

## BRAINS<sup>2</sup> TÜRKİYE IMPLEMENTATION PROGRAM

# TURKISH SPACE ECOSYSTEM INVENTORY

“Strategic Research and Capacity Building”



Business and Government Consultancy

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\* **BRAINS<sup>2</sup> TÜRKİYE** is a brand/initiative with multi-programs based in Türkiye 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**.

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**BRAINS<sup>2</sup> TÜRKİYE** Programs, titled "**Building International Comparative Vision, Strategy, Ecosystem and Market**", aims to explore and understand the technologies involved in Türkiye's strategic agenda, within the scope of its current scientific and industrial strength/potential, to examine which of the domains in such technologies may promise the highest potential for future growth, and the National Sectors and their advantages that they may have from this growth. The new ecosystems, which is the subject matter of **BRAINS<sup>2</sup> TÜRKİYE** in this context, grow by ten billion dollars each year with the markets emerging in various domains, ranging from SMEs to main contractors and technology companies or startups, creating **huge markets**, which have not matured yet but have the potential to create new opportunities, and continues to grow with many new technological developments and private sector initiatives. **The National Sectors**, the boundaries and scale of which become clear as the research efforts to explore the unutilized capacity that boosts both public and private sectors progress through the **BRAINS<sup>2</sup> TÜRKİYE**'s subject-specific programs with the objective of identifying the most feasible and promising national interest areas, has become a part of the sectors that have the potential of the highest impact on the competitiveness, economic effectiveness and growth. The third activity of **BRAINS<sup>2</sup> TÜRKİYE** program will be formed under the title **Turkish Space Ecosystem Inventory “Strategic Research and Capacity Building”**.

## Spacefaring Nations

Space and deep space explorations are at the forefront of the domains in which nations tend to have a competitive edge for political supremacy. Today, all spacefaring nations with financial power, even certain non-state actors, set goals and conduct research on deep space explorations.

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The USA is planning to extract the Moon's resources and use them on-site as part of its Artemis project and to pave the way for a space economy, while it has long been seeking to launch a permanent settlement on the Moon. The United States appears to be ready to put humans, on a regular basis, on the lunar surface, on its possible lunar base, which might also be used as a springboard to launching some other missions. For this end, it issues regulatory rules dealing with details or procedures for these initiatives along with technical works and initiates bilateral partnerships with Nasa's Artemis Accords, which was signed up by certain countries involved in this project. Asteroid explorations and sample collection missions have also been underway, which not only underpin the future asteroid mining activities, but also help further scientific discoveries. The United States has also plans for sending astronauts, for the first time, to Mars until the 2030s, while Nasa's Perseverance rover, which was sent to Mars in 2020, continues to send data. China is the first country that achieved in landing a vehicle on the far side of the Moon. China has also plans for launching a permanent research mission on the Moon, similar to that of the United States. China is the second country that sent a rover to Mars in 2020, which still continues its exploration mission. China's another project, which is still in progress, aims to collect samples from this planet until 2030. Some other countries, such as the United Arab Emirates, Israel, Russia, India and Japan, are among the countries that have ambition concerning the missions to Venus and some asteroids as well as the Moon and Mars. Spacefaring nations have also plans for producing agricultural goods on the lunar soil (or regolith), developing nuclear-powered space flight to expedite transport in space, launching a new space station, and initiating asteroid mining during the two decades to come.

In addition to states, the ambitions and efforts by non-state actors, private space companies, for space missions is undeniable. Space tourism, which started with Earth orbit, will reach beyond the orbit and the Moon during the years to come. There is even an initiative, presented by a private company, to form a colony on Mars.

### **National Space Program**

Considering its economic and technological background, it is clear that the Türkiye's space activities is far behind that of developed countries. Türkiye, which has not yet stepped into deep space domain, has recently started to develop space research programs underpinned by public organizations. The Turkish Space Agency (TUA), which was founded at the end of 2018, has developed a 10-year space research plan as part of the National Space Program in February 2021. Its 2022-2030 National Space Program Strategy Document, which was announced by the authorities in May 2022, provides a roadmap for the goals set in the plan.

Although "rocket launching", which is the most popular among the objectives of the program, is seen as a starting step to reach the Moon, the order of priorities should be re-considered in this context. This project has the objective to validate the technologies that will be developed and used for the next phase.

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The process of collecting data with a rover after soft landing on the Moon’s surface, which is the second stage of the national space program, is planned to be completed by 2028. It is aimed for this project to use, as much as possible, domestic and national resources. The goal for 2023 is to make a hard landing with a hybrid rocket, in other words, to crash into the lunar surface. Hybrid rocket tests and the design efforts for spacecraft are also in progress, which will be followed by product development works. Although the some of the materials for the development of the space vehicle are provided by some other countries, the hybrid engine, which is a domestic production as a whole, is produced by DeltaV.

One of the other objectives, as part of the National Space Program, is to have an independent space base where Türkiye can launch its own satellites. Türkiye has plans for building its space base in one of its partner countries, due to the nature of its geographical location, which is not available for such activities. Certain alternative ways of rocket-launching, such as using a water surface in collaboration with Russia, is also being considered but negotiations still continue on choosing the best alternative. Using, in collaboration with Russia and Kazakhstan, the Baikonur cosmodrome, which is another option for non-commercial satellite launches in particular, is still being considered.

Or, satellites up to 100 kilograms, and limited to low earth orbit, can be launched from a location within the borders of Türkiye itself by using the Micro Satellite Launch System, which is under development. Another step is the attendance by one of the Turkish scientists, for a 4 or 6-month training, to the International Space Station for research and training activities, which take a two-year period of time. The procedures for this step, which is planned to be in cooperation with the USA and SpaceX and to be actualized in the first half of 2023, have already begun in May 2022.

Another step is to conduct extensive observation or spacewatch studies on space-zone weather analysis concerning the safety of space missions and satellites. Scientific research on space weather will be coordinated by the Space Weather Application Center, based on the collective experiences gained by its counterparts in other countries. Among the objectives of this center are explorations for still unknown celestial bodies, observations on the already discovered ones, tracking satellites, controlling space debris etc. It is reported that the assemblage processes of the DAG (Eastern Anatolian Observatory) telescope for observations with accuracy will be fully developed and ready to use in 2022. And in the near future, an experimental optical cube satellite mission will be performed with an objective to make space-based observations. One of the additional objectives is to develop regional positioning and timing systems, as well as laser-based distance measuring systems and separate radar-based systems. A roadmap for this purpose will be provided based on the comprehensive feasibility studies. It took more than a decade for India, even though its advanced engineering skills, or even for the European Union, even though its strong economy, to develop their own systems.

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Creating a satellite brand with a globally competitive edge is also among the objectives in this field. Türksat 6A, which is 60% domestic brand, is one of the prominent example of the capabilities observed in the satellite domain. However, many satellite components or technologies in general still cannot be developed independently without the contribution of some other countries. For this reason, another objective is to unite the satellite technology efforts for using resources more efficiently as well as increasing the pace of product development. For this end and with the gradual incorporation of available capabilities and infrastructures, a national company will be established, which will be coordinated by TUA.

The main objective for the achievements by the National Space Program is to have a qualified staff in space studies domain. For this purpose, it is aimed to improve the quality of engineering departments, such as aerospace engineering that are directly related to space research, as well as other related science departments. An additional step is to have more efficient infrastructure, laboratories in particular, for space studies. It is also reported that many undergraduates have had the opportunity for higher education abroad as part of MEB scholarships program. The graduates, those who have returned to Türkiye, are hired by TUA.

It appears that Türkiye will need much more capabilities for the coming years when certain ideas, including interstellar journeys by using the Moon as a springboard or a fuel station, massive explorations such as life on another planet or black holes or some other celestial bodies thousands of light years away will continue to occupy the international space agenda.

## Conclusions and Recommendations

We expect that this activity, “**Turkish Space Ecosystem Inventory**” program, which was announced by TASAM three years ago as part of **BRAINS<sup>2</sup> TÜRKİYE Space Program**, will contribute to the implementation and elaboration of the Turkish Space Policy and Strategy Document.

International relations domain plays an important role in the space policy of each spacefaring nation that focuses on taking and developing the space ecosystem inventory. High-risk scientific space projects are exceptionally open to cooperation between the nations. Many space projects have been initiated and developed by space agencies such as NASA, ESA and JAXA in a way that is required to be in cooperation not only with each other but also their counterparts in other countries. Türkiye's ESA membership, which plays an important role as part of international cooperation, would provide itself a competitive edge. As a primary step, the development and improvement of a modern Turkish Space Ecosystem Inventory would facilitate and accelerate the challenging and time-consuming membership admission processes. There would be an opportunity to make use of the joint missions with ESA or other few spacefaring nations in the meantime.

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The “**Turkish Space Ecosystem Inventory**” **Implementation Program** will not only demonstrate Türkiye's current academic and industrial strength and capabilities, but also inquire for space domains that promise the highest potential for future development and the advantages that the Turkish space industry will gain from this development.

This new ecosystem, which started along with the space race in 1957, is still in its infancy or its earlier stages. Today, however, it represents a huge market of enormous scale, which has not reached its competitive edge yet and has a variety of new opportunities. It grows billions of dollars further each year with many new technological innovations and private sector initiatives, creating new markets in various domains, ranging from SMEs to main contractors and technology companies.

The limits or scale of the sector will only reveal itself as a result of the studies for discovering the untapped potential of space. This potential plays an important part in increasing the efficiency of the private and public sectors when it comes to identify the most reasonable and promising areas of interest for the National Space Sector. This sector will soon take its place among the sectors that have the potential for the strongest impact on the competitiveness of the country, the effectiveness of the economy and the welfare of the nation.

**The TUA set certain goals, in a short run, by following a different path from the inclusive space policy followed by many developed countries in the first stages of development process. The priority, however, is to identify the actors for collaboration and to choose the ways of adaptation when integrating into the current space agenda. It would be a better choice for Türkiye, as a developing country, to improve its capabilities by learning its lessons, which provides more effective outcomes in a short period of time. “Turkish Space Ecosystem Inventory” Implementation Program would not only contribute to the national efforts by its inventory and capacity building perspective, but also assist the decision-makers by proactive suggestions.**

#### **Primary Point**

**Strategic Research and Capacity Building**

#### **Secondary Points**

**National Space Inventory and R&D Construction**

**Space Resources Ecosystem and Türkiye's Exploration/Action Potential**

**International Cooperation/Integration, Space Governance and Regulation**

**Indigenous Space Human Resource: Brain/Labor, Education/Employment**

**Global Space Market, Leading Turkish Firms, Competitive Capacity**

**Türkiye's Commercial Space Capabilities, Challenges and Opportunities**

**Türkiye's Military Space Capabilities, Challenges and Opportunities**

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## **REGULAR OUTCOMES**

### **Ecosystem Inventory**

### **Strategy Documents**

### **Sectoral Inventory Research**

Research and classification works on the secondary sectors (R&D, education, training, software, hardware, production, services, etc.) involved in the space markets, including Satellite Production, Launch Services, Satellite Direct to Home TV, Satellite Radio, Satellite Broadband, Satellite Services, Fixed Satellite Services Transponder Rental, SUS Managed Services, Mobile Communications, Earth Observation [Ground Observation], Earth Observation-Based Data Analytics, Consumer Ground Equipment, Global Navigation Satellite System Devices, Chipsets and Applications, Network Ground Equipment, Ubiquitous Global Broadband, Commercial Space Situational Awareness, Custom Smallsat Launch [Micro Satellite Launch], Smallsat Manufacturing [Micro Satellite Generation] and Suborbital Human Space Flight.

### **Developing Social Awareness about Space**

### **Focusing on the Use of Space Technologies in Defense and Security Domains**

### **Planning for Future Brain and Work Force, Expertise and Professions on Space**

### **Preparation of Trainings for Experts in Space Domains**

### **Focusing on Space Domain in Education**

### **Providing Information for the Adaptation of Space Studies to Industry**

### **Periodical Reports**

There is a need for regular monitoring or research efforts on space ecosystem, both nationally and internationally, in close cooperation with public - private sector - university - think tanks and regular reports that include considerations such as key points, conclusions or recommendations. It is also significant that a special budget should be allocated for this end. The studies, in this context, should be carried out meticulously in line with the measures against outdated approaches as well as with the fight against all types of technological, commercial and political counterintelligence or espionage.