing ideas and external views - Highlight best practices - Undertaking specific activities (e.g. refining the work programme, giving advises on research methodologies - Participating consensus building activities	External experts			
Dissemination	- Announcement of the outcomes	Steering Committee Working panels Experts			
Implementation	- Drawing strategies to put policies into practice	Steering Committee Ministries			
Coordination	- Organisational structures are established for implementation	e.g. Science, Research, Education Departments			
Application	- Policies are applied	Stakeholders			

Policy Function	Tasks	Actors	Resources		
			People	**Time**	**Funds**
Evaluation	- Assessment and evaluation of the implementation processes - Giving advises from the evaluation results	Steering Committee			

7. A CASE: TURKISH SCIENCE AND TECHNOLOGY POLICY MAKING

7.1 The history of S&T policy making in Turkey

Since its foundation, the Turkish Republic has been constructing a sound scientific infrastructure. Until 1960's, however, science and technology was not a detached policy issue, and scientific research was regarded as an academic activity of universities. The establishment of TUBITAK, the Scientific and Technical Research Council of Turkey, marks a turning point in national science and technology policy in the country.

TUBITAK was established in 1963 for the purpose of organizing, coordinating and promoting basic and applied research. For some ten years, its main function was confined to supporting basic research in the universities through its grant scheme. Over the years, parallel to new developments in the economy, the mandate of TUBITAK has been gradually expanded towards supporting industrial technological activities and contract research. An important development in this direction was the establishment in 1972 of Marmara Research Centre (MRC) in Gebze, (at Marmara region near Istanbul, where the majority of Turkish industry is located).

As mentioned above, Turkey entered the S&T policy era in the early 1960's, with the establishment of TUBITAK. The debut coincided with the start of the five-year economic planning period. The first period of the Turkish S&T policy lasted from early 60's to late 80's, following the main trends of the developed industrial economies from 20 years behind. Turkish economy entered its new stage, by getting integrated with the world economy after sweeping economic reforms of the early 1980's, which liberalized the economy.

In the early phase the main targets of national S&T policy were easily formulated by TUBITAK without any official S&T policy document, through a tacit consensus within the Government. In this phase, the targets were to broaden R&D infrastructure by training researchers and establishing public R&D facilities, and to create a research tradition by encouraging, supporting and carrying out research activities almost exclusively in the academic sector to catch up with the critical values of the R&D indicators. In short, the Turkish S&T system was regulated by a supply-oriented S&T policy (science-push approach) for a relatively long span of time.

The first detailed S&T policy document was prepared in 1983 with the contribution of over 300 experts under the coordination of Ministry of State. This document, entitled "Turkish Science Policy 1983-2003", explicitly recognized the role of technology for development, and suggested priority areas of technology. Although these technology areas were broadly defined, this document could be regarded as the first attempt towards defining "critical technologies" in Turkey. This document led to the creation of a new institution in 1983, the Supreme Council for Science and Technology (SCST), as the highest S&T policy-making body chaired by the Prime Minister or his deputy. The Supreme Council enabled designing S&T policies with the participation of S&T related ministers, high level officials, experts and representatives of non Governmental organizations responsible for the management of economic and social development.

The Supreme Council for Science and Technology, officially established in 1983, had its first operational meeting only in 1989. In the mid-1990s, the Supreme Council started to play an active role in formulating the national S&T policy as the central component of the National Innovation System, reacting swiftly to the developments in the world economy.

In its second meeting in 1993, SCST approved the document entitled "Turkish Science and Technology Policy 1993-2003". This document paved the way for new policy initiatives in the 1990s, such as R&D support programs. This was a new turning point in the S&T policy in Turkey, as there was a paradigm shift from "building a modern R&D infrastructure to "innovation oriented" national policies. The policy formulated in this document was further elaborated in 1995 with "The Project for Impetus in Science and Technology", which formed the S&T chapter of the Seventh Five Year Economic Development Plan [1996-2000]. Figure.7 shows the Turkish Science, Technology and Innovation system at that time.

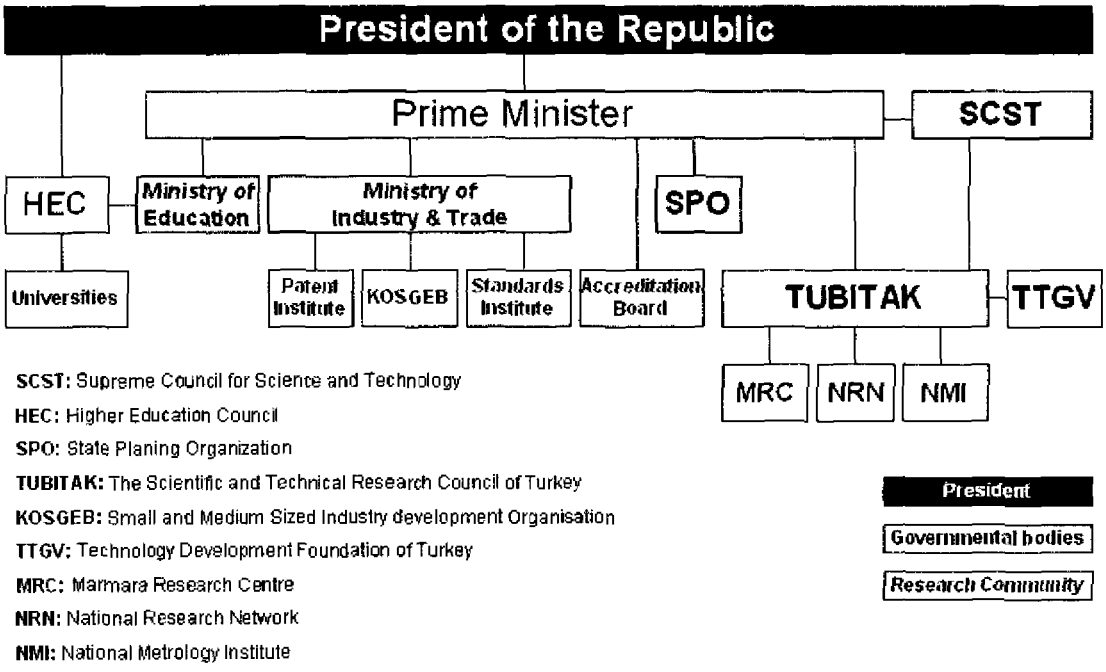

Figure.7: Turkish Science, Technology and Innovation System

7.2 Vision 2023 Project

The Supreme Council for Science and Technology took the decision, in its sixth meeting on December 2000, that new national S&T policies should be formulated, and priority areas should be set for the next two decades, in order to create an innovative economy and society in 2023, which marks the 100th Anniversary of the foundation of the Turkish Republic. TUBITAK, as the general secretariat of the SCST, has accordingly detailed the project entitled "Vision 2023: Science and Technology Strategies", which was approved by the Council a year later in its seventh meeting in December 2001.

The "Vision 2023" project involves the first-ever national foresight exercise of Turkey, together with three more sub-projects that aim at collecting and evaluating data on the current science, technology and innovation capacity of the country. The project has been initially planned for a 2-year period, and its implementation started in January 2002. The time plan was later amended, and the new plan targeted completion of the sub-projects, preparation of their synthesis in the form of a policy document, and its submission to the SCST in 2004.

7.3 Turkish National Technology Foresight Exercise

The technology foresight exercise, conducted for the first time in Turkey, constituted the backbone of the "Vision 2023" project.

A Steering Committee, consisting of 65 representatives from 27 governmental institutions, 29 industrial organizations and NGOs, and 9 universities was formed as the top-level organizational body of the "Vision 2023" project. The Steering Committee has guided the project by taking the strategic decisions and approving the reports and policy recommendations generated during its implementation. Operational and budgetary decisions have been taken by the Executive Committee, which is chaired by the President of TUBITAK, and brings together three representatives of the Steering Committee with the related administrative officials of TUBITAK. The Project Office formed within the Science and Technology Policy Department of TUBITAK has been responsible for the implementation of the project. Other organizational bodies included national and international advisors and panel chair groups.

The methodology adopted for the Turkish Technology Foresight Project involved panels, a two-round Delphi survey executed by the Project Office in co-ordination with the panels, and a prioritization scheme similar to the one used in the UK and Czech exercises. Ten panels were formed on certain socio-economic fields and two others on cross cutting issues, such as education/human resources and environment/sustainable development. Figure 8 shows the organization of the Turkish National Technology Foresight Exercise.

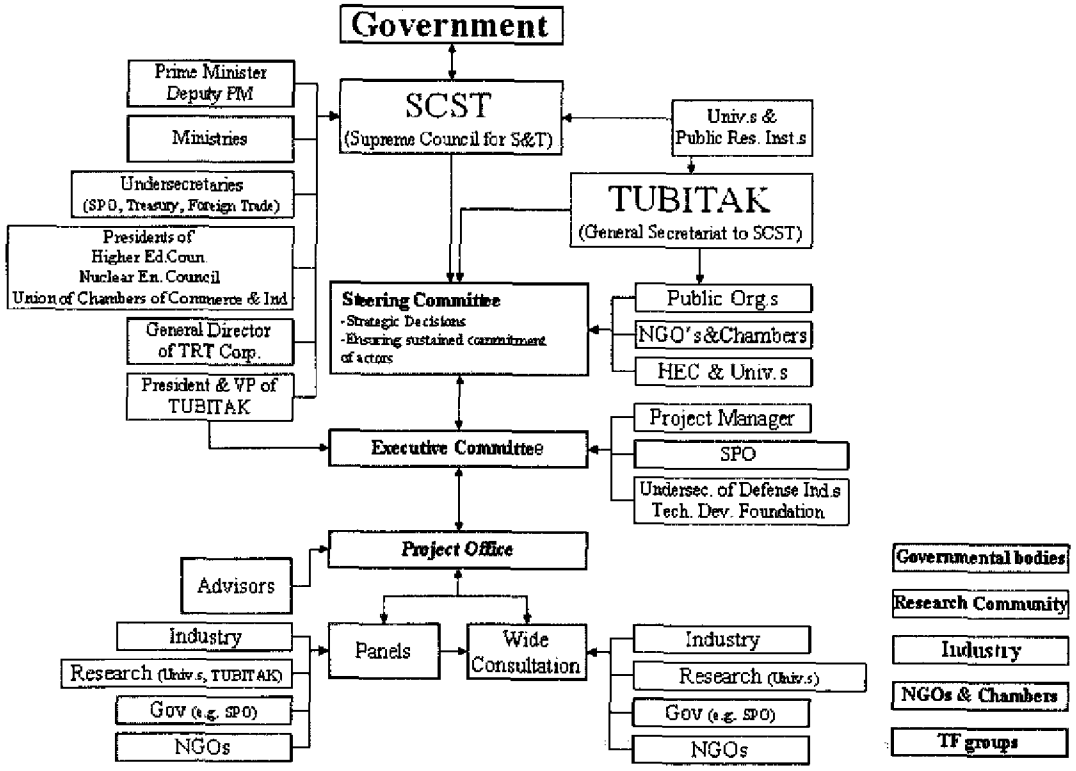

Figure.8: Turkish Science and Technology policy making with Foresight

7.4 Outcomes of Vision 2023 and National TF Exercise

The tangible outcome of the Technology Foresight exercise carried out under Vision 2023 Project has been 24 reports, specifically, the 12 panel reports, 1 Delphi report, 3 synthesis reports, and the reports of the 8 Strategic Technology Groups. It is expected that these reports, together with the reports of the other three sub-projects of the Vision 2023, will be utilized at the public, academic and the corporate level in developing S&T policies of individual companies, sector organizations, research units and governmental bodies.

So far there have been two developments in this regard. First, the resolutions of the "2004 Turkish Economy Congress", organized by the State Planning Organization[6], has adopted the S&T Policies Working Group Report, which was exclusively based on the findings and recommendations outlined in the synthesis reports.

[6] State Planning Organisation (SPO) is an undersecretary reporting directly to the prime minister and responsible for five-year development plans of Turkey.

Secondly, as the Vision 2023 Project was initially launched with the purpose of preparing a science and technology strategy document for a 20-year period, TUBITAK formed a Strategy Group with the mandate of preparing such a document based on the findings and recommendations of the reports. In August 2004, the Strategy Group submitted the draft entitled "National Science and Technology Policies: 2003-2023 Strategy Document".

The proposed strategy has three essential elements:

i) Focusing on strategic (priority) areas of technology. In this context, three generic and emerging areas of technology, and 42 specific technology fields were proposed, all based on the two-year long consultation period of the foresight exercise.

ii) Increasing R&D expenditure, with specific targets for both public and private sector share.

iii) Development of R&D manpower, with specific targets.

The document proposes that a "National R&D Fund" be established and managed, and the following mechanisms be adopted, with which a Turkish Research Area will be established around the priority areas:

i) National Programmes

ii) Public Procurement

iii) Targeted Projects (from public bodies and sector organizations along with their own strategic plans).

The document emphasizes the importance of public awareness and commitment of Government to science and technology issues, and proposes initiation of five national programmes in selected priority areas in 2005. Finally, stresses the need for systematic monitoring and evaluation of the steps taken, as well as continuous foresight is underlined.

The draft strategy document was brought to the agenda of the 10th meeting of the Supreme Council for Science and Technology held in 8 September 2004. The Supreme Council decided that, after all the Council member organizations express their views on the draft document, the final strategy document and a five-year action plan is to be prepared by TUBITAK, for adoption in the next meeting scheduled in March 2005.

While a science and technology strategy based on the technology foresight exercise is yet to be adopted, the Government has recently announced a decision on the R&D expenditure of Turkey (GERD) in line with one of the essential recommendations of the draft strategy document. It was announced that Turkey's GERD will be increased from the current 0.64% to 2% by the year 2010, and an additional 275 Million USD public funding be reserved in 2005 for supporting R&D activities in defense industries, human resource development and popularization of science.

There is no doubt that this is a very important step taken by the Government towards realizing the S&T vision formulated during the technology foresight process. Allocating portion of the 2005 funds to promote science and technology in the society and industry, and to support human resource development is also emphasized in all panel reports and in the draft strategy document. However, a strategy based on supporting certain industrial sectors would not be compatible with the basic philosophy of the Vision 2023 project. Vision 2023 project has been planned and implemented in order to identify strategic areas of technology that various panels, which represent various industrial sectors as well as socio-economic activity areas, demand for the realization of their visions of future. Moreover, although S&T issues and policies are in close interaction with industrial issues and policies, science and technology affects almost every dimension of life, industry being only one of them.

Vision 2023 process has mobilized a considerable number of people from industry, academia and public bodies. It also attracted the attention of mass media to a certain extent. In this way some intangible outcome of the exercise, such as raising awareness and increasing commitment to science and technology issues have been achieved.

Finally, the Vision 2023 project in general, and the technology foresight programme in particular constituted an important step towards harmonization of Turkish S&T system with that of the European Union. First of all, with this project Turkey responded to the call for Foresight in the High-Level Expert Group Report "Thinking, debating and shaping the future: Foresight in Europe" which stated that: "Starting from a science & technology perspective, Foresight activities contribute to the development of the European knowledge-base and propose visions for the future of European society"[7]. Secondly, Turkey has actively taken part in the joint initiative of 15 countries (11 EU Member States, 3 Candidate Countries and one associated country) to coordinate their national foresight

[7] "Thinking, debating and shaping the future: Foresight for Europe". Final report by the HLEG for the European Commission, EC Directorate for Research, Unit RTD-K.2, June 2002.

programmes, with a view to increase their national and European impact and to implement joint programmes. The coordination activities envisaged in this networking initiative called the "ForSociety" also aim to provide effective support to European scientific and technological integration along with the spirit of the European Research Area (ERA), especially in view of the enlarged EU and operational implementation of Article 169[8].

In conclusion, the first technology foresight exercise of Turkey represents a successful integration of the Foresight method into the decision-making process, as a valuable instrument for strategy and policy. Corroborating this connection, the foresight exercise focused mainly on determining priority areas of technology (which is a characteristic of what is known as second generation of foresight). This approach took into consideration the particular conditions of Turkey, where fragmentation and lack of critical mass of researchers and resources were noted to be the main problems of Turkey's research landscape. Although a systematic evaluation of the process has not yet been done, there are indications that it contributed to networking among actors from industry and academia, and has increased the awareness on S&T issues. The impact of the whole process will be better evaluated after the detailed allocation of the increased public funds for research is announced, and the policy on the next rounds of foresight activities is clarified.

[8] See http://www.era-net.forsociety.net

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