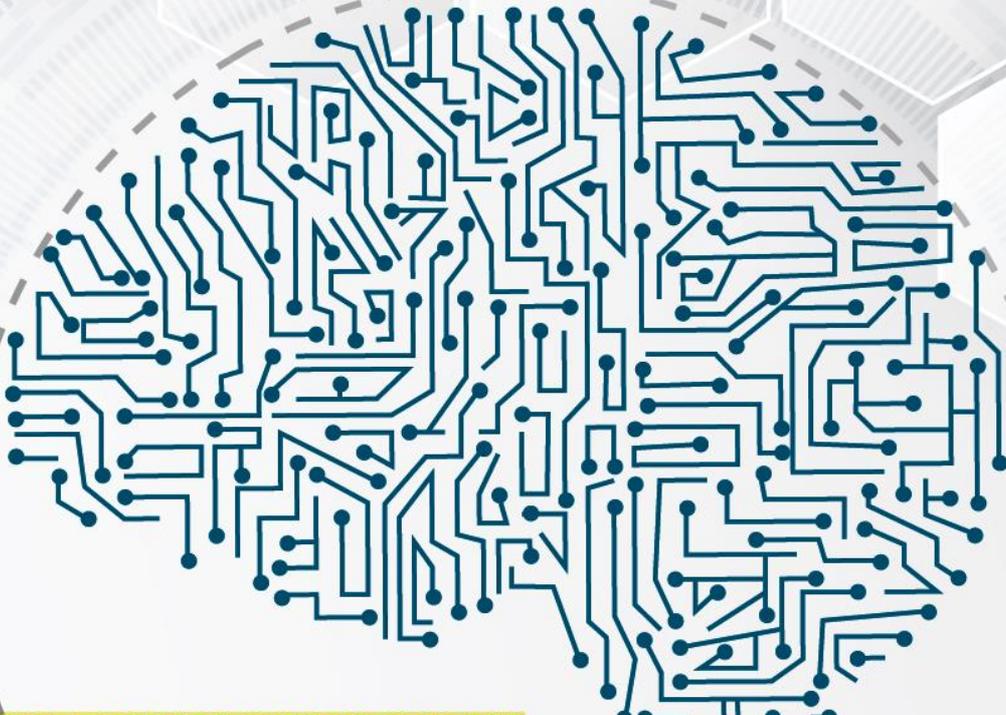


( **Biotechnology** | Robotics | Artificial Intelligence | Nanotechnology | Space | Strategic Services )

# **BRAINS<sup>2</sup> TÜRKİYE**

# **BIOTECHNOLOGY PROGRAM**

**“Development of Vision, Strategy, Ecosystem and Market,  
through the International Comparison”**



**BIOTECHNOLOGY PROGRAM**

**ROBOTICS PROGRAM**

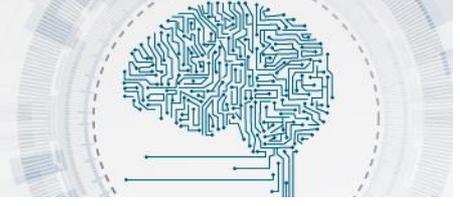
**ARTIFICIAL INTELLIGENCE PROGRAM**

**NANOTECHNOLOGY PROGRAM**

**SPACE PROGRAM**

**STRATEGIC SERVICES PROGRAM**

# BIOTECHNOLOGY PROGRAM



( Biotechnology | Robotics | Artificial Intelligence | Nanotechnology | Space | Strategic Services )

## **BRAINS<sup>2</sup> TÜRKİYE\* BIOTECHNOLOGY PROGRAM**

**“Development of Vision, Strategy, Ecosystem and Market,  
through the International Comparison”**

\* **BRAINS<sup>2</sup> TÜRKİYE** is a brand/initiative with multi-programs based in Turkey which develops market, ecosystem and capacity in the ‘**Biotechnology**’, ‘**Robotics**’, ‘**Artificial Intelligence**’, ‘**Nanotechnology**’, ‘**Space**’ and ‘**Strategic Services**’ fields. The programs planned through identical visions and strategies for each main fields which transforms the new business models and multidimensional power distribution in the global economy, are implemented under the common title of **BRAINS<sup>2</sup> TÜRKİYE**.

### **VISION (DRAFT)**

Biotechnology is an interdisciplinary field which contains the research, development and production processes of products with economic value by the using living materials. Due to recent developments in genetic techniques; the transfer of genetic materials between organisms and the existence of organisms which are suitable for the production and optimization of new metabolites with commercial importance have accelerated the applications in this field.

As the biotechnology aims to understand, intervene, change and direct the functions of human, animal and plant cells; various techniques and processes are used in this field. Thus, it is possible to produce new products which are not produced by microorganisms which are genetically manipulated in order to gain the desired specifications. The importance of these products with high economic value increases the importance of the related studies. Developments in biotechnology and molecular biology are very important for the fields such as environment & energy and food production.

Biotechnology is also defined as the methods which are used to apply genetic modification on plants, animals and microorganisms or to obtain new organisms through applying technology in natural sciences in order to treat living creatures or to develop products for industrial use. The biotechnology where natural sciences such as cell and tissue biology culture, molecular biology, microbiology, physiology and biochemistry are used mutually with the engineering branches such as genetics, machinery, electronics and computers; covers all studies performed by using DNA technology in order to develop plants, animals and microorganisms, and to obtain materials or products which cannot be found naturally or found very rarely.

# BIOTECHNOLOGY PROGRAM



Biotechnology, which differs from other technologies through creating its own demand as it transforms basic inventions into useful commercial products in a short time, has a very wide activity field such as protein and hormone production for human health; production of vitamins, antibodies and antibiotics; purification of organism enzymes and biomolecules which live in difficult conditions and their usage in industry; production of new vegetable and fruit; elimination of harmful genes in humans; production of vaccines, pesticides, medicinal plants; even the production of artificial organs and tissues to replace damaged or non-functioning organs and tissues. The global market shares of biotechnological products are as follows; 77% in food industry, 12% in antibiotics industry, 7% in medicine and 3% in agriculture.

The biotechnological applications which covers many fields in our daily life, are classified with sub-sectors by considering fields of activity through assigning the colors codes such as "Red" (health and diagnosis), "blue" (water and sea), "yellow" (food and nutrition), "green" (agriculture and environment), "brown" (irrigation and desert), "white" (industry and R&D), "gray" (fermentation and bioprocess), "gold" (bioinformatics and nano-biotechnology), "black" (bio-terrorism and bio-crime).

The vision of Turkey is determined as "to take place among the leading countries of the world through increasing the technological knowledge level and value added production in the field of biotechnology" through taking opinions of the responsible and related public institutions beside the universities and non-governmental organizations which bear responsibilities within the scope of Turkey's Biotechnology Strategy and Action Plan; and the general purpose is determined as "to improve our R&D and innovation ecosystem capacity in biotechnology field, to make our country an attraction center which develops technology and which produces innovative, value added and suitable products towards global competition".

The below given three sub-objectives are determined in the strategy for the "health biotechnology", "agricultural biotechnology" and "industrial biotechnology" fields: 1) To develop a health biotechnology sector which develops, produces and exports high value-added and innovative products such as bioactive molecules, drugs, systems, tissues and organs; which is qualified and compatible with international standards and which has qualified researchers, technological infrastructure and which has reached international competitive capacity, which is integrated with the world and which complies with regulations and ethical rules. 2) To develop and produce innovative products and to create and industrial scale structure which adopts green production through efficient use of genetic resources of Turkey created by the bio-diversity and the recyclable resources. 3) To become a country which focus on R&D studies in order to develop biotechnological techniques and practices through considering the risks in terms of environment and human health in the agricultural sector and which applies the biosafety criterion effectively regarding the produced products through utilizing advanced technology by considering international developments.

# BIOTECHNOLOGY PROGRAM



The objectives within the scope of the action plan are as follows respectively; “To Perform Legal and Administrative Arrangements”, “To Improve Technical Infrastructure”, “To Improve Production Infrastructure”, “To Improve Health Biotechnology Sector”, “To Improve Industrial Biotechnology Sector”, “To Improve Agricultural Biotechnology Sector”.

Even many European countries – same like Turkey - has kept the distance against the biotechnology for a long time because of the negative reputation of GMOs, the “Bio-economy” which represents trade activities on biological systems in the free market is ascending in Europe. Bio-economy is based on mainly agriculture and animal farming sectors beside chemistry, health, medicine, cosmetics, energy and many other sectors. The current volume of the bio-economy in Europe is over 1.5 trillion Euros.

According to the "Biotechnology Sector Innovation System" report of Turkey Technology Development Foundation; as the USA lead the global biotechnology, volume of bio-economy is 100 billion \$ as the share of agriculture is 76 billion \$ in USA, the volume of bio-economy in Canada 87 billion \$. Israel, Ireland, South Korea, China, Singapore and India have taken a competitive position in this field within last years. While the yearly growth rate of biotechnological sector was calculated as 17% in developed countries since the beginning of the century, this figure has reached 36% in developing Asian countries. Venture capital funds are allocated towards “Biotechnology” which is determined as a strategic sector in these countries, and the programs towards training qualified specialists are featured and legal arrangements are applied to facilitate for such trainings.

**This new ecosystem, which is still considered in infancy period, currently offers a huge market on this scale - which has no matured competition and provides many new opportunities - as it creates new markets with the volume of tens of billion dollars for SMEs, main contractors and technology companies, and continues to grow through many technological developments and private sector initiatives.**

Our country has no specific road map in the field of Biotechnology even though a Biotechnology Specialization Commission was established within the scope of the 7th Development Plan. It is very hard to find proper market data. If we assume that the industrial biotechnology consists of companies which develop products from biological raw materials by using enzymatic/microbial transformations techniques; we can say that our bio-economy has grown regarding the enzymes, bread yeast, starter cultures, green chemicals, biomaterials, bio-preparations, biofuels, vaccines, natural intermediates, environmental technologies etc. In recent years, studies related with this sector have been increasing especially in universities and the biotechnology initiatives have increased significantly through the increasing interest of the private sector. It is very important for Turkey to support the existing and new initiatives through preparing a strong program and road map in order to increase the it’s’ share in the world bio-economy.

# BIOTECHNOLOGY PROGRAM



**BRAINS<sup>2</sup> TÜRKİYE Biotechnology Program** will analyze which Biotechnology fields would provide highest potential for future growth and which benefits can be gained from this growth by the Turkish Biotechnology sector, through considering Turkey's available strength and potential both in academic and industrial sectors.

Upon determining the industrial fields together with their sizes and scales as a result of the studies performed towards discovering the idle potential of Biotechnology industry in order to find the most reasonable and promising interests for the **National Biotechnology Sector** and to increase the efficiency of the private and public sector; such determined industrial fields shall be considered as the sectors which might have the strongest contribution to the competitiveness of the country, the efficiency of the economy and the welfare of the nation.

**BRAINS<sup>2</sup> TÜRKİYE Biotechnology Program;** aims to provide "Biotechnology Strategy" options to Turkey and to be one of the leading stakeholders in the field of Biotechnology in Turkey through asking the right persons \*\* the right questions\*\*\*.

The purpose of the program includes: "Connecting the global trends with local needs" through the contributions of Turkish experts in ; bringing the Biotechnology experts in Turkey and to utilize the output of such meetings and knowledge for the benefit of the Country; preparing an environment for events to strengthen the connections between the expert community; **contributing Turkey's commercial position in the market which grows rapidly, determining the products which Turkish companies are capable to produce and which potential customers to which Turkish companies are capable to serve depending on the capability analysis and the potential of the markets, in order to contribute the Turkey's biotechnology capacity, ecosystem and market development.**

**BRAINS<sup>2</sup> TÜRKİYE Biotechnology Program;** will match the products and customers in accordance with the domestic and global position of the Turkish companies through analyzing the capabilities of the leading Turkish companies while finding answers regarding where our country should be positioned in that sector.

Within the scope of this Program; the multidimensional specific studies and activities which comparatively examines the Biotechnology Strategies/documents and markets of the countries such as US, Russian Federation, China, France, Germany and Japan, and in which the ideal strategy option for Turkey is presented shall be analyzed.

# BIOTECHNOLOGY PROGRAM



## Main Theme

**Development of Vision, Strategy, Ecosystem and Market through the International Comparison**

## Sub-Themes

**Development/Inventory of Biotechnology R&D**

**Biotechnology Sources Ecosystem**

**Biotechnology Governance and Regulation**

**Biotechnology Human Resource**

**Biotechnology and Security**

**Sectorial Analysis and Classification of Global Biotechnology Market**

**Analysis of Leading Turkish Firms and Product Matching**

**Cooperation and Competition through International Comparison**

**Diplomacy of Biotechnology**

## STRATEGY (DRAFT)

### To develop social awareness towards Biotechnology

- To increase the awareness of youth about the professions of future and to forward them towards these professions
- To increase awareness about biotechnology
- To develop forecasting approaches for sub-branches of such professions

### Planning the Workforces and Professions of Future

- Detailed assessment of the workforce and professions of future towards finding out the skills required for these professions
- To determine the professions for biotechnology industry and to plan alternative education and employment fields for the people who want to be qualified for this profession
- To develop the occupational skills of the people who will develop and support products/services by using the “biotechnology” which will be needed by the labor market in the near future.

# BIOTECHNOLOGY PROGRAM



## Focusing on the Use of Biotechnology in Defense and Security Fields

- To establish a center where institutions and individuals from all over the country can apply for the implementation of education and information activities towards “Biotechnology”
- As the center to be established will have a crucial importance for achieving the development in a better way, it shall be established as an institute where orienting and sector based trainings can be provided.
- To provide R&D funds and facilities for primary topics determined for researchers in this center which will be supported by the government or authorities.

## Focusing on Usage of Biotechnology in Education

- To lead the establishment of a biotechnology -focused “data collection policy” for the stakeholders in education
- To contribute the development of products/services which will support the teachers at preparation, process and evaluation of Biotechnology-themed content during the teaching activities.
- To collect data about the individual learning for personalization of education on every aspect of the development of Biotechnology

## To Arrange Trainings to Train Experts in Biotechnology

- To provide trainings in order to ensure development of products/services (for experts in physics, chemistry, computer, electronics, machinery, biomedical engineering and information technologies) by using Biotechnology
- To provide trainings on topics for training assistant and intermediate personnel required for the development of tools and materials which will be used by the specialists in the sub-fields of biotechnology.
- To create awareness among the researchers in universities about the biotechnology applications
- To contribute arrangement of the curriculum to include sector-based use of biotechnology applications especially at the undergraduate degree of the universities.
- To provide trainings for researchers from different disciplines (health, law, education, fine arts, etc.) to ensure them to use Biotechnology and outcomes in their researches.
- To arrange informative studies on Biotechnology application areas
- To provide trainings for entrepreneurs about the Biotechnology applications

# BIOTECHNOLOGY PROGRAM



## Sectorial Review and Classification of Global Biotechnology Market

- To divide the global Biotechnology market into sectors, and to determine the market potential for the future through analyzing the related global markets and customers
- To analyze and classify the R&D, education, application, software, hardware, production, service etc. sub-sectors in the Biotechnology market mainly for the **Agriculture and Food Processing** [Plant Breeding Technology, Animal Breeding Technology, Functional Food Products, Food Diagnosis and Safety], **Wood Processing and Pulp Production** [Enzymes in Pulp and Paper Industry], **Chemical Industry** [Bio Based Chemicals], **Environmental Technologies** [Bio-remediation], **Energy Industry** [Bio-energy], **Health Care** [Therapeutic Products, Diagnosis, Drug Invention Technologies, Bio-processing], **National Security** [Bio Defense].

## Analysis of Turkish companies that will lead the sector and product matching

- To determine in which sectors of this market Turkey would be a significant actor
- To determine the leading companies for these sectors
- To determine the competent universities and institutions regarding R&D studies towards these sectors
- To determine the required certificates and processes for the market
- To determine the products which can be produced by these companies
- To match the products and leading companies which are determined for these sectors

## Informative Studies for Adaptation of the Biotechnology in the Social Life and Industry

### \*\* Right Persons

It is also very important for achieving the goal of this program to ask right questions as well as asking the right questions to the right people. It shall be ensured that the ecosystem shall include all stakeholders in order to analyze the global trends accurately and to determine the right options for Turkey. Therefore, it is a priority to ensure the inclusion of the representatives of the private sector, who create and experience this transformation, besides ensuring all stakeholders such as academicians, public and non-governmental organizations etc.

# BIOTECHNOLOGY PROGRAM



## \*\*\* Right Questions

It is one of the most important steps of this Program to identify and ask the right questions. Targets of this program towards achieving “holistic and holistic results” and maintaining the focused approach, are highly dependent on asking the right questions.

- Does Turkey really need a Biotechnology strategy? If so, why?
- What should be the scale of Turkey's Biotechnology target? Should it compete globally or compete just with equivalent countries?
- How can we participate the international organizations the policy building processes for Biotechnology and what kind of contributions can we provide?
- On which Biotechnology areas should Turkey focus? Developing and expanding biotechnology methods and usages? Producing biotechnology products/services? Producing and commercializing software, hardware and materials used in biotechnology education? etc.
- What should Turkey aim for raising its' labor force? Should our education system train experts who develop Biotechnology products and services, or should it train people who will be employed in the ecosystem created by Biotechnology sector?
- If Biotechnology will be developed, what should be done in order to proceed in compliance with national and international ethics and law and in order to establish required institutional infrastructures?
- What is the current situation of the products and services which are required to develop biotechnology software, hardware, materials in Turkey?
- In which critical sectors the biotechnology would increase the efficiency exponentially? Which steps should be taken if production and development studies are initiated towards these sectors?
- Which export markets should be targeted if Turkey produces biotechnology products and services?
- How to deal with prejudices and errors in the field of biotechnology? Is there a model about these issues which can be presented by Turkey for the world?
- Should it be considered in the Biotechnology strategy to develop policies for the sectors where the employment rates will decrease as the Biotechnology usage expands?
- How Biotechnology education would be delivered at universities? Through opening focused specific undergraduate departments or through adapting curriculum of the relevant faculties?