THE RELATIONSHIP BETWEEN NATIONAL TECHNOLOGICAL INITIATIVE OF TÜRKİYE AND TECHNOLOGICAL PLANNING

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Abstract

Advancements in technology, national, and international forces, such as urbanization, migration, and cybersecurity concerns, have increased the vital importance of technology planning at both the organizational and national levels. Reduced product and technology lifecycles, increased R&D investments, more customized and complex products, and shortened periods between production and marketing of the products caused by technological progress have resulted in uncertainty, making the competition a struggling area for business organizations. When integrated with the overall business plan, technology strategy becomes an efficient tool for competitiveness. Technology planning has also been widely accepted as a significant impetus for national development. Although technological developments have led to prosperity for every society, the gaps between the well-being of societies continue to widen. Those gaps are primarily caused by technological disparity and are overcome through improving technology development capacity. Based on this, technology planning has become an instrument for policy counseling in most industrialized countries, particularly in developing ones. As in many developing countries, Türkiye is obliged to increase its innovation capacity by stimulating private and public R&D in sectors in which competitive pressures prevail to successfully maintain its national innovation and entrepreneurship ecosystem where participating institutions operate effectively. Türkiye needs to sustain its development in science, technology, and innovation and to focus on critical technologies to achieve its technological objectives in line with its 2023 vision.

Keywords
Technology planning, Technology acquisition, Technology exploitation, S&T policy, National development

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Introduction

The definition and meaning of technology vary across disciplines so that research on technology reflects distinctive status, contexts, concerns, and points of view. Those variations result in that technology being expressed in either "artifacts," "knowledge," or "solidified social relations" (Nightingale, 2014, p.1). However, regardless of its terms, it is widely recognized and accepted that technology provides the impetus for national development. This is perhaps best verbalized by the anonymous quotation, "technology is a game for the rich, a dream for the poor, and a key for the wise; it is the master key for development" (Sharif 2017, p. 186).

Technology, which has been profoundly affecting the development of human civilization from the beginning of human history, has become prevalent in every aspect of human life in our century. As the rate of technological development and society's dependence on technology has increased, the success of individuals, private enterprises, global corporations, and government activities have become highly reliant on technology (Khalil & Shankar, 2013, p. 3).

Many scholars and managers notice the strategic importance of technology in creating value for organizations and industries (Phaal et al., 2004). Moreover, in a competitive market environment where products are more complex and customized, product-life cycles are contracted, and product to market time is shortened, the role of technology becomes more critical for firms. Therefore, technology planning is considered an effective tool to cope with increasing competition (Bray & Garcia, 1997).

If organizations engage in open innovation and technological knowledge is commercialized, the significance of technological planning will likely increase (Lichtenthaler, 2008). Additionally, the wide recognition and acceptance of the role of technology in national development (Sharif, 1986; Sharif, 1989, Drejer, 1996) have raised the importance of technology planning at the national level. Our study reveals the importance of technology planning at organizational and national levels. Also, this study provides a brief history of national science and technology initiatives in Türkiye and discusses the relationship between technological planning and National Technological Initiative of Türkiye.

1. Technological Management

Abrupt increases in the rate of technological change and the profound effects of technology on globalization and competition in the 21st century have forced organizations to engage in technological innovations. However, these developments have created some difficulties for private enterprises to collaborate and coordinate their production and management technologies. As a solution to these problems, the concept of technology management has emerged and gained awakening interest in modern business life. As opposed to the common view that R&D departments are primarily responsible for technological development, the success of technology management is dependent on the entire organization (Phaal et al., 2004; Phaal et al., 2013; Khalil and Shankar, 2013).

Technology management is an interdisciplinary research area encompassing engineering, natural sciences, social sciences, business theory, and industrial practice and has gained awakening interest, especially after World War II (Khalil & Shankar, 2013, p. 10-18). However, its historical roots date back before the 21st century as a research area. It was thought to be based on Francis Bacon's philosophical writings in the 17th century, based on "laboratory organizations" (Brockhoff, 2003, p. 31).

According to the European Institute of Technology and Innovation Management (EITIM), technology management "addresses the effective identification, selection, acquisition, development, exploitation and protection of technologies (product, process and infrastructural) needed to achieve, maintain [and grow] a market position and business performance in accordance with the company's objectives." (Phaal et al., 2004). In simple words, technology management, or managing technology, refers to "managing the systems that enable the creation, acquisition and exploitation of technology" (Khalil & Shankar, 2013, p. 10). It has three dimensions, which are national, organizational, and individual. At the national level, it shapes public policy (macro-level); at the organizational level, it deals with the emergence and viability of competitive enterprises (micro-level); and finally, it concerns with increasing the value that individuals contribute to society at the individual level (Khalil & Shankar, 2013, p. 11).

Researchers of technological management mainly deal with the creation of new technology and improvement of existing technology and their studies are divided into "contextual" and "organizational." Contextual researchers are concerned about the association between technological changes at the industry level and the adaptations to those changes at the firm level. On the other hand, organizational researchers focus on factors affecting technological innovations in the organizational, functional units, such as R&D and production departments (Gopalakrishnan & Damanpour, 1997, p. 20). As a research area, technology management covers the issues related to generating and exploiting technology, integrating technology strategy with business strategy, managing technology in improving the flexibility of manufacturing and service systems and in, gaining competitive advantage, structuring organizations in accordance with technological change (Khalil & Shankar, 2013, p. 17).

This study primarily focuses on the effects of technology planning, as a part of technology management, on national development. Based on this, the following sections will provide a framework for technology planning and then discuss the relationship between technology planning and the National Development Movement of Türkiye.

2. Technology Planning

Technology planning is one of the thoughts of schools that technology management embraces. It emerged as a response to the complex and dynamic business environment. Sustainability in technological advancement and intensifying competition resulted in uncertainty, creating a new environment where R&D spending was increased, product-life cycles were reduced, and the time difference between the discovery of a new process and its application was shortened. As a result, technology change became unpredictable and complex, so technology planning became crucial for organizational competitiveness (Drejer, 1996).

When literature on technology planning is examined, it is seen that studies mainly focus on planning for learning technology (Hoffman, 1996; Fishman and Pinkard, 2001; Fishman and Zhang, 2003; Vanderlinde and van Braak, 2012; Keengwe and Malapile, 2013). On the other hand, the role of technology plans or technology planning on organizational performance (e.g., Lichtenthaler, 2008) and competitive advantage (e.g., Nauda & Hall, 1991) is also discussed in the literature.

Technology planning compels organizations to develop plans to acquire technology from outside sources and exploit their internal technology. Information about the technology that the competitors deploy, the strength and weaknesses of the competitors' technologies, and the organization's adaptability to shift from one technology to the other is provided by

the technology audit. Technology audit is a continuous process to evaluate an organization's situation in technology compared to the competitors in the market. It aims to identify the strengths and weaknesses of the organizational technology and the external factors affecting the technology planning of the organization (Khalil & Shankar, 2013). Another tool for technological planning, technology road mapping provides communication between technological resources, business objectives, and changing variables in the environment of an organization (Phaal, et al., 2004). It is an effective tool to identify which technologies to be used in which time frames. Furthermore, it specifies needs for new products that will determine technology development and selection decisions; lists the alternatives for technology as a solution to those needs; facilitate to select of the appropriate technology among the alternatives; and finally, assists in forming and implementing a technology plan to develop or deploy those technologies (Bray & Garcia, 1997).

Technological changes are forecasted, and organizations also benchmark their technologies with their competitors' technology. Then managers make decisions on 1) which technology or set of technologies to pursue in the future, 2) when to shift the existing technology or to acquire e new technology, 3) whether to be a follower or a leader in a particular technology, 4) through which methods (developing technology in-house using internal R&D group, using the unified technological know-how and resources in a joint venture, outsourcing for R&D rather than developing technology in-house, licensing-in, or purchasing technology from outside of the organization) to acquire new technology, (Khalil & Shankar, 2013). According to Ford (1988), integrating the available methods for acquiring new technology is needed for an effective acquisition strategy. Additionally, the acquisition methods chosen are affected by the R&D strength of an organization relative to its competitors and how immediately the organization needs to acquire the new technology. The life cycle of the technology to be acquired is also essential to decide on the acquisition method. Organizations tend to purchase old technologies from outside sources rather than in-house development. Finally, to what extent is technology critical for the survival of an organization and does the variance of an organization's investment in different acquisition methods affect the decisions on which combination of acquisition methods are used (Ford, 1988). The exploitation of technology is intimately related to and has identical methods to technology acquisition (Ford, 1988) but has contradictory decisions (Khalil & Shankar, 2013). An alternative to employing its own products or production techniques is that an organization may produce or market a product through another organization's production technology (contracted-out production or marketing). In addition, an organization may engage in joint ventures with other organizations to combine their production technologies or produce or market its product by using the production technology of a newly established organization. In some circumstances, an organization needs a supporting production technology or a market capability to exploit its technology effectively, and it needs to engage in the acquisition of technology. In such cases, technology acquisition and exploitation merge and contracting out and creating joint ventures become more effective techniques. On the other hand, licensing-out is an effective method for technology exploitation when the organization is powerful in that technology in the market (Ford, 1988).

In the technology planning literature, several frameworks are proposed for technology planning. Porter et al. (1991), for example, identified the steps of technological planning as forecasting the technology, organizational environment, and the market, assessing the strengths and weaknesses of the organization, establishing organizational target and objectives for the planning period, developing a consensus strategy among candidate

actions, and implement an action plan (Khalil & Shankar, 2013). Likewise, Nauda & Hall (1991) identify different steps for technology planning: identifying technology requirements, assessing the competition, analyzing external trends, setting strategic goals, determining technology development needs, estimating required investment, reaching consensus on needed resources, and executive commitment. On the other hand, Jamel & Jamel (2014) specified the differences between the sub-disciplines of technology planning, which are foresight, technology forecasting, and strategic technology planning. In subsequent sections, these elements of technology planning will be discussed.

2.1. Technology Foresight

Anderson (1997) relates technology foresight to "shaping the future through the concerted action of self-sustaining networks of interested groups" (Anderson, 1997, p. 666). Technology foresight aims to identify technology priorities that yield the best economic and social outcomes. It is more related to the future states of the economic, technological, and social variables outside the organization. It helps organizations gain insight into new emerging trends and associated risks in the external environment. It also improves organizations' adaptive organizational learning and innovation capabilities (Jemala & Jemala, 2014). Technology foresight at the national level may also enhance the national innovation system (Canongia, 2007).

2.2. Technology Forecasting

Technology forecasting became popular in the 1970s. It aims to predict the future state of technology and businesses through econometric methods and modeling techniques (Anderson, 1997, p. 666). According to Zahra (1996), technology forecasting "serves as an important bridge between the content of a company's technology strategy and the process by which this strategy is developed" (Zahra, 1996, p. 199).

Contrary to technology foresight, technology forecasting concerns "highly individual conditioned technology state or figures and the probability of their occurrence at a certain time in the future" and relies on past data (Jemala & Jemala, 2014, p. 73). Technology forecasting provides predictions on the nature and the effects of technological development based on several procedures and techniques, providing valuable inputs for technological foresight. Future states of technology vary according to the nature and physical constraints of the technology, social and environmental factors affecting technological advancement, and market circumstances relative to competitors. For a practical forecast, technology managers must have a deep insight into technology life cycles and factors affecting technological development and the rate of innovation (Khalil & Shankar, 2013; Jemala and Jemala, 2014).

2.3. Technology Strategy

Technology strategy is broadly defined as "a portfolio of choices and plans that a firm uses to address the technological threats and opportunities in its external environment" (Dasgupta et al., 2011, p. 264). Considering that technological change is one of the critical aspects of competition, an organization integrating its technology with its overall organizational plan will likely benefit from technological changes (Frohman, 1985; Nauda & Hall, 1991). Therefore, scholars argue that technology strategy should be regarded as an intrinsic part of business strategy and plan (Matthews, 1992; Metz, 1996). Technology strategy is critical not only for high-tech organizations but also for all organizations, and it encompasses the development, pursuing, and capitalizing on the overall organizational

knowledge and abilities (Ford, 1988). Since technological changes have profound effects on the industry's structure as a whole and competitive advantage, the technology strategy of a single firm plays a vital role in its overall business plan. With the main focus on the effect of the technology in sustaining competitive advantage, a firm's technology plan deals with the choice of technologies to be developed, the technologies to build leadership in, and the decisions on technology licensing (Porter, 1985).

Dasgupta and his colleagues (2011) identified other factors affecting technology strategy. First of all, government policies and regulations, such as patent laws, entry barriers to the industry, and policies on economic stability or accumulation of physical and human capital, have significant effects on technology planning, affecting the competitive position of the organizations. The external environment in which organizations operate also affects strategic technology planning. Organizations operating in dynamic, hostile, and heterogeneous environments tend to be followers rather than innovators and exploit technology from outside sources rather than develop it in-house. Scholars also argue that the speed of change in technology in the value chain activities of an organization also influences strategic technology planning. Organizations whose value chain activities depend on quickly changing technology need more knowledge investments to keep up with the technological changes and find it risky to rely on outside sources (Dasgupta et al., 2011).

Since technology is integrated into almost all managerial activities, technology planning is a part of overall planning in an organization (Porter et al. 1991). Also, according to Liu & Shyu (1997), "the technology planning cannot be separated from market opportunity and competitors' activities." (Liu & Shyu, 1997, p. 671). According to Frohman (1985), strategic planning may fail to predict all the technical developments and how these developments would affect markets and products. Technology can be used as an effective "competitive weapon" when strategic planning systematically deals with technology forecasts and assessments related to market needs and opportunities (Frohman, 1985. p. 50).

3. Technology Planning and National Development in Türkiye

Although technological developments have increased the well-being of every society, the gaps between relative prosperities of the societies continue to be widened, and eliminating those gaps is the most struggling issue human development faces in this century. The technological disparity lies at the root of the prosperity gaps between societies. This is overcome through technological capacity building, which leads to economic growth and higher living standards and well-being of individuals in a society (Sharif, 1999). According to Sharif (2015), "the real difference between a developed and a developing society is indeed the technological innovation capacity to better satisfy and restructure the human needs set" (Heffner & Sharif, 2008). In this framework, in most industrialized countries, technology planning has become an instrument for policy counseling to overcome technological disparity and enhance technological innovation capacity (OECD, 1998).

Concerns relevant to the formulation and planning of technology policy have gained awakening interest internationally since the significance of technology for national development has been commonly accepted (Sharif, 1986; Sharif, 1989; Drejer, 1996). Developing countries, particularly in Asia, consider technology a critical factor for socioeconomic development (Sharif, 1989). According to Huang et al. (2014), science and technology planning is critical for nations, particularly for the new and emergent technologies since it enables them to keep up with technology development trends and gain an advantageous position in future competitions.

Türkiye is one of the many developing countries that have realized that technology planning provides the impetus for economic and social prosperity and engaged in prominent initiatives to maintain its strength in science and technology areas and sustain its national innovation ecosystem. Technology planning is critically significant for Türkiye to achieve its objectives and targets in line with its 2023 Vision within the framework of the National Technology Initiative. In this context, the following sections will provide a brief insight for Türkiye's science and technology initiatives since the 1960s.

3.1. Science, Technology, and Innovation Policy Making in Türkiye

The first science and technology policy in Türkiye was attempted to be formulized after the First Five Year National Development Plan in 1963 was enacted. In the same year, the Scientific and Technological Research Council of Türkiye was established for "designing, promoting and coordinating science and research activities at the national level" (Sarıtaş, 2008, p. 1). Until the 1980s, science and technology policy, which primarily focused on the "promotion of basic and applied research in the natural sciences," was formulated by the Scientific and Technological Research Council of Türkiye without any participation from the government. Government agencies dealt with fragmented policies and short-term needs until the technology policy concept emerged and was integrated with other policies on employment, investment, and industry with the enactment of the Fourth Five Year National Development Plan covering the period 1973-1977. The first integrated technology policy in Türkiye was prepared between 1980 and 1983 and established with the title of "Turkish Science Policy: 1983-2003", which can be considered the earliest effort to define critical technologies in Tukey. However, the science and technology policy studies gained momentum after the Supreme Council for Science and Technology foundation in 1983. In 1993, the document entitled "Turkish Science and Technology Policy: 1993-2003" was approved by the council and then a new era in technology policymaking began adopting an innovation orientation (Sarıtaş et al., 2007 p. 10-13).

According to The Scientific and Technological Research Council of Türkiye (2013), the science, technology and innovation vision of Türkiye is "to contribute to new knowledge and develop innovative technologies to improve the quality of life by transforming the former into products, processes and services for the benefit of the country and humanity" (The Scientific and Technological Research Council of Türkiye, 2013, p. 3). In line with this vision, six categories of strategic technologies were identified, which are namely "Information and Communication Technologies, Biotechnology and Gene Technologies, Nanotechnology, Mechatronics, Production Process and Technologies, Material Technologies, Energy and Environmental Technologies, Design Technologies" (The Scientific and Technological Research Council of Türkiye, 2013).

Like many developing countries, Türkiye also has an "innovation shortfall" caused by low productivity and low growth levels. It needs to increase private and public R&D and innovation in sectors where competitive pressures prevail. The most prominent way to enhance economic development and welfare and solve societal problems is to build an efficient innovation system (The Scientific and Technological Research Council of Türkiye, 2010, p. 1).

3.2. National Innovation and Entrepreneurship System

Türkiye needs to sustain its development in science, technology, and innovation to achieve its technological objectives in line with its 2023 vision. Based on this, all institutions associated with science, technology, and innovation operate to develop the climate of

entrepreneurship and innovation. The National Innovation and Entrepreneurship System, which ensures the generation of such a climate, aims to create technologies providing economic value-added and skilled human resources. The Supreme Council for Science and Technology, established in 1983, is the highest-order assembly within the National Innovation and Entrepreneurship System of Türkiye. Its functions include making, governing, and implementing science and technology policies. Other prominent actors in the Turkish National Innovation and Entrepreneurship System consist of firms, R&D centers, and higher education institutions as R&D conductors. Industrial zones, development agencies, technology development zones, techno parks, technology transfer offices, and other technology platforms act as facilitators. In addition, the Turkish Patent Institute, Turkish Standards Institute, Turkish Accreditation Agency, National Metrology Institute of the Scientific and Technological Research Council, and regularity bodies such as the Turkish Competition Authority are agents that contribute to market formation. Finally, ministers, the Turkish Academy of Sciences, The Scientific and Technological Research Council, Union of Chambers and Commodity Exchanges of Türkiye, Technology Development Foundation of Türkiye, Council of Higher Education, venture capital firms, and banks act as fund providers in that ecosystem (The Scientific and Technological Research Council of Türkiye, 2013). Promoting R&D, innovation, and entrepreneurship in the business enterprise sector, boosting academic R&D, strengthening demand for R&D and innovation through public procurement, and enhancing international science and technology cooperation requires all institutions in the Turkish National Innovation and Entrepreneurship System to act in concert focusing on the national critical technologies.

3.3. Critical Technologies

According to the 11th National Development Plan of Türkiye covering the period of 2019-2023, critical technologies are defined as "technologies that cannot be procured from abroad or that, despite being procured, cannot be maintained for various reasons and may endanger the operation, and therefore, are required to be manufactured domestically" (The Scientific and Technological Research Council of Türkiye, 2003, p. 23). According to the 11th National Development Plan of Türkiye covering the period of 2019-2023, critical technologies of Türkiye are identified as "artificial intelligence, internet of things, augmented reality, big data, cybersecurity, energy storage, advanced materials, robotics, micro/nano/opto-electronics, biotechnology, quantum, sensor technologies, and additive manufacturing technologies" (Turkish Republic Presidency of Strategy and Budget, 2019, p. 84).

In the last century, developments in the national and international arena, such as urbanization, migrations, progress in knowledge-intensive sectors, and cybersecurity concerns, have increased the importance of reliance on critical technologies. Therefore, for the realization of the National Technology Initiative of Türkiye, it will be ensured that road maps are prepared, the necessary infrastructure is established, the necessary qualified human resources are trained, and the social orientation is focused on these areas (Turkish Republic Presidency of Strategy and Budget, 2019).

3.4. National Technological Initiative of Türkiye

With the vision of "defending the global common interest rather than the interests of only a few global companies and countries," the National Technology Initiative includes "policies that will increase Türkiye's global competitiveness, ensure its economic and

technological independence, and make breakthroughs in critical technologies." The first successful example of the National Technology Initiative was seen in the defense industry. With the national technology development projects, the share of domestic suppliers in production increased from 20% to 68%; the production capacities of advanced technologies such as satellites, radar missiles, and unmanned aerial vehicles (UAV) have increased (Turkish Republic Ministry of Industry and Technology, 2019). Bayraktar Mini UAV, Türkiye's first domestic and national unmanned aerial vehicle, was provided to the service of the Turkish Armed Forces in 2007. Bayraktar VTOL UAV (Vertical Landing Unmanned Aerial VehiclE) and Bayraktar TB2 were produced for reconnaissance and intelligence missions in the following years. Bayraktar Akıncı UAV project designed to fulfill some of the tasks performed by fighter jets was also completed. The test drives of the National Combat Unmanned Fighter Aircraft Bayraktar Kızılelma will begin soon (BAYKAR, 2022). Required attempts are taken, and road maps are created to disseminate these critical developments in the defense industry to other sectors (Turkish Republic Ministry of Industry and Technology, 2019).

Many projects and programs have been implemented in other sectors within the framework of the National Technology Initiative, which aims to ensure that all segments of the society participate in domestic and national technology development projects with a common sense of excitement and ownership.

Within the scope of the Technology Oriented Industry Movement Program, medium-high and high technology areas will be provided with R&D, P&D, investment, and export support "in line with the aim of increasing value-added production" and products of top priority (highly value-added products) in these areas have been identified. In addition to program incentives, investors will also be able to benefit from support provided by the Small and Medium Enterprises Development Organization of Türkiye (KOSGEB) and the Scientific and Technological Research Council of Türkiye (TÜBİTAK) (Turkish Republic Ministry of Industry and Technology, 2022).

For young generations with high potential to produce technology, Experimental (DENEYAP) Technology Workshops started on March 26, 2022, with the cooperation of the Ministry of Industry and Technology, the Ministry of Youth and Sports, the Scientific and Technological Research Council of Türkiye, and the Turkish Technology Team Foundation. Students who pass the acceptance exam within the program's scope, which aims to initiate 100 Experimental Technology Workshops in 81 provinces, will be able to attend technical training in Experimental Technology Workshops that will be held entirely free of charge for three years (DENEYAP TURKİYE, 2022).

TEKNOFEST, the World's most prominent aviation, space, and technology competition, has brought students, graduates, and professionals from all over Türkiye together since 2018. Participants compete with their projects in the technology fields of the future. The contestants are provided with support for the material, technical training, transportation, and accommodation, while cash prizes are given to the winners. TEKNOFEST competitions, which aim to contribute to the human resources of our country in the field of engineering, steadily gain awakening interest from Turkish society (TEKNOFEST, 2022).

Discussion

Technological progress has created a new dynamic competitive environment where products are more complex and customized, product and technology lifecycles are shortened, and time-to-market is reduced. These developments have increased the critical

importance of technology planning for business organizations (Phaal et al., 2004) and national development (Sharif, 1986; Sharif, 1989; Drejer, 1996; Huang et al. (2014).

There is no single framework for technology planning in the literature. Commonly, the frameworks provided by scholars consist of forecasting technology, identifying internal strengths and weaknesses, assessing the market environment, analyzing the external environment, setting goals and objectives for the specific planning period, benchmarking the technology of rivals, deciding which technology development techniques to use, estimating the technology development needs and required resources, and implementing an action plan (Nauda & Hall, 1991; Khalil & Shankar, 2013).

Jamel & Jamel (2014) specified the differences between the three sub-disciplines of technological planning: technology foresight, technology forecast, and technology strategy. Accordingly, technology forecast relies on past data. It predicts future probabilities of technological changes through different procedures and techniques, providing input for technology foresight, whereas technology foresight uses past, current, and prospective data to assess the future states of economic, social, and technological changes. On the other hand, technology strategy consists of an array of choices and plans to respond to technological threats and opportunities in its external environment (Dasgupta et al., 2011) and relies on past and current data (Jamel & Jamel, 2014). Technology planning becomes a "competitive weapon" for business organizations when integrated with the overall business plan (Frohman, 1985. p.50) and provides the impetus for economic and social prosperity, overcoming the technological disparity concerns at the national level.

Like many developing countries struggling with "innovation shortfall" (The Scientific and Technological Research Council of Türkiye, 2010, p.1), Türkiye has initiated attempts to build a national innovation and entrepreneurship ecosystem starting in the 1980s. Furthermore, in line with its 2023 science, technology and innovation vision, which envisages Türkiye as a country "that can transform the knowledge it produces and the technologies it develops into innovative products, processes and services for the benefit of the country and humanity," (The Scientific and Technological Research Council of Türkiye, 2013), it provides further prominent initiatives to sustain its national innovation and entrepreneurship system, to sustain its innovative position in the international arena, and to channel necessary infrastructure, qualified human resources, and social orientation to the development of strategic technology areas and critical technologies to accomplish its technology objective and targets in the framework of National Technological Initiative.

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