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Turkish S+T Vision 2023

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Summary

'Vision 2023: Strategies for Science and Technology' is a national project aimed at providing Turkish stakeholders with a vision for the development of science and technology vision in Turkey over a period of 20 years. It involved comprises four strands: Technology Foresight, Technological Capacity, R+D Manpower and R+D Infrastructure. The Technology Foresight strand provided the backbone of the Vision 2023 project. The remaining three programmes supporting the Foresight strand by collecting data on the existing science, technology and innovation capacity, hard data on R+D manpower as well as R+D infrastructure, as well as an inventory of national technology assets and an overview of the institutional and legal framework for research prevailing at this time.

From Fragmentation to Foresight

Although the Turkish Republic has strived to further social, economic and industrial development since its foundation in 1923, the first attempts to formulate an S+T policy coincided with the introduction of the First Five Year National Development Plan in 1963. TUBITAK - the Scientific and Technological Council of Turkey was established in the same year was given the mission of designing, promoting and coordinating science and research activities at national level.

During the 1960s and 1970s S+T policy in Turkey was mainly based on the 'promotion of basic and applied research in the natural sciences'. In this early phase, S+T policy was formulated by TUBITAK on the basis of tacit consensus with the government and without any official policy document. As in many countries these earlier attempts occurred in a context which lacked a participatory policy-development culture. Most decisions in the government and government agencies were based on very short term necessity and policies as a result were often piecemeal. The concept of technology policy and its integration with the industrial, employment and investment policies was introduced in the Fourth Five Year National Development Plan covering the period 1973-1977.

Until the turn of the millennium there was little success in realising concerted actions of the rather fragmented S+T actors around the priority areas. Assessments of S+T policy measures of the time show that the measures themselves were not to blame. S+T policy implementation has always been difficult in Turkey. The main reasons have been a:

- Lack of ownership of the R+D agenda by stakeholders,
- A lack of political support,
- A low level of dissemination,
- Isolation of S+T from other policy domains and
- Fragmentation of research and of research resources.

Eventually the SCST or Supreme Council for Science and Technology decided that new national S+T policies were needed and that priority areas should be established for the next two decades in order to create an innovative economy and society by 2023 – the 100th Anniversary of the foundation of the Turkish Republic. TUBITAK as the general secretariat

of the SCST developed the initiative 'Vision 2023: Science and Technology Strategies' and it was approved by the Council in December 2001.

'Vision 2023' includes the first-ever Turkish national foresight exercise. This is accompanied by three sub-projects that aim to collect and evaluate data on the current science, technology and innovation capacity of the country.

Raising Awareness for S+T

TUBITAK as the key actor in the Technology Foresight initiative suggested using Foresight as an instrument to overcome the problems related with the lack of participation, isolation and fragmentation in planning and implementation of S+T policies. The SCST stated aim of the programme as '*to implement a long term technological foresight programme for establishing a strategy, considering scientific, technological, socio-economic and political trends in the European Union and in the world and taking into account similar exercises previously conducted as well as using input from other modules of the Strategy Document*'.

Turkey has suffered from a low level of funding for R+D and TUBITAK has found it very difficult to convince politicians of the importance of science and technology research investments for long term economic growth. The science system also suffered from a general lack of resources to support the development of technologies of the future. The 'Vision 2023' programme was intended to obtain the commitment of stakeholders, most importantly of politicians, to addressing these weaknesses. Foresight was seen as a useful method for creating the commitment that would bring together researchers, private companies, academia and non governmental organizations with a view to influencing politicians. 'Vision 2023 Technology Foresight Programme' was started in order to:

- Build a science and technology vision for Turkey.
- Determine strategic technologies and R+D priorities.
- Formulate an S+T policy for the next 20 years.
- Involve a wide range of stakeholders.
- Create public awareness of the importance of S+T for the overall socio-economic development of the nation.

The major client was TUBITAK, an agency that funds R+D projects and develops R+D human resources in Turkey. The TTGV or Turkish Technology Development Foundation which funds R+D projects via World Bank resources became a client as well.

Looking Abroad for Incentives

At the start of the exercise TUBITAK analysed foresight programmes in countries such as Japan, the US, the Netherlands, Germany and the UK. During the reviews of other programmes, the use of expert panels and of Delphi survey techniques stood out as being widely used. These methods were considered useful for the Turkish situation. The designers of the Turkish foresight exercise were looking for methods that would bring tangible benefits in terms of real outcomes. The Delphi concept was easy to understand and relatively easy to use especially for those who had never been directly involved in a foresight exercise before.

Foresight as a Tool to Support National Networking

Eventually the overall approach adopted included:

- **Expert Panels**,
- A two-round **Delphi Survey** to be executed by a Project Office in co-ordination with the panels, and
- A **Prioritisation Scheme**.

The main function of the expert panels was to identify technologies to be developed in the future and thereby anticipate the demand for new technologies. The use of panels also provided 'process benefits' in terms of network development and communication among stakeholders.

By considering the technology-supply issue, the Delphi process addressing the likelihood of achieving the envisaged technological developments and tested them against a set of prioritisation criteria.

A **Steering Committee** was in charge of the prioritisation process. Various criteria were used to make a comparative assessment of the contribution of different technologies to socio-economic development of the country. The technologies were assessed by considering their impacts on:

- Competitive strength,
- Science and technology innovation capability,
- Environment and energy efficiency,
- Creation of national value added by local resources, and
- Quality of life.

Panels to Reflect on Key Drivers and Trends

The **panels** were assigned to evaluate the current situation in their own fields by analysing **key drivers** and **trends** on the basis of **desk research** and **SWOT**. They used **brainstorming** techniques to build a vision and **voting** to **prioritise TTA**s or technological activity areas. **Cross Impact Analysis** was used to develop the vision and check it for consistency.

A standard **Task Definition Document** was given to all panels. This document identified four phases that the panels were expected to go through:

- Vision Building,
- Dissemination,
- Delphi, and
- Policy Proposals.

The steps necessary in each phase were also given to the panels in the two-page Task Definition Document that served as a background document. However, they were also allowed to work in different ways and use different methods to achieve expected outcomes. Thus, each panel was free to follow a dif-

ferent course or to make amendments provided they are able to systematically support and justify their decisions. As a result some panels used additional techniques such as workshops.

Government, industry, academia and NGOs were the main stakeholders and participants. The **Steering Committee** of the 'Vision 2023' programme consisted of 65 representatives from 27 Governmental institutions, 29 industrial organisations and NGOs, as well as 9 universities. It guided the project by taking strategic decisions and by approving the reports and policy recommendations.

Operational and budgetary decisions were taken by the **Executive Committee**, chaired by the **President of TUBITAK** and bringing together three representatives of the Steering Committee with related administrative officials of TUBITAK.

Social Signals of Demand for a Vision

'Vision 2023 Technology Foresight' was a national level 'holistic' programme covering main socio-economic sectors in the country and relevant themes. The main reason for focusing on the socio-economic sectors was because they were seen as the only structured body from which to get signals of the demand for science and technology. They were also considered as the main 'implementers' of science and technology policies.

In its first meeting in April 2002 the Steering Committee selected the sectors on which the work would focus on the basis of two main criteria: Selected sectors were those with:

- A competitive advantage today that might likely persist for the next 20 years, or
- Sectors of relevance to other policy domains.

Identifying Strategic Fields

Following the constitution of a list of possible priority sectors, a voting session was carried out. The selected sectors were represented with 12 panels 2 of which were cross-disciplinary in nature. The selected panels were:

- Education & Human Resources
- Environment & Sustainable Development
- Information & Communication
- Energy & Natural Resources
- Health & Pharmaceuticals
- Defence, Aeronautics and Space Industries
- Agriculture and Food
- Machinery and Materials
- Transportation and Tourism
- Textiles
- Chemicals
- Construction and Infrastructure

The Technology Foresight exercise was completed in early 2004. The tangible outputs of the exercise included 24 reports, made up of 12 panel reports, 1 Delphi report, 3 synthesis reports and 8 reports from **Strategic Technology Groups**.

The synthesis reports were produced with the aim of bringing panel outputs and the list of priorities. The Project Office amalgamated 94 TAAs proposed by the panels under 69 headings. It classified them into four categories by considering their relevance to or impact on:

- Competitive Advantage,
- Quality of Life,
- Sustainable Development, and
- Information Society.

Finally a workshop was held to identify **Strategic Technology Fields** underpinning above-mentioned four TAAs. The Project Office grouped those technology fields in eight categories. These categories and their relevance to Turkey's scientific, technological, economic and social development can be summarised as follows:

Information and Communication Technologies: The Foresight exercise revealed that all the sectors of the Turkish economy will exhibit demand for these technologies as a basis for advancement in the future.

Biotechnology and Genetic Engineering: These fields were seen as important for based on the consideration that they provide critical input for health, agriculture and industrial production sectors. Analysis indicated that Turkey has the potential to become a world player in certain domains of molecular biology, biotechnology and genomics. Health and agricultural sectors were considered the first industries to benefit from these fields starting from about 2010.

Nanotechnology: This was seen as a revolutionary topic with a wide range of potential applications such as the development of lightweight super-strength materials, the development of new generation computers, enhancement of the human nervous systems, and reduction of environmental pollution. Scientific, technological and industrial advances in this area were considered to play a fundamental role in the future in wealth creation and in national defence.

Mechatronics: The development and production of integrated human-machine products were seen as a key area to be investigated through research on micro- and nano-electro-mechanic systems and sensors, robotics and automation technologies, and other generic areas including control technologies and algorithms, micro-mechanics, micro-electronics, and embedded software. These technologies were seen as keys to increase competitiveness in sectors that are already well developed in Turkey's such as automotive, household goods and defence.

Production Processes and Technologies: These areas were considered important for the sustainability of competitiveness

in areas such as automotive engineering, textiles and household goods production. Since it is now easier for these sectors to move their production facilities from one country to another around the globe, remaining competitive was considered essential. Areas such as flexible production systems, rapid prototyping systems and material shaping systems were identified as priorities for future investigation.

Material Technologies: The materials sector provides input to all industrial activities including aerospace, communications, defence, automotive and construction. In the exercise a number of specific technologies were identified as important for further development. Turkey holds the largest Boron reserves in the world and so boron technologies are considered important as were composite materials, polymer technologies and smart materials.

Energy and Environmental Technologies: The development of new energy sources and the use of existing natural resources in the most efficient and cleanest way was also considered a key issue for the future. For this purpose R+D activities on the following technologies were identified as being crucial: Hydrogen technologies and fuel cells, renewable energy, nuclear energy, environmentally sensitive fuel and combustion technologies, as well as water treatment and reuse technologies.

Design Technologies: Design was considered to play a fundamental role in new process and product development and in increasing the productivity of existing processes and products. In order to achieve these goals key areas included virtual reality software and virtual prototyping, simulation and modelling software, grid technologies, parallel and non-parallel computing software development.

It was considered that these were the areas in which Turkey needed to develop capabilities and achieve improvements. For this reason groups of experts called **Strategic Technology Groups** carried out detailed technical studies in order to set the strategies in each of these technology categories in the form of a 20-year roadmap. Finally TUBITAK formed a **Strategy Group** whose mandate was to prepare a document based on the findings and recommendations of the previous reports. The Strategy Group submitted a report, entitled 'National Science and Technology Policies: 2003-2023 Strategy Document' in August 2004.

Increasing the R+D Budget

The 'Vision 2023' process mobilised a considerable number of people from industry, academia, government administration and NGOs. It attracted the attention of mass media and resulted in the drafting of an S+T policy document with a 20 year perspective. This was submitted to the government and in line with essential recommendations of the strategy document the government has recently announced a decision to increase R+D expenditure. The governments stated aim is to **increase Turkish GERD from 0.64% to 2% by the year 2010**. The government has set aside **additional public funding to the value of €275 million in 2005** to support human resource development and to promote science and technology in society and industry.

On the basis of resolutions announced at the '2004 Turkish Economic Congress', the **State Planning Organisation** has adopted the **Report of the S+T Policies Working Group**. This report was exclusively based on findings and recommendations outlined in the synthesis reports of the Foresight exercise.

Although a systematic evaluation of the exercise has not yet been carried out, there is strong evidence that the 'Vision 2023' Technology Foresight exercise has made a real contribution to communication and networking among stakeholders and increased awareness of science and technology issues at national level. The impact of the whole process and its various outputs will be easier to evaluate after the announcements of increased public funds for research and after a clarification of policy regarding the next round of the exercise.

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