**NETWORK ANALYSIS OF SAMSUN INNOVATION ECOSYSTEM**

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**ABSTRACT**

*This research is about to explain the features of Samsun innovation ecosystem. The study aims to determine the way Samsun region has taken in Innovation indicators the development of the ecosystem. Exact purpose is to develop innovation data set, to collect the secondary data, and to analyse the performances of the academic and private sector on innovation. The main question is what are the features of Samsun innovation ecosystem network and/or how is the Samsun innovation ecosystem network explained? This research is the first, but not last, academic study which combines theoretical and practical perspectives on innovation ecosystem network analysis in provincial level in Turkey. Having reviewed the previous studies prepared by development agencies, including OKA in Samsun and theoretical background from the researchers such as Freeman C. and Luc S., Curley M.G., Moore C.F., Gomes L.A., Dedehayir O., Burt R.S. and Barabasi A.L. for the concept of Innovation Network and Ecosystem Analysis. As a methodology, firstly, it started with desk research, that provided qualitative and quantitative data. Literature research has been done and innovation network and ecosystem analysis examples have been examined then specified indicator set which consists of nineteen (19) indicators and three sections as institutional, academic and industry indicators and data collected from the relevant institutions. This research was prepared under the limitations of geographical coverage of Samsun and exclusion of private sector companies. The findings of this study are that Samsun has a great infrastructure in human capital of researchers and interface institutions although not having great performances in private sector. For the result-oriented performance, there is a need for a stronger university-industry cooperation model on a city scale so, this cooperation will both support the university and contribute to the holistic development of the province in the medium and long term.*

***Keywords****: Innovation, Ecosystem, Innovation Ecosystem, Samsun*

1. INTRODUCTION; THE PROBLEM AND CONTEXT OF THE RESEARCH

As a result of the development in communication technologies after the 1990s, especially in the production of information, the speedy change, radical differentiation in industrial competition elements, the evolution of university-industry cooperation and the complex structures triggered by them, national or regional new technology production and development systems involving many countries. It has created a different “information value chain” that extends from distribution, commercialization, impact assessment, social control and prosperity. The main feature of this system starting from the identification of problems based on practice and social welfare, its solution, implementation, the formation of regulations on the subject and the use of the outputs and the involvement of all parties together in the regional policies involving these systems. It emphasizes the importance of establishing connections between all macro and small companies, R&D institutions and industry, innovation clusters, designing and implementing public policies that will establish new connections and strengthen existing connections and highlight strong cooperation networks. There are many actors such as companies, customers, investors, universities, decision makers, umbrella organizations and collaborations between these organizations in complex structures are observed. These collaborations can be R&D or a similar collaboration for an innovative project, or they can be in a network or cluster created for different purposes.

**1.1. Introduction to the Research Problem**

Recently, some Turkish regional development agencies have published innovation ecosystem analysis for the regions and/or provinces they are responsible for, such as Bursa (BEBKA, 2020a), Bilecik (BEBKA, 2020b), Eskisehir (BEBKA, 2020c) and Izmir (IZKA, 2016). However, these publications prepared not in academic but from a governance and business perspectives to prepare for policy making. As a leading institution in the field of innovation in Samsun, OKA published the TR83 Middle Black Sea Regional Innovation Strategy (OKA, 2017a) includes the current status of the region, the global competitive conditions and the strategic goals of the vision that are aimed to be achieved as a unique and basic document and/or roadmap of the regional innovation. The main question of this study is “what are the features of Samsun innovation ecosystem network”?

**1.2. Context of The Research**

Within the scope of the thesis, at beginning stage, literature research has been done and innovation network and ecosystem analysis examples have been examined. The study, aims to determine the way Samsun region has taken in R&D and Innovation indicators the development of the ecosystem, consists of four different chapters. Firstly, the introduction chapter evaluates the research problem and context of the research with three sub-titles as i) Introduction to the Research Problem, ii) Context of The Research and iii) Research Aims. In the second chapter, it is reviewed the theoretical background for the concept of Innovation Network and Ecosystem Analysis. In the third chapter, covers overall Research Design Strategy, data collection methods, research procedures, data analysis and influencing factors and limitations are also taken place in this chapter. In the last chapter current state of R&D and innovation in Samsun is explained under three titles within fifteen sub-titles. Academic and Research Infrastructure, Innovation Capacity in Private Sector and Infrastructure for Supporting R&D and Innovation are first part of the issues within this chapter. Finally, there are conclusions for further researchers.

**1.3. The Research Aims**

The aim of the research was to explain the features of Samsun innovation ecosystem. The analysis was accomplished by means of three specific aims. The first was to collect official information from various institutions to determine the comparative capacity of innovation in Samsun compared to other peer cities. The second aim was to collect relational data on the flow of innovation-related information regarding innovation ecosystem of Samsun. The third aim was to (a) explain comparative capacity of innovation of Samsun compared to other peer cities. In this study, the exact purpose is developing R&D and innovation indicator set, collecting and analysing the necessary secondary data from institutions and organizations related to the indicator set, analysing the R&D and innovation situation of the private sector.

**2. THEORETICAL BACKGROUND FOR THE CONCEPT OF RESEARCH AND DEVELOPMENT AND INNOVATION, INNOVATION ECOSYSTEM**

**2.1. From Research and Development to** [**Innovation**](#_bookmark2)

Research is a scientific-technological activity for knowing and learning the unknown. Development is the activity of directing existing knowledge or technology to new levels with new regulations (Öğüt, 2001). R&D activity can be defined as regular studies to obtain new information that will enable the development of science and technology or to produce new materials, products or tools with existing information, to create new systems, processes and services, including software production, or to develop existing ones. R&D includes creative works based on a systematic basis in order to increase the knowledge of the person and the society and to transform this knowledge into new practices.

Innovation as a concept refers to both making new and/or renewing a process and being new as a result. As an innovation process in Organisation for Economic Co-operation and Development (OECD, 2013) literature, it is defined as ‘turning an idea into a marketable product or service, a new or improved method of production or distribution, or a new method of social service’. Innovation also refers to the marketable, new or improved product, method or service introduced at the end of this conversion process (Core Cities Working Group, 2004). In the definition made by OECD for innovation, the concept of innovation, which goes beyond R&D, is divided into four categories. These are listed as product innovation, process innovation, market innovation and organizational innovation. Today, innovation is becoming an increasingly important and frequently used concept in various fields such as industry, service, agriculture, information technologies and financial sector. Innovation, which contributes to economic growth by increasing the efficiency and competitiveness of countries, is considered as an important factor guiding economic activities worldwide. Innovation is one of the most important elements that societies are fed as technological, socio-economic and physical environment. At this point, cities are trying to have technology and innovations that are developing every day for the growth and sustainability of the innovative ecosystem (Cooke, 2008).

**2.2. Innovation Ecosystem**

Innovation is a great challenge. It thrives in an environment full of uncertainty, with many interrelated factors. This environment includes not only the coming together of the necessary components, but also the dynamism dimension that includes the learning, adaptation and evolution of these components together. Innovation is an increasingly distributed and collective process involving various components as well as the interaction between them (Freeman and Luc, 1997). The traditional innovation model uses scientific research as the foundation of innovation and suggests that change is linear from research through invention to innovation, diffusion and marketing of innovation. However, today this model is considered incomplete and misleading. Increasing numbers of researchers have begun to develop a holistic view of innovation and technological development (Bergek et al., 2008). Accordingly, a wide variety of system configurations have emerged in innovation studies, such as national innovation systems (Edquist (1997), Lundvall (1992) and Nelson (1992)), the technological systems approach (Carlsson and Stank (1991)) and the sociotechnical systems approach (Bijker (1995) and the network approach (Håkansson (1990). Network science has caused a significant evolution in innovation studies (Allen, Maguire, & McKelvey, 2011) and imposed a shift in focus from manufacturer-centered to network-centered approaches (Powell, Koput, & Smith-Doerr, 1996; Iansiti & Levien, 2004).The emphasis on nonlinear and network-based innovation has led to the adoption of the ecosystem framework in innovation work, in an attempt to capture the multiplicity and complexity of the innovation process (see, for example, Adner, 2006; Iansiti & Levien, 2004; Moore, 1993). By taking into account the complex social dynamics of the system, it can be observed that there is a gradual transition from the innovation system to the innovation ecosystem in academic discourse (Jucevicius & Grumadaite, 2014). In this context, one of the most appropriate words to describe the environment in question is ecosystem.

The term ecosystem was first applied by Rothschild (1990) in the fields of business and economics. In Rothschild's book Bionomics, he likens the understanding of economics to the understanding of a biological system. Likewise, Moore (1993) introduced the term business ecosystem to emphasize the essence of competition between components of an ecosystem. Based on Suominen (2016), the innovation ecosystem is a self-evolving elite cluster as an independent domain among clusters such as business, information and digital ecosystems as well as digital platforms (Gomes et al., 2015; Valkokari, 2015; Dedehayir, Mäkinen and Roland Ortt, 2016; Suominen, Seppänen, & Dedehayir, 2016). There are different types of innovation ecosystems. Oh et al. (2016; 54-56) distinguishes seven types of innovation ecosystems in relation to economical contexts they are mentioned. These are corporate (open) innovation ecosystems, regional and national innovation ecosystems, digital innovation ecosystems, city-based innovation ecosystems, high-tech SMEs-oriented innovation ecosystems, hyper-local innovation ecosystems and university-based ecosystems.

3. RESEARCH QUESTIONS AND METHODOLOGY

This chapter presents how the research was designed and implemented and a method was applied in this study. It explains the rationale for the research approach and describes the research design and setting. The procedures for obtaining data, preparing the data for analysis, and the analysis process are also documented.

**3.1. Research Questions**

The research question of this study is “what are the features of Samsun innovation ecosystem network?” In other words, how is the Samsun innovation ecosystem network explained and/or described?

The several sub-questions follow this main question as;

1. What is the current comparative capacity of innovation of Samsun compared to other peer cities?

2. What is the innovation network structure like?

3. What is the innovation level of Samsun ecosystem and what are its strengths and weaknesses compared to other peer cities?

**3.2.** **Overall Research Design Strategy**

**3.2.1. Research Design**

The research design is a descriptive network analysis. The aim of the research was to explain the features of Samsun innovation ecosystem network through social network analysis. The analysis was accomplished by means of three specific aims. The first was to collect official information from various institutions to determine the comparative capacity of innovation in Samsun compared to other peer cities. The second aim was to collect relational data on the flow of innovation-related information regarding innovation ecosystem of Samsun. The third aim was to (a) explain comparative capacity of innovation of Samsun compared to other peer cities. These aims in relationship to the study design and data collection strategies are detailed in Table 1.

|  |
| --- |
| **Table 1. Project Research Design and Data Collection Plan** |
| **Research Design** |
|  | **Aim 1** | **Aim 2** | **Aim 3** |
| **Aim** | Collecting official information from various institutions to determine the comparative capacity of innovation of Samsun compared to other peer cities. | Collecting relational data on the flow of innovation-related information. | Explaining comparative capacity of innovation of Samsun compared to other peer cities |
| **Research****Question(s)** | **What are the features of Samsun innovation ecosystem network?** |
| 1. What is the current comparative capacity of innovation of Samsun compared to other peer cities? | 2a) What is the network structure like?  | What is the innovation level of Samsun ecosystem and what are its strengths and weaknesses compared to other peer cities? |
| **Data****Collection**  | 1. Collect relationaldata from official institutions regional and/or national level. 2. Transpose dataobtained for secondary analysis. |  | 1. Documentation ofinnovation level of Samsun ecosystem and its strengths and weaknesses compared to other peer cities. |
| **Data****Analysis** | 1. Quantitative analysisof data regarding comparative capacity of innovation of Samsun compared to other peer cities using MS office Excel.2. Preliminarydescription of thecomparison.  | 1. Preliminarydescription of thenetwork  | 1. Interpretation ofempirical findings. |
| **Result** | Empiricaldescription of thecomparative capacity of innovation of Samsun  | 1. Descriptive empiricalstructure of the network | a) Expected impact of findings |

**3.2.2. Rationale**

When planning a social network analysis research, researchers should act in accordance with certain procedures and steps as in other scientific research approaches. In addition to the rules to be followed in scientific studies (Creswell, 2012), social network analysis has its own unique working style and techniques used in the analysis of network structure.

**3.2.3. Data Sources and Analysis**

The research analyses of the secondary data sets were performed using tools such as MS Office Excel. Data collected from official institutions in regional and/or national level.

**3.3. Research Procedures**

**3.3.1. Setting**

There is no generally accepted method and data set for measuring innovation in regional innovation studies. It is used as a method to obtain an indicator set by increasing the indicators that are important at the firm level to the regional level. In addition, indicators such as the number of universities, the number of researchers, the projects carried out at universities and the number of patents is added to this group because they are important in terms of regional innovation capacity. Since the regional innovation capacity includes the relevant activities of all stakeholders in that region, the supports they provide, the projects they carry out or other supports they provide to this ecosystem, the method and indicator set applied for a region or country cannot be valid for another region or country. Each region should create its own indicators as well as international basic indicators. Within the scope of the study, Samsun regional innovation indicators set was created, data specific to Samsun and other peer cities regarding this indicator set were obtained and the data were analysed. Official correspondence, internet browsing, and survey applications were used to obtain data. The methods used are discussed in detail in the relevant sections of the study.

The settings are Samsun Innovation Indicators Set which consists of nineteen (19) indicators and three sections as institutional, academic and industry indicators. This indicator set, which is prepared to analyse the R&D and innovation performance of Samsun, reflects the development of Samsun in R&D and innovation by collecting data from the relevant institutions and organizations.

**Table 2. Innovation Indicators Set of Samsun Province**

|  |  |  |
| --- | --- | --- |
| **Institutional** | **Academic** | **Industry** |
| Population *from TURKSTAT* | Number of Units & Departments in Universities *from YÖK* | Number of Projects Completed in TÜBITAK-TEYDEB R&D Programme *from TÜBITAK*  |
| Value in Innovation Index (2016-2017) *from URAK* | Number of Applications to TÜBITAK ARDEB Programme *from TÜBITAK* | Number of Patent Applications in Total *from Turk Patent Institute* |
| Number of University *from YÖK* | Number of Projects Supported by TÜBITAK ARDEB Programme *fro*m TÜBITAK | Number of Patents Registered in Total *from Turk Patent Institute* |
| Number of Researchers in Universities (PhD and Higher Degree) *from YÖK* | Project Awarding Rate (Awarded/Applications) in TÜBITAK ARDEB Programme  |  |
| Number of R&D Centers (Law of 5746) *from MoIT* | Number of Project Applications per 100 Researchers in TÜBITAK ARDEB Programme *from TÜBITAK* |  |
|  | Number of Projects Supported per 100 Researchers in TÜBITAK ARDEB Programme *from TÜBITAK* |  |
|  | Average Budget of Project Supported by TÜBITAK ARDEB Programme (1000 TL) |  |
|  | Number of Patent Applications per University *from Turk Patent Institute* |  |
|  | Number of Patents Registered in total per university *from* *Turk Patent Institute* |  |
|  | Number of Patents Application per 1000 Researchers  |  |
|  | Number of Patents Registered in Total per 1000 Researchers  |  |

Information obtained from 6 institutions on indicators in Table 2. carefully analysed for Samsun province and some other peer cities.

**3.3.2. Geographical Coverage**

Within the scope of the study, 7 provinces, including Samsun, were tried to be analysed comparatively within the scope of data acquisition possibilities. These provinces were selected because of their values of National Innovation Index of Turkey (URAK, 2019) and their number of population (TURKSTAT, 2020) which are close to each other. Three of selected provinces have higher value and other three of them have lower value than Samsun in the Index (Table 3) Accordingly, the provinces in the study are as follows:

**Table 3.** **Geographical Coverage**

|  |  |  |
| --- | --- | --- |
| **Province** | **Population** | **Innovation Index Value (2016-2017)** |
| Kocaeli | 1.953.035 | 12,83 |
| Kayseri | 1.407.409 | 6,89 |
| Manisa | 1.440.611 | 4,05 |
| **Samsun** | **1.348.542** | **3,08** |
| Kahramanmaras | 1.154.102 | 2,48 |
| Balikesir | 1.228.620 | 0,99 |
| Mugla | 983.142 | 0,92 |

Source: URAK, 2019

**3.3.5. Data Collection**

Firstly, this research started with desk research, that provided qualitative and quantitative data. Literature research has been done and innovation network and ecosystem analysis examples have been examined. Secondly, the data sets required to determine the innovation indicators in the provinces within the scope of the study and were requested from the relevant institutions. In addition, access to data presented online on the websites of the institutions was provided. Innovation capacity of Samsun study was analysed using the correlation with the peer cities and Turkey mean under the Innovation Indicators Set of Samsun Province (Table 2).

**3.3.6. Data Preparation**

After the data is collected, the data must first be made suitable for analysis. Besides preparing the quantitative analysis table of data regarding comparative capacity of innovation of Samsun compared to other peer cities using MS Office Excel.

**3.3.7. Data accuracy**

Reliability of network analysis depends on accurate data entry. After data entry was completed, 100% of the data were re-checked by original resources.

**3.5. Influencing Factors and Limitations**

The findings of this study must be seen and interpret in the light of its limitations. Firstly, provincial level innovation network analysis in Samsun province by using a quantitative approach. Secondly, by asking the institutions themselves and excluding other stakeholders such as private companies, important elements may have been overlooked. By using different concepts and research strategies, the phenomenon could be researched from a different perspective and afterwards compared to the results of this study.

 **4. FINDINGS; SAMSUN INNOVATION ECOSYSTEM NETWORK ANALYSIS**

This chapter presents current state of affairs as the institutional capacity of Samsun province was evaluated under the headings of academic and research infrastructure, private sector infrastructure and infrastructure for Supporting R&D and innovation.

**4.1. Current State of Affairs; Institutional Capacity in R&D and Innovation**

**4.1.1. Academic and Research Infrastructure**

Academic units constitute one of the most basic elements of the innovation ecosystem. The higher the number of universities and other academic units in a region, the stronger the infrastructure for innovation studies. However, the number alone is not a sufficient indicator. Besides the number, the quality of the academic units is also extremely important. There are state and foundation universities that carry out education, training and research activities in every region of Turkey. Regions should create an effective synergy with these units and other relevant non-governmental organizations such as professional organisations that are other units of innovation, research centers and foundations and associations to increase their innovation characteristics. While analysing the current situation of academic and research infrastructure, primarily the distribution of units in the universities in Samsun was examined. There are a total of 2 universities actively operating in Samsun, all of which are state universities. Ondokuz Mayis University was founded in 1975 and is the oldest and well-established university in the city. Later, Samsun University was established in 2019. There are 23 faculties, 3 institutes, 13 vocational schools and 32 research and application centers within the universities in Samsun. Analysing the number of faculties, institutes, colleges, research and application centers and departments, Ondokuz Mayis University ranks first, and Samsun University ranks second (Table 4).

**Table 4.** **Number of Units in Universities in Samsun Province**

|  |  |  |  |
| --- | --- | --- | --- |
| **Units** | **Ondokuz Mayis University** | **Samsun University** | **Total** |
| Faculty | 18 | 5 | 23 |
| Institute | 2 | 1 | 3 |
| College | 2 | 1 | 3 |
| Vocational School | 12 | 1 | 13 |
| Research and Application Center | 23 | 9 | 32 |
| Episode | 197 | 50 | 247 |
| Program | 371 | 135 | 506 |
| Department | 75 | 0 | 75 |
| Associate Degree Program | 88 | 10 | 98 |
| Bachelor’s Program | 93 | 24 | 117 |
| Master's Program | 145 | 9 | 154 |
| Doctorate Program | 94 | 2 | 96 |
| Proficiency in Art Program | 2 | 0 | 2 |
| Interdisciplinary Master's | 26 | 0 | 26 |
| Integrated Doctorate Program | 0 | 0 | 0 |
| Interdisciplinary Doctorate Program | 12 | 0 | 12 |

Source: YÖK, 2021a

Researchers are the most important resource in education and training activities as well as in R&D and innovation studies. In order to increase the innovation performance of universities, regions and countries, it is extremely important to increase this power as well as to use it effectively. The number of researchers in the regions covered by the research is parallel to the number of universities. Among the provinces included in the study, Kocaeli has the highest number of universities, with 1.864 researchers in 2021, and 1.834 researchers in Kayseri. Mugla, one of our regional provinces, ranks fourth with 1.299 researchers, while Samsun ranks third with 1.630 researchers (Figure 1).

**Figure 1. Number of Researchers in Universities in 2020**

Source: YÖK, 2021a

In addition to total number of researchers in Samsun, when the development of the academic staff between the years 2016-2020 is examined, it is seen that there is an increase of 19.23% between the beginning and end of the period (Figure 2). The number of researchers, which was 1.367 in 2016, tended to increase and reached 1.630 in 2020. The continuous increase in the number of researchers is a positive indicator for Samsun's innovation performance. However, as in many fields, the quality of the researchers is much more important than the number of researchers in terms of innovation.

**Figure 2. Number of Researchers in Samsun by Years (2016-2020)**

Source: YÖK, 2021a

**4.1.1.1. Capacity of Academic Projects and Innovation**

Projects aiming to produce new knowledge, high value-added goods and services constitute the basis of R&D and innovation studies. Firms and academic units in the private sector constitute the first step of innovation production with the projects they carry out. While benefiting from private sector own resources and the support of public institutions and organizations for the financing of these activities, academic units mainly benefit from research funds of national and international institutions and organizations and carry out project studies. TÜBITAK is the most important institution that funds academic projects at the national level, together with the universities' own research funds. In this section, the TÜBITAK ARDEB performances of the universities in the provinces within the scope of the study were examined comparatively.

**4.1.1.1.1. TÜBITAK-ARDEB Project Performances**

TÜBITAK supports academic R&D and innovation projects with ARDEB programme. Besides providing an important support for scientific research, the program is a prestige fund for beneficiaries. The number of projects within this scope is an important indicator in terms of R&D and innovation, as it forms the basis of innovative products and services.

When the number of project applications within the scope of the TÜBITAK-ARDEB program between 2016 and 2020 in the provinces within the scope of the research is examined, Kocaeli and Kayseri is in the first place with 1.444 project applications, Samsun is in the third place with 778 projects, Mugla ranks fourth with a total of 464 project applications, Manisa is in the fifth, Kahramanmaras is in the sixth and Balikesir is in the seventh. (Figure 3). When the number of projects supported within the scope of the TÜBITAK-ARDEB program between 2016 and 2020 in the provinces is examined, Kocaeli is in in the first place with 273 supported projects, Kayseri is in the second place with 180 supported projects, Samsun is in the third place with 91 supported projects. Mugla ranks fourth with a total of 48 projects, Manisa is in the fifth with a total of 40 projects, Kahramanmaras is in the sixth with a total of 30 projects and Balikesir is in the seventh with a total of 19 projects (Figure 3). Although the number of projects is an important indicator in the graph of the general distribution of the projects within the scope of the TÜBITAK-ARDEB program between 2016 and 2020, the project awarding rate (total supported/total applications) is an indicator that has meaning in terms of the R&D and innovation quality of the projects. From this point of view, Kocaeli is in the first place with an average rate of 18,91%, Kayseri is in the second place with a rate of 12.47%, and Manisa is in the third place with a rate of 11,83%. Samsun is fourth with an average of 11.70%. Although there is not a big difference in project success rate among those cities, Samsun has the potential to increase this rate in terms of R&D and innovation studies (Figure 3).

**Figure 3.** **TUBITAK ARDEB Projects per Provinces (2016-2020)**

Source: TUBITAK, 2021a

When the project awarding rates within the scope of the TÜBITAK-ARDEB program are examined in Samsun in the periods of 2014-2018, 2015-2019, 2016-2020, a decreasing trend is observed. The awarding rate, which was 14.56% between 2014-2018, decreased to 13.86% in the 2015-2019 period and to 11.70% in the 2016-2020 period. (Figure 4).

**Figure 4.** **TÜBITAK ARDEB Project Awarding Rate of Samsun per 5-year-Period**

Source: TUBITAK, 2021a

Considering the average distribution of project budgets within the scope of the TÜBITAK-ARDEB program between the years 2016-2020 in the provinces, Kocaeli ranks first with a total project budget of 370.8 million TL, Kayseri is the second with 58.6million TL and Samsun is the third with 40.1 million TL. Mugla is fourth with 22.5 million TL, Balikesir is fifth with 15.0 million TL, Kahramanmaras is sixth with 11.1 million TL and Manisa is seventh with 5.4 million TL (Figure 5).

**Figure 5.** **Average Budget of TÜBITAK ARDEB Projects (TL) (2016-2020)**

Source: TUBITAK, 2021a

It would be incomplete to make comments based on the number of projects applied and supported and to plan accordingly. In this context, the number of projects per researcher is the most accurate performance indicator. When the number of projects per 100 researchers in terms of project applications and supported projects between the years 2016-2020 is examined, Kayseri ranks first with 78.7 projects per 100 researchers, while Kocaeli is the second with 77.4 projects and Samsun with 47.7 projects is the third. Mugla is fourth with 35.72 projects, Manisa is fifth with 31.07 projects, Kahramanmaras is sixth with 31.04 projects and Balikesir is seventh with 19.91 projects. When evaluated in terms of the number of projects supported, Kocaeli ranks first with 14.6 projects, Kayseri takes the second with 9.8 projects, and Samsun takes the third with 5.5 projects. Mugla is in fourth with 3.7 projects, Manisa is in fifth with 3.6 projects, Kahramanmaras is in sixth place with 3.03 projects and Balikesir is in seventh with 1.68 projects. (Figure 6).

**Figure 6.** **Number of TÜBITAK ARDEB Projects per 100 Researchers (2016-2020)**

Source: TUBITAK, 2021a

**4.1.1.2. University Competence Analysis**

The study of Field-Based Competency Analysis of Universities which was created by the Scientific and Technological Research Council of Turkey (TUBITAK) and first published in 2016, has been updated and published (TUBITAK, 2021b). The purpose of the Field-Based Competency Analysis of Universities study is to enable the performances of universities to be evaluated comparatively on the basis of research fields. The study included 131 sub-research areas. University competency analysis was carried out on the basis of volume and quality indicators; quality indicators have a weight of 60% and volume indicators have a weight of 40%. In 2021, updates were made in order to measure the system with a more quality focus and to increase the quality of the measured indicators. In this context, the previous quality dimension, which consists of the relative citation effect of the publications to the world and the number of publications in the top 10% of the highest citations worldwide, has been expanded. In addition to these indicators, research efficiency of academics; The nature of R&D and innovation projects; the number of publications cited by patents; and international cooperation, and its contribution to the internationalization of our country/university have been added. In the volume dimension, 4 indicators are included. These are the contribution to the knowledge in the world, the share of the critical mass that creates academic value in that field in Turkey, the R&D and innovation project volume, the relative focus index of the university on Turkey in the relevant field. Within the scope of the current competency analysis study, 2014-2018 for data related to publications and citations; based on the 2014-2019 period for the data on the projects; 160 universities established in 2014 and before were evaluated. Data on the indicators were obtained separately for Turkey and the world through the Scopus database and the SciVal program. TUBITAK database was used for project data; both national and international project data of universities are included in the calculations. As a result of the calculations, graphics that visually present the competency levels for research fields and universities are included in the report. Competency graphs with volume and quality axes were drawn for those who have at least 6 data on the basis of fields and universities. The study was first published in November 2020 and has been updated in February 2021.

Ondokuz Mayis University is competent in food processing, bioenergy and plant protection (Figure 7) This situation paves the way for a sectoral structuring in Samsun, which is at the forefront in food areas. Samsun University is competent in inorganic chemistry and robotics (Figure 8). The concentration on these areas points to a prominent structure in the chemistry and robotic sectors in Samsun. However, this structure needs to be transformed into result-oriented studies in cooperation with industry.

**Figure 7.** **Ondokuz Mayis University Competence Analysis**

 

Source: TÜBITAK, 2021b

**Figure 8. Samsun University Competence Analysis**

**** Source: TÜBITAK, 2021b

**4.1.1.3. Universities’ Performance in Intellectual Property Rights (IPR)**

According to the data of the Turkish Patent Office, when the patent performances of the universities in the provinces within the scope of the research are compared in 2019, Kayseri is in the first place with 91 patent applications, Samsun is in the second place with 31 patent applications and Kahramanmaras is in the third place with 13 patent applications. Kocaeli is the fourth with 6 patent applications, Manisa is the fifth with 2 patent applications, and Balikesir and Mugla are sharing the sixth place with 1 patent application (Figure 9).

**Figure 9.** **Number of Patent Application by Universities (2019)**

Source: TURKPATENT, 2020

When the number of university patent applications per 1,000 researchers is analysed, Kayseri is in the first place with 49,62 patent applications, Samsun is in the second place with 19,02 patent applications and Kahramanmaras is in the third place with 13,14 patent applications. Kocaeli is the fourth with 6,44 patent applications, Manisa is the fifth with 1,84 patent applications, Balikesir is the sixth with 0,88 patent applications and Mugla is the seventh place with 0,77 patent application (Figure 10).

**Figure 10. Number of Patent Application per 100 Researchers (2019)**

Source: TURKPATENT, 2020

When the number of university patent registrations per 1,000 researchers is analysed, Kahramanmaras is in the first place with 7,08 patent registrations, Kocaeli is in the second place with 5,90 patent registrations and Kayseri is in the third place with 5,45 patent registrations. Balikesir is the fourth with 5,31 patent registrations, Samsun is the fifth with 0,61 patent registrations, Manisa and Mugla shares the seventh place with zero patent registrations. (Figure 11). The low number of patent registrations is closely related to whether universities have an intellectual property rights policy, whether these policies can encourage researchers or not, and the potential of patents to turn into a commercial product. However, it should be noted that patent registrations take between 3 and 5 years on average, so the numbers may change instantly.

**Figure 11. Number of Patent Registered per 100 Researchers (2019)**

Source: TURKPATENT, 2020

**4.1.2. Innovation Capacity in Private Sector**

**4.1.2.1. Private Sector Infrastructure**

R&D and Design centers established by private sector companies are another important part of the R&D and innovation ecosystem in our country. Because the main purpose of these structures is to increase both the profitability and competitiveness of their parent companies by producing high value-added goods and services. In this section, the innovation status of the private sector is analysed through R&D centers that’s because there is not any design center in Samsun as of 2021 yet, performance in project processing and Intellectual Property Rights and for Supporting R&D and Innovation.

**4.1.2.1.1. Research and Development (R&D) Centers**

R&D centers, which were established by the private sector for the first time in 2008 within the scope of Law No. 5746, are supported by the government with R&D discounts, exemptions and incentives. These centers house trained engineers, technicians, designers, etc. It not only provides qualified employment with its manpower, but also contributes to the competitiveness of the company and the country with high value-added goods and services produced as a result of R&D and innovation activities.

According to the data of the Ministry of Industry and Technology, the number of R&D centers in our country, which has increased since 2008, reached 1229 as of 2021. When the number of R&D centers in the provinces within the scope of the research is examined, Kocaeli ranks first with 124 R&D centers and Manisa ranks second with 33 R&D centers. While Kayseri ranks third with 13 R&D centers, Kahramanmaras ranks fourth with 12 R&D centres, Balikesir ranks fifth with 11 R&D centres, Samsun ranks sixth with 3 R&D centres and Mugla ranks seventh with 1 R&D centre. (Figure 12). The number of R&D Centers in Samsun constitutes 00,24% of Turkey. This situation shows that the competition level of private sector innovation capacity is low when compared to other cities. When the situation of companies operating in Samsun is examined, it is seen that they have the potential to establish much more R&D centers. For this reason, it is expected that the number of R&D centers will increase in this direction in the future.

**Figure 12. Number of R&D Centers (2021)**

Source: MoIT, 2021

**4.1.2.2. Project and Innovation Performance of Private Sector**

R&D and innovation constitute the most important work area for private sector companies in providing competitive advantage. Private sector companies increase their competitiveness in the national and international arena. However, due to the very low success rate of R&D and innovation actions, companies often cannot allocate sufficient resources to these activities. This situation is also negative for the technological development of our country. In this context, the government has designed support mechanisms to encourage the private sector to R&D and innovation. The purpose of these mechanisms is to encourage companies to R&D and innovation activities by supporting the risk that the private sector will have difficulty in taking. Public support for R&D and innovation activities of the private sector is given in different programs by TÜBITAK-TEYDEB, KOSGEB and the Ministry of Industry and Technology. With this study, we leave the entrepreneurship issue aside and focus on the performance of TÜBITAK-TEYDEB programs and Intellectual Property Rights.

**4.1.2.2.1. Project Performance in TÜBITAK-TEYDEB Program**

In line with our country's science, technology and innovation policies, TÜBITAK-TEYDEB aims to contribute to increasing the competitiveness of private sector organizations and to the dissemination of R&D culture by supporting research-technology development and innovation activities. TÜBITAK-TEYDEB programme has been supporting R&D and innovation in our country for 23 years, especially SMEs since 1995. These supports are in the form of non-refundable grants and are given according to the R&D nature of the projects and vary between 50% and 75%. Projects that do not develop new goods and services, do not provide competitive advantage to the company and do not have export potential are not supported. For this reason, it is essential that the projects include real R&D and innovation, be of the type that will provide a competitive advantage to the company and increase employment.

When the number of completed projects in the TÜBITAK TEYDEB programme between 2015-2020 is analysed, Kocaeli ranks first with 331 projects, Manisa ranks second with 138 projects, and Kayseri ranks third with 64 projects. Balikesir is fourth with 23 projects and Kahramanmaras is fifth with 15 projects. Samsun and Mugla share the sixth place with 6 projects each (Figure 13).

**Figure 13.** **Number of Completed TÜBITAK TEYDEB Projects (2016-2020)**

Source: TÜBITAK, 2021c

**4.1.2.2.2. Performance in Intellectual Property Rights (IPR)**

Patent is one of the internationally important R&D and innovation performance indicators. Both universities and private sector companies are encouraged to obtain patents for the invention and know-how they have obtained as a result of their R&D and innovation studies. Because the patent provides the company with a monopoly right and competitive advantage for a maximum of 20 years in relation to the product. The higher the number of patents in a region, the higher the R&D and innovation performance of that region, and accordingly, the higher its competitiveness. For this reason, patenting is a subject that is encouraged and supported by companies.

Considering the patent applications filed and registered between the years 2015-2020, Manisa with 2,108 patent applications in total is followed by Kocaeli with 1,631 patents, Kayseri with 691 patents, Samsun with 278 patents, Kahramanmaras with 205 patents, Balikesir with 194 patents and Mugla with 186 patents. is following. Considering the number of registrations, Kocaeli with a total of 565 patents is followed by Manisa with 337 patents, Kayseri with 135 patents, Samsun with 33 patents, Balikesir with 30 patents, Kahramanmaras with 27 patents and Mugla with 17 patents. However, since the registration of patent applications takes 3 to 5 years, these numbers change over time (Figure 14).

**Figure 14. Number of Patent Applications & Registrations in Total (2015-2020)**

Source: TÜBITAK, 2021c

**4.1.3. Infrastructure for Supporting R&D and Innovation**

**4.1.3.1. Interface Institutions**

**4.1.3.1.1. Samsun Technology Development Zone (Samsun Teknopark)**

Technology Development Zones are academic, social and cultural sites established to encourage and enable entrepreneurs, researchers, and academicians who want to create goods and services with new or advanced technologies, to conduct their industrial and commercial activities within university premises and benefit from its resources. The establishment of the Samsun Technology Development Zone was initiated on an 80.000 m² plot in Ondokuz Mayis University's Atakum Campus with the decree of the Council of Ministers announced in July 2009. Samsun Technology Development Zone Managing Corporation, also known as Samsun Teknopark, was founded in June 2010 with the partnership of the university, public-private sector, and NGOs. The construction of the Samsun Teknopark Administration Building and Incubation Center started in March 2012 and was put into service in the second quarter of 2014. Samsun Teknopark encourages its stakeholders to turn their scientific knowledge potential into technological products and navigates research with the aim to address the needs of industry.

Samsun Teknopark thrives to create an environment where the scientific knowledge potential can turn into technological products and researches within the university can be developed to address the needs of the industry. It aims to carry out activities in fields including but not limited to information technologies, automation, material development, nanotechnology, pharmaceuticals, molecular biology, biotechnology, defense technology, environmental technology, medical technology, and mechatronics. There are two basic services for entrepreneurs in Samsun Teknopark; pre-incubation center and incubation offices. Entrepreneurs can receive pre-incubation support for the testing and commercialization of innovative business ideas. In addition, entrepreneurs who demonstrate R&D and innovation work at the pre-incubator center can continue to work and take advantage of the support by taking part in our incubation offices. These structures are form so that entrepreneurs can work with other entrepreneurs, enabling communication and interaction.

There are 71 companies in Samsun Teknopark. As considering the sectoral distribution, 61% of the Companies are in the field of software, 8% in energy, 8% in machinery equipment, 10% in agriculture and 13% in other industries including packaging, food, electronics, manufacturing, construction, medical, chemistry, automotive supplier industry and telecommunication. As of June 2021, approximately 342 full-time and part-time personnel are employed in Companies in Samsun Teknopark (SAMSUN TEKNOPARK, 2021).

**4.1.3.1.2. OndokuzMayis University Technology Transfer Office (OMU TTO)**

Ondokuz Mayis University Technology Transfer Office is acted between universities, research centers and the private sector; was established to provide necessary and needed connections with researchers, entrepreneurs, investors and industrialists. OMU TTO is in service with five different modules as Module 1. Awareness Promotion and Information Training Services, Module 2. Services for Benefiting from Support Programs, Module 3. Project Development Management Services University-Industry Cooperation Activities, Module 4. Intellectual Property Rights Management and Licensing Services, and Module 5. Incorporation and Entrepreneurship Services (OMU TTO, 2021).

**4.1.3.1.3. Samsun University Technology Transfer Office Research and Application Center (SAMÜ-TTO)**

Samsun University Technology Transfer Office Research and Application Center (SAMÜ-TTO) was established within Samsun University with the official gazette number 30808 published on 21 June 2019. SAMÜ-TTO, with its experienced team in project development, business development and public, university and industry collaborations, provides information and consultancy services on outsourced project development, national and international support programs, organizing informative events, creating cooperation between academics and industrialists and creating projects together. continues its activities with the aim of establishing the culture of development, creating national and international collaborations, encouraging entrepreneurship and providing consultancy services to researchers and industrialists with whom it cooperates on intellectual and industrial property rights. SAMU TTO is in service with five different modules as Module 1. Awareness Promotion and Information Training Services, Module 2. Services for Benefiting from Support Programs, Module 3. Project Development Management Services University-Industry Cooperation Activities, Module 4. Intellectual Property Rights Management and Licensing Services, and Module 5. Incorporation and Entrepreneurship Services (SAMU TTO, 2021).

**CONCLUSION**

R&D and innovation have become one of the indispensable elements of competition today. Countries whose industry is supported by effective R&D incentives are at the top of the World Competitiveness Rankings. Expectation as a country or region is the return of the R&D studies carried out as products containing advanced technology that will create added value for a country's and/or region’s economy and increase national and/or regional competitiveness in the international market in line with the J.A. Schumpeter’s (2017) theory of economic development. In connection with the national targets, regional development goals of Samsun include developing infrastructures for R&D and innovation-oriented, medium-high and high value-added production, increasing the efficiency and competence of universities and research institutions as well as supporting technology-oriented entrepreneurship. The Samsun Innovation Ecosystem Analysis study, which was prepared as a preliminary step for understanding the capacity of Samsun on innovation.

From the perspective of infrastructure in academic research, Samsun, which has 2 universities, ranks third with 1.630 researchers in the regions covered by the research. In addition to total number of researchers in Samsun, there is an increase of 19.23% of the academic staff between the years 2016-2020. The continuous increase in the number of researchers is a positive indicator for Samsun's innovation performance in line with the Jackson’s (2011) emphasis on human & financial resources. However, as Samsun is in the third place with 778 projects applications and 91 projects supported within the scope of the TÜBITAK-ARDEB program, the project awarding rate (total supported/total applications) of Samsun is 11.70% means as fourth ranking among peer regions, although Samsun has the potential to increase this rate in terms of R&D and innovation studies. The most remarkable issue is that the project awarding rates within the scope of the TÜBITAK-ARDEB program are examined in Samsun in the periods of 2014-2018, 2015-2019, 2016-2020, a decreasing trend is observed. On the other hand, Ondokuz Mayis University is competent in food processing, bioenergy and plant protection while Samsun University is competent in inorganic chemistry and robotics. The concentration on these areas points to a prominent structure in the chemistry and robotic sectors in Samsun. However, this structure needs to be transformed into result-oriented studies in cooperation with industry. As a result of innovation studies, Samsun is in the second place among the regions with 31 patent applications. This proves that universities in Samsun have an intellectual property rights policy encouraging researchers.

As innovation capacity of the private sector in Samsun is low compared to the provinces within the scope of the study in terms of the number of R&D centers and even not any design center, it is possible to say that the presence of high value-added sectors in the province, especially the defence and automotive industry, may have a positive effect on the increase in R&D and design centers in the coming period. However, although the competition level of Samsun industry is lower than other provinces in the number of TEYDEB R&D project completed (6) deserves the sixth ranking in seven, it’s performance in number of patent applications (278) and registrations (33) is successful among the provinces in the region between 2015-2020.

As a result, there is a need for a stronger university-industry cooperation model on a city scale in line with some researchers’ arguments (iUrban, 2014; Cooke, 2008; Kinay, 2006). This cooperation will both support the university and contribute to the holistic development of the province in the medium and long term.

**REFERENCES**

Adner, R. (2006) "*Match Your Innovation Strategy to Your Innovation Ecosystem*", Harvard Business Review, 84(4): 98–107.

Allen, P. M., Maguire, S. and McKelvey, B. (2011). The SAGE Handbook of Complexity and Management. pp. 79–93.

BEBKA (2020a). Bursa Inovasyon Ekosistemi Analizi. Retrieved June 6, 2020, from <https://www.bebka.org.tr/admin/datas/sayfas/89/2020-bebka-bursa-inovasyon-3_1601991053.pdf>.

BEBKA (2020b). Bilecik Inovasyon Ekosistemi Analizi. Retrieved June 6, 2020, from https://www.bebka.org.tr/admin/datas/yayins/234/bilecik-inovasyon-2020-final\_1598007815.pdf.

BEBKA (2020c). Eskişehir Inovasyon Ekosistemi Analizi. Retrieved June 6, 2020, from <http://bebka.org.tr/admin/datas/yayins/232/eskisehir-inovasyon-ekosistemi-2020_1596099034.pdf>.

Bergek, A. et al. (2008) Functions in Innovation System Approaches, Technological Forecasting and Social Change, 79(4), pp. 413–432. doi:10.1016/j.techfore.2006.03.002.

Bijker, W. (1995) Of Bicycles, Bakelites, and Bulbs: Toward a Theory of Sociotechnical Change, Inside Technology, p. 390. doi: 10.2307/2077312.

Carlsson, B. and Stank (1991) ‘On the nature, function and composition of technological systems’, Journal of Evolutionary Economics, 1, pp. 93–118.

Cooke P. (2008). Proximities, knowledges and innovation biographies, EURODITE Project Papers.

Core Cities Working Group. (2004). Our Cities are Back: Competitive Cities Make Prosperous Regions and Sustainable Communities. London: ODPM.

Creswell, J.W. (2012). Educational research: planning, conducting, and evaluating quantitative and qualitative research. Boston: Pearson Education, Inc.

Dedehayir, O., Mäkinen, S. J. and Roland Ortt, J. (2016) ‘*Roles during innovation ecosystem genesis: A literature review’*, Technological Forecasting and Social Change. Elsevier Inc., pp. 1–12. doi: 10.1016/j.techfore.2016.11.028.

EC (2012). Research and Innovation Strategies for Intelligent Specialization. Retrieved June 6, 2020, from https:// ec.europa.eu/regional\_policy/sources/docgener/presenta/smart\_specialisation/smart\_ris3\_ 2012.pdf

Edquist, C. (1997) Systems of Innovation: Technologies, Institutions and Organizations.Cassell Academic.

European Union (2015) Growing A Digital Social Innovation Ecosystem For Europe: DSI Final Report. doi: 10.2759/448169.

European Union (2016) Regional innovation ecosystems CoR guide: learning from the EU’s cities and regions. Available at: https://publications.europa.eu/en/publicationdetail/-/publication/6a43bcbb-85a9-43fc-afa3-db58c42f4730/language-en.

European Union (2017) Place-Based Innovation Ecosystems: Espoo Innovation Garden and Aalto University (Finland). doi: 10.2760/31587.

Freeman, C. and Luc, S. (1997) The economics of industrial innovation. Psychology Press.

Gomes, L. A. de V. et al. (2015) ‘*Unpacking the innovation ecosystem construct: Evolution, gaps and trends’*, Technological Forecasting and Social Change. Elsevier Inc. doi: 10.1016/j.techfore.2016.11.009.

Håkansson, H. (1990) ‘*Technological collaboration in industrial networks’*, European Management Journal, 8(3), pp. 371–379. doi: 10.1016/0263-2373(90)90016-Y.

Iansiti, M. and Levien, R. (2004) ‘*Keystones and dominators: framing operating and technology strategy in a business ecosystem’*, Harvard Business School, Working Paper, pp. 3–61.

Jucevicius, G., & Grumadaite, K. (2014) "*Smart Development of Innovation Ecosystem*", 19th International Scientific Conference; Economics and Management (pp.125-129). Riga, Latvia: Procedia.

Lundvall, B. (1992) National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning. Pinter Publishers. Retrieved June 6, 2020, from https://books.google.fi/books/about/National\_Systems\_of\_Innovation.html?id=B\_C3AAAAIAAJ&redir\_esc=y.

Mersin TSO (2008). Mersin Inovasyon Stratejisi 2006-2016. Retrieved June 14, 2020, from  [http://oda.mtso.org.tr/files/mersin\_inovasyon\_stratejisi.pdf](https://www.kosgeb.gov.tr/Content/Upload/Dosya/Mali%20Tablolar/KSEP/Kobi_Stratejisi_ve_Eylem_Plani_%282015-2018%29.pdf).

MoIT (2019). The National Industry and Technology Strategy Document of Turkey (2019). Retrieved June 6, 2020, from <https://sanayi.gov.tr/anasayfa>.

MoIT (2021). Ar-Ge, Tasarim Merkezleri ve Teknoloji Gelistirme Bölgeleri. Retrieved May 17, 2021, from https://www.sanayi.gov.tr/arge-tasarim-merkezleri-ve-tgb.

Moore, J. F. (1993). Predators and prey: a new ecology of competition. Harvard Business Review, 71(3), 75–86. doi:Article.

Nelson, R. R. (1992) ‘*National innovation systems: A retrospective on a study’*, Industrial and Corporate Change. doi: 10.1093/icc/1.2.347.

OECD. (2013). OECD Science, Technology and Industry: Scoreboard 2013. Organisation for Innovation For Growth.

Öğüt, A. (2001). Bilgi Çaginda Yönetim. Ankara: Nobel Yayin Dagitim.

Oh, D.-S., Phillips, F., Park, S., & Lee, E. (2016) "*Innovation Ecosystems: A Critical Examination"*, Technovation, 54:1-6.

OKA (2017a). TR83 Middle Black Sea Regional Innovation Strategy. Retrieved June 6, 2020, from https://www.oka.org.tr/assets/upload/dosyalar/bolgesel-inovasyon-stratejisi-ingilizce-13-63.pdf.

OMU TTO (2021). Retrieved May 9, 2021, from https://tto.samsunteknopark.com/.

Powell, W. W., Koput, K. W. and Smith-Doerr, L. (1996) ‘Interorganizational Collaboration and the Locus of Innovation: Networks of Learning in Locus of Innovation: Networks of Learning in Biotechnology’, Source: Administrative Science Quarterly, 41(1), pp. 116–145. doi: 10.2307/2393988.

Rothschild, M. (1990) Bionomics: Economy As Ecosystem. Retrieved Jan. 6, 2020, from <http://www.amazon.com/Bionomics-Economy-Ecosystem-Michael-> Rothschild/dp/0805019790.

Samsun TEKNOPARK (2021). Retrieved May 9, 2021, from https://www.samsunteknopark.com/tr.

SAMU TTO (2021). Retrieved May 9, 2021, from https://tto.samsun.edu.tr/.

Suominen, A., Seppänen, M. and Dedehayir, O. (2016) Innovation Systems and Ecosystems : a Review and Synthesis, in The XXVII ISPIM Innovation Conference –Blending Tomorrow’s Innovation Vintage, Porto, Portugal on 19-22.06.2016.

TUBITAK (2021a). Üniversiteler Bazinda ARDEB Destek istatistikleri (2016-2020). Retrieved April 6, 2021, from https://www.tubitak.gov.tr/sites/default/files/18842/9\_universiteler\_bazinda\_ardeb\_destek\_istatistikleri\_2016-2020.pdf.

TUBITAK (2021b). Üniversitelerin Alan Bazinda Yetkinlik Analizi. Retrieved June 7, 2021, from <https://www.tubitak.gov.tr/sites/default/files/Guncel_Universitelerin_Alan_Bazli_Yetkinlik_Analizi.pdf>.

TUBITAK (2021c). E-TEYDEB\_Tamamlanmis Proje Sorgula. Retrieved June 7, 2021, from https://eteydeb.tubitak.gov.tr/teydebtamamlanmisprojeler.htm.

TURKPATENT (2020). istatistikler. Retrieved June 7, 2020, from https://www.turkpatent.gov.tr/TURKPATENT/statistics/.

TURKSTAT (2020). Adrese Dayalı Nüfus Kayit Sistemi Sonuçları, 2020. Retrieved June 6, 2020, from https://data.tuik.gov.tr/Kategori/GetKategori?p=Nufus-ve-Demografi-109.

URAK (2019). illerarasi Rekabetçilik Endeksi 2018. Retrieved June 6, 2020, from <http://www.urak.org/wp-content/uploads/2019/05/URAK_%C4%B0RE_2018-2.pdf>.

Valkokari, K. (2015) ‘*Business, Innovation , and Knowledge Ecosystems: How They Differ and How to Survive and Thrive within Them’*, Technology Innovation Management Review, 5(8), pp. 17–24.

YÖK (2021a). Üniversitelerimiz. Retrieved June 6, 2021, from https://www.yok.gov.tr/universiteler/universitelerimiz.