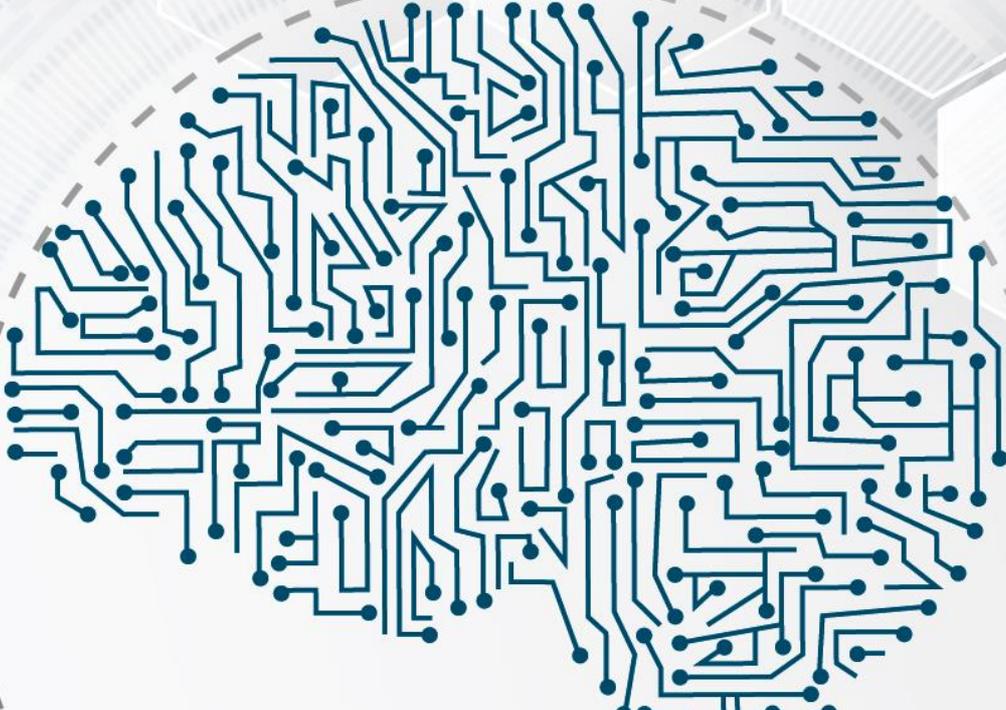


(Biotechnology | Robotics | Artificial Intelligence | Nanotechnology | Space | Strategic Services)

BRAINS² TÜRKİYE

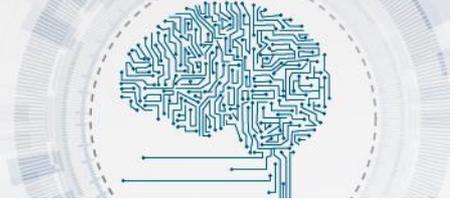
NANOTECHNOLOGY PROGRAM

“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

NANOTECHNOLOGY PROGRAM



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BRAINS² TÜRKİYE* NANOTECHNOLOGY PROGRAM

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

* **BRAINS² 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 **BRAINS² TÜRKİYE**.

VISION (DRAFT)

Nanotechnology is a science which creates new materials and systems through changing the physical, chemical and biological characteristics of atomic structures or components. Its’ main purpose is to increase the quality of life through production nanoscale materials in a controlled way in order to ensure more efficient use of limited resources.

As the Nanotechnology which focuses on the special characteristics of materials at quantum scale in the manufacture of macro scale products; covers the sciences such as earth science, molecular biology, organic chemistry, semiconductor physics, micro fabrication etc.; the practices and researches which is related with Nanotechnology has wide range of application areas such as developing new materials with nano dimensions, controlling the atomic scale directly, extensions of non-atomic device physics, new approaches towards based on the molecular self-assembly. It invests billions of dollars, especially in industrial and military applications. Governments invest billions of dollars in nanotechnology research, especially in industrial and military applications.

Through production capabilities of Nanotechnology in electronics, computers, pharmaceuticals, textiles, biomaterials and energy; it can produce many materials and tools which has wide range of application areas such as biotechnology, medicine, environment, space and defense, etc. The most important benefits of the nano scale products are their lighter and more robust characteristics in addition to their programmable structures and they require less material and energy in production.

According to the researchers, it seems inevitable that the innovations in the field of nanotechnology as the capacity of information technologies increases and consequently the materials and productions with nano scale will increase.

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Beside all these benefit provided by nanotechnology, it is also required to take some measures. Especially, the protective measures must be taken in order to ensure safety of environments where the nanoscale production and systems located.

It is very important to control and to take the protective measures in order to avoid the formation of nanostructures which might damage the environment and people due to their extremely small size. It is required to perform production activities in sterile environments in order to avoid spread of the wastes to the environment that might occur in such processes. Same like all new technologies; the nanotechnology might also cause some suspicions and problems such as toxicity, environmental impacts, its' potential impacts on the global economy and various doomsday scenarios etc. These concerns raise discussions about the necessity of official regulations for nanotechnology.

New methods have been applied to increase the quality of people's life especially in the health, and to meet human needs through technological advances induced by the use of scientifically validated techniques. Nano science and nano technology concepts which arise as a result of technological developments must also be considered within this scope. It is understood that a hardly competitive environment will occur in the following period under the light of the scientific studies carried out in this field, the new products that it develops and the economic impact that it creates. Therefore, the countries which allocate significant amount of funds for R&D investments, give a special importance to nanotechnology.

USA and Germany, South Korea, Japan and Taiwan are more prominent than other countries if we consider their scientific studies on nanotechnology, received patents, actively operating companies, qualified labor force and technology transfer.

China's investments and patents are rapidly increasing in this field. While the total R&D expenses was 1.2 billion \$in 2000, it has increased to 15 billion \$ in 2008 (the share of USA is nearly 5 billion \$).

It is projected that the workforce to reach 6 million people and the market size to reach 3 trillion dollars in the short term, in 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 for SMEs, main contractors and technology companies, and continues to grow with the private sector initiative.

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Under the Nanotechnology title referred in Turkey's Vision for 2023 Strategy; nano-electronics, nano-materials, nano-magnetism, nano-characterization, nano-fabrication, nano-photonics, quantum information processing in nano-scale and nano-biotechnology are determined as primary topics. There are considerable number of scientific studies and research centers in our country. Nanotechnology Engineering departments, which were established as of 2011 in our universities, contribute to the purpose of increasing the R&D activities and designing new products in this field through supplying the educated labor required by the industry.

BRAINS² TÜRKİYE Nanotechnology Program will analyze which Nanotechnology fields would provide highest potential for future growth and which benefits can be gained from this growth by the Turkish Nanotechnology 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 Nanotechnology industry in order to find the most reasonable and promising interests for the **National Nanotechnology 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.

BRAINS² TÜRKİYE Nanotechnology Program; aims to provide “Nanotechnology Strategy” options to Turkey and to be one of the leading stakeholders in the field of Nanotechnology 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; bringing the nanotechnology 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 Turkey's nanotechnology capacity, ecosystem and market development.**

BRAINS² TÜRKİYE Nanotechnology 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 Nanotechnology Strategies/documents and markets of the countries such as US, England, Russian Federation, China, France, Germany and Japan, and in which the ideal strategy option for Turkey is presented shall be analyzed.

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Main Theme

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

Sub-Themes

Development/Inventory of Nanotechnology R&D

Nanotechnology Sources Ecosystem

Nanotechnology Governance and Regulation

Nanotechnology Human Resource

Nanotechnology and Security

Sectorial Analysis and Classification of Global Nanotechnology Market

Analysis of Leading Turkish Firms and Product Matching

Cooperation and Competition through International Comparison

Diplomacy of Nanotechnology

STRATEGY (DRAFT)

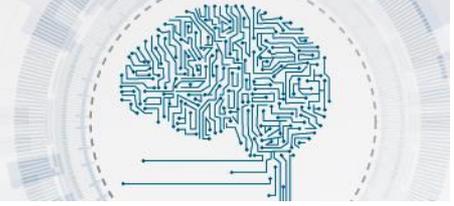
To Develop Social Awareness towards Nanotechnology

- To increase the awareness of youth about the professions of future and to forward them towards these professions
- To increase awareness about nanotechnology
- 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 nanotechnology 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 "Nanotechnology" which will be needed by the labor market in the near future.

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Focusing on the Use of Nanotechnology 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 “Nanotechnology”
- 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 Nanotechnology in Education

- To lead the establishment of a nanotechnology 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 Nanotechnology themed content during the teaching activities.
- Collecting data about the individual learning for personalization of education on every aspect of the development of Nanotechnology

To Arrange Trainings to Train Experts in Nanotechnology

- To provide trainings in order to ensure development of products/services (for physics, chemistry, computer, electronics, machinery, biomedical engineers and information technology experts) by using nanotechnology
- 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 nanotechnology.
- To create awareness among the researchers in universities about Nanotechnology applications
- To contribute arrangement of the curriculum to include sector-based use of nanotechnology applications especially at the undergraduate degree of the universities.
- To provide trainings for researchers from different disciplines (health, education, fine arts, etc.) to ensure them to use Nanotechnology technologies and outcomes in their researches.
- To arrange informative studies on Nanotechnology application areas
- To provide trainings for entrepreneurs about the Nanotechnology applications

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Sectorial Review and Classification of Global Nanotechnology Market

- To divide the global nanotechnology 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 nanotechnology market.

(The potential sectors will also be analyzed on the basis of opportunities which might be offered by this sector in the future despite the studies of the program mostly focus on these sub-sectors in which the nanotechnology is used widely today.)

Health Sector

Through the application of this technology in the health sector, exciting opportunities occurred for manufacturers in the nanotechnology market. As the nanoparticles facilitate the drug, etc. to be deliver specific cells in the human body, nanotechnology is used mainly as drug distributor in the health sector. Many international institutions report that improvements in usage nanotechnology in pharmaceutical industry will face an accelerated growth in the very near future. According to the report of the International Pharmaceutical Federation for the year 2017, in addition to 56 new drugs, also 7,000 new compounds are in the development phase. This technology is also being used widely in diagnostic techniques and antibacterial treatments. In addition to many new applications developed in the health sector, especially cell repair applications, also some other developments which support the nanotechnology market are also being developed.

Applications in Wastewater Treatment and Other Environmental Areas

The wastewater treatment is a profitable sector due to general growth in industry and regulations on wastewater. Wastewater is treated through membranes used in treatment plants, and as the number of wastewater treatment plants increases, the expectations towards a growing nanotechnology market also increases. Industries also use nano-EHS which is one of the lucrative applications of nanotechnology, in order to provide better safety. As the nano materials are environmental friendly and due to increasing concern towards protecting the environment, in order to produce such products nanotechnology is also used. Environmental applications of nanotechnology create new opportunities for actors in the nanotechnology market.

Nanotechnology for Advanced Renewable Energy

Nanotechnology is used to produce panels generating solar energy and to increase efficiency of panels via PV cells. The solar PV market is boosting due to the increasing demand for solar energy in various countries located in Europe, North America and APAC. Furthermore, the African solar energy market will absolutely show a sharp growth in the future. The use of nanotechnology in the solar energy industry is expected to offer opportunities in the nanotechnology market.

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(The rapidly growing markets which are listed below will be detailed in this study.)

Nanotechnology for Lighter but Stronger Materials

As nanotechnology is applied on composites, the devices built by using new generation graphene and carbon nanotube, will be lighter and stronger. This trend will grow and there is a strong and profitable growth potential in nanoplatelets market.

Nanotechnology in Construction Materials

The future is getting prepared for a noticeable boost in nanotechnology applications in the construction materials. It is a globally agreed fact that such a boost will emerge primarily in the insulation materials, cement and glass industries. Many countries and private sector players have already started to invest in this sector.

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 Nanotechnology 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.

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*** 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 Nanotechnology strategy? If so, why?
- What should be the scale of Turkey's Nanotechnology target? Should it compete globally or compete just with equivalent countries?
- How can we participate the international organizations the policy building processes for Nanotechnology and what kind of contributions can we provide?
- On which Nanotechnology areas should Turkey focus? Should it develop and extend nanotechnology methods and their usages? Should it produce nanotechnology products/services? Should it produce and commercialize software, hardware and materials used in nanotechnology education? Etc.
- What should Turkey aim for raising its' labor force? Should our education system train experts who develop Nanotechnology products and services, or should it train people who will be employed in the ecosystem created by Nanotechnology sector?
- If Nanotechnology 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 nanotechnology software, hardware, materials in Turkey?
- In which critical sectors the nanotechnology 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 nanotechnology products and services?
- How to deal with prejudices and errors in the field of nanotechnology? Is there a model about these issues which can be presented by Turkey for the world?
- Should it be considered in the nanotechnology strategy to develop policies for the sectors where the employment rates will decrease as the Nanotechnology usage expands?
- How Nanotechnology education would be delivered at universities? Through opening focused specific undergraduate departments or through adapting curriculum of the relevant faculties?