

THE SCIENCE AND TECHNOLOGY PARKS AND THEIR ROLE IN SUPPORTING DIGITAL TRANSFORMATION OF THE TURKISH ECONOMY

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Executive Summary:

Turkey has a large, diversified and vibrant economy.

Digitalization has played a key role in Turkish economy during the last two decades. The country has started to reap the benefits of digitalization. It ranked 41st among 132 countries in 2021 in terms of innovation¹. Since 2020, 5 startups from Turkey reached unicorn status in terms of market value².

In Turkey, a key component in digital transformation is Science and Technology Parks (STPs) and the country has invested heavily through the STPs to Turkey's digital transformation journey during the last two decades.

In my paper I focus on the role of STPs in digitalization of Turkish economy and explain their development and contribution to this journey.

1. Introduction

Turkey is a dynamic and developing G20 country uniquely linking east with west. The Country has a large and relatively young population. Half of its total population of 85 million is under the age of 32 as of 2020. Due to its unique and strategic location it has also been positioned as an international hub for some sectors such as airline travel, logistics, auto industry and food production.

With a developing economy supported by a young population Turkey is a large and attractive market for entrepreneurs and startups. The Eleventh Development Plan covering the five-year period from 2018 to 2023 address the importance of innovation and scientific and technological development. There is a strong emphasis on the entrepreneurship, digitalization, production of strategic and high technology and export oriented products in the Plan.

Entrepreneurship and startups play a key role in economic and social development, new technology development, elimination of unemployment and poverty and reduction of inter-regional differences. Innovative entrepreneurs bring much more benefits in any economy on earth.

¹ The World Bank, Firm Productivity and Economic Growth in Turkey, 2019

² Trendyol, Peak Games, HepsiBurada, Dream Games and Getir.

The most important stakeholders of entrepreneurship ecosystem are listed as universities, research centers, financial institutions, related public organizations, venture capital companies, angel investors, incubators, industrial regions, and technoparks (Science and Technology Parks- STPs). The International Association of Science Parks (IASP) defines STPs as organizations managed by specialized professionals whose main goal is to increase the wealth of the local community, by fostering the culture of innovation and the competitiveness of associated companies and knowledge based institutions.

According to the Law No: 4691 on Technology Development Zones, a technopark hosts high tech startups and companies, enables them to benefit from a specified university or technology institute or R&D center to develop their technology and/or software and convert their technological findings into a commercial product, method or service. They contribute to the development of the area and located inside of nearby of the collaborating university, technology institute or R&D center, integrating academic, economic and social structures.

STPs play an important role in developing entrepreneurship eco system and at the center of all these lies the entrepreneur as an individual.

2- Development of and the Role of STPs in Turkey

As a result of the global economic developments since 1970s and the decline in manufacturing intensive production, in order to increase production and to reap the benefits of digitalization, countries started increasingly to allocate funds to research and development (R&D) and initiated mechanisms to transfer research outcomes into the industry. One of the most important platforms is STPs. Since 1970s, countries across the globe allocated significant resources to the STPs to facilitate the transfer of R&D outcomes of universities and research centers to industry with the viewpoints of regional development, fighting unemployment and technology oriented production.

STP concept was initiated with the establishment of the Stanford Research Park in 1951. The world's first university research park, Stanford Research Park was established as a cooperative venture between Stanford University and the City of Palo Alto. Research Triangle Park in North Carolina which was launched in 1959 was another early university research park. The success and rise of the Silicon Valley led to the spread of STPs by the end of 1970s and the move reached out to other countries. Today, including the incubation centers, the number of STPs is estimated to be more than 4000 globally.

There are two main pillars of the R&D in Turkey:

- i) Science and Technology Parks
- ii) Research and Development (R&D) Centers

R&D centers are established and operated by private sector in Turkey. On the other hand, Universities are the key stakeholders and founders of STPs. As of March 2022, the total number of R&D centers and STPs are 1242 and 92 respectively in Turkey.

STPs provide locations and facilities that foster innovation and they support the development and commercialization of technology. They usually have incubation centers, acceleration programs, mentorship and other support programs. In Turkey, in some STPs, there is a certain level of clustering.

Both STPs and R&D centers are incentivized by the government mainly by lower taxation. R&D centers are established by relatively large companies in industry and services sectors and the companies have dedicated centers to carry out R&D activities. On the other hand, STPs are established in partnership with Universities and university -industry cooperation is aimed to be facilitated through research and development.

Under the guidance of the Development Plans, several support programs in Turkey have been designed for enhancing entrepreneurship and promoting R&D and innovation activities. As part of these efforts, STPs have been established after the required legal framework was defined in 2001.

11th Development Plan has ambitious targets regarding scientific and technological development and innovation by the year 2023. As it can be seen from the table 1, the ratio of R&D expenditure over the GDP is expected to increase significantly by 2023. The total number of R&D staff is expected to be doubled within the 5-year period from 2018 to 2023. Roughly one third of the total R&D staff is employed in STPs in Turkey.

Table 1: Research and Development Activities in Turkey (2018 vs. 2023 Target)

	2018	2023 (Target)
Total R&D expenditure/GDP (%)	0,96	1,8
Total number of R&D staff (FTE)	153.552	300.000
R&D staff with PhD or higher academic qualification per million people	352	863

Source: Eleventh Development Plan of Turkey

Total number of R&D staff is expected to be doubled during 5-year period from 2018 to 2023. Turkey has prioritized R&D spending and the significant increase in R&D expenditure during the last two decades has been associated with an increase in intellectual property applications. ³

Innovative entrepreneurship, taking root in 1980s developed further during 1990s with the rapid developments in technology and society.

³ The World Bank, Firm Productivity and Economic Growth in Turkey, 2019

The establishment of STPs Turkey started in 2001 with the enactment of Technopark Law numbered 4691. With the introduction of STPs legal structure in the law, Turkey started to converge toward developed countries' experience in the field of STPs.⁴

Main targets of the Law no. 4691:

- To produce technological information in the areas of high/advanced technologies
- Commercialization of the information produced,
- to support innovations that will increase product quality and standards in products and production methods,
- increasing the productivity and reducing the production costs,
- to support SMEs' adoption of new and advanced technologies,
- Provide job opportunities for researchers,
- Accelerate regional development,
- Entry of foreign capital into the country.

Within the scope of the law, direct (infrastructure-construction support to the managing company) and indirect contributions (various tax exemptions and exceptions for entrepreneurs and faculty members) are provided to the startups, companies, entrepreneurs and faculty members based in STPs.

The support and exemptions provided in STPs are summarized below:

- i) Income and Corporate Tax and VAT Exemption
- ii) Personnel Income Tax Exemption of the Staff Employed
- iii) Duty and Stamp Duty Exemption
- iv) Social security insurance premium support
- v) Doctoral Student and Intern Support

As of 2021, the total number of STPs in operation increased to 73. There are approximately eight thousand startups and other technology focused startups and firms in total in STPs in Turkey.

⁴ Cansız, M, Ulusoy, M. Demet, "Teknoloji Tabanlı Girişimcilerin Başarısında Yapısal, Ekonomik, Sosyal, Kültürel ve Beşeri Sermayenin Etkileri: Türkiye Örneği, Istanbul Journal of Sociological Studies, No:56, 2017

Table 2: The number of Active STPs in Turkey

Year	Number of Active STPs
2001	2
2002	2
2003	3
2004	6
2005	11
2006	14
2007	18
2008	18
2009	23
2010	28
2011	32
2012	34
2013	39
2014	42
2015	49
2016	51
2017	56
2018	61
2019	67
2020	72
2021	73

Source: Ministry of Industry and Technology, Annual Reports

As it can be seen from the table above, the number of STPs increased rapidly and more than doubled during the last decade.

Table 3: Key Indicators of STPs in Turkey

	March 2022
Number of Firms	7.707
Number of Firms with Foreign/Foreign Partners	289
Number of Incubation Firms	1.946
Number of Firms with Academician Partnership	1.602
Total Number of Personnel	79641
Number of Projects (Ongoing)	12581
Number of Projects (Completed)	45025
Total Sales (TL, billions, cumulative)	157
Total Revenues (USD, billions, cumulative)	6,8

Source: Ministry of Industry and Technology, Annual Reports, STPs Statistics

As of year-end 2021, firms located in STPs employ approximately 10 personnel on average. Almost a quarter of the firms operating in STPs are in incubation phase.

Table 4: Sectoral Distribution of Activities in STPs in Turkey (as of 2021)

Sector	Percent of the Total
Software Development and ICT	47,17%
Natural Sciences and Engineering	6,39%
Biotechnology	3,52%
Computer Consulting Activities	3,09%
Industry-Oriented Consultancy Activities	1,35%
Installed Electronic Card Manufacturing	1,21%
Other	37,27%

Source: Ministry of Industry and Technology, STPs Statistics

Software development and ICT comprised of half of the activities in terms of sectors in STPs as of 2021.

Table 5: Revenues of Companies Located in STPs

	Total Sales (USD, Billion)
2015	2,3
2016	2,4
2017	2,9
2018	3,7
2019	4,4
2020	5,5
2021	6,8

Source: Ministry of Industry and Technology, STPs Statistics

Total revenues of the startups and other firms located in STPs increased 195 % during the 2015-2021 period in USD terms.

Although STPs in Turkey are relatively new as compared to the developed countries, their ecosystem is developing rapidly. STPs and innovative entrepreneurs operating within this ecosystem contribute more to the innovation and technology generation capacity of Turkey as it is shown in table below.

Table 6: IP Rights Produced in STPs in Turkey (Since 2001 through March 2022)

IP Rights	Number
Total Number of Patent Registrations (National/International)	1.432
Number of Patent Applications (Continuing)	3.108
Industrial Designs-patented	285
Number of Industrial Design Applications (Continuing)	132
Software Copyrights Registered	694

Source: Ministry of Industry and Technology, STPs Statistics

European Union annually publishes innovation scoreboard⁵ to measure innovation performance of EU countries and benchmark their innovation performance with other countries. EU's innovation measurement framework comprised of four main type of activities:

- i) Framework Conditions
- ii) Investments
- iii) Innovation Activities
- iv) Impacts

Table 7: Turkey's Innovation Performance Benchmarked Against EU Countries (2014-2021)

	Summary Innovation Index time series: EU 27 vs Turkey (TR)							
Years	2014	2015	2016	2017	2018	2019	2020	2021
EU 27*	100.0	101.1	102.1	103.2	104.2	108.2	109.8	112.5
TR	55.0	55.7	55.9	59.2	62.8	70.4	73.5	55.3**

Source: European Innovation Scoreboard 2021, European Union, 2021

*: 27 EU member countries average index value

** : The decrease in 2021 figure stemmed from measurement issues.

Innovation performance of the European Union improved by 12.5 % between 2014 and 2021. Turkey's score relative to EU 27 rose from 0,55 in 2014 to 73,5 in 2020. The decline in Turkey's 2021 score is due to measurement problems.

Table 8: Turkey's performance scores per dimension relative to EU average in 2021:

Dimension	EU27	TR
Human Resources	100.0	44.9
Attractive Research Systems	100.0	41.0
Digitalization	100.0	83.2
Finance and Support	100.0	64.6

⁵ European Innovation Scoreboard 2021, European Union, 2021

Firm Investments	100.0	41.7
Information Technologies	100.0	22.3
Innovators	100.0	56.7
Linkages	100.0	66.5
Intellectual Assets	100.0	15.9
Employment Impacts	100.0	25.9
Sales Impacts	100.0	66.2
Environmental Sustainability	100.0	49.7

Turkey's relative scores are highest in digitalization dimension which comprised of broadband penetration and individuals who have above basic overall digital skills.

Intellectual Assets and Information Technologies are the dimensions for which Turkey scores lowest in relation to EU27 as shown in table 9.

Table 9. EU Innovation Scoreboard Measurement Framework

Use of Information Technologies TR relative score : 22,3	Intellectual Assets TR relative score : 15,9
-Employed ICT specialists -Enterprises providing ICT training	-Patent applications -Trademark applications -Design applications

Source: European Innovation Scoreboard 2021, European Union, 2021

These two dimensions has a lot of potential for improvement and STPs are one of the most important platforms to improve in these fields.

Summary and Conclusion

Turkey is a large country with a population of 85 million. It has a diversified economy and entrepreneurship culture is well developed. Innovative entrepreneurship taking root in Turkey during 1980s developed further in the 1990s with the developments in digitalization and internet technologies. Turkey has a vibrant startup ecosystem. With R&D centers, STPs are one of the two main pillars of this development.

The STPs play an important role in innovative entrepreneurship. Despite first experiments took place during 1990s, since 2001, Turkey's experience regarding STPs has started to converge toward developed countries experiences. In 2001, with the introduction new legal framework and tax incentives, STPs impact on innovation and economic development in Turkey has started to increase. STPs and the ecosystem created by STPs has grown rapidly since 2001. The number of companies located in STPs, the total number of employees, sales revenues and the number of IP rights increased rapidly despite from a lower base in recent years.

Turkey's relative innovation performance had improved significantly as compared to EU average between 2014 and 2020. In EU innovation scoreboard, Turkey is classified as an "emerging innovator". In EU innovation performance benchmarking, Turkey's relative digitalization score is high. Low level of intellectual asset creation and relatively insufficient use of information technologies are two main weak spots according to EU innovation study.

According to the World Bank, despite the increase of R&D expenditure as a percentage of the GDP, there are gaps in innovation capacity of Turkey relative to its peers. Large innovation gaps are found in university-industry collaboration, private R&D spending and quality of research institutions (The World Bank Report, 2019).

STPs are expected to play a key role and contribute more to the digitalization journey in Turkey.

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