Makale Türü: Araştırma Makalesi

THE ROLE OF TECHNOPARKS IN THE INNOVATION ECOSYSTEM AND A MODEL PROPOSAL FOR ITS DEVELOPMENT: TECHNOLOGY TRANSFER AND DEVELOPMENT CENTER [1]

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Abstract

Today, university-industry cooperation is one of the most important tools that enable the development of new products or production methods that will contribute to transforming knowledge into production, creating value at the national level by commercializing scientific studies, and increasing competitiveness in international markets. The aim of this study is to act as a bridge between science and industry by making use of innovation and to try to develop a new model proposal called "Technology Transfer and Development Center" for the development of this role by emphasizing the role and importance of the bridge established by Technoparks between University-Industry cooperation, which is an important interface. Attention was paid to include all stakeholders who have a say in science and industry at the local or regional level in the proposed model. It is thought that the local level science and industry actors will be represented under the roof of the technopark (through the creation of a liaison office) in universities and coordinated from a single center. Thus, it has been tried to prove that Technoparks will play a more active role in creating added value and increasing competitiveness at national and international level through a synergetic approach.

Keywords: Innovation, Technopark, Science-Industry Cooperation

İNOVASYON EKOSİSTEMİNDE TEKNOPARKLARIN ROLÜ VE GELİŞTİRİLMESİNE YÖNELİK BİR MODEL ÖNERİSİ: TEKNOLOJİ TRANSFER VE GELİŞTİRME MERKEZİ

Öz

Günümüzde bilgi birikimini üretime dönüştürmesine, bilimsel çalışmaların ticarileştirilerek ulusal düzeyde değer yaratılmasına ve uluslararası pazarlardaki rekabet gücünün arttırılmasına katkı sağlayacak yeni ürün veya üretim yöntemleri geliştirilmesini sağlayan en önemli araçlarından biri üniversite-sanayi iş birliğidir. Bu çalışmanın amacı ise inovasyondan faydalanarak bilim ve sanayi arasında köprü görevi görüp, önemli bir ara yüz olan Teknoparkların Üniversite-Sanayi iş birliği arasında kurduğu köprünün rol ve öneminin vurgulanması ve bu rolün geliştirilmesine yönelik olarak "Teknoloji Transfer ve Geliştirme Merkezi" isimli yeni bir model önerisi geliştirmeye çalışmaktır. Geliştirilen model önerisinde yerel ya da bölgesel düzeyde bilim ve sanayide söz sahibi olan tüm paydaşların yer almasına dikkat edilmiştir. Yerel düzeydeki bilim ve sanayi aktörlerinin üniversitelerde mevcut bulunan teknopark çatısı altında (irtibat bürosu oluşturulması yoluyla) temsil edilerek tek merkezden koordine edilmesi düşünülmektedir. Böylece Teknoparkların sinerjik yaklaşım yoluyla, ulusal ve uluslararası düzeyde katma değer oluşturma ve rekabet gücünün arttırılmasında daha aktif rol oynayacakları ispatlanmaya çalışılmıştır.

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Anahtar Kelimeler: İnovasyon, Teknopark, Bilim-Sanayi İş birliği

1.Introduction

Today, the level that science and technology have reached, on the one hand, brings comfort and prosperity to humanity. On the other hand, it has brought economic competition to very different dimensions in terms of countries. With the development of technology, higher technologies are produced, and more qualified products are being developed with higher technologies. In order to ensure their continuity in the face of these changes, businesses should try to strengthen their R&D functions by using developing and changing technologies.

Establishing R&D departments for small and medium-sized enterprises and conducting effective R&D work is difficult. Considering the costs required for R&D activities, it is difficult to establish an effective R&D department for such companies. For good and effective R&D, it is necessary to have good laboratory facilities as well as expert personnel. Establishing a well-equipped laboratory and employing expert personnel to work in such a laboratory can be costly for small and medium-sized companies. Thanks to the techno-cities established within the universities, such companies have the opportunity to work with research personnel who are experts in their fields and to benefit from the laboratories within the scope of the techno-cities at much lower costs. In this way, companies have the opportunity to carry out very strong R&D studies at low costs.

When we look at the development process of technology around the world, we see that new products are produced and developed thanks to developing and changing technologies. The role of technoparks in this development and the change experienced around the world is too great to be overlooked. The spread of technoparks in the world started with Silicon Valley, which was established in 1950 on the territory of Stanford University in the USA. It was established in Europe in the 1970s, especially in England, France, and Germany, and in the 1980s in Japan and Israel. The first technopark in Turkiye was established in 1996 at METU. Since 1950, over 4000 technoparks have been established in the world, including 38 in Turkiye, but only 22 of them are in active service.

Techno parks assume the position of a common platform and study center where the industrialist and the university meet so that the university can carry out scientific studies and projects in the direction desired by the industrialist. The industrialist may not know which researcher at the university provides what kind of service. Technoparks enable the industrialist and the researcher to meet in order to work with the most accurate researcher to meet the needs of the industrialist. In addition, entrepreneurs have the opportunity to benefit from the incentives provided by the state for technology parks.

2. Literature Reviewing

2.1. Conceptual Framework for Innovation

When both national and international literature on innovation is examined, it is seen that innovation has different meanings. The concept of "innovation" is derived from the Latin word "innovatus" and means the creation and use of new methods in social, cultural, and administrative environments. Although the concept of innovation, which is frequently on the agenda as one of the important elements for the success and survival of businesses in recent

years, is not the exact equivalent, although it is tried to be equivalent to words such as "innovation" and "renewal" in Turkish, the connotations of these words cannot fully meet the real meaning. The Turkish Language Association has worked to eliminate this confusion and recommended the use of the word innovation as a synonym for innovation. However, a consensus on what the concept of innovation corresponds to has not been reached. When we consider all these, although it does not fully reflect the meaning of the concept, the word "innovation" has the closest meaning at the moment (Deniz, 2012; Klç & Bilginolu, 2012: 17; Oylumlu, 2006: 17; nal, 2009: 103; Terziolu, 2008: 6).

Innovation is "the implementation of a new or greatly improved product (good or service) or process, a new or advanced marketing method, or a new organizational method in business practices, workplace organization, or external relations" (OECD, 2005). According to Keith and Theodore, "innovation is defined as a process that starts with an invention, continues with the development of this invention, and results in its entry into the market as a new product, process, or service" (Keith & Theodore, 1984, cited in Alpnar & Baç, 2007: 446-447).

Drucker defines innovation as "an act of proposing resources to create a new capacity for the creation of wealth while being a special tool of entrepreneurship" (Drucker, 1985: 30-31). According to Kotler, "innovation is not limited to new products or services. It also includes creating new jobs and business processes" (Kotler, 2005: 197).

Kuczmarski innovation: "It is a common attitude that enables businesses to see the conditions of the day and beyond and create a vision for the future (Kuczmarski, 1996: 3–9).

According to these definitions, an innovation is an idea, practice, or object that is perceived as new. The first company that makes a certain technical or new change is the innovator, and this action can be called innovation. It is the implementation of an idea for the first time by organizations with similar goals. Innovation is the realization of a change that is new to an organization and its environment. They have different applications in organizations. Innovation, which covers the period from the emergence of ideas to commercialization, is a set of organizational and individual behavior patterns combined with defined resource allocation decision points. Industrial innovation includes the design, production, management, and commercial activities carried out for the marketing of a new product or the first commercial use of a new process or equipment. Innovation is synthesizing a need in the market and producing a product that responds to this need (Dean & Goldhar, 1980; Rogers, 1983; Schmookler, 1966; Tiftik & Zincirkran, 2013: 541).

Research involving similar concepts about innovation (Adgüzel, 2012: 8; Durna, 2002: 9; Sakaryal, 2014: 185–193; Sat, 2013: 10; Tekin, 2009: 2; TMMOB, 2004; Zerenler et al., 2007: 656) shows that concepts such as invention (invention), creativity, change, technology, research and development (R&D), and entrepreneurship are considered together. It can be said that these concepts have a positive effect on innovation and, at the same time, make a positive contribution to innovative studies.

It is possible for all small or large companies to maintain their competitive power and survive by making innovations in their products or services. So much so that today companies can only meet the rapidly developing needs of consumers by innovating, and it is seen that they

are always one step ahead of their competitors. In addition, the innovation mentioned in innovation is not only to do something new, improved, and different but also to do something new that can create economic value for the company (Işk & Keskin, 2013: 44).

Although this attitude seems to reduce profitability at first, it will be seen that the opposite is true. When innovations are successful, it is seen that costs decrease, the production process shortens, and performance and productivity increase. The innovations made not only provide great benefits to the business in the long run but also contribute significantly to increasing the profit both indirectly and directly (Deniz, 2012: 13).

As a result, since innovation is a new way and method that creates value, it will be seen that it will serve purposes such as competitiveness in the market, originality, and awareness from others, becoming a leader, and increasing the profits of the enterprise, primarily by maintaining its existence.

2.2. Innovation Process and Stages

The innovation process consists of many elements, such as a new product, a new process, and the regulation of internal and external resources that contribute to development throughout the production process. Although the innovation process is broad, it is not an automatic one that will result in absolute success. For this reason, it is very important for companies to establish and implement the right process in order to develop and present innovation successfully. It is observed that the innovation process develops from simple and simple activities to complex applications in order to develop successful innovations in rapidly changing conditions (Klç, 2011: 106).

Innovation process: the emergence of the need for innovation, idea research, innovation-related development, applications, and finally the commercialization of innovation are carried out by presenting it to customers, that is, to the new market. Perhaps the most important stage of the innovation process is adding commercial value to innovation.

According to Peter F. Drucker, "Innovation is naturally the product of human intelligence. Those who are successful in these innovations, which are the products of intelligence, emerge as a result of the conscious and purposeful evaluation of innovation opportunities". Sources of innovation According to Drucker (2002), sources of innovation are **Internal resources** are: (1) unexpected developments; (2) incompatibilities; (3) Process requirements, (4) It is possible to list them as changes in market and sector structure and **External sources** are (1) changes in demographic structure, (2) perception changes, and (3) new information.

All of these trends affect businesses closely and appear to create innovation opportunities for them. It is thought that these resources will be useful in making use of the innovation potential in the business, creating an environment suitable for innovation, and making the innovation environment comfortable (Durna, 2002: 41).

2.3. Types of Innovation

Today, it has been seen that the economic markets, which are developing globally and undergoing rapid change, push companies to differentiate and innovate. It has been observed

that companies that have to innovate are fed or applied to different fields and different concepts. Types of innovation reached as a result of the literature review (Aydn, 2008; Coşkun, 2013:39; Grant, 2007; Hamel & Breen, 2007; Johansson, 2007) are (1) product innovation, (2) process innovation, (3) marketing innovation, (4) organizational innovation, (5) social innovation, and (6) radical and incremental innovation.

2.4. Factors Affecting Innovation Performance

According to Hult et al.; "Business performance is defined as the achievement of organizational goals related to growth and profitability in sales and market share, as well as the general strategic goals of the firm" (Hult et al., 2004). In this context, innovation performance can be defined as the number of innovation studies carried out in line with the strategy of the enterprises, their market and technological competencies, and the level of success or failure of these innovations in the market in terms of business profitability and market share. Therefore, sustainable innovation studies are necessary for businesses to reach the determined targets. For this reason, continuous measurement of innovation performance can have an effect on increasing the quality of innovation studies. On the other hand, by interpreting and explaining the innovation performance indicators, the company can see its position more clearly and can strategically decide what work to do in order to increase its innovation performance (Bülbül, 2014: 10).

2.5. Innovation Strategies

Companies gain a competitive advantage over their competitors by innovating, and it is thought that this will cause companies to have a longer life and get a larger share of the pie in the market. Innovation has become an issue of strategic importance for businesses. Innovation strategies show at what level businesses are interested in innovation. In general, the innovation strategies that will emerge as a result of the basic strategies of the enterprises are in the position of sub-strategy for the companies. For example, a business that takes a growth decision will likely follow an aggressive strategy accordingly. The main purpose of innovation is to take the business one step further by gaining competitive advantage or to stay ahead of the competitors in the market by surviving. In this case, businesses should adopt and use the most suitable one among various innovation strategies. Businesses can apply only one of these strategies or they can apply several of them at the same time according to various product groups. At the same time, as in the basic strategies, the business can change these strategies in order to adapt to changing conditions and situations (Gökçek, 2007: 69).

It is predicted that businesses that attach importance to innovation and provide a competitive advantage by innovating will increase their sustainable competitive advantage with their innovation strategies. Innovation strategies should not only be accepted as competitive strategies in the market but also be compatible with the strategies of the business and provide benefits. It is seen that the growth target strategies of the enterprise and its market share are also determining factors in the innovation strategy of the enterprise. (Adgüzel, 2012: 68–69). Innovation strategies include offensive innovation strategies, defensive innovation strategies, imitative innovation strategies, dependent innovation strategies, traditional innovation strategies, and innovation strategies that follow opportunities.

2.6. Asian and European Innovation Eco-Systems

The research and innovation systems in European countries are heterogeneous. Although countries implement the basic policies of the European Union, they differ according to their competitive strategies and regional needs. For example, Denmark and Ireland specialize in health and environmental technologies, Finland specializes in information and communication, and the Netherlands specializes in nanotechnology. In summary, in Asian, American, and European countries, countries have worked and continue to work to harmonize global and regional competition policies and innovation systems. In addition to designing all the players in Turkiye's national innovation ecosystem to multiply each other, the state's facilitator and establishing mechanisms that will improve cooperation between the players will contribute to the development of the ecosystem. Combining the two approaches here may benefit Turkiye.

2.7. Science-Industry Cooperation

Science-industry cooperation has developed as a result of the studies carried out to meet the industrial needs of universities. This model of cooperation involves industry donations to university research, etc. It started with providing support. Subsequently, it developed contract-based support for certain research projects carried out at universities. Recently, this cooperation model has continued to develop within more institutional structures.

There are many models of cooperation, both formal and informal. Stanford Research Park (Silicon Valley), which was established in Northern California in the USA in 1952 and has been operating to this day, is a good example of university-industry collaboration. Sometimes, it is possible to define all long-term and comprehensive projects within this cooperation network from an industrial organization's brief information about the result of an analysis made at the university.

Although a full classification of science-industry cooperation methods is not possible, a classification can be made as follows: General Research Supports, Contractual Research Studies, Educational Projects, State-Supported Research Projects Conducted with Science-Industry Cooperation, Contract-Based Research Studies, Research Consortiums, Science Industry Centers or Institutes, Technoparks and Incubation Centers, and Technology Transfer Centers

In Turkiye, there are organizations established by law within the scope of technology development organizations for science-industry cooperation. These are TÜBTAK, Higher Education Institutions, Ministry of Science, Industry, and Technology, KOSGEB, State Planning Organization (DPT), Turkiye Technology Development Foundation, Union of Chambers and Commodity Exchanges of Turkiye (TOBB), Turkish Informatics Industry Association, and TÜBSAD.

2.8. Conceptual Framework for Innovation Technology Development Zones (Technoparks)

Technopark International Association of Science Parks (IASP) defines it as "an organization managed by a professional manager whose main purpose is to increase the value of its members by improving its competitiveness and innovation culture" (IASP, 2008).

Technoparks aim to contribute to the development of the region and country by contributing to the commercialization of the knowledge developed in a university or research institution and by producing products with high added value. They are structures that incorporate R&D and innovation-oriented companies, are managed by a manager company, and have a number of support mechanisms stipulated in the legislation. Even though their goals are the same, different countries have different socio-cultural structures, development models, administrative and legal systems, etc., which has caused different naming of technoparks in different countries for different reasons.

In Turkiye, Law No. 4691 aimed to save technoparks from definitional confusion, and the name Technology Development Zones was used. However, although it is defined as a "technology development zone" in the law, the name "technopark is still widely used in Turkiye.

The regions established for the purpose of developing technology and innovation are most commonly known (30%) in the world as "Technology Park-Technopark"; the second place is called Science Park (24%). The most common name used in the USA for parks is "Research Park." It is "Science Park" in England and "Technopolis" in France.

The opinions on the compatibility between the names of the parks and the nature of their work are as follows: The rate of those who think that the names of technoparks are suitable for their activities is 72%; the rate of those who think otherwise is 13%. According to IASP, which recognizes technoparks as perfect locations for global knowledge economy organizations, technoparks are:

- Creating new job opportunities and adding value to mature companies
- To support entrepreneurship and mature innovative companies (incubating),
- They are areas established with the aim of providing attractive spaces for emerging knowledge workers and contributing to economic development by increasing synergy between universities and companies and thus improving the competitiveness of cities (IASP, 2008).

Technopark policies: It is accepted that they have three main objectives: (1) to revitalize declining or stagnant regions; (2) to develop an innovation environment; and (3) to develop new industries as a national policy (Castells & Hall, 1994: 238).

The combination of technology-oriented companies with technoparks and the creation of synergies ensures the development of an entrepreneurial and innovative culture in the region. For this reason, technoparks are established in regions where there is more technology, more educated workers, and industrial capacity. In the regions where technoparks are established, it can be seen that there is a significant increase in issues such as a qualified workforce and workforce productivity. However, this process needs to be supported by some government policies. Technoparks create new employment areas and accelerate the development of regional economies by establishing companies operating in new technology fields and integrating technology with R&D activities and industry.

Since the 1970s, many countries have established technoparks as part of their strategies to accelerate their growth. The two main purposes of the establishment of technoparks are to

carry the knowledge and experience of universities to the business world and to increase regional economic development (Koh et al., 2005).

The main purpose can be expressed as the orientation of the majority of entrepreneurial companies in technoparks toward R&D activities. However, research and studies can be handled under three groups: (1) innovation-based focus, (2) R&D-based focus, and (3) production-based focus (Hu et al., 2005).

2.9. International Technopark Organizations

International Association of Science Parks The International Association of Science Parks (IASP) is an organization with 349 technoparks as members and 200,000 companies associated with it. The International Union of Science Parks Association has four separate partner organizations (IASP, 2008): (1) the Asian Science Park Association (ASPA), (2) the Association of University Research Parks (AURP), (3) the World Association of Industrial and Technological Research Organizations (WAITRO), and (4) the World Trade Centers Association (WTCA).2.10. Technology Development Zones Law Practices

Technology Development Zones Law No. 4691 was accepted by the Turkish Grand National Assembly on June 26, 2001, was published in the Official Gazette on July 6, 2001, numbered 24454, and entered into force on the date of its publication. The law, which consists of 12 articles and two temporary articles, including enforcement and execution, determines the establishment, operation, management, and supervision of technology development zones and the duties, authorities, and responsibilities of the persons and institutions related to them. The Ministry of Science, Industry, and Technology has been shown as the ministry responsible for the implementation of the law. In order to achieve the objectives of establishing a technology development zone in a short time and effectively, a number of incentive practices have been introduced into the law.

3. Material and Method

3.1. Subject of Research

The subject of the research is evaluating the stakeholders in the innovation ecosystem in Turkiye in the light of examining the situation in R&D and innovation in Turkiye and around the world, emphasizing the role and importance of the bridge that Technoparks establish between science and industry cooperation, which is an important interface by acting as a bridge between science and industry by making use of R&D and innovation, and developing a new model proposal called "Technology Transfer and Development Center" for the development of this role.

3.2. Purpose of the Research

One of the most important tools for transforming knowledge into production is science-industry cooperation. Science-industry cooperation is used in various countries as a good tool to transform the basic and theoretical knowledge obtained in universities and research institutes into practice. In this context, it is thought to focus primarily on the role of technoparks within the scope of the innovation ecosystem and science-industry cooperation. It is aimed at developing a new model proposal for this role to be fulfilled more actively by strengthening it

with the participation of all stakeholders in the industry sector at the local and regional level and coordinating it from a single source under the roof of the technopark.

3.3. Research Method

In Turkiye, many strategy reports with the theme of R&D and innovation were prepared, workshops were organized, and conferences and fairs were organized. Significant progress has been made in all studies. In the studies carried out, the relevant areas of the studies presented in various activities organized under the titles of development, productivity, competitiveness, and innovation have been examined. Interviews and brainstorming meetings were held to reveal the common mind, workshops were examined, technology panels were attended, and on-site visits formed the basic processes of the study. Academic studies, documents prepared by international organizations, data sets, papers, and presentations presented in international organizations have been meticulously evaluated. The future trends and strategies of many global companies that develop and offer technology have been tried to be understood. Global standards, future visions, strategies, and action plans of developed and developing countries have also guided this study.

In studies conducted with a holistic approach, R&D and innovation have been examined in all aspects, from the conceptual point of view to their effect on wealth and welfare. The analysis focused on the relations between the competitive power of Turkiye and technology and science policies, and the economic effects and results of innovation were understood. The study presented an action plan, focusing on short-, medium-, and long-term recommendations and describing concrete projects.

Methods Followed in Common Mind Meetings In order to determine the framework, meetings were held with the participation of Technopark managers, academicians, and selected experts. Brainstorming, time-value matrix, and SWOT techniques were applied in 1 workshop, 4 focus-group meetings, and 2 panels attended by academics, experts, public administrators, private sector managers, entrepreneurs, and students, and it was tried to get the maximum contribution from the participants. It is aimed at producing a common mind by combining seemingly disjointed ideas.

In summary, the following stages were realized during the research process:

Research and Data Collection: Research was carried out to determine the situation in R&D and innovation in Turkiye and around the world.

Semi-structured, face-to-face, and in-depth interviews were conducted, and the opinions and suggestions of the business world on the subject were applied. In-depth interviews were conducted with more than 200 industry representatives, public administrators, academics, and experts.

Brainstorming Meetings Regular meetings were organized to identify projects, programs, and studies on R&D and innovation. Four focus group meetings were held with the participation of academics, experts, public and private sector managers, entrepreneurs, and students.

Literature review: The reports published on R&D and innovation in Turkiye and around the world were analyzed. Academic studies (doctorates, master's theses, academic articles, and papers), documents prepared by international organizations, data sets and papers, and presentations presented in international organizations were examined.

Participated in workshops on R&D and innovation,

The Ministry of Science, Industry, and Technology; Participation in Science (University) and Industry Summits Short discussions were held on the subject in meetings with participating experts, bureaucrats, and entrepreneurs. In this context, three summits were attended.

Participation in technology panels and fairs organized by universities In this context, 3 fairs and 7 technology panels were attended.

In light of the data obtained, the stakeholders that make up the national innovation ecosystem were evaluated, and the current situation was determined and compared with world examples.

The time value matrix of the national innovation ecosystem has been made, and the priorities for the importance of innovative works that will create the welfare of our country and secure economic foundations in the future have been ranked according to their importance.

SWOT analysis was made in light of the statistical data of technoparks in Turkiye, and the strengths and weaknesses, opportunities, and threats of technoparks were determined under separate headings and sub-titles. Strengths and opportunities of the SWOT analysis made in the study: strengths under a single heading, weaknesses, and threats under a single heading under weaknesses In addition, the analysis results obtained for technoparks in the study were accepted within the national innovation ecosystem.

As a result of the study, the TTDC application model has been developed, which will create synergy among the stakeholders (the Technology Transfer and Development Center), which will act as a catalyst to activate the regional innovation system that will enable the Technoparks to work more effectively. The need for a model that will increase science-industry cooperation and act as a catalyst between the existing centers and interfaces has been the result of the study. We named the new interface the Technology Transfer and Development Center (TTDC). From now on, the operation of this center, working on its corporate identity, financing, and legislative arrangements, and taking the model one step further may lead to the development of the desired cooperation and the obtaining of more qualitative results.

3.4. The Universe of the Research

Stakeholders constituting the National Innovation System: The technology and innovation eco-system is multidimensional and multilateral in nature. The parties that make up the universe of the research are listed: Vision and Strategy Setters, Policy Makers, Fund and Support Providers, Implementing Actors, Environment Providers, Facilitators, Human Resources Providers, Market Regulators, Information and Technology Transfers, Commercializers, Producers, Market Mobilizers, Beneficiaries

3.5. Techniques Used in Research

3.5.1. Time Value Matrix

Value matrix: Thinkers named Walsh and Mack argue that profitability of investments (total return on assets = ROI) with capital costs has an important place in business planning and portfolio analysis. According to the thinkers, in determining the business strategy, a value matrix should be developed that will consist of the capital cost and return on investment ratios. With the value matrix, the location of each SUB will be determined so that the value it carries for the enterprise can be determined.

Value analysis can be used to see the current situation in the businesses, to understand the trends from year to year by observing, to maintain the strategic plan as much as possible, or to correct the bad situation. In addition, the value matrix can be used to supplement the guiding policy matrix to compare the situation of similarly sized enterprises operating in the same line of business as competitors.

Aiming at Developing R&D and Innovation Capacity in Turkiye: A Time/Value Matrix Study

While creating the National Innovation System, there are things to be done in order of importance and priority. In this part of the study, the items are shown in a time value matrix in order of priority and importance in order to improve the R&D and innovation capacity in Turkiye.

Very important

- Determining what Turkiye's R&D and innovation strategies are
- Structuring support and incentive mechanisms within the framework of the principle of "playing the winning horse
- Establishment of a result-oriented financial support mechanism
- Establishment of a lean management system that eliminates multi-headedness in the public sector
- Forming a dynamic team of five people (3 private sector, 2 public) named "T Team" and monitoring Turkiye's R&D and innovation performance with this team.
- Submission to the Ministry and other relevant units
- Establishing SPVs for technology transfer
- Acquisition of foreign start-up companies with high growth potential
- Making the necessary legislative arrangements to compete with China
- Improving the investment climate
- Giving priority to R&D projects in every field (industry, agriculture, and services) and supporting them specifically
- Supporting large companies with high R&D capacity to grow on a global scale and supporting these companies to acquire effective small companies (national and global)
- Ensuring the establishment of consortiums between large companies and small national companies
- Establishing a merit-based management system in R&D priority areas
- Simple, understandable, and appropriate reorganization of the legislation
- Making the referee processes of the projects effective (budget, merit, objectivity)

- Making an R&D inventory of Turkiye
- Transferring the support and incentives provided to the R&D process to the marketing, commercialization, and sales processes
- Consideration of production at the national level in public procurement
- Supporting students with high technology development capacity and granting scholarships
- Ensuring that all public institutions that carry out R&D or support processes in Turkiye are restructured and become effective
- Supporting NGOs working in the field and encouraging new ones to be established
- Ensuring that thematic technoparks are supported according to national priority strategies
- Supporting large-scale global companies that will invest in technology in Turkiye
- Supporting M&A and cooperation between national and foreign SMEs
- Ensuring the establishment of venture capital companies
- Implementation of practices that improve commercial relations between large foreign companies and national SMEs
- Radical reorganization of management and working conditions in technoparks
- Ensuring banks transfer resources to innovation and R&D activities
- Provide incentives and support quickly and effectively.
- Supporting institutions to work together, writing success stories, and teaching them at universities

Important

- Selection of bureaucratic staff within the framework of Turkiye's R&D vision
- Implementation of action plans made at the macro, meso, and micro levels
- Elimination of compatibility problems between R&D and innovation approaches of institutions
- Making incentive and financial support mechanisms simple and plain
- ensuring the restructuring of universities and supporting research universities
- Developing a KPI model to measure the effectiveness of the financial supports used
- Making the referee processes of the projects effective (budget, merit, objectivity)
- TÜBTAK's transformation from a bureaucratic management model into an organization that works like a venture capital
- State leaders leading large R&D projects
- Reducing financing costs in R&D projects
- Establishing and promoting vocational college universities to train intermediate staff
- Promoting and supporting lifelong and adult education
- Complete restructuring of the Turkish education system (from pre-school to university)
- Development and implementation of a multidisciplinary training program
- Ensuring that high technological production is fed by emphasizing tolerance, morality, and sublime values in the social structure.
- Ensuring that R&D support is given especially to projects with high commercialization capacity.
- Developing a KPI to measure the performance of the national innovation system
- Implementation of public-stakeholder (PSP) cooperation as an effective model, especially in the field of R&D and innovation
- Determining Turkiye's competitiveness-based R&D and innovation strategies at the regional level

- Establishment of large-scale laboratories in pilot universities to encourage university-industry cooperation
- Making arrangements to support investors' risk taking
- Establishing a technology development culture that is disseminated to the whole society
- Supporting tech entrepreneurs
- Supporting creative imitation in high-tech
- Restructuring the GCC to support national technologies
- Establishment of a cluster-based R&D and innovation system
- Encouragement of executives working in the public sector
- Developing a strategic model for the development of human resources

3.5.2. SWOT Analysis Strengths and Weaknesses of Regions

A SWOT Analysis has been made showing the relations of Technoparks with the Ecosystem and their current status, which are among the main actors affecting the Innovation Ecosystem in Turkiye. Strengths, weaknesses, opportunities and threats of technoparks as a result of SWOT (strengths, weaknesses, opportunities and threats) Analysis studies, the results of research and examination reports made by public institutions and organizations, and interviews with the managers of technoparks and the officials of the companies operating within the technopark. attempted to be determined. The results obtained below are summarized by sticking to the opinions of the participants, except for spelling corrections:

Within the scope of SWOT Analysis, the "Public-University-Industry Cooperation Regional Meetings" held by the Science and Technology General Directorate of the Ministry of Science, Industry and Technology of Turkiye were held in Adana, Ankara, Antalya, Aydın, Balıkesir, Bursa, Hatay, İzmir, Kars, Kastamonu, Kayseri, SWOT Analysis in regional reports of Kocaeli, Konya, Manisa, Nevşehir, Samsun, Şanlıurfa, Van and Zonguldak was used. In addition, from the SWOT Analysis conducted within the scope of the Evaluation of the Applications of the Technology Development Zones Law No. 4691 of the State Supervisory Board and Developing a Suggestion for the Solution of the Problems in Practice, Prof. Dr. Technology Foresight study for Ankara University Technopark by Argun Karacabey and Mevlana Development Agency, TR 52 Region (Konya/Karaman) R&D Science and Technology Commission Report within the scope of 2010-2013 Regional Plan Preparation Studies. The interview with H. Gül Özal, ITU Arı Teknokent Corporate Relations Officer, and the information received via e-mail with Özgür Karayalçın, who is responsible for the statistics about METU Teknokent, were also included in the analysis. In addition to all these, the solution proposals and conclusions of the sources used within the scope of the study were used.

3.5.2.1. Strengths

The points that the participants see as an advantage for the technoparks in Turkiye are as follows:

a. Existence of Legal Infrastructure

b. Incentives are (1) Sufficient tax exemptions and exemptions are provided, (2) Having attractive regulations for foreign investors, (3) Grant infrastructure support is provided to investments, (4) Significant increases have been achieved in the R&D expenditures of our state

in recent years, (5) Having a wide variety of national and international incentives for R&D, (6) Allowing university professors to establish companies and become partners in companies without being associated with revolving funds.

c. Administrative Structures are (1) Ministry of Industry and Trade to be the relevant Ministry, (2) Local governments and chambers are in the organization, (3) Creating synergy by the coexistence of companies, (4) Clustering has a positive effect on competitiveness, (5) Allowing the establishment of new spin-off companies with advanced R&D culture and skills, (6) Establishing new companies with advanced technology and enabling small companies to grow, (7) Availability of many good practice examples.

d. Benefiting from the Presence and Facilities of the University:

- Utilization of university superstructure and infrastructure facilities (Laboratory, social facilities, etc.)
- In Turkiye, there are many universities with high research potential and human resources,
- Companies can easily access academic knowledge and areas of expertise in universities,
- Preparing spaces that allow cooperation,
- The positive effect of the project evaluation and monitoring process on the success of the companies,
- Academicians have the opportunity to earn additional income by transforming their knowledge into technological products,
- The existence of companies founded by academics and newly graduated students.

e. The beginning of the formation of knowledge and experience in technoparks

f. Qualified Human Resources

g. High Level Political Support

h. National and Global Economic Developments

3.5.2.2. Weaknesses

The weaknesses and problems of the technoparks in Turkiye and the issues that are considered as threats by the participants are as follows:

a. Problems Caused by Legislation and Administrative Practices

- The R&D Law No. 5746 keeps large companies away from the TDZ.
- Companies subject to Public Procurement Law No. 4734 cannot make investments.
- There are problems with licenses and permits within the scope of Zoning Law No. 3194.

- There are problems with the allocation of Treasury lands to regional management companies.
- There is a lack of information in keeping accounting records regarding R&D.
- It is not clear exactly what is within the scope of R&D activity.
- There are uncertainties about the powers of local governments and universities.
- The fact that technopark management companies are responsible for the tax loss caused by the companies and not explaining how to fulfill the burdened responsibility causes various problems.
- Overtime tracking of personnel working in the region reduces productivity.

b. Lack of Financial Resources are (1) Problems Encountered in Financing the Physical Infrastructure, (2) Enterprise Infrastructure Support Issues, (3) Problems Encountered in Other Incentives for Entrepreneurs.

c. Policy Issues

- The absence of the Ministry of Science and Technology,
- Lack of coordination between institutions and policies,
- The development of technoparks is only indexed to market dynamics,
- Inability of Technology Development Zones to specialize in certain areas,
- Software has become a dominant industry,
- Imbalance in the sectoral distribution of companies established in the regions,
- Establishment of TDZ in provinces where R&D culture and sufficient potential are not formed,
- The technopark and production sectors are not represented in the evaluation board and other commissions related to the TGB, and they do not have voting rights,
- Lack of philosophical unity in the legislation related to R&D supports,
- Technology Development
- It is more than the incentives and exemptions applied for their regions.

d. Problems Experienced in Relationships with Universities are (1) Problems Experienced in University-Administrative Company Relations, (2) Cooperation Problems Between University-Production Sectors.

e. Insufficient Promotion and Awareness

- Insufficient introduction of Technology Development Zones to target audiences,
- Lack of promotion in attracting international companies to the Regions,
- Lack of sectoral lobby,

- Lack of awareness at the university,
- Lack of organization for exchange of knowledge/experience between Technology Development Zones.

f. Collaboration Issues

3.6. Model (A New Model Proposal: Technology Transfer and Development Center (TTDC))

3.6.1. Technology Transfer and Development Center (TTDC) Definition

TTDC, Science-Industry interface and all actors (University, KOSGEB, İŞ-KUR, Development Agency, Chambers of Engineers, Chamber of Commerce and Industry, etc.) at the local or regional level in order to make their innovation roles more effective in an integrated and synergetic way. It is a platform where each unit will be represented through the existing technopark facility and infrastructure.

3.6.2. The Role and Importance of the Technology Transfer and Development Center (TTDC)

There is no path to prosperity and wealth without R&D and innovation. In order to realize the strategic transformation in increasing the R&D and innovation capacity in Turkiye, we need to activate the Science-Industry cooperation. In the R&D and innovation 2023 projection, while 0.96% of the gross national product is currently allocated to R&D and innovation in the innovation policy of the country, this rate is targeted as 3% in 2023 with a gradual increase. It is of great importance that these targeted shares are transformed into R&D and innovative studies/projects. The most basic synergy environment that will increase the number, quality and efficiency of these projects is science-industry cooperation.

3.6.3. Technology Transfer and Development Center (TTDC) Model

Countries and businesses that use "innovation" as a lever increase their production and income, especially despite the increasing crisis environment as a result of the fragility of economies. Being aware of this effect, governments add the necessary legislative changes and incentives to their policies to create an eco-system that supports R&D and innovation. In the last 10 years, the weight of R&D and innovation in economic and industrial policies has increased significantly.

Effect of the Technology Transfer and Development Center (TTDC) Model on National Innovation: As the name suggests, the model we call the Holistic Propagation Model from the Part to the Whole is the schematization of a wave effect operating model that shows the effect of TTDC on the National Innovation System and then on social welfare, triggering this intermediate process with a correct setup.

The R&D innovation ecosystem can actually be reduced to the individual. However, since it is a corporate identity and a sustainable structure that will mobilize the stakeholders that make up the system, it needs to gain a corporate identity. There is a need for a model center that will provide coordination between science, industry, the public, and social collaborations, which are the main actors in R&D innovation development. A holistic diffusion model has

developed in a structure that goes from the part to the whole in the impact assessment of this model.

3.6.4. Establishment Stages of the Technology Transfer and Development Center (TTDC)

The establishment stages and justifications of the Technology Transfer and Development Center (TTDC) model, which is a formation that will achieve the effective use of existing human resources, existing interfaces, synergy between its supporters and beneficiaries, and its sustainability after being financially established, are summarized below.

Stage 1 (Joint Service Section): The following services will be provided in this section. Providing many services from a single source will reduce the costs of the institution. In summary, the services to be provided are (1) Joint secretariat, (2) Financial advisor service, (3) Advocacy service and legal consultancy, (4) Shared internet service, (5) Office services ready to work, (6) Shared electricity, water, common expenses and zero rent.

Stage 2 (Separating Tables for Public Institutions and Organizations to Support University-Industry Cooperation): Experts to be assigned with the assignment of their institutions will continue to work in coordination with TTDC's business model and guidance. Because it is known that the relevant institutions and organizations want to increase their work within the University and to establish stronger relations with the university. Such a formation will not only support researchers and entrepreneurs, but also serve the purpose of the relevant institutions in order to provide more effective services and supports to the local area, which is the purpose of their existence. Some of the tables to be set up are as follows;

a. KOSGEB Desk: One of the most important pillars of University-Industry Cooperation is Tekmers. However, in today's conditions, many universities do not have the chance to establish Tekmer. Tekmer's are organizations that provide grants for R&D and innovation, provide easy support to universities and academic studies, and support projects based on R&D innovations, adding movement to Technoparks. However, a KOSGEB table to be installed will have a chance to work like a Mini Tekmer. In this way, inter-institutional relations will be strengthened and there will be a noticeable increase in the number of applications and projects to KOSGEB projects.

b. TSE Desk: Individuals and businesses from certain business sectors absolutely need TSE in order to benefit from TSE documents and services. From this point of view, more investors will actually come to TTDC to be established within Teknopark. With the mobility to be provided by the increase in arrivals and departures, a demand for Technopark will occur from visitors coming and going via TSE. These demands will support the existence goals of Technoparks, one of the main actors of Science Industry Interfaces. In the process, direct support will be received from the institution. Again, intellectual property rights and certification seminars and trainings will be provided for both students and academicians through focus group meetings and trainings that will be held within the University with the TSE representative.

c. İş-Kur Desk: With the desk to be opened here, cooperation with İşkur, University and Technopark will be developed. In this way, İşkur's vocational training activities will have the chance to perform the intermediate staff training services needed by the industry in the triangle of industrial establishments, technopolis and university continuing education center. In

this way, qualified internship opportunities for students as Applied Sciences will be programmed.

d. Development Agency Desk: Experts to be assigned from the Development Agency Investment Support Office and the Project Office will both promote the Development Agency grant and support funds within the university at the relevant dean's offices and centers, and increase the relations of academics with the Agency in one-on-one meetings. In this way, Agencies; Project applications with R&D and innovation qualities from the world of science will increase.

e. Credit Guarantee Fund Desk: More industrialists, investors and entrepreneurs will demand this table. Again, with the service to be provided by this table, the work will be done to indirectly bring together and unify the industrialists with the technopark. In addition, it will be possible to establish contact with the institutions and organizations that are deemed appropriate in this regard and create relevant desks.

Stage 3 (In this Stage, Headquarters or Sub-Offices of Institutions and Organizations will be included): There will be an increase in the rate of science-industry cooperation in strategic partnerships with these offices. In fact, partial coordination of the cooperation to be formed on a regional basis can be done through this interface.

a. TSO Project Office: The transfer of the Project office of the Chambers of Commerce and Industry to the TTDC will contribute to the investors, industrialists and the Trade and Industry segment of the University and Technopark to be in intense contact. In this way, it will cause science-industry cooperation and more frequent gathering of these segments.

b. University Project Office: In this center, experts who have gained the ability to prepare projects will develop their ability to prepare projects for youth and education projects, as well as for investment and R&D supported grant funds such as San-Ez, Teknogirişim, TÜBİTAK, TEYDEP, development agency and KOSGEB. In this way, they will have the chance to benefit from them in this field in their spare time from preparing youth and education projects.

c. University Career Counseling Center: Through this center, the concept of intern engineering or intern technical staff, which we want to establish as applied sciences, will be created. Intern capacities of companies will be determined with protocols to be signed with TSO, ESOB, TB, MMO, EMO, etc. Again, with the guidance of the University Rectorate, it will be possible to make a strategic cooperation protocol with all the deans and turn it into a giant center that organizes the internship and employment issues of the students. In addition, the intern student who will be successful will develop relations with the employer and when he graduates, the time to find a job will be shortened and it will be easier for the employer to find the personnel he is looking for.

Stage 4 (Moving Structure Stage); At this stage, there are well-equipped offices similar to incubation and pre-incubation centers. Academicians, doctoral or graduate students with projects, business ideas, business connections, brands and/or patents to be developed, successful senior undergraduate students, graduates of technical faculties who have graduated but have problems in finding a job, technical staff working in the public or market will be able

to work in the unit. When the person applies to the center with a project or idea, TTDC's Project Evaluation Board will review the project written text and then final evaluation of the project will be made through an interview. If the application is accepted, a special contract will be signed with the person and from that moment on, TTDC, the owner of the project, will be the expert in charge of the project. However, the rights and obligations of both parties will be determined clearly in the contract, and the rights of the person will be legally guaranteed. After that time, the person will be given an identity card as a center specialist during the project. When this academician or expert meets with the investor, he will be in a center that has the opportunity to work together with a lawyer who provides legal services, a financial advisor dealing with month-end withholding, tax, insurance, a good working environment, and representatives of all institutions and organizations related to his field. They will no longer shy away from the industry and business world, and on the contrary, they will want to attend all the focus group meetings themselves. They will both develop a dialogue through TTDC and bring the dialogues they will develop themselves to the center.

3.6.5. Expected Outputs from the Technology Transfer and Development Center (TTDC)

3.6.5.1. TTDC Outputs for Universities

- The quality of research and academic studies at universities will increase,
- An increase will be observed in the number of industry-oriented studies carried out in universities,
- Academic entrepreneurship will increase in universities,
- Entrepreneurship of university graduates will increase,
- The number of entrepreneurs from graduates will increase,
- There will be an increase in the number of R&D, innovation and entrepreneurship projects made to TÜBİTAK, EU, KOSGEB, Agency etc. institutions,
- Revolving funds of universities will increase,
- Technoparks, of which universities are the main actor and stakeholder, will be more active and will make them the main platforms of science-industry cooperation, freeing them from the character of leasing companies,
- For the application; the application area for doctorate and master studies will increase,

3.6.5.2. TTDC Outputs for the Industry Sector

- Industry will benefit from the research and academic studies carried out in universities, which are practical.
- Working environment and rate will increase with expert researchers and academicians,
- Industrialists, prototypes, patents, utility models etc. developed at the university. At the stage of transforming the works into economic value, they will be able to become a stakeholder or owner of innovative products and works through collaborations or purchasing rights.

- There will be an opportunity to develop joint projects with the developing entrepreneurship originating from the university.
- There will be an increase in the number of R&D, innovation and entrepreneurship projects made to TÜBİTAK, EU, KOSGEB, Agency etc. institutions.
- Industry needs laboratory services for some of its studies.
- The number of industrialist entrepreneurs will increase in technoparks.
- For the application; will have the chance to benefit from doctoral and graduate studies more easily and effectively.
- It will be possible to benefit from the facilities of many centers established at the university.
- The industrialist will gain time to solve the problem with whom he can solve the problem more easily through TTDC.
- Innovative studies applied in the industry will increase the economic gains for the industrialist.

4. Conclusion and Suggestions

In today's world, companies, entrepreneurs and talented people or talented organizations produce value, innovation, products that meet human needs, employment and creating resources for the public through taxation. Now, there is a need for high-capacity entrepreneurs and talented classes as well as artists, scientists, philosophers of countries. Even if R&D is done without building an ecosystem that puts innovative entrepreneurs at the center, it cannot be turned into profit.

Actions to improve Turkiye's innovation capacity are quite comprehensive and complex. It requires many years of work. Action plans have been made by various institutions for many purposes aiming to become the 10 largest economy in the world. Unfortunately, although these targets are important for Turkiye, they are not sufficient targets. Turkiye must also have goals such as prosperity, transparency, ease of work, competitiveness, scientific studies and innovation capacity. Turkiye’s R&D and innovation goals must be compatible with the economic goals. It should find solutions to many problems such as increasing the competitive power of the sectors and companies, improving the innovation capacity, producing brand new products and services, and achieving a livable environment, and it should be implemented successfully. By this way country can achieve their goals. In this direction, a 6-stage basic transformation plan is proposed in the study.

Suggestions

1. Determination of National Targets The first step is to analyze Turkiye's national competition and to determine its national targets in line with competitive advantage areas. A country that has not determined its competitive strategy is like a ship that does not have a compass and does not know its destination.

2. Legal Framework, Regulations and Standards According to national competition and regional needs, our national legislation and national standards must be compatible with international regulations. Second priority is; reviewing the legislation and standards, eliminating compliance problems and deficiencies.
3. Inter-Institutional Harmony and Synchronization Public, private sector, NGOs, media, information producing institutions, etc. We can say that if we cannot achieve harmony and synchronization between institutions, we will have difficulty in achieving the goals. 3rd step is to regulate the duties of the institutions in a way that does not cause conflicts, to determine the workflows between the institutions and what are the incompatibilities, if any, and to work to adapt.
4. Developing and Implementing Meso-Policy Developing sectoral and regional development policies in line with national policies and determining R&D and innovation policies in this direction is the 4th step.
5. Micro Projects Development and Implementation The 5th step is to produce and implement focus-oriented micro R&D and innovation projects in line with sectoral and regional R&D development and innovation policies.
6. Projects should be monitored in order to follow the Results and Monitoring Stages, monitor the results, identify deviations and inform the parties. Implementation support should be given to project implementers when necessary. Along with the developing and changing world, there are also changes in Turkiye. We can say that future prosperity is based on innovation and innovation will develop as a result of science-industry cooperation. Existing structures fulfill the partial functions of the TTDC model we have built. However, in the fiction, the science-industry cooperation that constitutes the R&D and innovation ecosystem of the province or region; Since it will bring many parties together, it can both increase the quality and number of these cooperation efforts and create a catalyst effect for the existing structures to work more effectively. Partial implementations of the model we advocate are seen in the USA, Europe and Australia.

There are important works to be done in the short, medium, and long term in order to increase the R&D and innovation capacity in Turkiye. In this context, the opinions and researches put forward in the common mind meetings we held are guiding for Turkiye. There is not only problem determination or recommendations in the study. A transformation program, innovation model, organizational form and project management approach have been developed. In addition, in order to realize this strategic transformation, concrete projects with determined aims, parties and targets are proposed.

1. First of all, Turkiye's economic development model should be reviewed, and a competition-based development approach should be adopted.
2. Talent and entrepreneurship should be at the center of our R&D and innovation system. The entire eco-system, including the state, should reward talent and support enterprise.
3. An eco-system that supports not only basic research or invention but also the commercialization process should be constructed from idea to profit.

4. All instruments to accelerate technology transfer, including innovative imitation, should be used as leverage for the innovation system.
5. Necessary arrangements should be made and its infrastructure should be strengthened in order to make the country attractive for everyone who develops domestic and foreign technology.
6. Turkiye should stop playing the losing horse and support the best.
7. There should be a transition from public administration to public management. Public; should be guiding, facilitating, supportive. Good governance and fundamental renewal should be encouraged.
8. It should focus on the right technologies at the right time and aim for efficient use of resources.
9. For the future, investments should be made in science, art and education. Innovation and entrepreneurship issues should be integrated into the curriculum.

Turkiye's competitive priority areas and the R&D projects focused/directed on these areas are necessary to clarify Turkiye's future R&D innovation roadmap. The details and recommendations on these issues can be found in the Ph.D. thesis from which this study is derived.

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