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Science and Technology Policy of Turkey
A Brief Outlook

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Summary

In this paper, I will explain the general frame of the Turkey's Science and Technology Policy. I, in particular, will deal with the concepts of 'innovation' and the 'national system of innovation' because ***'setting up the national system of innovation with all necessary building blocks and to improve the existing ones'*** is the focal point of our policy design. In this respect, I will try to point out our approach in the matter of gaining innovation ability and national system of innovation.

Overview of the Current Age:

Towards the Information Society…

We are witnessing today a historical process that is considered by some, in respect of its social, political, and economical effects, as a new revolution equivalent to the British Industrial Revolution. Some calls it a transition period to a new age, namely, age of information, thereby, to the post-industrial society -the information society. This new age has been characterized by the radical changes in technology basis of the production and labour process. Information technology based on improvements in microelectronics, computer and telecommunication technologies is playing a determinant role in these changes.

In words of C. Freeman (1989): *"The effects of information technology are so universal affecting every single sector of the economy, that they may be legitimately described as a change of 'techno-economic paradigm' providing scope everywhere for renewal of productivity increases through a combination of organizational, social and technical innovations and for a broad range of new and improved products and services."*

Information technology has been accompanied by its offspring-technologies such as flexible production and flexible automation technologies, and by the other new, pervasive generic technologies such as advanced material technologies based on the improvements in material sciences, and new biotechnology based on comprehensive developments in molecular biology, genetics and biochemistry. And, it is expected that new biotechnology, particularly, genetic engineering, is likely to play a key role in the 21st Century, that is comparable to the role of information technology of today.

Radical changes in the technology basis of labour process (it can be red as '**Fordist** labour process') are leading to radical changes in the pattern of mass production, which is the dominant perception of production system in market economies. The changes in the Fordist labour process, which started in Japan's automobile and electronic industry and then spread to all market economies[1] and, nearly, all industrial sectors, are so comprehensive it has been argued that the Fordist labour process, and, thereby, the production system based on it, are evolving into new ones[2].

In addition to the changes in technology basis of the production and labour process, the technology content of this process and the products is increasing gradually. Technology has become a productive power substituting muscular power completely and brain power to some extent. It is also changing the nature of all production forces including raw materials and means of production. Therefore its relative importance among the forces of production is increasing gradually.

In context of these technological changes, it is obvious that the countries having superiority in technology and science are progressing towards an absolute domination in industry and all other

[1] We are talking about 'Just-in-Time'.

[2] In Piore and Sabel's terms (1984), '**mass production**' is evolving into a new production system, namely, '**flexible specialization**'. According to Kaplinsky (1989), we are witnessing the transition to a new era, namely, the era of '**systemofacture**' and, thereby, to a new labour process: '**systemofacturing labour process**'. In Freeman's terms (1989), we are witnessing ***"a change of techno-economic paradigm"*** and, as a consequence of this change, some radical *"changes in organization and structure of both firms and industries, which accompany the introduction of information and telecommunication technologies"*.

economical activities. In short, technology has become the only key to the international competitive advantage. Thereby, superiority in science and technology is the determinant factor in increasing the welfare of society and improving the standard of living.

"Globalisation"

Another process that we are witnessing today is "globalisation". The most remarkable milestone of this process is the **Final Act of the Uruguay Round**[3] aiming at liberalization of the trade all over the world. ***"The Final Act** Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations is 550 pages long and contains legal texts which spell out the results of the negotiations since the Round was launched in Punta del Este, Uruguay, in September 1986. In addition to the texts of the agreements, the Final Act also contains texts of Ministerial Decisions and Declarations, which further clarify certain provisions of some of the agreements.* **The Uruguay Round was a global negotiation with a global result.** *(GATT, 1994)"*

In respect of our subject, the most important agreements covered by the Final Act are **the Agreement on Trade-Related Aspects of Intellectual Property Rights** and **the Agreement on Subsidies and Countervailing Measures**. The former brings about an international law system that protects intellectual property rights globally. The latter settles for which economical activities a government shall grant subsidy, or under what conditions and to what extent subsidies may be granted. It covers the subsidies ('assistance') for research activities conducted by firms or by higher education or research establishments on a contract basis with firms, and also contains the **countervailing measures** applicable globally for the states that do not follow the rules.

In a world where the conventional protectionism has been broken up, the determinant factor in international competition will be the ability of *"the transformation of an idea into a marketable product or service, a new or improved manufacturing or distribution process, or a new method of social service"*, namely, **the ability of innovation** (EC, 1995). This ability, in last analysis, depends on the ability of nations in science and technology.

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[3] It covers

- Agreement Establishing the World Trade Organization
- General Agreement on Tariffs and Trade
- Agreement on Agriculture
- The Decision on Measures Concerning the Possible Negative Effects of the Reform Programme on Least-Developed and Net Food-Importing Developing Countries
- Agreement on Textiles and Clothing
- Agreement o Technical Barriers to Trade
- Agreement on Trade-Related Investment Measures
- Agreement on Anti-Dumping
- Agreement on Customs Valuation
- Agreement on Preshipment Inspection
- Agreement on Rules of Origin
- Agreement on Import Licensing Procedures
- Agreement on Subsidies and Countervailing Measures
- Agreement on Safeguards
- General Agreement on Trade in Services
- Agreement on Trade-Related Aspects of Intellectual Property Rights, Including Trade in Counterfeit Goods
- Understanding on Rules and Procedures Governing the Settlement of Disputes
- Decision on Achieving Greater Coherence in Global Economic Policy-making
- Trade Policy Review Mechanism
- New Agreement on Government Procurement

The Agreement, signed in April 15, 1994 by the parties of Uruguay Round of Multilateral Trade Negotiations, was approved by the Grand National Assembly of Turkey in January 26, 1995 by the Law: no 4067.

Another Global Process Progressing Concurrently with "Globalisation": Regional Polarization

While the "globalisation" process is progressing, it seems that a political process based on **national motives** is gaining ground all over the world. Moreover, the nations perceiving that they could not be competitive one by one in world market place are tending to form regional blocks. The European Community's R&D policy is a remarkable example for this approach. For the 'total competitiveness' of the Member Countries, the EC's R&D policy, in accordance with Article 130f(1) of the Treaty establishing the EC, *"should address, as a matter of priority, problems of society**, improving the international competitiveness of Community's industry*** [underlined by us], *sustainable development, job creation, the quality of life and globalisation of knowledge, contributing to the development and implementation of the Community's policies and **the role of the Community in the world as a focal point of scientific and technological excellence*** [underlined by us]."[4]

It seems that when the blocks accomplish the political and legal infrastructure of organizing their in-block single markets, countries those are not involved in any block and, furthermore, have not any competence in science and technology will hardly have a chance to survive.

Only Strategic Choice for Turkey in Context of Global Processes: Gaining Ability in Science and Technology

In regard to the global processes talked about, it can be said that, science and technology have become the key factors in competitive advantage of nations as well as in competition among the firms. Thereby, the countries having superiority in science and technology are progressing towards dominating the information age and the future world, too.

The countries, such as Turkey, do not have any active role in those processes that carry the seeds of 21st Century, but they are directly affected by the consequences of them and they, inevitably, will continue to be influenced deeply. Turkey, in respect of those global processes, has to cope with many problems. Among them, the most vital one is to catch up with technological changes of the age. However, Turkey's challenge has two fronts in this respect. Turkey, which inherited the Ottoman Empire that had missed the evolutionary process towards an industrial society after the British Industrial Revolution, has not surpassed the industrialization threshold yet. Now, while the industrial societies are evolving into information societies, it has to face the problem of keeping up with technological changes leading the new age as well as the problem of overcoming that historical gap. **The performance of Turkey in solving these two problems simultaneously will determine her future.**

To cope with these two formidable problems at the same time necessitates gaining ability in science and technology. **Improving the scientific and technological ability of Turkey and creating a country that dominates science and technology is our only strategic choice. The policy that would lead to realization of that strategic choice is our national science and technology policy**.

[4] **"**Common Position (EC) Adopted by the Council on 12 February with a View to Adopting Decision of the European Parliament and of the Council Concerning the Fifth Framework Programme of the European Community for Research, Technological Development and Demonstration Activities (1998-2002); Annex I" (http://www.cordis.lu/uk/en/src/c-decis1.htm#decision)

Concept of Innovation Ability…

Gaining ability in science and technology does not only mean acquiring excellence in scientific and technological research. It also covers gaining ability '**to transform the scientific and technological findings into economical and social benefit**'. A nation can gain an advantage over others in the world market place if only she has such ability.

In our policy design, we, in general, have taken the ability '**to transform the scientific and technological findings into economical and social benefit**' as the **innovation ability**. To be prim and precise, it can be said that we have modified the definition of '**innovation**' concept, proposed by OECD, to some extent.

As it is known, as a concept, 'innovation' denotes both a process and its result. According to the definition proposed by OECD (1992; 1993), innovation, as a process, involves *"the transformation of an idea into a marketable product or service, a new or improved manufacturing or distribution process, or a new method of social service."* On the other hand, when the word 'innovation' is used to refer to new or improved product, equipment or service, which is successful on the market, it denotes the result of the process.

In the definition, the emphasis, either as a process or as a result, is on the '**marketability**'. The created innovation can be incremental or radical, but it has to be marketable.

Another remarkable point in the definition is that there has not been any implication on the '**idea**'. The idea, as long as a marketable result is obtained, can be related to conventional technologies as well as be related to advanced or high technologies. It can never even be related to technology. Nevertheless, in our era, scientific and technological contents of almost all products, methods, or services, which will be the subject for an innovation process, have increased considerably and, it seems that, are increasing continuously on the basis of generic technologies. Under these circumstances, innovation process itself is increasingly becoming more linked to technology and, of course, to science as the source of modern technology. As a recently issued OECD Report has cited (OECD, 1998b):

"The innovation process is drawing more and more on advances in knowledge by the science base, although there is no linear relationship between the two. Analysis in the United States shows a threefold increase in publication citations in patents delivered over the period 1987-94, an indication of stronger links between science and innovation."

In other words, the new ideas and new findings in science and technology have become the main source of innovation. So, the innovators/entrepreneurs are to understand, adopt and use the new technologies, sooner or later.

On that account, we can say that, in the final analysis, **innovation, as a concept, denotes the transformation of science and technology into an economic or social benefit 'just in time' for the market and the needs of society** (Göker, A. 1998). In this context, gaining ability in technological innovation is crucial. This is the challenge for both entrepreneur and nation in our era as Porter has said (1991):

"Revolutionary new technologies (information systems, bioengineering, new materials, super fast microchips, and others) provide the opportunity for an era of innovation and improving productivity in virtually all industries that may well be unprecedented in industrial history. We have only to accept the challenge and act upon it."

We have accepted the challenge and devised a national science and technology policy for it.

General Framework of the Turkey's Science and Technology Policy

The Supreme Council for Science and Technology (SCST) (see the Box I) approved the **"Science and Technology Policy of Turkey: 1993-2003"** (TÜBİTAK, 1993), at its meeting of 3rd February of 1993. This is the basic document of Turkey's current Science and Technology Policy. The policy expressed in this document was elaborated and based upon a solid ground with "**The Project of Impetus for Science and Technology**" (TÜBİTAK, 1996) within the scope of Structural Transformation Projects involved by **VIIth Five-Year Development Plan**.

Box I

Policy-Making Body in Science and Technology in Turkey

The Supreme Council for Science and Technology (SCST), authorised by the law as the highest policy-making body, has a key role in the Science and Technology System of Turkey. It was established in 1983.

The SCST is chaired by the Prime Minister and comprised of the Ministers of Defence, Finance, Education, Health, Forestry, Agriculture and Rural Affairs, Industry and Trade; the President of the Higher Education Council; the Under-secretaries of the State Planning Organization, Treasury, and Foreign Trade; the President of the Scientific and Technical Research Council of Turkey (TUBITAK) and one of his deputies; the President of the Nuclear Energy Council of Turkey; the General Director of the Broadcasting Corporation of Turkey; and the President of the Union of Chambers of Commerce and Industry of Turkey.

TUBITAK acts as the general secretariat to SCST. Preparatory studies on the issues taking place on the SCST's agenda, following up the implementation and evaluating the impacts of the SCST's decisions are conducted by TUBITAK.

TUBITAK was established in 1963. Its range of activities covers physical, engineering, medical and agricultural sciences and technologies.

TUBITAK, as a body authorised by the law:

- Provides financial support and acts as a fund management agency for R&D activities performed by the universities and the industrial enterprises;
- Performs basic and applied research, and experimental development in its affiliated research centres and institutes;
- Provides scientific and technological support through its facilities such as National Academic Network and Information Centre, National Observatory, Wind Tunnel and Metrology Labs.
- Supports promising science and engineering students, on the undergraduate and post-graduate levels, and researchers through fellowships and awards on TUBITAK grants;
- Provides information services in the fields of science and technology;
- Conducts and supports scientific and popular-scientific publication;

- ♦ Collaborates with foreign and national institutes and organizations in the fields within its range of activities;
- ♦ Acts as policy-making and advisory body to government in the fields of science and technology, and research; and
- ♦ Acts as general secretariat to the Supreme Council for Science and Technology.

Science and Technology Policy of Turkey: 1993- 2003

At its meeting of 3rd February of 1993, the **SCST**, emphasising the determinant role of S&T in respect of

- surviving the vividness of national economy,
- sustaining economic growth,
- upgrading the living standards, and
- international competitive advantage,

approved the National Science and Technology Policy for the next ten years.

Within the framework of this policy, in order to attain the economic and social goals of the nation, it has been suggested some measures to be taken in the fields of S&T.

These measures have been generally associated with the rational using of the resources and with the pursuing an integrated strategy for

- enhancing the intellectual capacity (intellectual or intangible capital) of the country,
- upgrading the R&D ability of the country in the new pervasive generic technologies,
- focusing this ability in the fields of economic priority,
- encouraging the activities aiming at the transforming the scientific and technological findings into economic and/or social benefit immediately,
- accelerating the diffusion of new generic technologies in all fields of economic activity.

In this context, the **SCST** has put forward some targets for the same period such as

- Increasing the number of R&D personnel to 15 per 10,000 labour force (7.5 in 1992);
- Increasing the GERD to 1% of the GDP (0.5% in 1992);
- Increasing the business enterprise's share of R&D expenditure to 30% of the GERD (24% in 1992);
- Raising the Turkey's rank (38 in 1992) in journals scanned by the Science Citation Index.

Taking into account Turkey's capabilities and the scientific and technological trends and forecasts, the following generic technologies, in general, have been accepted as priority areas of activity:

- Informatics,
- Advanced materials,
- Biotechnology, and
- [Aero]space technology.

The Project of Impetus for Science and Technology

Main suggestions within the framework of the **Science and Technology Policy of Turkey: 1993-2003** have been elaborated by the **Project of Impetus for Science and Technology** within the scope of Structural Transformation Projects involved by **VIIth Five-Year Development Plan**, at the beginning of 1995.

This project has proposed seven specific fields of investment in order to create a concrete base for enhancing the S&T capability (it can also be read as **innovation** ability) of the country. These specific fields converging the priority areas suggested by the **Science and Technology Policy of Turkey: 1993- 2003** are

- Construction of the National Information Infrastructure needed for the 21st Century and related Telematic Services Network;
- R&D in Flexible Manufacturing / Flexible Automation Technologies for learning these technologies by research, and for enabling the Manufacturing Industry of Turkey to innovate its labour process;
- Upgrading the Existing Railway System on the base of High-Speed Train Technologies;
- Aviation Industry, and related R&D on the base of selected products;
- R&D in Genetic Engineering-Biotechnology, and project based applications;
- R&D in Environmentally Sound Technologies, Energy Conserving and Efficient-Use Technologies, Environmentally Sound Energy Technologies; and related nation-wide applications;
- R&D in Advanced Materials; and related industries.

As it can be seen, some of these investments reflect a demand-pull strategy while the others reflect a technology-push strategy, and it can be said that there has been a certain approach of harmonisation in these suggestions.

In addition to these investment suggestions, the Project, in regard of the enhancing **S&T ability**, and, thereby, **the innovation ability** of the nation, includes some crucial measures pertaining to legal and institutional restructuring.

In this respect, it should be pointed out that the process of gaining ability in **innovation** is not a technical or linear process, and it cannot be limited to learning and absorbing the new technologies -i.e. technology transfer. It is much more complex than this. Gaining ability in innovation also involves many cultural, social, economical and political aspects and components, interactions amongst those components, and mechanisms for interaction; in shortly, it necessitates a specific system, namely, a **national system of innovation**, and, therefore, a systemic approach.

National System of Innovation: The Backbone of the Productive and Innovative Society

In this point, in regard to the "globalisation" process, it can be asked whether we need a **national** system, indeed. C. Freeman (1995) replies to the question:

*"Contrary to some recent work on so-called 'globalisation', **national*** [underlined by us] *and regional systems of innovation remain an essential domain of economic analysis. Their importance derives from the networks of relationships, which are necessary for any firm to innovate. Whilst external international connections are certainly of growing importance, the influence of the national education system, industrial relations, technical and scientific institutions, government policies, cultural traditions and many other national institutions are fundamental."*

For that matter, Ricardo Galli and Morris Teubal (1997) says:

"The concept of national system had a well-defined meaning in the past when basic decisions concerning the science, technology, and innovation policies of a given country were taken essentially at a national level. Nevertheless, increasingly, international linkages are dominant in science as well as in innovation and diffusion processes, leading National Systems of Innovation are to become ever more open systems. Thus the term may appear a mismatch to the current real geographic size and space of technical systems supporting innovation in any specific sector, which might be mostly international.
...
*"Nevertheless, the concept of **national system*** [underlined by us] *maintains its significance not only because it is shaped by national characteristics -size, social and economic development, sectoral specialization, endowment of resources, cultural traditions- but also since the required adaptation to the new paradigm is still largely done at the national level."*

M. Porter (1991) puts the matter explicitly:

*"... Firms will not ultimately succeed unless they base their strategies on improvement and innovation, a willingness to compete, and **realistic understanding of their national environment and how to improve it. The view that globalisation eliminates the importance of the home base rests on false premises...*** [underlined by us].

"As globalisation of competition has intensified, some have begun to argue a diminished role for nations. Instead, internationalisation and the removal of protection and other distortions to competition arguably make nations, if anything, more important. National differences in character and culture, far from being threatened by global competition, prove integral to success in it.

"It is the creation of knowledge and the capacity to act, which are the result of a process that is highly localized, that determines competitive success."

As a recently issued OECD Report (1998a) has also argued that:

"Imported technology is no substitute for a sound science base and domestic innovative capacity when determining long-run technological performance. The emphasis must be on assimilation of know-how through learning by doing and learning by research."

Now the question is which instrument enables us to perform *"a process"* that should be *"highly localized for creation of knowledge and the capacity to act"*, or, to create *"a sound science base and domestic innovative capacity",* and to *"learn by doing and learn by research"*. **The national system of innovation enables us, indeed**. In my opinion, the matter is so evident that there is no need any additional explanation, and it is also explicit that the first step for a nation aiming at being innovative should be to begin laying the necessary building blocks of the national system of innovation. And Turkey is doing so…

Science and Technology System and the Innovation System…

In this point, it should be noticed that the science and technology system and the innovation system are not identical. The innovation system, in a sense, is a product of the interaction between the science and technology system and the production system. And, as the innovation system develops, interaction between other two systems increases and the innovation ability of the nation rises. If the science and technology system, namely, Higher Education and the Research and [Experimental] Development System, has been isolated from production system, we cannot talk about the existence of any innovation system. In other words, innovation system necessitates the very existence of other two systems and the interaction between them.

Furthermore, we need some mechanisms -or some interfaces or transition zones- and intermediary agents for this interaction. University-industry corporate research centres, incubators, technoparks, technology centres, technology counsellors and consultants, information networks are the well-known examples of them. But the innovation system is still not so simple and has not completed yet. At these interaction zones, we will encounter the human problem; e.g. 'corporate research' is a matter of culture and we need training. Furthermore, creating the building blocks of the innovation system, such as 'corporate research centres' and 'incubators', and the activities conducted there, need financial support and, generally, public assistance, at least, at the beginning. This requirement list goes on to great extent.

Concept of National System of Innovation…

I think that it will be helpful to reach an understanding on 'concept of national system of innovation' because this subject is the focal point in our policy design. According to C. Freeman (1995): *"the first person to use the expression 'national system of innovation' was Bengt-Åke Lundvall… However, as he and his colleagues would be the first to agree (and as Lundvall himself points out) the ideas actually goes back at least to Friedrich List's conception of* ***'The National System of Political Economy'****, which might just as well have been called 'National System of Innovation"*.

Lundvall (1992) defines the concept of national system of innovation as *"all parts and aspects of the economic structure and the institutional set-up affecting learning as well as searching and exploring."* According to him *"the production system, the marketing system and the system of finance present themselves as subsystems in which learning takes place"* and *"determining in detail which subsystems and social institutions should be included, or excluded, in the analysis of the system is a task involving historical analysis as well as theoretical considerations...* ***a definition of the system of innovation must be kept open and flexible regarding which subsystems should be included and which processes should be studied.*** [Underlined by us]*"*

Freeman (1987) himself defines the national system of innovation as *"the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies."*

According to Patel and Pavitt (1994), who build their concept on the insights of Freeman, Lundvall and Nelson, 'concept of national system of innovation' can be defined as follows: *"the national institutions, their incentive structures and their competencies, that determine the rate and direction of technological learning (or the volume and the composition of change -generating activities) in a country."*

Regarding our concrete circumstances and our starting point, in our policy design for Turkey, we have taken this concept in a broader sense and deliberately descriptive manner as follows (TÜBİTAK, 1997):

"A system comprised of national institutions that have the following abilities:

- *Ability to acquire, diffuse, assimilate and utilize new technologies,*
- *Ability to improve existing products, and to design new ones,*
- *Ability to improve existing production processes, and to design new ones,*
- *Ability to design and produce the means of production or capital goods required by the improved or newly designed production processes,*
- *Ability to maintain technological R&D activity that feeds the mentioned improvement, design and production processes; and ability to conduct scientific research -i.e. basic research- that is the source of those technologies,*
- *Ability to improve existing organization methods [soft technologies] arranging the relations within and between research, development, design, production (manufacturing), and marketing compartments and reproducing those relations at a technologically higher level."*

It is obvious that national system of innovation contains all of the institutions necessary for creating and maintenance of those abilities. In other words, **the system is comprised of not only**

- Enterprises conducting innovative activities, and providing engineering, consulting and design services;
- Mechanisms for technology transfer (diffusion, assimilation and utilization);
- Universities conducting basic research, and the public research bodies conducting mission-oriented basic research;
- Professional research bodies such as laboratories of the enterprises conducting in-house research, and contract research centres, corporate research centres or corporate research consortia, generally, conducting industrial research and pre-competitive development activity;
- Education-training institutions;
- Quality assessment institutions on education and research;
- Technological facilities such as wind tunnels, simulators, accelerators, and so on;

but also includes;

- Information networks, and centres providing special information services;
- Institutions related to standards and quality control; national metrology system; national notification-accreditation-certification system;
- Incubators, technology development centres, technoparks, science parks, advanced industry parks, near by the universities or public research institutions, creating an **interactive and conducive environment** between research potential of universities or research institutions and creative-innovative entrepreneurs / enterprises based on advanced technologies;
- Demonstration centres for diffusion of tangible technologies;
- Technology counsellors and technology centres that will meet the technology requirements of enterprises and carry on the new scientific and/or technological findings to them in a **conceivable form** so that they can use and convert these findings into marketable products.
- Patent offices and the other institutions protecting intellectual property rights;

- Technological attachés;
- **Consulting bodies and firms** for consultative services on following special subjects:
  - Evaluating the feasibility of new business ideas and assessing the viability of new business opportunities;
  - Developing the business strategy/business plans;
  - Organizing the funding and access to financial resources;
  - Marketing, particularly, for the enterprises operating in international markets;
  - Patenting;
  - Technology auditing to help companies become more competitive in the market place and so enable them to achieve growth and develop their businesses;
  - Operations auditing aiming at improving the operational performance of companies and inculcating them a permanent process of continuous improvement;
  - Assistance in the implementation of a range of concepts such as 'Just-in-Time' and 'Total Quality Management';
  - Software development, data processing, and/or software and information procurement;
  - Innovation management, management and exploitation of R&D, and human resource development;
  - Assistance in identifying, gathering and dissemination of information on global best practices, and in developing appropriate benchmarking practices.
- Financial institutions providing **seed capital funding** to highly skilled individuals or teams, and new businesses with relatively long development phase, often involving new technology;
- Incentive mechanisms for technological innovation investments;
- Grant mechanisms for scientific research conducted by universities and in-house R&D activities of enterprises;
- Assistance or grant mechanisms for setting up contract research companies or centres, cooperative research centres or consortia, and for encouraging enterprises to conduct corporate research and to participate in corporate research programs;
- Assistance or grant mechanisms for creating interactive and conducive environments such as incubators, technoparks, demonstration or exhibition centres, information centres and networks;
- Institutions or foundations sharing the risks of the enterprises, on the base of their technologically innovative and creative projects, through credits repayable provided that the resulting product is commercialised successfully;
- Financial institutions for provision of additional equity funding through the **venture capital funds,** which have the resources and management skills to make commercial investments in growth-oriented enterprises.

All institutions or mechanisms mentioned above are the necessary components of national system of innovation, and the second group is, at least, as important as the first group in creating innovative capability in the country.

Furthermore, governments have significant responsibilities in designing national science and technology policies -and national innovation policies that go along with- and in policy implementation. In last analysis, national science and technology policies mean reorganization of

national resources, especially public resources, according to the priorities determined by those policies. And this requires, in the process of designing those policies, a consensus among different interest groups. The role of government starts here.

Many diverse institutions, individuals and sectors participate in policy implementation. The success of this multi-actor play depends on orchestration, which is mainly on the government's responsibility.

In this respect, it can be said that the government herself is a main component and has a key position in national system of innovation.

For a country, such as Turkey, that has not established all the necessary building blocks for a national system of innovation the role of government becomes very important in creating the suitable environment and climate, and the appropriate policy tools, for encouraging innovation.

In shortly, creating a national system of innovation and gaining ability in innovation is a matter of new arrangements related to scientific, technological, educational, financial, legal, administrative institutions and infrastructure. As a much more important point than this, it is a matter of restructuring the enterprise itself. Science and technology policy should respond all these requirements in a systemic approach.

As an OECD Report (1998a) mentioned before has put forward:

"To realize the full potential of innovation in fuelling growth, technology policy should be an integral part of overall economic policy. Innovation activities are dependent not only on the effective production, circulation and absorption of new knowledge, but also on the framework conditions for learning, financing, regulating, etc. Technology policies need to operate in a stable macroeconomic environment and complementary reforms in other fields. These include ***competition policies*** *which enhance innovation-driving competition but also facilitate collaborative research;* ***education and training policies*** *which develop the necessary human capital;* ***regulatory policies*** *which lessen administrative burdens and institutional rigidities;* ***financial and fiscal policies*** *which ease the flow of capital to small firms;* ***labour market policies*** *which enhance the mobility of personnel and strengthen knowledge flows;* ***communication policies*** *which maximize the dissemination of information; and* ***foreign investment and trade policies*** *which further technology diffusion on a global basis. New approaches or institutional arrangements may also be needed to coordinate these policies."*

Focal Point of Turkey's Science and Technology Policy and the Actual Agenda for Policy Implementation

It has said above that gaining ability in science, technology and innovation **is the only strategic choice for Turkey**. And it has emphasized that gaining this ability does not only involve scientific or technological aspects, but also includes many cultural, social, economical and political aspects and components, interactions amongst those components, and mechanisms for interaction; in shortly, it necessitates a specific system, namely, a **national system of innovation**.

Thereby, **establishing the national system of innovation** with all basic components and restructuring of the existing ones is the focal point of the **Turkey's Science and Technology Policy** aiming at creating a Turkey that

- has enhanced her ability in science and technology, and
- has gained capability of transforming science and technology to economical and social benefit,
- has got the respectability among the countries that contribute to the World's science and technology, to that common inheritance of humanity.

At its meeting of 25th August of 1997, the Supreme Council for Science and Technology (**SCST**), taking into consideration this agile requirement, has come to some crucial decisions related to **establishing the national system of innovation.** These decisions has constituted the **Turkey's Agenda for the years 1997-1998,** that can also be called as an 'action plan', in Science and Technology Policy Implementation. At its meeting of 2nd June of 1998, the **SCST** made some additions and amendments to these decisions (see Box II for the main articles of the Agenda).

Box II

Turkey's Agenda for the Years 1997-1998 in Science and Technology Policy Implementation

1. Devising a Master Plan for Establishing the National Information Network
2. Establishing The National Academic Network and Information Center
3. Legal, Administrative and Technical Arrangements for Spreading The Electronic Trade in Turkey
4. Issuing The Law of Technology Development Districts
5. New Legislative and Institutional Arrangements for the Management of Brainpower Resources:
   - Improving all Universities to a Level of Universal Quality on Higher Education and Scientific Research
   - Preparation of the Research Personnel Legislation
   - Training Academic Personnel; Encouraging Research; Improvement of Scholarship Systems for Doctorate and Post-Doctorate
6. Stimulating the Researches in the Fields of Social Sciences and Humanities
7. Issuing the Law of National Accreditation Council of Turkey
8. New Legislation for Restructuring the Public Research Institutions
9. Constituting National Research and Development Budget
10. New Arrangements Pertaining to the Decree of Government Assistance for R&D Activities Conducted by Industrial Enterprises
11. Measures for Spreading the Venture Capital Investment Partnerships
12. Technology and Innovation Support for the Small and Medium Sized [Industrial] Enterprises (SMEs)
13. Establishing University-Industry Cooperative Research Centers
14. Reviewing the Government Procurement Policy in Respect of Encouraging the Industrial Research in Turkey

15. Establishing the National Aerospace Council for Improving the Scientific and Technological Ability of the Country in this Field
16. Supplying the Required Funding Support for Turkish Partners to Participate in International Joint Research Projects and Developing Additional Mechanisms for This Purpose
17. Determination of the Regulatory Rules on the Studies of Biotechnology and Genetic Engineering
18. Determination of the National Policy on the Effective Use of Energy and Environment Friendly - Renewable Energy Technologies
19. Determination of the National Policy on the Environment Friendly Technologies
20. Determination of the National Policy on the Technologies of Marine Sciences; Technologies for Utilizing the Marine and Submarine Resources
21. Determination of the National Policy on Megascience
22. Innovation Policy Researches; Spreading the Techniques of Technology-, Innovation-, and Quality-Management; Assisting Innovation at Sectoral Level
23. Technology Development in Industrial Sector
24. Issueing a Decree on Supporting the Expenditures of Patent, Useful Model, and Industrial Design Registrations
25. Establishing the National Museum of Natural History, and Science and Technology Centers for popularising the science and technology issues

Conclusion

The societies built on Industrial Revolution are evolving into a new age, thereby, a new society, namely, the information society. The challenge of the societies of today is said to equal that of the societies witnessing the Industrial Revolution. The process of transition into this new age has been characterised by radical changes taking place at the technology basis of production and labour process, following the emergence of new pervasive-generic technologies led by the information technology. The social and cultural adaptation process is going on. The prospect of securing social and economic development therefore calls for new policies and strategies.

Other processes that we, in global scale, are witnessing today are “globalisation” and “regional polarization”. They are progressing concurrently with the revolutionary changes summarized above.

The particular challenge faced by Turkey is twofold:

- to cope with the unfinished process of industrialisation and industrial society restructuring, and
- to cope with the new process of evolving into information society.

Hence, any development strategy for Turkey has to respond to these formidable tasks in all.

The crucial point for Turkey is to gain ability in science and technology that have become the primary resource of economic growth and social prosperity. Gaining ability in science and technology does not only mean gaining ability in scientific and technological research. A nation can gain an advantage over others in the world market place if only she has the innovation ability, i.e.

the ability to transform the scientific and technological findings into economical and social benefit just in time for the market and the social needs. Her place in new international division of labour will depend on this ability. An important response to this urgent need has been provided by devising a national science and technology policy.

In policy design, the national system of innovation has been assumed as a fulcrum for Turkey enabling her to gain ability in science, technology and innovation, and to evolve into the information society. This assumption clarifies why the establishment of the national system of innovation constitutes the focal point of the National Science and Technology Policy aiming at creating a Turkey that

- has enhanced her ability in science and technology, and
- has gained capability of transforming science and technology to economical and social benefit,
- has got the respectability among the countries that contribute to the World's science and technology, to that common inheritance of humanity.

It must be underlined that the key point of success is to handle the issue of **establishing the national system of innovation** with all its economical, political and social aspects as well as to handle it in systemic integrity, continuity, and decidedly.□

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