



Viewpoint

Technology foresight in practice: A proposal for Turkish space vision



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ABSTRACT

Nowadays we witness a fundamental change in the perception of space-related issues. Once being a symbol of technological race and competition between opposing political systems, space studies have become a part of everyday life and an indispensable means in achieving economic, scientific, political and social goals. This research addresses space studies of Turkey – a late comer but rapidly progressing country in this field – which is recently emerging in the area of high technologies. In this context, major policies and projects which have brought the country to its present level are discussed. The current status of Turkish space industry is defined through SWOT analysis and a proposal for the country's space vision covering the next 20 years is put forward. Strategies and policies that will be supportive in achieving the proposed space vision are introduced.

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1. Introduction

Early considerations of space activities in Turkey dates back to 1990s [1] and space technology has been highlighted as one of the issues (along with informatics, advanced technology materials, biotechnology and nuclear technology) to affect almost all sectors of the economy and all fields of life [1,2]. Despite having been mentioned in political documents several times, not enough public awareness of the concern was aroused before the large-scale visionary study of Scientific and Technological Research Council of Turkey (TÜBİTAK), The Vision 2023.

Followed by Vision 2023, that surveyed space activities in the context of avionics and national defence [3], a much better understanding of the matter was reached so that, space studies were defined as a priority area and put on a legal ground for the first time with the official gazette no. 25621, dated 22 October 2004.

Soon, the 11th meeting of the Supreme Council for Science and Technology (SCST) held on 8 September 2004, it was decided to prepare an implementation plan on research and development (R&D) projects with 10 years' perspective. In this context, National Space Research Program was prepared in 2005 [4,5].

Subsequent to this, in line with the articles 482 and 530 of the 9th Development Plan covering the period of 2007–2013, space technologies were designated as a priority technology area to be supported [6].

Likewise, the National Science, Technology and Innovation Strategy for the years 2011–2016 prepared by TÜBİTAK, identifies space among the areas which requires additional momentum for R&D and innovation studies in line with Turkey's geopolitical position and needs [7].

On the other hand, Developments Assessment Report's chapter on the Decisions Concerning the National Space Research Program (2005/9) issued after the 25th SCST meeting held on 15 January 2013, speaks about the decision “to take all measures necessary for realizing the National Space Research Program as a long-term and sustainable state policy with its own budget and roadmap” [8].

As seen from all these work, space is a widely discussed subject on Turkey's agenda as well as occurring in various policy documents, and considered to be one of the priority technology areas. Nevertheless, despite this general perception, there is a lack of country-wide initiatives that will guide space studies and even detailed strategic plans on specific sub-technologies to be focused on.

2. Milestones

Turkey's first small satellite BİLSAT-1 was built together with the SSTL, a company of Surrey University and launched from Russia on 26 September 2003. The project was carried out by Space Technologies Research Institute (TÜBİTAK UZAY), a TÜBİTAK affiliate. BİLSAT, whose major function was remote sensing, also had a limited communication capacity as well. The participation of a team of engineers and technicians in the BİLSAT manufacturing process provided for technology transfer on small satellites. As such, the

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necessary infrastructure composed of clean rooms for satellite design and manufacturing, prototype laboratories, testing laboratories and design office was established. Also, an earth station was set up at TÜBİTAK UZAY for operational purposes of the satellite.

The second satellite built by using the technology transferred in the development process of BİLSAT-1 is RASAT. Launched from Russia on 17 August 2011, it was financed by State Planning Organization (SPO) and developed by TÜBİTAK UZAY. While the tender for satellite's imaging system was granted to South Korea's Satrect Initiative Company, it is the first earth observation satellite designed and manufactured in Turkey that also includes modules developed by Turkish engineers.

In light of the need for more advanced observation satellites to be used for image procurement mainly for civilian purposes as well as national security objectives, Turkey have started the GÖKTÜRK-1 Project. Yet, failing to achieve the expected progress through several international issues aroused by the observation specifications of GÖKTÜRK-1, GÖKTÜRK-2 Project was initiated by Turkish government.

Started under the coordination of Turkish Ministry of National Defence, GÖKTÜRK-2 was developed by TÜBİTAK UZAY and TAI using TÜBİTAK resources [9], and launched from China on 18 December 2012, even before the former project GÖKTÜRK-1. The project has contributed to the development of space technologies infrastructure and helped acquire the practical experience in the area of satellite design, manufacturing, testing and integration in Turkey.

3. Conceptual framework

Strategic management of space technologies is an important phase in the capacity building efforts of nations [10,11] and what strategic actions to take can best be organised around a synergistic, widely accepted vision that fulfils public prospects. Once the vision statement is reached in consensus, the next step is to take a snapshot of the sector by SWOT analysis, so that an in-depth perception of the sectoral capabilities can pave the way for successful future plans and actions.

3.1. Setting up the vision

A major element of strategic planning is the statement of vision which puts forth the desired point of destination in the future. The vision is the conceptual expression of the best future status one wants to achieve and the good, successful, realistic, reliable and attractive future of an organization [12,13]. On the other hand, strategic management analyzes what goals should be achieved in order to reach the desired future and the process leading the way to the achievement of these goals [14]. As such, it has been argued that the basic requirement for strategic level planning and management of the Turkish space activities is defining the country's space vision.

To define a vision for the country's space activities and engage in a brainstorming activity on space technologies, a workshop was organized in May, 2012 at the Institute for Defense Sciences. At the workshop that hosted public and private sector representatives, and members of research centres and academia, experts were consulted.

During the workshop, experts were asked to write down their views – on a separate paper on each round – concerning the desired future for Turkey in the area of space technologies, then the answer sheets were rotated among the participants until all ideas were exhausted. Thus, being given the opportunity to see each other's views, participants were able to make a conceptual pre-evaluation of their own ideas as well as arrive at new ideas not thought of at the first instance but formed through associating with

other participant's views.

In the following stage, all ideas were put upon a flip-chart, data set was narrowed down by grouping together similar opinions, and participants were given free time to vote for the group's combined ideas with the distributed sequins. At this stage, no restrictions were put on the participants other than using a single vote for each idea to prevent any loss of opinion. Setting no limits on the number of ideas experts could vote, allowed each group to identify its focus of interest while at the same time ranking the ideas by their level of importance. The highest ranking ideas were translated into national goals set to be achieved in the area of space technologies in the next two decades.

At this point, through the conciliators chosen separately from the two groups, two vision statements were organised into a single one and with the consensus of all participants, the space vision for Turkey was specified as follows: **“To be among the top ten countries integrated within the global value chain; that has established its complete innovation system in the area of space from basic research to economic value generation, that can launch its own spacecraft and can make the most of space”.**

3.2. SWOT analysis and the sectoral snapshot

SWOT analysis which is a research method developed through strategic management research carried out in Harvard Business School in the 1960s [15] is the abbreviation for the words “strengths”, “weaknesses”, “opportunities” and “threats”.

SWOT analysis is an assessment of the internal and external condition of an organization taken up on a micro or macro level. As such, it is an important analytical tool frequently mentioned in the strategic management literature and used by organizations such as universities and public institutions [16] in order to make situational derivations.

In this study SWOT analysis is used to determine the current status of Turkey in space technologies and is carried out by a 6 months' survey following the vision workshop. The participants were asked about their views regarding Turkey's strengths and weaknesses in space technologies as well as the existing opportunities and threats. The data set was narrowed down by grouping together similar statements in the answers and by looking at the frequency of the statements used in the answers, importance ratings were made.

3.2.1. Strengths

Turkey's strengths which are part of the internal factors' group of space technologies are shown in Table 1.

According to Table 1, the presence of space technologies among Turkey's strategic technology goals and as such, the supportive role of government in the area of space stands as the most important internal strength. This is followed by the presentation of demands by the demand and supply sides. Thus, the technical criteria for future satellite projects are shaped and new business opportunities for the national space industry are created.

Besides, the country's industry newly acquainted with space activities, and people working in this area are gaining not only the know-how that accompanies successful satellite projects but also the motivation which is a functional factor in engineering; thus paving the way for new project planning through which design and innovation capabilities could be further developed.

To keep the momentum in the area of space studies and to make the risks associated with future projects more affordable through the success in previous projects, sources were allocated recently for participant public institutions to finance future potential space/satellite projects. As long as financial sources are used in original design and manufacturing processes and existing infrastructures

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