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A RESEARCH ON SMALL AND MEDIUM SIZED ENTERPRISES' INNOVATIVENESS IN TURKEY IN THE FRAMEWORK OF SCIENCE AND TECHNOLOGY POLICIES

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ABSTRACT

A RESEARCH ON SMALL AND MEDIUM SIZED ENTERPRISES' INNOVATIVENESS IN TURKEY IN THE FRAMEWORK OF SCIENCE AND TECHNOLOGY POLICIES

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Innovation capability, which is one of the most important requirement for countries to have a place in global competition and to ensure sustainable economic development, has been discussed in the literature for many years and still continues to be relevant as a research topic. It is very important that all actors, including research institutions, manufacturing firms, policy-making institutions that play a role in the formation, implementation, support and maintenance of innovation ability, act together in determining strategies and transferring the right tools to the right channels. In this study, the effectiveness of the Small and Medium Sized Enterprises (SME) in the innovation system, which constitutes a large portion of the manufacturing industry in business activities, has been investigated within the framework of Turkish Science and Technology Policies based on the data published by European Innovation Scoreboard (EIS) and Small and Medium Enterprises Development Organization (KOSGEB). According to the results of the research, while the critical role of supports in raising awareness in research and development (R&D), product design, export and patent applications is revealed, it has been observed that external support provided to firms has a positive impact on encouraging SMEs. Research findings are also supported by existing literature. The study provides contribution to the innovation literature throught applied policy instruments as well as improve our understanding of innovation capability phenomenon, which is in at the maturation stage.

Key Words: Innovation, SME, R&D, Science and Technology

ÖZET

BİLİM VE TEKNOLOJİ POLİTİKALARI ÇERÇEVESİNDE TÜRKİYE'DEKİ KÜÇÜK VE ORTA ÖLÇEKLİ İŞLETMELERİN YENİLİKÇİLİĞİ ÜZERİNE BİR ARAŞTIRMA

Ayça KAYA ÇOŞKUN

Yüksek Lisans (İşletme Yönetimi)

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Ülkelerin küresel rekabette yer edinebilmesi ve sürdürülebilir ekonomik kalkınma sağlayabilmesi noktasında en önemli koşullardan biri olan inovasyon yeteneği literatürde uzun yıllar boyunca incelenmiş ve hala bir araştırma konusu olarak güncelliğini korumaktadır. İnovasyon yeteneğinin oluşması, uygulanması, desteklenmesi ve sürdürülmesinde rol alan, bir ülke içerisinde faaliyet gösteren araştırma kurumları, üretim yapan firmalar, politika belirleyen kurumlar dahil olmak üzere tüm aktörlerin stratejilerin belirlenmesinde ve doğru araçların doğru kanallara aktarılması konularında birlikte hareket etmesi oldukça önemlidir. Bu çalışmada ekonomik faaliyetlerin içerisinde üretim sanayinin çok büyük bir bölümünü oluşturan Küçük ve Orta Ölçekli işletmelerin inovasyon sistemi içerisindeki etkinliği Avrupa İnovasyon Skor Tahtası ve Küçük ve Orta Ölçekli İşletmeleri Geliştirme ve Destekleme İdaresi Başkanlığı tarafından yayınlanan verilerden faydalanılarak Türkiye'de uygulanan bilim ve teknoloji politikaları çerçevesinde analiz edilmiştir. Araştırma sonuçlarına göre finansal kaynakların araştırma ve geliştirme, ürün tasarımı, ihracat ve patent başvuruları konularında farkındalık yaratma noktasındaki kritik rolü ortaya koyulurken, firmalara sağlanan dışsal desteklerin küçük ve orta ölçekli firmaları cesaretlendirme noktasında pozitif etki ettiği gözlemlenmiştir. Araştırma bulguları ayrıca mevcut literatür ile desteklenmiştir. Çalışma, uygulanan politika araçları üzerinden inovasyon literatürüne katkı sağlamakla birlikte, henüz olgunlaşma aşamasında olan inovasyon yeteneği olgusuna yönelik anlayışımızı geliştirmektedir.

Anahtar Kelimeler: İnovasyon, KOBİ, ARGE,Bilim ve Teknoloji

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LIST OF ABBREVIATIONS

BIDEB :Department of Science Fellowships and Grant Programs

BILTEK:Ministry of Science, Industry and Technology

SCST Supreme Council for Science and Technology

SPO State Planning Organization

EIS European Innovation Scoreboard

EU European Union

EUROSTAT: Statistical Office of the European Communities

ICT: Information and communications technology

IMD:International Institute for Management Development

ISIC: International Standard Industrial Classification

ITEP:Advanced Technology Projects Support Program

KAMAG:Public Research Support Group

KOSGEB Small and Medium Enterprises Development Organization

NACE: Statistical classification of economic activities in the European Community

OECD Organisation for Economic Co-operation and Development

OIZ: Organized Industrial Zone

ÖYP:Scientific Human Resources Development Program

R&D: Research and Development

S&T:Science and Technology

SME : Small and Medium Size Enterprises

SAVTAG:Security Technology Research Support Group

TAEK:Turkish Atomic Energy Authority

TARAL Turkey Research Area

TEYDEB Technology and Innovation Grant Programs Directorate

TDZ:Technology Development Zone

TGP:Technology Development Project Support Program

TUBITAK Scientific and Technical Research Council of Turkey

TSI Turkish Statistical Institue

TURDOK Turkish Scientific and Technical Documentation Center

TTGV: Technology Development Foundation

UBTYS:National Science, Technology and Innovation Strategy

UNESCO United Nations Educational, Scientific and Cultural Organization

YÖK: The Council of Higher Education (YÖK)

WIPO: World Intellectual Property Organization

INTRODUCTION

Technology is developing very rapidly in today's world and consumer needs are constantly changing. The way for countries to keep up with developing technology is possible through their innovative capability. Innovative capability enables firms of a country to create valuable goods and services by using efficient and innovative methods, and taking advantage of outcomes as a result of commercialization of newly introduced products. It can be inferred that being competitive is directly related to being innovative. In order to survive in the competitive market, it is crucial for businesses to keep up with changes and technological developments which provide them being productive and competitive in return.

One of the most obvious things about innovation is that it does not exist by itself and some actions need to be taken in this direction to create capability. This include, allocating financial resources and acquiring qualified personnel. Moreover, high quality of the connections between business networks and the existence of well educated and qualified workforce that can easily adapt to innovations are also effective in the process. Considering the risks, many firms, especially small ones, avoid investing in innovation activities because they fear that their investments will be wasted. At this stage, policy makers, which aim creating the sustainable development, agree on the necessity of supports that will eliminate these concerns in order to spark innovation spirit.

In recent years, the term innovativeness is positively associated with the level of economic development of a country. This level is taken for granted and its acceptance has lead government bodies and academic institutions to concentrate on finding ways of improving innovative capacity of manufacturing industry within the country. Understanding the nature of innovation drivers together with connections between them, and using required tools properly is considerably important in the path of achievement in economic development. In this direction, innovation enhancement programmes in government policies has emerged as one of the major concerns of policy-makers. These programmes were tried to be regulated to improve these factors which are considered to have a direct or indirect effect on innovation.

Before deciding to improve something, shortcomings and weaknesses should be defined at the beginning and measures is supposed to be taken accordingly. By this way, it could be possible to use tools effectively and apply the most suitable interventions to the right channels which need to be intervened and managed. Because of the fact that if something can not be not measured, it can not be managed, controlled and planned.

The innovation capability, which has been widely emphasized by various policy papers and academic literature in recent years, is a phenomenon that is not easy to measure and benchmark. Many economists, researchers, statisticians and organizations that investigate the factors affecting innovation capability, directed their attention to form some methods in order to make performance measurement under the guidance of Organisation for Economic Co-operation and Development (OECD). As a consequence of their investigations, a guide entitled as "Oslo Manual" is prepared with the aim of providing convenient comparability of statistical data for researchers and policy makers which enables them to take most appropriate actions. Despite the fact that innovation is classified in different ways and evaluated with different indicators, the most widely used is the classification prepared by OECD in cooperation with European Commission. Based on the Oslo Manual, various methods are designed in order to collect data on innovation to measure national innovation performance in the European Union (EU).

One of the most famous methods, on which this study also relies, is European Innovation Scoreboard (EIS) which has been developed by European Commission. This method follows a path by selecting innovation related indicators and gathering wide range of data on selected indicators and calculating the overall innovation grade of countries and makes comparative assessment of the innovation performance across the EU and other candidate nations including Turkey.

The assessment is based on a wide range of indicators covering framework conditions, investments, innovation activities and its impacts. Framework conditions refer main drivers of innovation performance external to the firm, investments refer expenditures made in both the public and business sector, innovation activities refer different aspects of innovation in the business sector, impacts refer the effects of firms' innovation activities (European Commission,2019). EIS analyzes these designated indicators by using the data collected from the statistical institutions of the countries.

This study has been prepared in the light of the data given by a guide called "European Innovation Scoreboard" issued by the European Commission every year. The reason why this analysis is used as a roadmap in this research is the existence of the quantitative data collected from the member countries, neighbour and candidate countries. This data is regularly collected every year and the clear statistical data created by comparing the innovation performance of the countries since its introduction in 2000.

After observing Turkey's current situation in innovation related science and technology policies and the innovation performance of Turkey with respect to EU, the purpose of this study is to analyze differences between firms in innovation drivers according to their size and the extent to which support programmes encourage the innovation activities of firms. In this extent, it is also expected to reach an overview of the SME innovativeness and which selected innovation variables differ according to firms size.

The performance of Turkey with respect to average performance of 28 European member countries is observed in the light of EIS data. Since data allows to monitor changes in countries' innovation performance over time and follow related progress, data for Turkey and EU were taken out from the current performances of among all investigated countries in the 2019 report of EIS and compared with the EU mean. Then, by taking deduced benchmark results as a reference, some selected criteria which are assumed to be determinants of innovation capability are examined based on the firm size. The point which is tried to be reached is to observe the behavior of firms towards these parameters according to their scales.

This thesis is structured as follows: in the first part of this study, the concept of innovation, its inputs and outputs that are widely accepted in the literature is analyzed. Inputs refers to factors that make innovation possible and outputs refers to the acquisitions gained as a result of innovation.

Following that, a brief analysis on Turkey's value added performance of manufacturing industry based on technology levels, along with Turkey's export and import values are summarized. In the same context, the innovation based policy framework of Turkey is mentioned including the subsidies relevant to fostering innovative activities. Finally, the relevant literature is overviewed with evaluating views of major economists who carried out very important studies on innovation behavior.

In the second part of this thesis, data set, model and variables are specified and empirical findings are presented. The input-output approach of EU's towards innovation over time and the actions taken in this direction are briefly mentioned. Indicators in EIS assessment concept are defined based on EIS methodology and innovation indicators are discussed for the period between 2011 and 2018. After that, using statistical results of sample firms in Turkey, the difference of selected variables of innovation are measured.

In the final part, concluding comments, the importance and limitations of the study are outlined.

The discussion of innovation indicators from the EIS point of view to the firm level should be useful to literature for better understanding of the major source of innovation spirit and thus using the most appropriate tools in the improvement of right instruments.

CHAPTER I

CONCEPTUAL FRAMEWORK

1.1. THE CONCEPT OF INNOVATION AND INVENTION

Creativity gains which might be retrieved from innovative products became one of the important motivators for industries and firms. This alteration and renewal process is called ‘innovation’. The concept of innovation being an integral part of this study, mainly means developing new ideas by using current information, and producing and commercializing knowledge intensive and technology based products in the end. As OECD (2005:18) stated “Innovation activities include all scientific, technological, organisational, financial and commercial steps which actually lead, or are intended to lead, to the implementation of innovations.”

In the document named Oslo Manual (2018:20), published by OECD and Statistical Office of the European Communities (Eurostat), innovation is defined as “a new or improved product or process (or combination thereof) that differs significantly from the unit’s previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)”, where the term “unit” means actors responsible for innovations.

In the earliest definition, economist and political scientist Joseph Schumpeter defined innovation as ‘the critical dimension of economic change”. Schumpeter argued that economic change revolves around innovation, entrepreneurial activities, and market power. He sought to prove that innovation-originated market power could provide better results than the invisible hand and price competition. Schumpeter argues that technological innovation often creates temporary monopolies, allowing abnormal profits that would soon be competed away by rivals and imitators. He underlined that these temporary monopolies were necessary to provide the incentive necessary for firms to develop new products and processes (Pol and Carroll, 2006).

Porter and Stern (1999:12) defined innovation as "the transformation of knowledge into new products, processes, and services that involves more than just science and technology (S&T). It involves discerning and meeting the needs of customers. Improvements in marketing, distribution, and service are innovations that can be as important as those generated in laboratories involving new products and processes."

Although invention is one of the aspects of innovation, these two concepts should be distinguished from each other. The invention is a new idea which has the potential to be applied in the economy while innovation is application of an idea to the economy. Even if they are on the same path, to create innovation from invention, invented things should be developed, manufactured and marketed by entrepreneurial efforts (OECD, 2019:12). Bhasin (2012) defined invention as the creation of a product or introduction of a process for the first time whereas he defined innovation developing or contributing to something that has already been invented. Rogers (1998:5) emphasized the main distinguishing feature of innovation from invention as its requirement to be a commercial product eventually whereas invention does not need it.

Innovation is the commercial application of new ideas to the products, processes or any other aspect of a firm's activities. It stays as an invention, if new ideas are not converted to a product/process creating market impact.

In the 4th edition of Oslo Manual published by OECD in (2018 :21), innovation is divided into two types as product innovations and business process innovations.

- Product innovation means introducing significantly different new or improved good/service to the market than the firm's previous introduced goods/services.
- Business process innovation means putting significantly different new or improved business process into service than the firm's previous business processes.

There are some indicators used in literature to measure the innovation capacity as R&D activities, patent performance, scientific publications, number of researchers, R&D support and technology transfer. All these indicators are collected, observed, evaluated and analysed by international organisations like Organisation for Economic Co-operation and Development (OECD), United Nations Educational, Scientific and Cultural Organization (UNESCO), World Intellectual Property Organization (WIPO), World Bank, Statistical Office of the European Communities (EUROSTAT) etc. Commonly used indicators to measure innovativeness are R&D expenditure and patenting activities in literature.

1.2. SELECTED INPUTS OF INNOVATION

Fundamentally, the main and indispensable input of innovation is human since innovation does not occur on its own. It arises from R&D effort and human is the one performing R&D activity, following technological developments, selecting and obtaining the most appropriate technologies for the country, and ensuring the expansion of these technologies in an economic benefit. Since the educated and skilled human force is likely to produce creative and innovative ideas, qualification of human capital is a significant factor in determining innovativeness level.

In literature, commonly used inputs of innovation are considered as R&D, R&D support and technology transfer however it should be noticed that the main input of all is the human capital. As Independent Industrialists' and Businessmens' Association, Turkey (2012:124) pointed out, there is no meaning of allocating resources for R&D, infrastructure and technology transfer unless there is no qualified human resource to evaluate these investments efficiently. Therefore, it is obvious that in order to increase innovative capability investing human capital who uses these instruments is considerably important as much as investing for R&D.

1.2.1. Research and Development

Innovation cycle starts with a new idea and research and development (R&D) process, then good or service is expected to be commercialized in order to complete this cycle. The fundamental model of the innovation process is shown in Figure 1

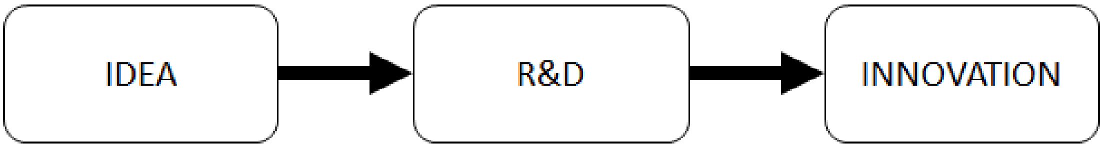

Figure 1: Fundamental model of innovation process

R&D is a systematic and creative study to produce new systems, processes and services or develop current ones with the aim of producing new information or production of new products and tools by using current information.

In the Frascati Manual prepared by OECD (2015:44), research and experimental development is defined as "the creative and systematic work which contributes accumulation of knowledge and new applications of existing knowledge." According to this paper, R&D must satisfy five criteria that are to be novel, creative, uncertain, systematic and transferable and/or reproducible.

Frascati Manual (2015:50-51) divides R&D into 3 types as basic research, applied research, experimental development;

- *Basic research* is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view.

- *Applied research* is an original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific, practical aim or objective.
- *Experimental development* is systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge.

This knowledge is directed to producing new products or processes or to improving existing products or processes.

Related literature states important findings between R&D and innovation. R&D capacity is an important input of innovation, and might be thought as the first step. In literature, R&D intensity and being an innovator are mostly associated with each other. Lederman and Saenz (2005) by using firm-level data, proved that R&D is positively correlated with innovative activities and R&D to be driver for countries to have higher income. Romer (1990) showed that investment in technology and expenditure on R&D has a great impact on increase in productivity and growth. In the same way, Lichtenberg (1992) found high correlation between R&D activities and level/growth rate of productivity.

Kim (2011) studied the effect of R&D activities on economic growth for Korea by using Cobb-Douglas production function between the years 1976-2009 and found a strong relationship between R&D and economic growth. By using the same method, Rodríguez and Bilbao (2004) found a positive relation between R&D and innovation, therefore economic growth. In the study of Cohen and Levinthal (1989) named ‘Second face of R&D’, they argued that R&D is not only a tool for achieving innovation, but also contributes to identify, assimilate and exploit available knowledge from the environment.

As shown in Figure 2, fundamental sources of R&D are R&D expenditure, R&D personnel, technology transfer, which are discussed below.

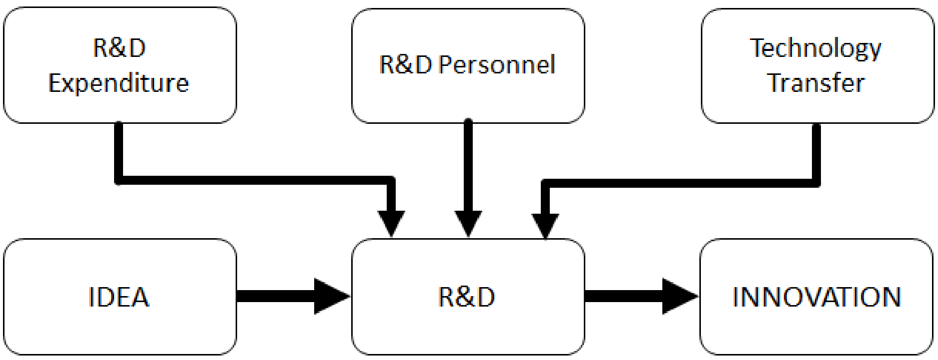

Figure 2: Sources of R&D

Funding R&D by the public and private sector and investing in people by supporting their education and training enhances R&D activities to be sustained and developed.

Eaton and Kortum (1999) proved that the increasing spending on R&D activities promotes a country's innovativeness level. Similarly, Lichtenberg (1992) found that R&D investment significantly promotes growth rate of productivity.

Innovation policies set and applied by the government should be R&D oriented due to the fact that R&D is the core element of innovation. Bor, Chuang, Lai, Yang (2010) pointed out that investment in R&D is accepted as a main criterion to measure a country's economic development and competitiveness because of the fact that these investments support economic growth through various channels as innovation, development of human capital. At the same time, Trajtenberg (1990) suggested "R&D investment" as a key factor for determining the technological potential of countries and, therefore, underlined such investments as an effective factor to gain economic growth and innovative ability. Furthermore, Rodriguez and Bilbao (2004) emphasized that contributions to R&D allows countries to achieve higher standards of technology and higher levels of income and growth as a result of producing new and superior products. In developed countries, it is obvious that R&D is constantly supported and financed by public institutions. Besides, while comparing the innovation performances of countries in literature, public spending on R&D is taken as one of the substantial criteria.

While mentioning R&D activities, human capital which is the most important input of R&D activities, should not be ignored. The success in R&D activities highly depends on employment of qualified personnel (MÜSİAD, 2012:123). Along with funding R&D, investing in human capital by means of education/training to improve their qualifications is very important. With qualified human force, it is easier to transfer accumulated knowledge to innovation. Therefore, it can be said that countries with high skilled human forces benefit more from their R&D efforts.

According to OECD Insights document entitled ‘Human Capital: How what you know shapes your life’ (2007), contributions of human capital to economic growth is argued in detail and it is interpreted that the idea of investing human capital has emerged in reaction to economic change. This document also verified the existence of bidirectional flow between education and economic growth. The document also mentioned the contributions of education to increased capability of the workforce to achieve more complex jobs. Likewise, OECD (2000:3) emphasized the importance of investment on education as the new technologies need skilled human force. Similarly, MÜSİAD (2012:125) pointed out the necessity of a supportive and encouraging education system and linked the success in innovation to the quality of education system of a country.

Number of people employed in the knowledge-intensive industry which is called STI (Science, technology and innovation) Human Resources in literature, indicates the extent to which a country gives importance to R&D activities. Human resources devoted to R&D can be used as a measure to analyse innovativeness of a country. Therefore, investing in human capital seems necessary to acquire new ideas, develop knowledge and be innovative.

1.2.2. Technology Transfer

Technology transfer is the implication of a technology by a new user or usage purposes, here, a technology which is developed for one purpose is implemented either for a different application.

Or, by a new user such as the usage of an existing technology for a new area of application or the extension of the existing technology for further R&D activities.

Technology transfer can be closely associated with innovation as it can also be observed as the displacement of ideas, knowledge and information from one area to another. In this context, the movement of ideas during technology transfer can also be combined with R&D activities, device infrastructure and the implementation of academic ideas into practice by the industry.

Technology transfer can be in different scopes: National, international and in-house (inward) are the primary ones. Accordingly, alternative definitions for technology transfer exist. For example, a firm can import technology from abroad.

As the technology transfer involves the movement of knowledge between two parties, it can also be in different forms.

Firms can transfer know-how, a systematic knowledge for process implementation or technical innovation, technology development capability, tacit knowledge and technology strategy. The main goal here is to transform the new knowledge into new products and services. At the same time the technology transferred also leads to actions and skills.

The essence of the technology transfer process is the knowledge on the location of developed technology which is subject to transfer as well as the source and the method of transfer. The main locations for technology transfer can be counted as follows:

- Private R&D offices,
- Technology and fiscal consultancy offices,
- Universities,
- Machinery manufacturing facilities,
- Government R&D units,
- The ones that protect the intellectual property rights (Ayhan, 2002:215).

In accordance with these, three of the technology transfer methods mainly comprises the followings;

- Licensing: License is an agreement to manufacture and sell another company's product in exchange of a royalty fee (Bovée and Thill, 2015: 363). Here technology owner is called as the "licensor" and the acquier as "licensee". The licensing process is undertaken for both sides to exploit benefits from the process. As an advantage, the licensor does not have to bear the costs related to opening up to a foreign market, the licensee bears the costs (Jones and George, 2015:213).

- Hiring skilled employees: This method can be assumed as the most classical one of all and which has been implemented for a long time. In this process one company can hire a skilled employee for different purposes such as R&D knowledge and implementation of the related projects. Similarly universities and R&D institutions may recruit specialists (including foregin ones) is also assumed as a technology transfer method (Ayhan, 2002:222). In this way the company gains the required technology in a quick way whilst the newcomers bring their own knowledge and working methods. Some of these might be previously used by the precedent into the company.

- Collaboration: Collaboration between universities/research institutes (academia) and firms can be provided via different forms of technology transfer mechanisms in order to refect the research results of the academia in the private sector.

  The examples which unifies the academia and public research institutions' research potential with the innovative entrepreneurship of the industrial organizations includes technoparks, science parks, university-industry collaboration centers (Baykara, 2006: 279). Another example is the Knowledge Transfer Partnership Programme whose aim is to to transfer the technology in the broadest sense between universities/colleges and small firms (Smith, 2006:259)

Regarding the types of technology transfer, two different variants can be mentioned. The first variant is national technology transfer activities. This process can be undertaken in different ways. One of methods is that the firms can transfer technology to another subsidiary. Another meothod is "dual use" Technologies. Dual use, in industrial terms is the transfer of the research, development and production potential at the defence industry to commericial one for civil purposes (Baykara, 2006:95)

Second type of technology transfer is international technology transfer activities. The main reason for international technology transfer activities is to monitor the technological developments around the globe. In additon to that, selection of the convenient technology, integration and adoption of the transferred technology and the dissemination of the independent technology.

Besides the ones that has been explained in detail above, some of the different methods of international technology transfer are as follows (Ayhan, 2002:221);

- Know-how agreements,
- Scientific and technical cooperation agreements,
- Leasing,
- Equipment and facility agreements,
- Foreign Direct Investment (FDI) activities,
- Staff training in an abroad country,
- Technical documentation,
- Reverse engineering,
- Getting specialists' support

In order to have a proper international technology transfer mechanism, monitoring of the global technologies, selection of the required technology (ies), assimilation of the technologies, improvement of the transferred technology and its disseminations are important.

1.3. SELECTED OUTPUTS OF INNOVATION

The most important and noticeable output of innovation is economic development. Economic development is strongly linked to innovative performance and in order to measure innovative performance of a country, some outputs as patent numbers and scientific publications give quantitative information. Having a patent application is a clue that there is a new knowledge or product to be protected (Rogers, 1998:11), and publishing scientific studies is a proof that there are some studies which are carried out in the field of innovation and this field is considered important in a country.

An increase in innovation input indicators as investing R&D activities and human resource contributes innovation output indicators positively. Summary of the input/output relation is given in Figure 3.

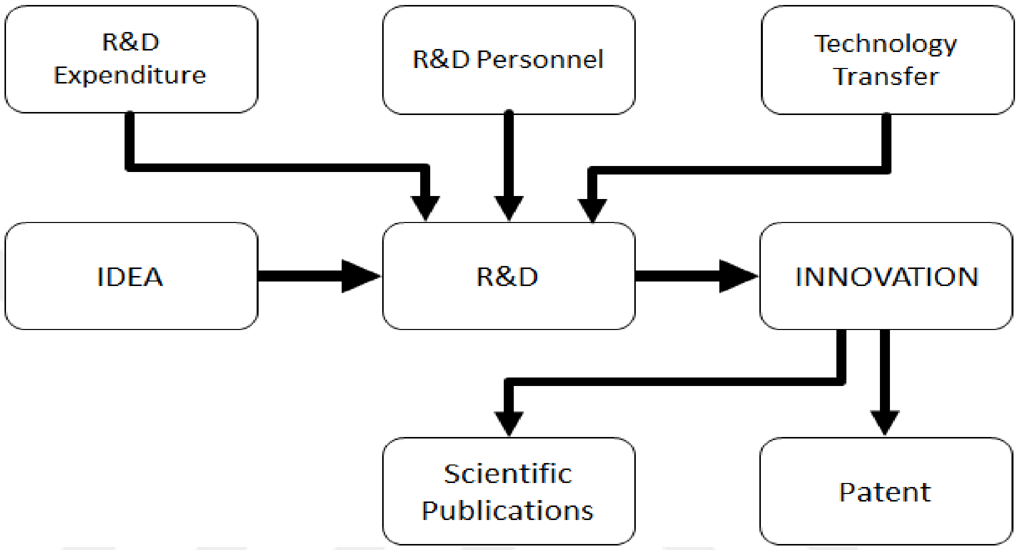

Figure 3 : Inputs and Outputs of Innovation

1.3.1. Patent and Utility Model

Like R&D expenditure and personnel, which are the inputs of technological activities, patent is one of the most important tools used to measure the level of technological innovation as a visible output. In order to ensure the sustainability of the product which is created as a result of R&D activities, patent applications are needed. It can be called as a final step of invention and defined as a document which gives the exclusive right of use for invented things to the applicant and prevents the using, producing or selling of invented things by the third parties for a given period.

World Intellectual Property Organization defined 'patent' as a document issued by a government agency, describing an invention and creating a legal situation for a patent owner to produce, sell, use and import an invented thing (WIPO, 2004:27).

It is the monopoly rights that are granted to the patent / utility model owner for a limited time and place, in order to prevent the unauthorized production, sale, use or import of the invention by third parties (TPI, 2018).

In order to convert an invented item to the patented, it must have certain standards as industrially applicable (useful), new (novel), exhibit a sufficient “inventive step” (be non-obvious) (WIPO, 2004:17).

In addition to patents there are other types of Intellectual property rights (IPR), such as copyright, trademarks and design. With a general approach to the relation in between the patent and innovation in the literature, Acs, Audretsch and Feldman (1991) reported that patents and innovations move in the same direction. Griliches (1990) emphasized the importance of patenting activities as a measure on innovativeness and found strong correlation between R&D expenditures, patent and productivity growth. Likewise, Acs and Audretsch (1989) asserted that patents provide a reliable clue to measure innovativeness.

Regarding the related literature which underlines the relation between innovation inputs; relation between the patent and R&D activities appears as the first important that is considered, along with R&D spending, patent statistics are largely used to measure the level of a country’s R&D activities. In this context, Pakes and Griliches (1980) reported the relationship between patent applications and R&D expenditure by using data for 121 U.S companies within the period 8-year. In the end, they found a strong relationship between R&D expenditures and the number applied and granted patents, and they described the link between R&D and patent as a “knowledge production function”.

The number of patents granted to a country, might give a good picture of this country’s activeness in technology. In order to make more precise analysis, patent indicators should be evaluated with other science and technology (S&T) indicators (OECD, 1994:12)

The patented products resulting from R&D activities, are an input for economic performance indicators. The returns from these products both encourage entrepreneurs to undertake R&D through the monopoly function of the patent, and to provide financial resources to develop new products (Saatçioğlu,2013).

1.3.2. Scientific Publications

In literature, scientific publication density of a nation is considered as an important indicator of being active in scientific related research.(eg. Napier, Serger and Hansson ,2004; Hollanders and Cruysen,2008).

The presence of scientific publications and research shows that studies in the field of science have been carried out and science is considered as an important subject in this country. Published studies allow flow of knowledge and accessibility of publications which promotes future scientific studies. Since the source of scientific papers in a country is largely derived from universities residing in that country, R&D activity performed by universities is accepted as crucial. This due to the fact that it is supposed that R&D studies carried out at universities promote an increase in scientific publication level.

European Commission (2019:86) suggested that collaboration enhances density of scientific activity and high citation rates might give a picture of having a quality research system.

The activity of scientific publications is measured by three criteria (Ak and Gülmez, 2004:527) as;

- The number of publications published by international journals
- The number of citations
- The level of publishment of a paper in the journals which scanned by scientific indexes

Two data sources are used to measure the value of scientific publications as Web Of Science (Thomson Reuters) and SCOPUS (Elsevier).

The number of scientific publications which gives insight into the innovation potential and the quality of human capital of a country (Ekizceleroğlu, 2008) is used in the measurement of a country' position in the field of science. This position is measured with respect to other countries by comparing the scientific qualifications of universities or countries, and determining academic performance of scientists (Ünal and Seçilmiş, 2013:19). Thus, scientific publications are generally considered as an output of innovation activities in the literature.

1.4. ENTREPRENEURSHIP

Entrepreneurship is a main source of innovation and creativity since entrepreneurial approaches contribute to the commercialization of innovation where, entrepreneur is the person who creates wealth through innovation. Therefore, there is a close link between innovation and entrepreneurship. In general terms, entrepreneurship is the process of bringing land, labor and capital together and taking the risk involved in producing a good or a service in the hope of making a profit. In this context entrepreneur is a risk taker who starts and operates a business in hope of making a profit.

Entrepreneurs are not only taking risks but also make judgmental decisions for bringing the factors of production together and have a perceptual sense in order to do that. They also do take the responsibility of their decisions.

In the document entitled 'Measuring Entrepreneurship' within the context of Entrepreneurship Indicator Program (OECD, 2009:6) , entrepreneurs are defined as "the business owners who seek to generate value through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets. Entrepreneurial activity is defined as enterprising human action in pursuit of the generation of value through the creation or expansion of economic activity, by identifying and exploiting new products, processes or markets. Entrepreneurship is the phenomenon associated with entrepreneurial activity."

Due to all entrepreneurial activities are people-driven, the quality of human capital and skill level of the workforce is very important. Educated human capital makes acquisition and adaptation of knowledge easier for a country in the competitive environment (Kuriakose, Goldberg, and Zhang, 2011:34). This concept can also be closely linked to the notion of "technical entrepreneurship" In this concept "technical entrepreneurs" are the entrepreneurs that are mostly related with innovation.

According to Smith (2006:195) technical entrepreneurs are involved in following activities:

- Application innovators: They implement existing technologies in complementary products in the existing markets. In such a case, different versions of the existing products can be routed to new markets
- Market innovators: They implement existing technologies to new markets. In such a case, technologies that are used in such markets do not have to carry radical features. Here, innovation is based on offering the existing technologies to new markets in a different way. Products can be assumed as new ones in the markets where they are not acknowledged.

- Technology innovators: Develop new technologies and make radical scientific changes. Such products with new technologies are offered to existing markets. New products can also be used as substitutes to existing products.

- Paradigm innovators: Is the most extreme version of the technology innovation. Similar innovators generally offer new products to new and undeveloped markets.

Accordingly, to improve productivity, make new investments, create jobs and promote growth, it is vital to have an active entrepreneurship ability. Entrepreneurial activity which creates sustainable dynamism, has an importance due to its role of fostering competition and economic growth (Kuriakose, 2013:1). In relation with that " Countries and regions with vibrant innovation and entrepreneurship ecosystems tend to witness higher productivity rates, leading to increased economic growth and more robust job creation." (Shiv Nadar University, 2019)

Some entrepreneurial decisions are based on experience and some of them on research. In some cases, training is important to satisfy the required talents. The training might not always be on technical knowledge issues but also some of the notions related with the environment. These notions can be counted as the business, the people, the customers, the competition – and entrepreneurs apply existing knowledge to a new situation for innovation purposes. As entrepreneurs make decisions they learn, analyze and decide, reflect and revise, and consider what went right/wrong. They hold detailed knowledge of subjects that are important and keep the lessons of good and bad practice for future reference in head. Types of technical innovators are sugessted by Smith (2006:191) as research, producer, user and opportunist.

In OECD Ministerial Conference document on "Developing entrepreneur competencies" entrepreneurship competencies is defined as "combine creativity, a sense of initiative, problem-solving, the ability to marshal resources, and financial and technological knowledge"(OECD, 2018:3).

Holcombe (1998:45) claimed entrepreneurs pave the way for economic growth by making productivity more efficient and more innovative in an economy. Joseph Schumpeter (1983/1934) defined entrepreneurs as "the person who transforms invention to innovations that will bring commercial success. By this way, entrepreneurs contribute to the economic development of their countries while contributing to the development of their companies." According to Kao (1989), entrepreneur acts as a catalyst both in its own society and any place in the world, who is creative in designing new things, producing and implementing new ideas.

CHAPTER II

THEORETICAL FRAMEWORK

Today, in order to achieve global competitiveness, sustainable economic growth and social welfare for countries, conducting development strategy based on science, technology and innovation is crucial more than ever in history. Economic growth results in better life standards in the society and higher competitiveness ability of a country. As European Commission (1995) pointed out in 'Green Paper on Innovation' that investing in research, know-how, technology and the skills has a great importance for gaining competitiveness for a country, region or firm. In the same way, an independent Business School IMD (International Institute for Management Development) who analyses and compares all countries around the world in terms of competitiveness each year, uses main criterias as R&D activities, expenditures for R&D activities, S&T policies, qualified human resource, exports of high-tech products (Ekizceleroğlu, 2008).

International trade, especially export, is an engine of growth for economic development, which allows countries to flow money from other countries to their home country. Nations' ability to create export earnings is seen as a key indicator of competitiveness and generating wealth. It is obvious that producing and exporting high value-added products contributes much more than low-value added products to countries' budget in terms of financial return. Lee and Hong (2012) proved that countries exporting high-value added products have shown higher growth rate than countries exporting low-value added products. Atkinson (2013:3) defined 'competitiveness' as the ability to export more in value added terms than imports. The magnitude of export earnings mainly based on the quality and value of a product traded between countries. The role of innovation here is to determine export trends of companies in a nation and increase the opportunity of countries to engage in export (Roper and Love, 2001:19).

Over the years, a number of theories have been put forward by economists to illustrate the reasons for differences in trade volume and economic growth between countries which have different structures and sizes.

Until the 1950s, the term ‘knowledge’ was not mentioned in economic theories, and classical economists like Adam Smith, David Ricardo, Alfred Marshall, Heckscher-Ohlin considered ‘labor and capital’ the main variables of their models. They defended that trade should have been done depending on labor or capital intensiveness of nations. However, to the contrary of these theories, Leontief (1986) revealed that the USA which had the highest capital stock in the world imported capital intensive goods but exported labor intensive goods. This proof is known as ‘Leontief Paradox’ in literature and it showed that there are other parameters as well as qualified human force, R&D activities that should be taken into account beyond labor and capital factors. This initiated the process of new theories focusing on the ‘knowledge’ factor in production and international trade activities.

Afterwards, economic theories took shape in different directions with the increasing importance of knowledge and its reflections on societies. For the solution of problems, modern economic theories draw attention to effective distribution of resources and development of human resources and consequently having sustainable increase of social welfare through developing science-technology and innovation. Today, having knowledge became considerably important in gaining competitive advantage rather than having natural resources, capital and labor which are the traditional production factors.

Modern theories like ‘Skilled-Labor Theory’ (Keesing and Kenen), ‘Technology Gap Theory’ (Posner, 1961), ‘Product Cycle Theory’ (Vernon, 1966) examined the effects of factors as qualified workforce, R&D, innovation on the production and export structures and foreign trade of countries.

Michael Porter approached the term ‘competitiveness’ comprehensively and deeper than others. Porter asserted that with the effect of globalization in competition and technology, classical theories are sentenced to be overshadowed and used variables are unable to explain the whole trade that takes place today. He says; ‘’National prosperity is created, not inherited. It does not grow out of a country's natural endowments, its labor pool, its interest rates, or its currency's value, as classical economics insists’’ (Porter, 1990:73). In contrast to other traditional models, he included not just factor conditions, but also other important variables at the same time.

He emphasized that all social, historical, cultural and institutional structures of the nations affect global competitiveness, but the capacity to produce knowledge is one of the leading factors in global competition. He clearly expressed his point of view on new theory requirements in his words as; ‘A new theory must move beyond comparative advantage to the competitive advantage of a nation. It must reflect a rich conception of competition that includes segmented markets, differentiated products, technology differences, and economies of scale. A new theory must go beyond cost and explain why companies from some nations are better than others at creating advantages based on quality, features, and new product innovation. A new theory must begin from the premise that competition is dynamic and evolving; it must answer the questions: Why do some companies based in some nations innovate more than others? Why do some nations provide an environment that enables companies to improve and innovate faster than foreign rivals?’ (Porter, 1990:77)

2.1. SCHUMPETER: CREATIVE DESTRUCTION

Schumpeter is one of the most important economists in this field, who examined the effects of innovations on firms, markets, nations' economies, economic development and growth, and economic system. He defends that innovation is the source of productivity and companies of a nation might continue their existence through innovation in a dynamic competition environment.

Joseph A. Schumpeter is one of the most important economists who examined the concept of innovation. His greatest contribution to literature is about the importance of technological developments and innovations for the capitalist system, and the existence of entrepreneurs who create innovations.

In his book named ‘Capitalism, Socialism and Democracy (1942)’, he proposed the theory of ‘creative destruction’. Schumpeter linked ‘creative destruction mechanism’ to technological developments and suggested that when new innovations emerge, old ones become destroyed and replaced with new ones (Yıldırım & Kostakoğlu, 2014:93). According to this theory, all conditions as business strategies, market needs and consumer demands are constantly changing with the effect of technological developments and actors in the market are forced to catch these changes to survive. Innovative ability enhances competitiveness of companies in a nation by promoting them to make production at lower costs and higher quality and distinctively than its competitors (Korkmaz, Ermeç and Yücedağ, 2009:84). Therefore, the competitiveness level of companies is directly proportional to the innovativeness ability. Due to consumers keep consuming unquestioningly and unsatisfied in capitalist economies, existing products are sentenced to be saturated and innovative products are expected to come up.

According to Schumpeter, in the capitalist system, competitiveness of firms proceeds through innovation in products, processes, markets and strategies, not directly through price (Turanlı and Sarıdoğan, 2010). He emphasized that capitalism is build on the innovations and the profits granted from innovations. In order to achieve monopolistic high profits, enterprises are constantly in competition among themselves and during this process, technological developments and thus economic growth takes place (Erdoğan and Canbay, 2016:34).

Schumpeterian theory considered innovation as a part of a technological process. Schumpeter defined steps of the process of the emergence of a new product has three distinct phases as invention, innovation and diffusion called ‘innovation trilogy’ (Mahdjoubi, 1997:2). Entrepreneur and innovative companies who lead innovations have a crucial role in conducting trilogy in performing innovation activities and encouraging other entrepreneurial activities (Tiryakioğlu, 2009).

2.2. PORTER: DIAMOND MODEL AND THEORY OF COMPETITIVE ADVANTAGE OF NATIONS

Michael Porter is one of the most important economists who is well known in the area of competitiveness and focusing mainly on productivity. In the book named 'The Competitive Advantage of Nations' in 1990, he suggested a model called the 'Diamond Model' to examine the reasons of competitive differences between nations.

According to Porter, competitive advantage arises from productivity and productivity arises from innovative activities. In order to gain and sustain competitive advantage, companies operating in a nation must continuously improve productivity in high value output by increasing the quality of product, adding new features on existing products or creating new and efficient ways of production, and thus providing higher standard of living for the citizens in a nation (Porter, 1990:76).

Bryan (1994) and Khemani (1997) defended that competitiveness is derived from productivity and in order to be able to increase competitiveness, human resource, capital and natural resources should be improved and technological developments should be closely followed (Bryan,1994, Khemani,1997 in Çivi, Erol, İnanlı and Erol, 2008:4). In the same way, Oliver Cann Head of Media Content, World Economic Forum Geneva stated that productivity drives countries to be competitive, which leads to economic growth by promoting social welfare (Cann, 2017). The World Economic Forum defined competitiveness as 'the set of institutions, policies and factors that determine a country's level of productivity.' (Porter and Schwab, 2018: 3). Figure 4 summarizes the perspective of Porter's towards the source of prosperity.

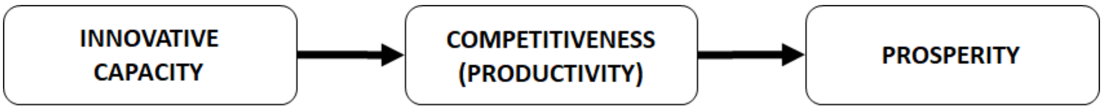

Figure 4 : Porter's Perspective of Prosperity (Porter 2001:5)

In 'Diamond Model', Porter determined four attributes of nations in order to measure the competitiveness level of nations as factor conditions, demand conditions, related and supporting industries and firm strategy, structure and rivalry (Porter, 1990).

By these attributes, he examined the characteristics of a nation supporting its companies to gain competitive advantage in particular industries and defined four attributes to explain the diamond of national advantage. Each element in the diamond model forces companies to respond to changes.

Additionally, these four factors on the diamond of national advantage constantly interact and support each other. For this reason, they should be considered in the system as a whole. Any change in one factor directly affects others.

The most important and distinctive part of his model is to take 'government' effect into consideration while analysing the national competitive advantage. 'Chance' factor is also included in his theory which could impact the nation's competitiveness level indirectly.

Figure 5 indicates four main and two indirect factors which Porter included in Diamond Model.

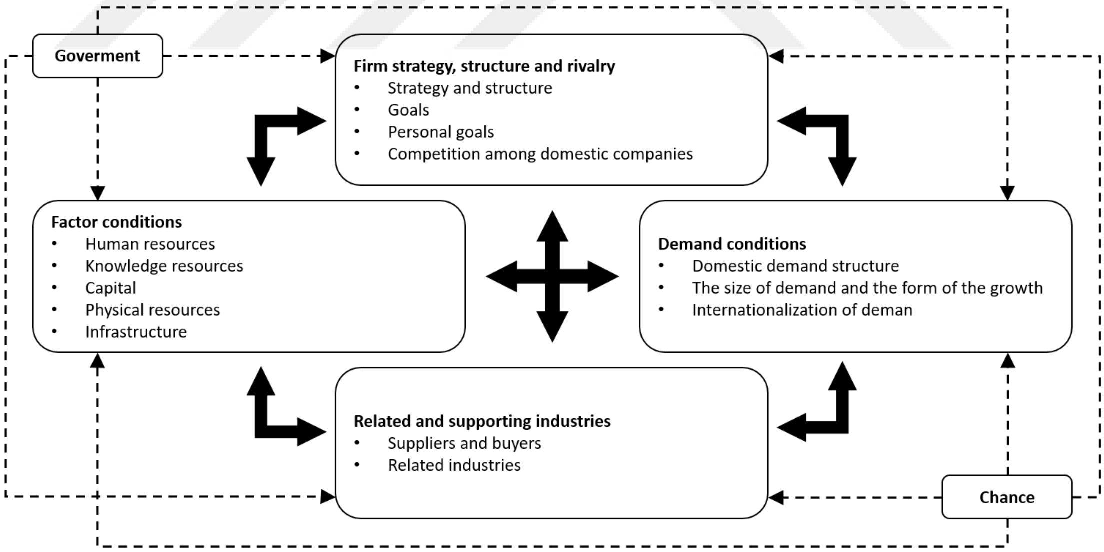

Figure 5 : Porter's Diamond of National Competitve Advantage (Porter 1990)

- *Factor Conditions*: Standard factors of production are known as land, labor, capital and infrastructure. Porter (1990) broadened and detailed this term by adding the education level of the human force, the existence of a scientific base and the quality of infrastructure of a country as the necessity of knowledge-intensive industry.

As a matter of fact, having basic factors of production might be an advantage for a country if the industry operates in the field of natural mining or agriculture-based areas where there is no need for technology and skilled human force. However, in today’s conditions, these are not adequate to create competitive advantage. To achieve competitive advantage, it is necessary to create and use advanced factors of production such as industrial specialization, R&D and engineering skills, which provides a country to be innovative and technology-based (Erkan and Erkan, 2004:13). Today, the quality of human force and knowledge-based infrastructure is more important than having abundant human force and raw materials.

According to Porter (1990), even if a nation does not have well-equipped factors of production, it can create it by continuous and efficient investment tools and a nation succeeds in an industry in which it is good at creating factors.

- *Demand Conditions:* Local demand, foreign demand, potential markets, the characteristic of demand, the level of buyers’ demanding, consumer preferences altogether compose the demand conditions.

The characteristics of local buyers have a great impact on the characteristic of a nation’s innovativeness. Conscious local demand provides early recognition of possible changes and opportunity to act earlier than competitors. Gürpınar and Barca (2007:46) states that a more demanding domestic market leads to competitive advantage by creating export and new market opportunities.

According to Porter, rather than the size of home demand, the sophistication of buyers in home country has an importance. Home demand shapes the behavior of companies and forces them to innovate and improve their competitiveness level to meet buyer’s needs in terms of product quality and features. Porter emphasized the importance of home-demand with his words ‘Nations gain competitive advantage in industries where the home demand gives their companies a clearer or earlier picture of emerging buyer needs, and where demanding buyers pressure companies to innovate faster and achieve more sophisticated competitive advantages than their foreign rivals.' (Porter, 1990:82).

- *Firm Strategy, Structure and Rivalry:* The strategy is the defined methods of companies, which determine the path they follow in order to reach their objectives. The strategies of companies are mainly shaped by the national environment they exist in, and it determines in which industries a company could have the opportunity to gain competitive advantage (Smit, 2010:117). A strategy selected correctly based on needs of strategic management and accurate risk analysis is very important for global competition. The intense competition in the environment in which the companies are located will be a driving force for firms to develop their competitiveness and be innovative.

  Rivalry in a nation pushes companies to improve product quality, adding new features on existing products, at last producing differentiated products than rivals, which means innovating. (Porter, 1990:76)

- *Related and Supporting Industries:* According to Porter (1990), another determinant of national competitive advantage is the presence of local industries. In addition to this, presence of internationally competitive producer industries, subsidiary industries or supporting industries for an industry in which a nation concentrates on, which is called "cluster", are also the determinants. Cluster basically refers to regional condensation of a group of companies which have similar and interrelated activities. Porter defined clusters as a group of companies including governmental and other institutions (universities, standards-setting agencies, think tanks, vocational training providers, and trade associations etc) which cooperate for the production of related goods or services and sharing a specific geographic region (Porter, 1998:78).

The existence and activities of these industries considerably promotes competitiveness, and thus export trends of related industries operating in the same region (Barca, Döven and Taşkın, 2006:131). It is because of the presence of related industries allow companies to capture capabilities of local suppliers and service providers due to the transfer of knowledge between companies and the organisations who are the source of knowledge (Ketels and Memedovic, 2008:382) and to absorbe the advantage of speed, knowledge, close relationship and cost in an efficient network. It paves the way for benefiting from effective flow of knowledge, frequent face-to-face relationships, access to skilled labor force. It also paves the way for mutual R&D activities, shared business rules and behavior, which results in easier collaboration and innovativeness (Öcal and Uçar, 2011:293).

It is easier to perceive opportunities and develop ideas if you are right in the middle of the action with a group of leading companies, suppliers and research institutions nearby.

Geographic proximity allows generating more commercially valuable innovations (Gittelman, 2007:2) as being geographically close facilitates effective interaction between R&D actors for knowledge transfer (Mudambi and Swift, 2012). Porter emphasized the importance of working closely as "suppliers and end-users located near each other can take advantage of short lines of communication, quick and constant flow of information, and an ongoing exchange of ideas and innovations" (Porter, 1990:83).'

2.3. ETZKOWITZ: TRIPLE HELIX: UNIVERSITY- INDUSTRY- GOVERNMENT RELATIONSHIP

The need for creating university-industry cooperation arises from the need of achieving better economic development, technological adequacy, R&D, productivity, industrialization, qualified human force, higher education. (Ensari, 1989; Koç and Mente, 2007:6)

Etzkowitz (1993) examined the relationship of university, industry and government in detail and developed the concept of the Triple Helix of university-industry-government relationships. In his model, he considered universities as a leading actor due to their role of creating novelty. Universities are supposed to make research and produce knowledge, industry is supposed to turn this knowledge into a commercial product and generate wealth. According to Viale and Etzkowitz (2005:7), each actor acquires some skills and perspectives of others, but each maintains their own identity and priority. Thus, each of them becomes the creative source of self-innovation and can support creativity in other fields. Therefore, the communication between university and industry is very important to transfer of knowledge. However, in order to provide systematic integrity between university and industry, the government must take necessary precautions and apply needed policies. Innovation enhancement argument of Etzkowitz is summarized in Figure 6

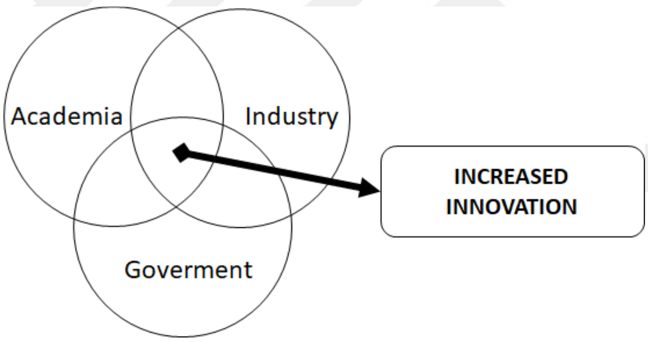

Figure 6 : Triple Helix Model of Etzkowitz

Along with individual performances of firms, research institutes, and universities, the success of innovation performance depends to a great extent on the quality of communication of all actors as a whole (Smith, 1996; OECD, 1999:24). Therefore, within the scope of this trilogy, the government's role cannot be underestimated as government is one of the most important tools, who acts as a guide governing interaction among other actors. Even though the main force to foster innovation is individual companies with the help of effective national innovation infrastructure, they are not the only determinant of a country’s innovation ability. The innovative performance depends on the dynamics of the system, the success of the actors and systematic integrity between them. Effective public policy, effective policy interventions, quality of human resource, clusters in which companies both compete and cooperate for innovation at the same time. At the same context, universities and other institutions all play a vital role in the innovative ability of a company.

Therefore, it can be said that there are three main elements of the national innovation system comprised of universities, industry and government. Porter (1990:87) suggested that the role of government is not direct but very effective as forcing and encouraging companies to innovate, by providing required conditions and applying legislative regulations. It supports attributes in the diamond by setting rules in order to encourage change, promote domestic rivalry, stimulate innovation.

Contributions like thematic research programs and financial incentives provided by governments are essential in order to build strong ties between university and industry (Godin and Gingras, 2000:276). Ranga and Etzkowitz (2015) emphasized the importance of government intervention on the development of entrepreneurial universities by encouraging them and the rise of new enterprises by simplifying the procedures they encounter to innovate. Likewise, Leydesdorff (2006) highlighted that in a knowledge-based economy, the creation of the knowledge base depends on the synergies created between the three main actors of the economy: academia, business and government.

Today, the zones in which university-industry cooperation concentrates on are named as ‘technoparks’. Technoparks are called with different names in the world as Science Park in England, Research Park in America, Technopole in France, Technopolis in Japan, Grunderzentrum (Founding Center) in Germany. Besides, there are different names like Enterprise Center, Innovation Center, Excellence Center, Industrial Park in literature (Babacan,1995 in Gül and Çakır, 2014:82).

The main objective underlying the idea of technoparks is, by creating spatial proximity between industry and university, increasing the interaction and common problem-solving abilities of both sides (Acar, 2008:39). Technoparks incorporates R&D and innovation-based companies, contributes to transfer knowledge produced under the scope of universities to commercialized products and obtains high value-added products by this way contributing to the development of a nation (Alkibay et al., 2012:65).

Babacan (1995) defined ‘technoparks’ as the research centers and also intermediary institutions founded with the aim of increasing economic development of a country. Accordingly, technoparks provide technical and managerial support to entrepreneurs for the development and production of new and advanced technologies under its role of research center. Technoparks also contribute to the transformation of university-industry relations into concrete cooperation under its role of intermediary (Erkan et al., 2007). Since technoparks create new employment opportunities, resource savings, innovation spillovers, and thus competitive advantage for countries, they are functional for national level government policies (Acar, 2008:46).

In addition to a nation’ in transportation, energy, health, information technologies’ infrastructure; the factors shaped by national policies such as education, and incentives affect a country’s innovativeness. Additionally, regulations, financial and monetary instruments, intellectual property rights, ease of access to the market all directly affect the ability of innovation of a country.

Government policies should take a part in all different parts of an economy as a complement in order to obtain sustainable growth (Braunerhjelm, 2010:42). Governments use some instruments to support innovation as public procurement, grants, subsidies, loans, equity funding, fiscal incentives and tax incentives (OECD, 2014:156). However, as pointed out by Metcalfe (1994), government policies in S&T should be considered beyond the boundaries of R&D incentives. At this context, government policies should be directed towards supporting successful technologies, promoting national or international policies, supporting individual or collaborative activities of companies, and creating some non-profitable institutions in order to ensure the creation and diffusion of technological opportunities. In this context additional roles of governments are as follows;

- Setting competition and common commercial policies to stimulate competition and innovation

- Formulating educational policies to create qualified workforce and transfer of knowledge
- Formulating financial/fiscal policies to increase capital mobility
- Formulating communication policies for the spreading of information horizontally and vertically
- Formulating administration and financing policies to overcome bureaucratic obstacles
- Setting foreign capital and trade policy that strengthens the diffusion of globally generated technology within national boundaries.

2.4. RELATED LITERATURE

A large number of studies in literature on the analysis of causality relationship between competitiveness, R&D, patent, innovation, productivity, government policies, export, prosperity and growth have been investigated over the years. Many studies show that R&D and innovation are highly correlated with each other and both affect export performance positively (Ayar and Erdil, 2018:45). Other studies have indicated a clear connection between innovation and the creation of an entrepreneurial economy, and most of the studies have agreed that regardless of firms size, innovation has a positive effect on companies' competitive ability (Kaufmann and Tödtling, 2002 , Şahbaz and Tanyeri, 2017).

Çiftçi (2008:232) indicated that innovations emerging from R&D activities in one country, on the one hand, allow for more output by using the same amount of physical and human capital, which in turn leads to an increase in productivity and on the other hand, have positive effects on economic growth. Similarly, Yoo (2008) stated that technological innovations have a positive effect on total factor productivity and exports in technological products and found a strong relation between high-tech exports and economic development. Korkmaz, Ermeç and Yücedağ (2009) analysed the relation of innovation capability and competitiveness with the data collected from 70 manufacturing firms by using face to face survey method, and they provided evidence that innovative effort is the main driver of economic development and national competition. Wakelin (1998) aimed to reveal the role of innovation on export behavior in his study. The researcher inferred that innovative firms are more likely to export, and as the number of innovations in enterprises increases, the possibility of entering into export markets is also increasing. In another study on the relation between innovation and export, Kirbach and Schmiedeberg (2008) proved that the enterprises dealing with innovation activities are more likely to increase export earnings.

It is well known that competitiveness is an extremely effective tool for achieving national prosperity. Companies with an entrepreneurial character operating in a nation which are able to innovate and produce high-technology, enable its country to increase competitive level and economic development with the effect of increasing export volume. This contributes to the nation in positive ways such as increasing per capita income, improvement in domestic activities and productivity, which means increased prosperity in a nation overall. Since SMEs constitute a majority among enterprises in most of the countries, competitiveness of SMEs has a great importance to enhance overall competitive performance (Yülek and Daş, 2016).

SMEs are considered as a major source of entrepreneurial activities and economic impetus (UNCTAD, 2016) as they have a significant contribution to employment, GDP and exports of a country (Razak, Abdullah and Ersoy, A., 2018:1). Therefore, their participation to innovative activities stimulates both their development and country's the economic growth.

Kuswantoro et al. (2012) suggested that entrepreneurial orientations resulting from innovativeness are highly related with SMEs performance. Terziovski (2010) found a positive relationship between the level of innovation and SME performance by examining furniture manufacturing SMEs in Indonesia. Similarly, Atalay et al.(2013) found a proof of the positive impact of innovations on firm performance by analysing Turkish automotive industry.

The common problem of SMEs is the limited financial capacity which restrain their innovation activities (Kaufmann and Tödtling, 2002) . Therefore, the role of R&D support meaning government leadership, integrated strategic planning and effective regulation, financial support and enforcement are crucial to encourage SMEs' innovative efforts. Petrariu, Bumbac and Ciobanu (2013) pointed out that both funding R&D and developing human resources have a substantial positive effect on innovation performance of a company. Örücü, Kılıç and Savaş (2011) suggested that the most important factor which provides SMEs an enhanced innovative ability is the level of resources they allocate for R&D.

R&D support provided for SMEs allows them to be more successful in carrying out R&D related activities, innovation and export respectively and so contribute to development of competitiveness at the country level.

R&D expenditures will both increase the competitiveness of the companies and the economic development with the effect of increasing export gains. Bozkurt (2015) used data for the period between 1998 and 2013 for Turkey and deduced a positive correlation between R&D expenditure and economic growth by using Johansen cointegration test. Similarly, Falk (2007) examined OECD countries for the years between 1970-2004 by using panel data analysis and found that R&D expenditures have a strong positive effect on economic development. Yıldırım and Kesikoğlu (2012) analyzed the causality relationship between R&D expenditures and export trends in Turkey by using panel data for the period between years 1996 and 2008. According to findings, R&D expenditures strongly affect the volume of export in a positive way. From this proof, they inferred that R&D policy is an important tool which can be benefited to increase the export level of a country. Gülmez and Yardımcıoğlu (2012) examined the data for 21 OECD countries for the years between 1990 and 2010 with the aim of analysing the relationship between R&D expenditures and economic growth, and following the research, they found a positive relationship between them in the long term.

Due to patents are visible results of innovative activities, it is basically used in measurement of innovation level of nations. Patents have an effect on economic performance by promoting the diffusion of technology and creating opportunities for further innovation (TUBITAK, 2010).

The findings allocated from the study of Comanor and Scherer (1969), revealed that as the amount of personnel and physical capital assigned to R&D increases, patent applications also increase. This proves that the more qualified human resource leads to more innovative activities.

Schmoch et al. (2003) analysed the impact of patent applications on economic indicators as sectoral exports and value-added, and found high correlation between sectoral patent ratios, export and value-added levels in some European countries, USA and Japan which have high number of patent applications. It is concluded that the R&D intensity promotes to the patent ability, and the development of patent ability gives observable positive results in technological development (Schmoch et al.,2003 in Zachariadis, 2003). In another study, Özsağır and Çütçü (2015), examined the relationship between the numbers of patent applications and international trade by using the Vector Error Correction Model, and inferred that there is a positive relation between them in the long run.

CHAPTER III

GENERAL OVERVIEW OF SCIENCE AND TECHNOLOGY

3.1. CLASSIFICATION OF TECHNOLOGY

Technological classification arised from the use of technology in different intensities in different sectors and the need of understanding the economic activities and performance of countries. Having internationally harmonized classification defining technology-intensive industries and products is notably helpful in order to analyse the effect of technology on industrial performance. (Hatzichronoglou, 1997).

There are various classification techniques constituted by different institutions for many years like ISI-OST-INPI classification formed by World Intellectual Property Organization (WIPO) (Schmoch, 2008), Statistical classification of economic activities in the European Community (NACE) formed by Eurostat (2008) and International Standard Industrial Classification (ISIC) classification formed by OECD (2011). Most commonly used methods in literature are ISIC Rev.3 and Nace Rev.2.

Turkish Statistics Institute (TSI) collects and publishes data on manufacturing performance of Turkey by using NACE Rev.2 classification, and export and import performance based on technological level by using ISIC Rev.3 classification.

In the ISIC Rev.3 classification, the manufacturing industry is divided into four main categories by OECD (2011) as high-technology, medium-high-technology, medium-low-technology and low-technology based on R&D intensity used in industries and each industry is assigned a number from 15 to 37 as shown in Table 1

Table 1 : Classification of manufacturing industries based on technology (ISIC Rev.3)

ISIC Rev.3	
High-technology industries	
Aircraft and spacecraft	353
Pharmaceuticals	2423
Office, accounting and computing machinery	30
Radio, TV and communciations equipment	32
Medical, precision and optical instruments	33
Medium-high-technology industries	
Electrical machinery and apparatus	31
Motor vehicles, trailers and semi-trailers	34
Chemicals excluding pharmaceuticals	24 excl. 2423
Railroad equipment and transport equipment	352 + 359
Machinery and equipment, n.e.c.	29
Medium-low-technology industries	
Building and repairing of ships and boats	351
Rubber and plastics products	25
Coke, refined petroleum products and nuclear fuel	23
Other non-metallic mineral products	26
Basic metals and fabricated metal products	27-28
Low-technology industries	
Manufacturing, n.e.c. ; Recycling	36-37
Wood, pulp, paper, paper products, printing and publishing	20-22
Food products, beverages and tobacco	15-16
Textiles, textile products, leather and footwear	17-19
Total manufacturing	15-37

Another classification method which is indicated in Table 2, developed by Eurostat is NACE Rev.2 (Statistical classification of economic activities in the European Community) with the aim of classifying manufacturing industries.

Table 2 : Classification of manufacturing industries based on technology (NACE Rev.2)

NACE Rev.2	
High-technology	
Manufacture of basic pharmaceutical products and pharmaceutical preparations	21
Manufacture of computer, electronic and optical products	26
Medium-high-technology	
Manufacture of chemicals and chemical products;	20
Manufacture of electrical equipment; Manufacture of machinery and equipment n.e.c.; Manufacture of motor vehicles, trailers and semi-trailers; Manufacture of other transport equipment	27 to 30
Medium-low-technology	
Manufacture of coke and refined petroleum products;	19
Manufacture of rubber and plastic products; Manufacture of other non-metallic mineral products; Manufacture of basic metals; Manufacture of fabricated metals products, excepts machinery and equipment;	22 to 25
Repair and installation of machinery and equipment	33
Low technology	
Manufacture of food products, beverages, tobacco products, textile, wearing apparel, leather and related products, wood and of products of wood, paper and paper products, printing and reproduction of recorded media;	10 to 18
Manufacture of furniture; Other manufacturing	31 to 32

Since the ISIC and NACE classifications, which are two main classification of activities, have the same breakdowns at the binary level, binary level breakdowns are used in the study. Both classification methods are composed based on technological intensity.

3.2. CURRENT STATE OF INNOVATION AND HIGH TECHNOLOGY PRODUCTION IN TURKEY

With economic globalisation, countries' primary objective became knowledge-based production in order to increase their productivity and competitiveness. Higher levels of competitiveness and social welfare are important indicators of development. Innovation-driven (knowledge intensive) countries show higher development levels in comparison with the factor-driven (labour intensive) countries (Işık and Kılınç, 2012:60). Obtaining higher levels of development which can be derived from firm's intensiveness on technology, allows them to increase innovation levels, explore new markets, effective use of available resources and pay higher to their employees. An industry based on high technology contributes both the performance in international trade and improvement of other sectors (Hatzichronoglou, 1997).

In emerging markets, export of technology intensive goods has a substantial influence on sustainable competitive advantage and economic growth. Therefore, Turkish policy maker institutions have started to concentrate on increasing the share of high technology in total production. According to the Industrial Strategy Document 2015-2018 published by the Ministry of Science, Industry and Technology (2015), Turkey defined its priority industries as energy, water, food, health, defence and aerospace. Main objective of this document is building an industrial structure which contributes increasing share in world exports, produce mainly high value added and high-tech products, and have qualified workforce, by increasing competitiveness and productivity level of Turkish industry (SCST, 2015:33).

The production and percentage values of Turkish manufacturing industry based on NACE Rev.2 technology classification between 2005 and 2018 is shown in the Table 3.

Table 3 : Production values according to technology classes (TSI)

PRODUCTION VALUES									
Years	**High Technology**		**Medium-High Technology**		**Medium-Low Technology**		**Low Technology**		**Total**
	₺B	%	₺B	%	₺B	%	₺B	%	₺B
2005	13,76	4,44	73,85	23,85	90,04	29,08	131,95	42,62	309,59
2006	15,37	4,08	91,17	24,21	121,47	32,25	148,63	39,46	376,65
2007	13,12	3,19	101,83	24,72	134,11	32,56	162,88	39,54	411,94
2008	13,98	2,95	113,99	24,05	170,28	35,93	175,65	37,06	473,92
2009	14,31	3,20	102,00	22,78	139,38	31,13	192,02	42,89	447,71
2010	15,34	2,85	122,64	22,76	178,77	33,18	222,09	41,22	538,84
2011	17,80	2,50	165,88	23,29	252,55	35,46	276,01	38,75	712,23
2012	19,54	2,53	174,50	22,61	271,12	35,13	306,59	39,73	771,75
2013	19,95	2,30	200,09	23,10	300,92	34,74	345,21	39,85	866,17
2014	23,84	2,39	232,36	23,31	336,49	33,75	404,28	40,55	996,98
2015	29,34	2,63	270,84	24,25	363,76	32,57	452,91	40,55	1.116,85
2016	31,91	2,61	301,71	24,72	391,38	32,07	495,50	40,60	1.220,50
2017	39,74	2,52	400,53	25,43	532,38	33,81	602,19	38,24	1.574,83
2018	56,81	2,70	545,29	25,92	730,90	34,74	770,80	36,64	2.103,81

* Compiled by the author by using TSI data

According to the data retrieved from TSI, it is seen that the total manufacturing value of Turkey has increased from 309,59 billion TL to 2.103,81 billion TL from 2005 to 2018. However, it is also obviously seen that the ratio of production value in high-technology is quite low when comparing with the share of low-technology production value.

The value added by the manufacturing industry in GDP of Turkish manufacturing industry based on NACE Rev.2 technology classification between 2005 and 2018 is shown in the Table 4.

Table 4 : Value added values according to technology classes (TSI)

VALUE ADDED									
Years	**High Technology**		**Medium-High Technology**		**Medium-Low Technology**		**Low Technology**		**Total**
	₺B	%	₺B	%	₺B	%	₺B	%	₺B
2005	2,66	4,45	14,72	24,67	17,68	29,63	24,60	41,24	59,66
2006	3,28	4,41	18,57	24,98	23,76	31,97	28,72	38,64	74,32
2007	2,97	3,79	19,99	25,49	24,99	31,86	30,49	38,86	78,44
2008	3,69	3,96	24,10	25,87	31,85	34,19	33,52	35,99	93,16
2009	4,35	4,94	22,64	25,67	25,45	28,86	35,73	40,52	88,16
2010	4,64	4,69	25,17	25,44	30,58	30,92	38,53	38,95	98,91
2011	4,61	3,55	33,99	26,14	42,35	32,56	49,11	37,76	130,05
2012	5,15	3,80	34,86	25,71	41,34	30,49	54,23	40,00	135,58
2013	5,71	3,41	43,05	25,73	52,96	31,65	65,61	39,21	167,34
2014	6,86	3,54	49,06	25,31	61,14	31,55	76,75	39,60	193,81
2015	9,05	3,85	59,84	25,44	76,30	32,44	90,03	38,27	235,23
2016	10,95	3,99	70,10	25,54	89,22	32,52	104,14	37,95	274,40
2017	13,01	3,79	91,22	26,55	114,45	33,31	124,91	36,35	343,60
2018	20,11	4,34	126,88	27,39	154,56	33,37	161,63	34,89	463,19

* Compiled by the author by using TSI data

Similar interpretation can be made from these indicators as the value added of high-technology industries is excessively lower than low-technology industries even though the total value added of manufacturing industry shows continuously increase from 2005 to 2018.

Table 5 and Table 6 show Turkey's export and import structure respectively, based on ISIC Rev.3 technology classification from 2005 to 2019.

Table 5 : Export values according to technology classes (TSI)

EXPORT									
Years	**High Technology**		**Medium-High Technology**		**Medium-Low Technology**		**Low Technology**		**Total**
	₺B	%	₺B	%	₺B	%	₺B	%	₺B
2005	5,56	5,99	26,41	28,47	24,97	26,92	35,82	38,62	92,75
2006	6,38	5,51	35,65	30,80	33,66	29,09	40,03	34,60	115,72
2007	5,83	4,44	42,71	32,53	39,80	30,31	42,98	32,73	131,32
2008	5,15	3,19	49,79	30,82	60,64	37,54	45,96	28,45	161,54
2009	5,16	3,47	44,85	30,27	51,25	34,59	46,91	31,66	148,17
2010	5,40	3,25	51,04	32,16	50,58	31,87	51,68	32,56	158,70
2011	6,69	2,55	67,81	32,00	68,85	32,49	68,55	32,35	211,90
2012	8,63	2,60	73,34	28,44	97,61	37,85	78,28	30,36	257,87
2013	9,18	3,20	85,12	31,55	82,42	30,55	93,06	34,50	269,79
2014	11,00	2,85	101,83	31,61	94,03	29,19	115,26	35,78	322,12
2015	13,46	3,01	116,63	31,89	107,24	29,32	128,38	35,11	365,71
2016	14,20	3,33	134,03	33,15	114,47	28,31	141,65	35,03	404,35
2017	20,81	2,64	186,01	34,59	151,91	28,25	178,98	33,29	537,71
2018	26,78	2,72	276,63	36,16	213,24	27,88	248,32	32,46	764,96
2019	33,48	2,92	331,04	36,04	252,61	27,50	301,34	32,81	918,48

* Compiled by the author by using TSI data

From the export indicators it is clearly observed that the share of high-technology holds the lowest share and remains with the rate around 3% over the last seven years. Moreover, decreasing share of high-technology in exports from 3,01% to 2,72% between the years of 2005-2018 might be a clue of Turkey's relatively weak performance on producing high-technology. Additionally, the share of medium-high technology holds the highest rate during the last two years. This might also be considered as an indicator that companies operating in Turkey have started to pay more attention in producing higher level technology based products rather than lower technologies over the last years compared to previous ones.

Table 6 : Import values according to technology classes (TSI)

IMPORT									
Years	High Technology		Medium-High Technology		Medium-Low Technology		Low Technology		Total
	₺B	%	₺B	%	₺B	%	₺B	%	₺B
2005	18,17	14,31%	58,25	45,88%	34,26	26,98%	16,29	12,83%	126,98
2006	22,67	14,25%	70,78	44,51%	45,37	28,53%	20,21	12,71%	159,03
2007	22,66	13,01%	75,82	43,56%	52,97	30,43%	22,63	13,00%	174,08
2008	24,36	12,65%	80,16	41,64%	63,01	32,73%	25,00	12,98%	192,54
2009	25,31	14,76%	73,37	42,79%	48,34	28,19%	24,44	14,25%	171,45
2010	31,67	14,50%	93,56	42,83%	62,51	28,61%	30,71	14,06%	218,46
2011	39,54	12,83%	133,12	43,20%	94,05	30,52%	41,47	13,46%	308,18
2012	40,67	12,81%	132,89	41,85%	102,01	32,13%	41,97	13,22%	317,53
2013	46,30	12,35%	154,57	41,22%	126,41	33,71%	47,73	12,73%	375,00
2014	57,70	14,05%	173,23	42,17%	124,40	30,29%	55,43	13,49%	410,76
2015	71,59	15,78%	201,25	44,36%	119,90	26,43%	60,90	13,43%	453,64
2016	85,70	16,95%	226,74	44,84%	129,83	25,68%	63,34	12,53%	505,61
2017	105,41	15,15%	286,38	41,15%	226,31	32,52%	77,85	11,19%	695,94
2018	112,00	13,53%	348,05	42,06%	272,86	32,97%	94,60	11,43%	827,51
2019	134,40	15,33%	355,57	40,57%	281,51	32,12%	104,95	11,97%	876,43

* Compiled by the author by using TSI data

Regarding import performance indicators, it is obviously seen that the import trend is mostly concentrated on the medium high technology segment at 40% for all years from 2005 to 2018. The remarkable point here is that while Turkey's high-technology production and exports are below 4%, high-technology imports are at around 15% during the same years. It might be regarded as an evidence that Turkey imports high-technology of which it is not able to produce and export.

Based upon all above data, it can absolutely be inferred that Turkey's manufacturing industry and export structure is highly centred around 'low-technology' and 'medium-low-technology' industries. Such a structure of the manufacturing industry has not been able to get out of the traditional sectors with low technology content, which resulted in an increase in the dependency of production and exports on imports.

Having relatively higher production and export of low-technology based (low-value added) products than high-technology based products (high-value added) may end up with an increasing gap between export and import of a country in a negative way. This means an increase in trade deficit of a country and causes a great negative effect on a country's economic development level, so may lower per capita income, lower welfare level and lower competitiveness level relatively.

Achieving sustainable growth and international competitiveness depends on increasing productivity on the basis of technological development. For this reason, various S&T and industry policies have been carried out by countries for years with the aim of determining the sources of productivity increase and the effectiveness of technological developments. Accordingly, implemented S&T policies in Turkey will be examined comprehensively in the next topic.

3.2.1. Implemented Science & Technology and Innovation Related Policies in Turkey

Turkish innovation policies are discussed in the S&T policy documents. The budget allocated for innovation activities is reported in Five-Year Development Plans by the State Planning Organization (SPO). S&T policies are a set of regulations applied by government bodies in order to maximize the performance in S&T. Policies on science consist of obtaining sufficient resources for science, and distributing allocated resources between activities efficiently with the aim of increasing social welfare, while policies on technology are generally more focused on specific sectors. These sectors include nuclear power, space technology, computers, drugs and genetic engineering that are crucial for economic growth (Lundvall and Borrás, 2005:8).

In Turkey, identifying S&T policies and other embodiments have emerged in the 1960s for the first time. SPO affiliated to the Prime Ministry was founded on 30th September,1960 with the aim of planning and accelerating economic, social and cultural development, ensuring the efficient use of country resources. Additionally, other aims include preparing annual development methods and programs, and monitoring their implementation.

After 1963, Turkey switched to the planned development phase by setting economic development targets in the annual development plans, under the leadership of the SPO. Annual development plans are set every 5 year and, after the establishment of the SPO, 11 Five-Year Development Plan have been prepared. Until today, 11 plans have been developed as summarized in Table 7.

Table 7 : Development Plans Between 1963 and 2023

Development Plans	**Year Interval**
1st Five-Year Development Plan	1963 - 1967
2nd Five-Year Development Plan	1968 - 1972
3rd Five-Year Development Plan	1973 - 1977
4th Five-Year Development Plan	1979 - 1983
5th Five-Year Development Plan	1985 - 1989
6th Five-Year Development Plan	1990 - 1994
7th Five-Year Development Plan	1996 - 2000
8th Five-Year Development Plan	2001 - 2005
9th Five-Year Development Plan	2007 - 2013
10th Five-Year Development Plan	2014 - 2018
11th Five-Year Development Plan	2019 - 2023

The common target of all development plans is to increase social welfare. Therefore, in the development plans, the targeted development has been tried to be achieved by taking into account total investments, total expenditures, demand situation in the country and propensity to save.

One of the most important steps in the Turkish ST policy, is the establishment of the Scientific and Technical Research Council of Turkey (TUBITAK) in 1963 with the aim of enhancing R&D activities, coordinating and encouraging research institutions, providing access to existing scientific and technical information. In accordance with this, appertaining to TUBITAK, in 1967, Turkish Scientific and Technical Documentation Center (TÜRDOK) was established in order to satisfy Turkish researchers' and industrialists' information needs.

In the 1960s and 1970s, S&T policies identified in Turkey have been limited in the field of promoting natural sciences, basic and applied research (TUBITAK-BTP, 1999:1).

Due to the Fourth Five-Year Development Plan (1979-1983) coinciding with the 24th January 1980 decisions period in which Turkey started to apply an open economic model by leaving closed economic model, S&T subjects were much discussed than previous development plans in line with the requirements of the global economy. Open economy model has pushed the local producers, who have not previously been competitive and were not concerned about the market, to compete and keep up with the environmental conditions.

In the early 1980s, in cooperation of the SPO and TUBITAK with the participation of scientists and experts, the first detailed Science Technology Policy in Turkey is' Turkish Science Policy: 1983-2003 " was published. In this document, the concept of technology is considered as the base topic and the priority areas of technology are determined (Bayraktutan & Bıdırdı, 2015:41).

One of the most important developments in this period was the establishment of the Supreme Council for Science and Technology (SCST) with the Decree Law No. 77 on 4 October 1983 (TUBITAK, 2012:9). Governance of case in Turkey, SCST act as the highest authority. Its primary duties are providing technical support for the government during the formulation of long-term S&T policies, setting R&D goals in S&T areas and finally mobilizing public institutions within R&D plans/programs.

Regarding the substantial ratio of SMEs presence in Turkish Economy, supporting them is one of the major goals of the SCST. As of 2020, the number of active SMEs in Turkey is 3.652.521, which means capturing 99,83 % share of the total economy. They hold 72,7 % of total employment, 50,6 % of total value added, 61,7 % of total sales, 58,3 % of total investments, 55,1 % of total exports and 35,3 % of R&D expenditures (KOSGEB, 2020).

The success of SMEs in innovation to survive in the global economy highly depends on the financial resource they allocate for R&D activities. At this stage, relevant government institutions should step in when an enterprise needs resources to conduct R&D activities.

One of the institutions of Turkey to support SMEs’ activities is Small and Medium Enterprises Development Organization (KOSGEB) which was founded on 20th April, 1990. The main purpose of KOSGEB is to identify SME needs, find solutions to challenges they face, develop their ability to effectively pursue technological innovations, foster their participation in the global economy. (The Union of Chambers and Commodity Exchanges of Turkey, 2010).

The Ministry of Industry and Trade defined SMEs as “enterprises with no more than 250 employees and whose revenue or net sales does not exceed 125 Million TL annually” with Law No. 2005/9617 on 19th October, 2005.

In all industrialized and developing countries, businesses with fewer than 250 employees constitute the majority of companies (Johnson, 2015) and encouraging innovation in SMEs is the prior policy of governments to stimulate economic development.

In the Fifth Five-Year Development Plan (1985-1989), the concept of ‘high technology’ was mentioned for the first time. As a matter of fact, within the scope of university-industry cooperation, a techno-park application was initiated in cooperation with Istanbul Technical University and Istanbul Chamber of Industry and Commerce in 1985. (SPO, 1985)

Besides in this period, as a mission of supporting R&D activities of private sector and increasing competitiveness of private sector “Technology Development Foundation of Turkey (TTGV) (1991)” was founded. Moreover, as a mission of promoting research, ensuring adoption of scientific thought, creating researcher human resource “Turkish Academy of Science (1993) (Law No. 497)” has been established.

For that purpose, the Ministry of Finance and Customs provided an additional source for The Scientific and Technological Research Council of Turkey (TUBITAK), and TUBITAK launched the Scientist recruitment program from the Soviet Union in 1992. This led to the employment of approximately 50 scientists in Turkish universities. These scientists have worked efficiently in the field of basic sciences. (TUBITAK, 1993: 6)

At the second meeting of the SCST on February 3, 1993, the document entitled as“Turkish Science and Technology Policy 1993-2003”, including the targets, priority areas and the measures to be taken to reach these targets, has been presented by TUBITAK and approved. This document constitutes the main topics of the Seventh Five-Year Development Plan and also foundation of today's S&T Policy of Turkey.

In the context of Turkish Science and Technology Policy 1993-2003, it is planned to give priority to informatics (a combination of computer, microelectronics, telecommunication technologies), advanced technology materials, biotechnology, nuclear technology and space technology. It has been stated that the need to create monetary and human source, increase the share of private sector in research-development expenditures, and take measures to improve the world science technology contribution level. In order to increase the number of PhD students, foreign doctoral programs are to be rearranged, undergraduate education will be encouraged to science branches, secondary education and higher education enrollment rate will be increased. In addition to this, human resource transfer and qualified human resource ratio will be increased from abroad (TUBITAK, 1993:1-34).

Turkish Science and Technology Policy 1993-2003' has widened by the policy paper named 'Science and Technology Breakthrough Project (1995)'. This project shows the ways to turn the S&T produced into a country that has gained the ability to innovate and transform it into an economic and social benefit. In order to achieve the scientific and technological breakthrough and produce the brain power that is the creator of S&T, the importance of the education system is emphasized. In this context, primary priority is determined as the allocation of country resources to education and R&D (TUBITAK, 1997).

At the SCST's 6th meeting on 13 December 2000, it was decided to prepare Turkey's S&T Strategy covering the years 2003 to 2023 and in this context, TUBITAK was commissioned. The project called "Vision 2023: Science and Technology Strategies" consists of 4 sub-projects: "Technology Foresight Project", "National Technology Inventory Project ", "Researcher Information System (ARBIS)" and "TUBITAK National Research Infrastructure Information System (TARABIS)". Under this project, determining the prior R&D areas and strategic technologies for Turkey, involving S&T into the country's agenda, increasing awareness of society on the importance of S&T, and encouraging more effective participation, are counted as primary objectives (TUBITAK, 2014:33). Strategic Technologies underlying the priority activities published in Vision 2023 Strategy Paper are gathered under 8 main headings. These headings include; information and communication technologies, biotechnology and gene technologies, nanotechnology, mechatronics, production processes and technologies, material technologies, energy and environmental technologies, design technologies (MÜSİAD, 2012:31).

The results of the studies were brought together in “National Science and Technology Policies 2003-2023” document. Based on this document, “Science and Technology Implementation Plan (2005-2010)" were prepared and “Turkey Research Area (TARAL) where the private and public sectors by and non-governmental Organizations strategically focus and collaborate on R&D, is founded. In National Science and Technology Strategy (2005–2010), main objectives are defined as enhancing well-being, developing competitiveness and to create a society having higher awareness for S&T. In order to succeed these objectives, the need for investing in R&D, improving the quality and quantity of researchers and stimulating demand for R&D is emphasized (UNESCO, 2010:202).

The “International Science, Technology and Innovation Strategy” covering the years 2007-2010 and “National Innovation Strategy” covering the years 2008-2010 were the other documents prepared within the framework defined by the TARAL. The main objectives of these strategies are to promote innovation and efficiency, to use science technology capacity in the most efficient way and to support sustainable and competitive structure.

In addition, with the aim of creating technological information through the cooperation of universities, research institutions and the productive sector, the “Technology Development Zones Law (TDZ) (No.4691)” known as Technopark's Law was proposed. TDZ aimed to contribute substantially to the development of university-industry cooperation has been enacted in 2001. With this law, it is facilitated for academicians to contribute to technology production in TDZs.

TDZs Law (SCST, 2017);

- Provide innovations in product and production methods
- Reduce production costs
- Improve product quality and productivity
- Support technology-intensive production and entrepreneurship
- Create job opportunities for researchers and qualified people
- Accelerate the inflow of foreign capital that can bring high technology to the country
- Support technology transfer
- Perform technological knowledge production
- By serving the purposes of commercializing the technological knowledge produced, it aims to make the industry competitive and export oriented at the global level.

Under this law, 85 TDZs have been established between 2001-2019 as indicated in Table 8 (Ministry of Industry and Technology, 2020).

Table 8 : Number of Technology Developments Zones

Cities	**Number Of Zones**
Adana, Afyonkarahisar, Aydın, Balıkesir, Batman, Bolu, Burdur, Bursa, Çanakkale, Çankırı, Çorum, Denizli, Diyarbakır, Düzce, Edirne, Elazığ, Erzurum, Eskişehir, Giresun, Isparta, Kahramanmaraş, Karabük, Karaman, Kastamonu, Kayseri, Kırıkkale, Kırklareli, Kütahya, Malatya, Manisa, Muğla, Nevşehir, Niğde, Osmaniye, Rize, Sakarya, Samsun, Sivas, Şanlıurfa, Tekirdağ, Tokat, Trabzon, Van, Yozgat, Zonguldak,	1
Antalya, Gaziantep, Hatay, Konya, Mersin	2
İzmir	4
Kocaeli	5
Ankara	10
İstanbul	11

In 2008, the "Law on Supporting Research and Development Activities" was issued with the aim of supporting R&D tax incentives and innovation activities. With this law, it has been possible for the universities to take their real place in the innovation system and in guiding the country's economy.

At SCST's 22nd meeting on 13 December 2000, implementation plan for the period 2011-2016 named "National Science, Technology and Innovation Strategy (UBTYS)" has been prepared. This strategy aimed to ensure the continuity of the positive developments of the Science and Technology Implementation Plan 2005-2010, and to ensure the sustainability of the policies. In UBTYS (2011-2016), automotive, machinery and manufacturing technologies, energy, information and communications technologies (ICTs), water, food, defence and aerospace industries are defined as priority areas for R&D. The role of TUBITAK is to provide necessary funds for high-technology production and R&D projects which enable the creation of these products (OECD, 2012:398).

Other documents prepared within the scope of this strategy are" National Science and Technology Human Resource Strategy and Action Plan 2011-2016", "National Energy, R&D and Innovation Strategy", "National Water, R&D and Innovation Strategy "and "National Food, R&D and Innovation Strategy".

In 2011, the name of the "Ministry of Industry and Trade" was transformed into the "Ministry of Science, Industry and Technology". The Ministry of Science, Industry and Technology has undertaken the task of developing, implementing and coordinating science technology and innovation policies with its new structure and supporting R&D and innovation activities.

In 2012, in order to ensure efficiency and sustainability in operations, Ministry of Development and TUBITAK signed "Cooperation Protocol About Performance Monitoring and Evaluation of Competence of Research Centers of Higher Education". This protocol aimed creating collaborative work with universities for classification, performance measurement, monitoring efficacy and assessment of current and future research centers. (TUBITAK, 2012:33)

SCST concentrated on the 'National Innovation and Entrepreneurship System' in its 23rd meeting and discussed necessary steps to be taken to foster this system. For the same purpose, the council refers to the importance of the role of education and human resources to achieve desired goals for 2023 in its 24th meeting. (TUBITAK,2012:12)

10th Five Year Development Plan prepared for the years 2014-2018, takes Turkey's 2023 goals as a reference. Main objective of this plan is to increase the share of high technology sectors in the manufacturing industry in order to increase international competitiveness and export of high value-added products. In accordance with this aim, priority will be given to the production of intermediate goods and industrial raw materials in order to ensure that the inputs used in the production of high technology are used locally. By this way, external dependence on imported intermediate goods and raw materials is to be minimized. Furthermore, in order to encourage innovation activities and strengthen the commercialization process, it was decided to establish an intellectual property rights system. (Ministry of Development, 2014:94)

In almost all policy documents of Turkey and all meetings of the SCST managed, policies and strategies are well articulated with the aim of building a national innovation system. Policy documents support to ensure competence of Turkey's S&T, to create employment opportunities in knowledge-based industries, to improve well-being. Policy documents also aim better identify allocation and distribution of financial instruments, to promote cooperation between required actors in producing knowledge, to encourage researchers for intellectual property and patent applications and much more. Therefore, it can be inferred that significant progress has been made in establishing the legal and institutional basis.

While Turkey shows relatively good performance in setting policies, it is obvious that Turkey has still a way to go to turn policy requirements into practice.

3.2.2. Support Programmes to Promote Technology and Innovation

Being able to produce technology and having a high level of innovative capacity drives governments to promote innovative activities due to the perceived contributions to creating jobs and wealth. In order to gain a better position in global competition, upgrading and incentivize innovation, series of support programmes were introduced in Turkey.

Main actors in the Turkish Financial Support System are;

- The Scientific and Technical Research Council of Turkey (TUBITAK)
- Small and Medium Enterprises Development Organization (KOSGEB)
- Technology Development Foundation (TTGV)
- The Council of Higher Education (YÖK)
- Ministry of Science, Industry and Technology (BILTEK)
- Ministry of Finance
- Ministry of Development

Regarding the institutional framework, in the private business enterprise sector, institutions as TUBITAK, SCST, KOSGEB, TTGV, develop policies with the aim of providing financial support to increase research and innovation capability, technological development capacity, innovation culture and competitiveness of Turkish industry. Technology and Innovation Grant Programs Directorate (TEYDEB) launched by TUBITAK is one of the important organizations that provides funds to project-based R&D activities for private enterprises.

Support programs carried out by TUBITAK TEYDEB is listed below;

- 1503 - R&D Project Brokerage Events Grant Programme
- 1505 - University-Industry Collaboration Grant Programme
- 1511 - Research Technology Development and Innovation Projects in Priority Areas Grant Programme
- 1601 Capacity Building for Innovation&Entrepreneurship Grant Program
- 1602 - TUBITAK Patent Support Programme
- 1501 - Industrial R&D Projects Grant Programme

- 1507 - SME RDI (Research, Development & Innovation) Grant Programme
- 1509 - TUBITAK International Industrial R&D Projects Grant Programme

TUBITAK (2019) announced the amount of provided supports and the number of applications shown in Table 9;

Table 9: TUBITAK's Support Programmes

Suppor Name	Number of Application	Approved	Amount Million TL
1503 - R&D Project Brokerage Events Grant Programme	32	32	0.823
1505 - University-Industry Collaboration Grant Programme	99	25	9,6
1511 - Research Technology Development and Innovation Projects in Priority Areas Grant Programme		2111	544,3
1602 - TUBITAK Patent Support Programme	N/A	1289	28,88
1501 - Industrial R&D Projects Grant Programme	2461	948	340,7
1507 - SME RDI (Research, Development & Innovation) Grant Programme	1082	281	122,86
1509 - TUBITAK International Industrial R&D Projects Grant Programme	68	28	44,6
1601 Capacity Building for Innovation&Entrepreneurship Grant Program	29	11	N/A

It is well-known that conducting innovative activities requires financial support. In this context, the prior issue is related to SMEs which encounter many difficulties in performing R&D activities due to insufficient financial resource. Considering that Turkish economy is highly composed of SMEs, supporting them is one of the priorities of the SCST.

TUBITAK launched several support programmes to stimulate the entrepreneurship ecosystem. On the academia side, in accordance with this purpose, SCST (2012) announced 'Entrepreneurial and Innovative University Index' to encourage, and also measure entrepreneurial and innovation oriented activities and technology transfer in universities;

- 1514 Venture Capital Funding Program
- 1512 Entrepreneurship Multi-phase Programme
- 1512/B Individual Entrepreneurship Multi-Phased Co-Financing Programme

- 1601 Capacity Building for Innovation and Entrepreneurship Grant Programme

KOSGEB initiated below support programmes for entrepreneurs;

- Entrepreneurship Development Support Programme
- R&D and Innovation Support Programme
- SME Technological Product Investment Support Programme
- Strategic Product Support Programme
- International Market Support Programme
- SME Development Support Programme
- KOBIGEL-SME Development Support Programme
- Cooperation Support Programme
- International Accelerator Support Programme
- Emerging Companies Market SME Support Programme
- Credit Interest Support Programme
- Industrial Application Support Programme
- Thematic Project Support Programme
- Laboratory services
- İŞGEM/TEKMER Programme

KOSGEB (2019:47) announced a report which includes general information on total support amount and number of enterprises it provided to the enterprises as given in Table 10.

Table 10 : Implemented KOSGEB Support Programmes in 2019

Support Name	Amount (TL)	Number of enterprises
R&D and Innovation, Industrial Application Support Programme	87.229.328	1.207
General Support Programme	243.001.775	19.711
SME Project Support Programme	469.862	5
Cooperation Support Programme	3.163.106	14
Entrepreneurship Development Support Programme	475.289.402	25.077
Thematic Project Support Programme	62.238	2
KOBIGEL-SME Development Support Programme	495.760.995	3.293
International Accelerator Support Programme	3.656.011	23
SME Technological Product Introduction and Marketing(Teknopazar) Support Programme	2.859.267	57
Strategic Product Support Programme	109.970.294	70
SME Technological Product Investment Support Programme (Teknoyatırım)	76.897.542	70
SME Development Support Programme	150.382.370	13.968
Advanced Entrepreneur Support Programme	127.667.876	5.264

TTGV is established to support R&D and innovation for entrepreneurs. The foundation aims to strengthen the competitive position of the private business sector in the global market by supporting R&D activities. In this context, the Technology Development Project Support Program (TGP) and Advanced Technology Projects Support Program (ITEP) are implemented.

The quality of human resources has a vital importance on the R&D capability and innovation level of a country. For this reason, STI human resources' development programmes have a critical importance as well.

STI human forces is supported through programmes of the Department of Science Fellowships and Grant Programs (BIDEB) launched by TUBITAK. BIDEB aims to support existing and future scientists by creating opportunities to improve their capacities.

BIDEB implemented below support programs;

- Co-Funded Brain Circulation Scheme Support Program
- Project Training Activities Support Program
- Graduate Scholarship Support Program for The Least Developed Countries

The Council of Higher Education (YÖK) also composes programmes with the aim of improving human source which are listed below;

- Graduate/Postdoctoral Research Programs,
- PhD Scholarship Program
- Research Program for Faculty Members
- Scientific Human Resources Development Program (ÖYP)
- Farabi Exchange Program.

Some specific programmes implemented under the guidance of TUBITAK are summarized below;

- The Defence Research Programme (With cooperation of Ministry of Defence)
- The National Nuclear Technologies Development Research Programme (With cooperation of Ministry of Energy and Natural Resources and Turkish Atomic Energy Authority (TAEK))
- The National Space Research Programme (With cooperation of Turkish Armed Forces, related ministries, universities and private companies)

With the aim of developing human resources in the field of space technologies, TUBITAK implements an international scholarship programme. By this programme, selected students who have a chance to attend graduate programmes abroad, have the opportunity to be more aware of space sciences through seminars, training courses, visit to the National Observatory (UNESCO,2010:208).

While supporting human resources, creating effective co-operation between actors contributing research activities is also vital. TUBITAK Academic Research Funding Programs Directorate (ARDEB) supports R&D activities of researchers who are from universities, government institutions and private R&D firms in order to let them generate technological products in accordance with global advances and national priorities.

Support programs performed by TUBITAK ARDEB is listed below;

- 1001 - Scientific and Technological Research Projects Funding Program
- 1002 - Short Term R&D Funding Program

- 1003 - Primary Subjects R&D Funding Program
- 1005 - National New Ideas and Products R&D Funding Program
- 1007 - Public Institutions Research Funding Program
- 3001 - Starting R&D Projects Funding Program

Ministry of Science, Industry and Technology implements Industrial Theses Support Program (SAN-TEZ) which contributes cooperation between firms and universities, commercialization of scientific studies composed by universities and support of M.S and PhD theses to encourage students to develop new, technology-based products or processes.

There are many advantages of 'The Law on Technology Development Zones' and 'The Law on Supporting Research and Development Activities' as infrastructure and tax incentives for the private firms (especially SMEs) operating in R&D and located in the technoparks. The law is implemented by the Ministry of Industry and Trade in cooperation with the Ministry of Finance. Incentives provided under this law aim to increase private investment in R&D, stimulate cooperation between firms and universities, encourage the creation of technology-based firms. Incentives also include attracting foreign companies' R&D departments or branches to invest in the country and thus supporting the transformation of knowledge into economic and social benefits. Due to all these contributions, building an effective technology cluster system is necessary. A technology cluster is a phenomenon in which collaboration with production sectors, companies, suppliers, universities, research institutions and organizations exist.

TUBITAK provides Patent Application Promotion and Funding Program (1602) to encourage national and international patent applications in Turkey. TUBITAK also works on improving its support programmes like Technology Transfer Office Support Programme to promote universities to turn R&D results into commercialized products and thus increasing benefits to society. In accordance with this purpose, TUBITAK funds Technology Transfer Offices for training, capacity building for university-industry co-operation, project management support, academic entrepreneurship activities, and intellectual property rights support.

The Ministry of Finance also provides funds to higher education institutions under the Scientific Research Program (BAP). These funds are distributed to R&D projects by each institute according to their own regulation.

Ministry of Development funds for both private and public sectors to build an infrastructure composed of qualified researchers and their cooperation. Likewise, TUBITAK launched The Support Program for Research Projects of Public Institutions to provide financial support to develop new products and processes to meet the needs of public organizations in R&D projects. TUBITAK Public Research Support Group (KAMAG) and TUBITAK Defense and Security Technology Research Support Group (SAVTAG) supports projects offered to Public Institutions Research and Development Support Program.

3.3. GENERAL OVERVIEW TOWARDS THE RESEARCH AND INNOVATION OF EUROPEAN UNION

Likewise Turkey, EU also realized the necessity of strengthening its economic and social structure and increasing its competitiveness in the new global environment with rapidly developing technology.

After European Council is founded in 1957, initial involvement in research activities of EU started in the early 1980s. Since 1984, European Commission proposed eight framework programmes covering average three to four years period with the aim of supporting research and innovation activities of EU (Table 11).

Table 11 : Framework Programmes of EU Between 1984-2020

Framework Programmes	Year Interval	Budget
1st Framework Programme (FP1)	1984 – 1987	€ 3.75 billion
2nd Framework Programme (FP2)	1987 – 1990	€ 5.4 billion
3rd Framework Programme (FP3)	1990 – 1994	€ 6.6 billion
4th Framework Programme (FP4)	1994 – 1998	€ 13.1 billion
5th Framework Programme (FP5)	1998 – 2002	€ 14.96 billion
6th Framework Programme (FP6)	2002 – 2006	€ 17.5 billion
7th Framework Programme (FP7)	2007 – 2013	€ 50 billion
8th Framework Programme (Horizon 2020)	2014 – 2020	€ 80 billion

Main targets of these programmes which is commonly mentioned in EU policy papers are strengthening the EU’s research and innovation infrastructure, supporting the actors in the innovation process, enhancing the industrial competition and promoting the cooperation between EU member coutries. Total budget dedicated to framework programmes is gradually increased. The most remarkable point is that EU doubled allocated budget in the FP4 (from € 6.6 billion to €13.100 billion). This might be perceived as a reflection of EU’s ambition in the way of obtaining strongest economic position in the world and the importance EU attaches to research and technological developments.

Even though Europe has studied innovation with its European Framework Programs since 1984, is obviously stated in the document entitled as Green Paper on Innovation in 1995 that Europe has an inadequate ability to transform technological and scientific findings to innovations and competitive advantages. In order to overcome weak performance, this document points out the importance of stimulating the innovation ability of human resource. The document also points out developing strong relations between actors (education institutions, research centers and businesses), building an efficient fiscal policy for innovators, providing an appropriate and simplified environment for innovators in terms of standards, intellectual and industrial property (European Commission, 1995:5). This document can be considered as Europe’s first paperwork addressing the importance of having a strong innovation policy to build a knowledge-based economy.

Launching the Lisbon Strategy in 2000 was the Union's most important step with regard to reshaping its economy. Under this strategy, European Council aimed to make EU “the most dynamic and competitive knowledge-based economy in the world by 2010 capable of sustainable economic growth with more and better jobs and greater social cohesion and respect for the environment" (European Commission, 2010). In accordance with this purpose, increasing the share of GDP in science and research, development of education system, meeting the needs of SMEs (Kok, 2009), encouraging R&D investment and cooperation between innovation actors were the main decisions taken. The establishment of European Research Area (ERA) is aimed in 2000 to fulfill these targets. A considerably higher budget was set for the FP4 for training and mobility compared to previous programs as its main focus was on the diffusion of new technologies and integration of SMEs. While holding the common target of previous FP's "maintaining European research capacity", FP5's primary objective was defined to solve existing problems and socio-economic challenges of which EU faced (Roediger-Schluga and Barber, 2006:5). To ensure the higher involvement of key actors (European laboratories, universities and companies) in research and innovation, procedures are decided to be simplified with the aim of increasing their productivity in high quality technologies, and so increasing the industrial competitiveness and the welfare of European citizens (European Commission, 2014:1).

FP5's thematic and horizontal programmes (European Commission, 2014);

Thematic Programmes to solve the specific problems;

- Quality of life and management of living resources (LIFE QUALITY)
- User-friendly information society (IST)
- Competitive and sustainable growth (GROWTH)
- Energy, environment and sustainable development EESD)

Horizontal Programmes as a part of Thematic Programmes;

- Confirming the international role of Community Research (INCO 2)
- Promotion of innovation and encouragement of SME participation (INNOVATION-SME)
- Improving human research potential and the socio-economic knowledge base (HUMAN POTENTIAL)

The main focus of FP6 was to promote cooperation between major actors(universities, research centres and industry) in research and innovation. With the aim of commonization research in EU locally, regionally, nationally and internationally, it was decided to ‘'Integrating and strengthening the European Research Area' and 'Structuring the European Research Area' (European Commission, 2014:1).

FP7 is carried out under the leadership of ERA, in which the amount of allocated funds for research and innovation projects are determined and S&T activities are promoted. Main objectives of FP7 is defined as; supporting cooperation for transnational research projects, supporting ideas of individual research projects, strengthening human capital in research, and supporting Europe’s key actors of research and innovation sources like regional clusters, SMEs (European Parliement, 2017:20). In addition to that, European Institute of Innovation and Technology is built with the aim of supporting research and innovation.

When the allocated time for Lisbon Strategy ended in 2010, it was obviously seen from the actual outcomes that European Commission could not fully satisfy to meet its targets even if it had positive effects on EU (European Commission, 2010). As an example, the share of GDP in R&D was %1,86 in 2000 and aimed to make it %3 in 2010. But realized outcome was just %2 (Höpker, 2013). Rapidly spreading global financial crisis in 2008 had a great impact on this failure. Thus, European Council initiated a new strategy called ‘Europe 2020’ in 2010 in order to actualize the targets of Lisbon Strategy. Targets are obviously defined as ‘smart growth, sustainable growth and inclusive growth’ (European Commission, 2010). Within the scope of smart growth, strengthening the Union's performance in the fields of education, research and innovation were discussed. With the aim of generating inclusive growth, it is envisaged to increase investment in education and create more employment opportunities for young, women and elderly people. And lastly, with the aim of sustainable growth, the EU's main ambition was to create a more competitive economy.

Behind the EU’s intention of investing in education, it is obviously seen that Europe was well aware of the critical role of entrepreneurs on innovation activities. With regard to this, supporting SMEs’ entrepreneurial activities was one of the most important topics the EU studied on. In the Entrepreneurship 2020 Action Plan, three measures were identified as the most urgent points to be intervened; entrepreneurial education, eliminating administrative obstacles for entrepreneurs, revitalizing Europe’s entrepreneurship culture and fostering new entrepreneurs (European Commission, 2020).

Europe put its most comprehensive FP for Research and Innovation, called Horizon 2020 (2014-2020) into force in 2014, in which a budget of 80 billion Euro has been allocated to be used in R&D and innovation activities. Its three priorities identified as excellent science; industrial leadership; and societal challenges(European Parliement, 2017:22). Additionally, as a part of this programme, Innovation Union initiative is established to create an environment for research and innovation activities on the basis of EU, and to create growth by turning innovative ideas into commercial products.

CHAPTER IV

DESCRIPTIVE ANALYSIS FOR INNOVATION PERFORMANCE

In order to understand the dynamics of innovation and define the relationship between innovation and economic growth, the EU tried to find the most reasonable way of measuring the innovativeness of member countries. At the request of Lisbon Council, European Commission developed EIS - it was called Innovation Union Scoreboard (IUS) between 2001 and 2016- which is published annually since 2001 in order to monitor innovation performance of EU Member States (European Council, 2009). Also, some other European and neighbouring countries like Iceland, Israel, Norway, North Macedonia, Serbia, Switzerland, Turkey, Ukraine and some of its main competitors like Australia, Brazil, Russia, India, China, South Africa, Canada, Japan, South Korea and the United States are also included in EIS evaluation. These reports ensure the analysis of change in innovation performance of these countries from year to year, and evaluation of results in terms of specific innovation indicators for the released year.

Innovation performance of examined countries is measured by Summary Innovation Index which is obtained from innovation performance of each country by aggregating the various indicators in one single number meaning average data of 27 indicators. List of countries involved in European mesurement system is shown in Table 12.

Table 12 : Contries included in the research

Year	Number	Countries included in the research
2010	27	Croatia, Iceland, the Former Yugoslav Republic of Macedonia, Norway, Serbia, Switzerland, Turkey, the US and Japan
2011	27	Croatia, Iceland, the Former Yugoslav Republic of Macedonia, Norway, Serbia, Switzerland, Turkey, the US and Japan
2013	27	Croatia, Iceland, the Former Yugoslav Republic of Macedonia, Norway, Serbia, Switzerland, Turkey, the US and Japan
2014	27	Croatia, Iceland, the Former Yugoslav Republic of Macedonia, Norway, Serbia, Switzerland, Turkey, the US and Japan
2015	28	Iceland, the Former Yugoslav Republic of Macedonia, Norway, Serbia, Switzerland, Turkey, the US and Japan
2016	28	Iceland, the Former Yugoslav Republic of Macedonia, Israel, Norway, Serbia, Switzerland, Turkey, Ukraine the US and Japan
2017	28	Iceland, the Former Yugoslav Republic of Macedonia, Israel, Norway, Serbia, Switzerland, Turkey, Ukraine the US and Japan
2018	28	Iceland, the Former Yugoslav Republic of Macedonia, Israel, Norway, Serbia, Switzerland, Turkey, Ukraine the US and Japan

As a result, countries are classified into 4 groups as 'Innovation Leaders (performance above 120% of the EU average), Strong Innovators (performance between 90% and 120% of the EU average), Moderate Innovators(performance between 50% and 90% of the EU average) and Modest Innovators (performance below 50% of the EU average)' (European Commission, 2019).

From 2001 to 2017, there were 25 indicators under three main heading as 'Enablers, Firm Activities, and Outputs' and eight dimensions which were used in order to measure innovation performance.

By the publication of EIS 2017, the measurement system is advanced with the aim of better analysis of innovation driving variables and impacts of them. Indicators are increased to 27 from 25. These indicators are grouped into four main categories covering framework conditions, investments, innovation activities and impacts. Framework conditions can be considered as main drivers of innovation performance external to the firm, investments are expenditures from the public and business sector, innovation activities include various aspects of innovation in the business sector, and impacts are the results (outcomes) of companies' innovation activities.

The current measurement concept used in the EIS has 4 main and 27 different indicators which indicates the difference between the 10 innovation determinants. These 4 main determinants are framework conditions, investments, innovation activities and impacts. Framework conditions consist of human resources, attractive research systems, and innovation-friendly environment. Investments consist of finance and support and firm investments. Innovation activities consist of innovators, linkages, intellectual assets. Impacts consist of employment impacts and sales impacts. The general headline of the indicators in the EIS is given in Figure 7. And detailed descriptions, content and data source of each indicator is given next.

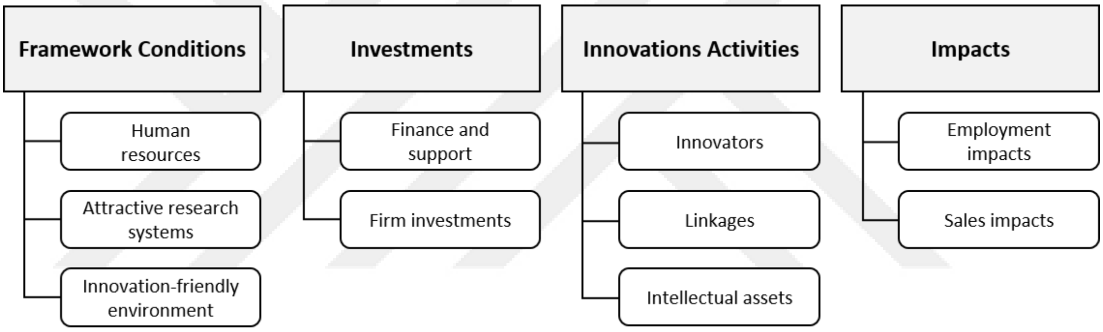

Figure 7 : EIS Indicators

Framework Conditions

Human Resources

- ***New doctorate graduates per 1000 population aged 25-34 :*** Indicator gives the number of doctorate graduates in per 1000 population between and including 25-34 years. European Commission (2019) defined it as 'a measure of the supply of new second-stage tertiary graduates in all fields of training (International Standard Classification of Education). For most countries, ISCED captures PhD graduates' number. Data for the number of doctorate graduates is extracted from Eurostat.

- ***Percentage population aged 25-34 having completed tertiary education :*** This indicator shows the number of people aged 25-34 with some form of post-secondary education in total population between and including 25-34 years. European Commission (2019) defined this indicator as " a general indicator of the supply of advanced skills which is not limited to science and technical fields, because the adoption of innovations in many areas, in particular in the service sectors, depends on a wide range of skills." Data for this indicator is extracted from Eurostat.

- ***Percentage population aged 25-64 involved in lifelong learning :*** This indicator includes all population aged between 25 and 64 years. No matter what the person's current or future job is, indicator considers all formal or informal learning activities targeting to improve knowledge, skills and competence (European Commission, 2019). Data source for this indicator is the EU Labor Force Survey.

Attractive Research Systems

- ***International scientific co-publications per million population :*** It indicates the number of international scientific co-publications (with at least one co-author based abroad) per million population. European Commission (2019) considers international scientific co-publications as an important driver of scientific productivity and believes that it has a great impact on the quality of scientific research. Data is extracted from Scopus and calculated by Science-Matrix.

- ***Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country :*** This indicator gives the number of scientific publications among the top-10% most cited publications worldwide in total number of scientific publications of the country. It is considered as an important indicator for the quality of research system, as the higher quality of publication leads to having more citation rate (European Commission, 2019). Data is extracted from Scopus.

- ***Foreign doctorate students as a % of all doctorate students :*** It indicates the share of foreign doctorate students in the total number of all doctorate students. As European Commission (2019) states that the diffusion of knowledge and continuous research supply arise from the high-skilled foreign doctorate students' mobility. Data source is Eurostat.

Innovation-friendly environment

- ***Broadband penetration :*** This indicator gives the share of enterprises with fast (at least 100 Mb/s) download speed internet connection access in total number of enterprises. Data sources are Eurostat, Community Survey of ICT Usage and E-commerce in Enterprises.

- ***Opportunity-driven entrepreneurship (Motivational index) :*** It is also called 'motivational index'. Data is extracted from Global Entrepreneurship Monitor (GEM). Based on the terminology of Global Entrepreneurship Monitor (GEM), there are two types of entrepreneurship as 'improvement-driven entrepreneurship' and 'necessity-driven entrepreneurship'. Opportunity-driven entrepreneurs are people who are able to expand their businesses and increase their revenues by using technological developments while necessity-driven entrepreneurs are people whose aim to keep their business stable in order not to be deprived of their regular income. GEM's Motivational index measures the ratio between the share of people involved in improvement driven entrepreneurship and the share of people involved in necessity-driven entrepreneurship (European Commission, 2019).

Investments

Finance and Support

- ***R&D expenditure in the public sector (% of GDP):*** This indicator refers to the share of total R&D spending by the government and the higher education sectors in GDP. As European Commision admitted that R&D spending is one of the most important indicators of how much a country attaches importance to knowledge based growth. Data source is Eurostat.

- ***Venture capital expenditures (% of GDP):*** This indicator gives the ratio of venture capital expenditures in total GDP. Venture capital expenditure is considered as a driving factor for creating new enterprises as it helps new businesses to expand their activities. Venture capital data is extracted from Invest Europe and GDP data is extracted from Eurostat.

Firm Investments

- ***R&D expenditure in the business sector (% of GDP)***: It measures the share of total R&D spending in GDP provided by the business sector. It aims at creating new knowledge especially within science-based firms. Data source is Eurostat.

- ***Non-R&D innovation expenditures (% of turnover):*** This indicator measures the share of non-R&D innovation spending in enterprises' total turnover. Non-R&D activities mean innovation activities that do not involve R&D processes such as investing in machinery and equipment, training, product design, acquiring patents etc. Data source is Eurostat, Community Innovation Survey.

- ***Enterprises providing training to develop or upgrade ICT skills of their personnel:*** It captures the number of enterprises supporting their personnel in terms of training programs to make them gain 'Information and Communication Technology (ICT)' skills in the total number of enterprises. European Commission (2019) asserts that the attempt of an enterprise to improve ICT skills of its employees makes a great contribution to development of overall skills of employees. Data source is Eurostat, Community Survey of ICT Usage and E-commerce in Enterprises.

Innovation Activities

Innovators

- ***SMEs introducing product or process innovations as % of SMEs:*** This indicator measures the share of SMEs who introduce a new product or process to the market in the total number of SMEs in a country. Data source is Eurostat, Community Innovation Survey.

- ***SMEs introducing marketing or organisational innovations as % of SME:*** This indicator measures the share of SMEs, who adopt a new organizational method (business practices, workplace organization or external relations) in their businesses or who start to use new marketing strategy (revisions on product design, packaging, product placement, product promotion or pricing) that has not been used before, in total number of SMEs in a country. Data source is Eurostat, Community Innovation Survey.

- ***SMEs innovating in-house as % of SMEs:*** This indicator captures the share of SMEs who innovate in-house in the total number of SMEs in a country. Data source is Eurostat, Community Innovation Survey.

Linkages

- ***Innovative SMEs collaborating with others (% of SMEs):*** It is the measure of share of SMEs who are involved in innovation co-operation activities with other enterprises or public research institutions in total number of SMEs. Data source is Eurostat, Community Innovation Survey.

- ***Public-private co-publications per million population:*** This indicates the number of academic publications authored as a result of public and private sector cooperation per million population. Data source is Scopus.

- ***Private co-funding of public R&D expenditures (percentage of GDP):*** It measures the percentage of expenditures which is spended for R&D by the government and the higher education sector from the funds provided by private sector, in total GDP. Data source is Eurostat.

Intellectual Assets

- ***PCT patent applications per billion GDP (in PPS):*** This indicator measures the number of international Patent Cooperation Treaty (PCT) patent applications per billion GDP. Patent applications give a good idea of how active a country is in producing innovation. Patent data source is OECD, GDP data source is Eurostat.

- ***Trademark applications per billion GDP (in PPS):*** This indicator measures the number of trademark applications to EU Intellectual Property Office (EUIPO) and World Intellectual Property Office (WIPO) per billion GDP. Trademark data is collected from both EU Intellectual Property Office (EUIPO) and World Intellectual Property Office (WIPO), and GDP data source is Eurostat

- ***Design applications per billion GDP (in PPS):*** It indicates the number of design applications to EU Intellectual Property Office (EUIPO) per billion GDP in Purchasing Power Standard. Design applications data is extracted from EU Intellectual Property Office (EUIPO), and GDP data is extracted from Eurostat.

Impacts

Employment Impacts

- ***Employment in knowledge-intensive activities (% of total employment):*** This indicator measures the number of employees in knowledge intensive activities in the total employment. Data source is Eurostat.

- ***Employment in fast-growing enterprises (% of total employment):*** Data indicates the number of employees in fast-growing enterprises in total employment for enterprises with 10 or more employees. It gives to what extent fast-growing enterprises are successful in innovativeness compared to all fast-growing business activities. It allows the understanding of the ability of a country to respond changes in order to benefit from emerging demand. Data source is Eurostat.

Sales Impacts

- ***Exports of medium and high technology products as a share of total product exports:*** This indicator measures the share of medium and high technology products' exports in total exports of a country. Data source is Eurostat (ComExt) for Member States, and UN ComTrade for non-EU countries.

- ***Knowledge-intensive services exports as % of total services exports:*** It signifies the share of knowledge intensive services' exports in total services exports of a country. Data source is Eurostat.

- ***Sales of new-to-market and new-to-firm innovations as % of turnover:*** This indicator signifies the share of total sales of new or significantly improved products in total turnover for all enterprises. Data source is Eurostat, Community Innovation Survey.

4.1. ANALYSIS

4.1.1. Purpose and scope of the study

The purpose of the study is to answer the question of the innovativeness level of SMEs in Turkey and differences of SMEs from large-scale companies in terms of innovation-related variables. Accordingly, it is also expected that the results of this study are expected to shed light for which innovation inputs SMEs are stronger.

On the country basis, it is a great necessity to make innovation management by conducting performance analysis. In order to measure innovation performance, various institutions like European Commission, OECD and World Bank work through to develop the most efficient system by using different methods.

4.1.1.1. Small and Medium Sized Enterprises

Since the economic systems,sectoral volumes, government policies and priorities of the countries where small and medium sized enterprises (SMEs) are located vary, there is no universal definition of SME in the literature. Having a certain definion of business types provides great convenience to build an effective policy determination and implementation towards improvement and supporting these businesses.

While the most common upper number is 250 employees designated for SME, some countries like United States, which considers SMEs as enterprises employing fewer than 500 people, define different limits (OECD, 2005:17).

The enterprise division of EU set out by European Commission in the document called "Commission Recommendation 2003/361/EC" paper (European Commission, 2003) defines different types of enterprises as stated below;

- Micro scale enterprises : Enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million.

- Small scale enterprises : Enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million.

- Medium scale enterprises : Enterprise which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.

In Turkey, with Law no 2005/9617 SMEs are defined as below (KOSGEB, 2005) ;

- Micro scale enterprises: The annual number of employees are less than 10 people, and annual turnover/balance sheet does not exceed 3 Million TL.

- Small scale enterprises : The annual number of employees are less than 50 people, and annual turnover/balance sheet does not exceed 25 Million TL.

- Medium scale enterprises: The annual number of employees are less than 250 people, and annual turnover/balance sheet does not exceed 125 Million TL.

SMEs constitute the main core of the economy both in the EU in Turkey, and they contribute economic development of countries as a result of their flexible manufaturing structures, easy adaptation of changing market conditions, creating employment opportunities (Salur, Demirci and Kesen, 2018:86).

Table 13 proves how effective SMEs are in the economies of Turkey and European countries. They hold a share 73.9 % of overall employment, while SMEs in EU hold share 66.5 %. Besides, in Turkey SME value added share is 53.9 % whilst average share of EU is 56.4 % (European Commission, 2019:).

Table 13 : SMEs distribution in Turkey and EU-28

Class Size	Number of enterprises			Number of persons employed			Value added		
	Turkey		EU-28	Turkey		EU-28	Turkey		EU-28
	Number	*Share*	*Share*	*Number*	*Share*	*Share*	*Million €*	*Share*	*Share*
Micro + Small	2810257	98.9 %	98.9 %	8362377	55.9 %	49.6 %	73182	32.8 %	38.1 %
Medium sized	26895	0.9 %	1.0 %	2694575	18.0 %	16.9 %	46952	21.1 %	18.1%
SMEs	2837152	99.8 %	99.8 %	11056952	73.9 %	66.5 %	120135	53.9 %	56.3 %
Large	5017	0.2 %	0.2 %	3895124	26.1 %	33.5 %	102676	46.1 %	43.8 %
Total	2842169	100.0 %	100.0 %	14952076	100.0%	100.0 %	222811	100.0 %	100.0 %

Due to the important contributions of SMEs to the economy, countries that are willing to obtain sustainable economic development, develop policies with the aim of creating an enviroment which facilitates their activities, and provide improvement of their structures.

In this study, two types of analysis are used. First one is the comparison of EIS innovation indicators on the country basis in order to understand if the SMEs in Turkey are strong or not in terms of innovativeness. However, in this section not only SME related indicators but also other innovation related indicators have been analyzed. Therefore, main output of this section is to understand Turkey's position towards the EU on the basis of innovation indicators and to deduce the strong and weak points of Turkey at the end including the SMEs. The results of the first analysis shed light to the statistical analysis of a sample of firms in Turkey by using selected variables of innovation.

4.1.2. Data Sources, Timeline and Samples

In the first part of the analysis EIS current performance data has been considered between years 2011 and 2018. Although EIS country rankings have been published since year 2003, the namings of the variables in consideration changed throughout the years. Recently, EU has been compiled the dataset for consideration under same namings which designated the main dataset in this study. Therefore data years between 2011 and 2018 constituted the timeline at focus.

The initial analysis rests on data obtained from the EIS, which is collected and analyzed by European Commission annually. It provides the opportunity to consider innovation performances comparatively. The data sources of EIS are European Statistical Office and other internationally recognized organizations as OECD, World Intellectual Property Office (WIPO), Scopus, Global Entrepreneurship Monitor (GEM), and National Statistical Offices (European Commission, 2019).

Each indicator under the framework is used in order to observe the Turkey's performance variation during years and performance benchmarking of Turkey and EU is evaluated. Same as the EIS method, if there is a missing data for a year; data of the previous year will be used. If there is no data available for an indicator, the indicator is not evaluated.

In the second part, sample firms are selected among the ones who have received KOSGEB’s various supports such as R&D and Innovation Support Programme, SME Technological Product Investment Support Programme, Strategic Product Support Programme, KOBIGEL – SME Development Support Programme, Entrepreneurship Development Support Programme, Industrial Application Support Programme in a mixed scale. The goal of this section is to analyze the relationship between indicators of innovative performance and firm size of those firms.

For the second part of the analysis, by using internet search, information about the firms’ profiles has been collected in order to understand their characteristics and attributes towards innovative activity. Selected firms are extracted from the KOSGEB’s monthly magazines which have been published since 2015. KOSGEB mentioned about 248 enterprises who had benefited from the various types of support programmes KOSGEB serves as of March 2020.

After using EIS analysis of all indicators, observing Turkey’s strengths and weaknesses in terms of innovation drivers would be possible. Therefore, this will enable to make interpretations, assumptions and even suggestions for Turkey on what kind of measures Turkey needs to take. After benchmarking the performances, second part of the analysis for futher examination on enterprises specific to Turkey is conducted to be able to understand the extent to which the firm size affects selected variables of innovation.

In the second part of the analysis after obtaining the detailed information from the websites of these firms, observations and work on understanding relationships among the variables by using the SPSS 20 software is made. Levene’s test is used to evaluate the equality of variances for the grouping variable which is selected as “firm size”. From the firm data this variable is calculated in a way that is compatible with the general firm size classification, where SMEs are the ones that is employing less than 250 staff and the “big sized” are the ones that are employing more than 250 persons. Accordingly, the null hypothesis is that the population variances from which the samples are drawn are equal. In here, if the resulting p-value is bigger than 0.05 it is concluded that the group variances are equal, and vice-versa. At the latter case, it is concluded that there is a difference between the population variances. It should also be noted that, in the light of collected data, firm size is chosen as a 'comparing variable' with the aim of understanding how effective firm size in innovativeness capability since it is found out from EIS data that SMEs in Turkey performs well in terms of innovation activities.

The followings are the variables selected to compare SMEs' innovative performance of Turkey with respect to EU.

Innovation Activities – Innovators;

- SMEs introducing product or process innovations as % of SME
- SMEs introducing marketing or organisational innovations as % of SME:
- SMEs innovating in-house as % of SMEs

4.1.2.1. Difference Analysis between SMEs and Large-Scale Companies

The following are the variables selected to analyze sample firms' innovative performances indirectly. The reason of selecting these variables in this study is that the level of data accessibility over the internet search is limited to these. It should be also pointed out that not all EIS innovation indicators can be reduced to firm level.

- **Technology Level:** Data has been used to measure the extent to which the firm size affect the technology level of a firm.

- **Design:** This variable indicates existence of design activies has been used as an indicator based on the firm size.

- **Export:** This variable signifies the presence of export activies. It has been used as an indicator based on the firm size.

- **Patent:** This variable underlines the presence of patent activies in a firm. Again this variable has been used as an indicator based on the firm size.

- **R&D:** This variable denotes the existence of R&D activies has been used as an indicator based on the firm size.

- **Establishment after supports:** Data has been used to measure the extent to which the support programmes encourage the establishment of small and medium sized enterprises. It is an indicator based on the firm size.

CHAPTER V

RESEARCH FINDINGS

In this first section of the analysis; benchmark results based on the indicators under EIS are presented in a way to compare EU mean performance and Turkey on selected variables.

5.1. FINDINGS RELATED TO EIS INDICATORS

5.1.1. Framework Conditions

5.1.1.1. Human Resources

- ***New doctorate graduates per 1000 population aged 25-34:***
  According to Table 14, in Turkey, there is no noticeable change in the performance during the reference period. Turkey's performance on new doctorate graduates has just increased by 19% over seven years while the EU's improvement is 40%. For all years from 2011 to 2018, Turkey performed below the EU.

- ***Percentage population aged 25-34 having completed tertiary education:***
  Due to there is no data available until 2014 for Turkey and EU, the data collected in 2014 is also used for previous years. There is a performance improvement from 2014 to 2018 for both Turkey and EU, and it can obviously be observed that Turkey's performance is relatively weak with respect to EU (Table 14).
- ***Percentage population aged 25-64 involved in lifelong learning:***
  Due to the fact that there is no data available for 2017 and 2018, the same data of 2016 is used for these years. While the participation in lifelong learning

activities rate of the population aged 25-64 in Turkey is nearly 6%, it is almost 11% in the EU. During all years, there has been no remarkable change in both countries and Turkey performs well below the EU (Table 14).

5.1.1.2. Attractive Research Systems

- ***International scientific co-publications per million population:***
  Turkey's performance in producing scientific publications is quite low at approximately 90% with respect to the EU, even though there is a slight increase from 2011 to 2018 (Table 14).

- ***Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country:***
  Due to there is no data available for both Turkey and EU in 2017 and 2018, data from 2016 is used for these years. 5% of the scientific publications in Turkey are among the top-10% most cited publications worldwide, while the same indicator is about 11,5% in the EU (Table 14) .

- ***Foreign doctorate students as a % of all doctorate students***:
  Due to there is no data available for both Turkey and EU in 2018, data of 2017 is repeatedly used for the year 2018. There has been a continuous increase of Turkey's performance from 2011 to 2016. However, the average share of foreign doctorate students is quite low with respect to the EU's (Table 14).

5.1.1.3. Innovation-friendly environment

- ***Broadband penetration:***
  Due to there is no data available for both Turkey and EU until 2014, and additionally 2015 data is missing for Turkey, the same data has been used for previous years. Turkey's performance in broadband penetration is better than the EU in the years between 2015 and 2017. In 2018, the EU has been able to reach the performance of Turkey (Table 14).

- ***Opportunity-driven entrepreneurship (Motivational index):***

  The rate of opportunity driven entrepreneurship is relatively low in Turkey compared to the EU. The performance of Turkey has increased by 20% since 2011, while this rate has been 38% in the EU. As a result, performance difference has increased (Table 14).

Table 14 : Framework Conditions Indicators

		2011	2012	2013	2014	2015	2016	2017	2018
Human Resources									
New doctorate graduates per 1000 population aged 25-34	EU	1,50	1,80	1,95	1,94	2,01	2,09	2,09	2,09
	TR	0,40	0,40	0,40	0,35	0,41	0,48	0,48	0,48
Percentage population aged 25-34 having completed tertiary education	EU	37,20	37,20	37,20	37,20	37,90	38,20	39,00	39,80
	TR	23,80	23,80	23,80	23,80	26,50	29,40	30,50	31,80
Percentage population aged 25-64 involved in lifelong learning	EU	10,70	10,70	10,70	10,80	10,70	10,80	10,90	10,90
	TR	5,70	5,70	5,70	5,70	5,50	5,80	5,80	5,80
Attractive Research Systems									
International scientific co-publications per million population:	EU	757,55	821,97	875,07	933,29	969,58	1016,55	1051,12	1070,39
	TR	76,42	88,70	95,98	97,76	106,36	119,01	118,88	120,94
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	EU	10,93	11,10	11,21	11,23	11,32	11,46	11,46	11,46
	TR	5,08	4,72	4,42	4,72	4,69	5,08	5,08	5,08
Foreign doctorate students as a % of all doctorate students	EU	21,2	21,9	19,2	19,0	20,1	21,0	20,3	20,3
	TR	3,2	3,8	4,5	5,0	6,5	7,4	7,0	7,0
Innovation-friendly environment									
Broadband penetration	EU	9,0	9,0	9,0	9,0	10,0	12,0	16,0	18,0
	TR	14,0	14,0	14,0	14,0	14,0	15,0	17,0	18,0
Opportunity-driven entrepreneurship (Motivational index)	EU	2,6	2,6	2,5	2,5	2,6	3,0	3,4	3,6
	TR	1,5	1,5	1,7	1,8	1,8	1,9	1,9	1,8

5.1.2. Investments

5.1.2.1. Finance and Support

- ***R&D expenditure in the public sector (% of GDP):***
  The average R&D intensity of Turkey and EU have decreased from 2011 to 2018. Even though EU's performance is higher compared to Turkey, performance of Turkey has remained quite close to EU's performance during seven years (Table 15).

- ***Venture capital (% of GDP):***There is no data available for Turkey.

5.1.2.2. Firm Investments

- ***R&D expenditure in the business sector (% of GDP) :***
  Due to there is no data available for both Turkey and EU in 2018, data from 2017 is used for the year 2018. Unlike R&D expenditure by the public sector, Turkey has a tendency to increase its R&D expenditure by business sector from 2011 to 2017. However, Turkey still performs well below the EU in terms of average R&D intensity in the business sector (Table 15).

- ***Non-R&D innovation expenditures (% of turnover):***
  Due to the fact that data for Turkey is only available for the years 2013 and 2014, same data of last updated year is used for missing years. Turkey's performance is quite higher than EU at 2,7% in terms of enterprises' total turnover is spent on non-R&D innovation activities while the EU has just 0,86% (Table 15).

- ***Enterprises providing training to develop or upgrade ICT skills of their personnel:***
  Turkey performs slightly below the EU in the number of enterprises creating opportunities for their employees to improve ICT skills. The EU has shown an

increase of about 21% during seven years while Turkey's performance stood in a stagnent position (Table 15).

Table 15 : Investment Indicators

		2011	2012	2013	2014	2015	2016	2017	2018
Finance and Support									
R&D expenditure in the public sector (% of GDP)	EU	0,71	0,72	0,72	0,71	0,71	0,69	0,68	0,68
	TR	0,45	0,46	0,43	0,43	0,44	0,43	0,41	0,41
Firm Investments									
R&D expenditure in the business sector (% of GDP)	EU	1,24	1,27	1,28	1,30	1,31	1,33	1,36	1,36
	TR	0,35	0,38	0,39	0,43	0,44	0,51	0,55	0,55
Non-R&D innovation expenditures (% of turnover)	EU	0,57	0,69	0,69	0,76	0,76	0,86	0,86	0,86
	TR	2,59	2,59	2,59	2,70	2,70	2,70	2,70	2,70
Enterprises providing training to develop or upgrade ICT skills of their personnel	EU	19,0	19,0	19,0	20,0	21,0	22,0	21,0	23,0
	TR	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0

5.1.3. Innovation Activities

5.1.3.1. Innovators

- ***SMEs introducing product or process innovations as % of SMEs:***
  For this indicator, 2016 data is used for the last two years due to there is no data available for Turkey and EU in 2017 - 2018. Compared to the previous years, the performance level of Turkey and EU has reversed after 2013 because of the fact that Turkey's improvement level is higher than the EU. Improvement rate of Turkey is 28% while this rate is just 2% in the EU. Here, Turkey performs much higher than the EU (Table 16).

- ***SMEs introducing marketing or organisational innovations as % of SMEs:***
  For the years of 2017 and 2018, due to there is no data available for both Turkey and EU, data from 2016 is used for the last two years. In Turkey, more than 50% of SMEs have introduced a new marketing or organizational innovation

in 2016. During five years, values in Turkey are fluctuating but considering the result, performance in Turkey has strongly increased in this indicator. Unlike Turkey, the EU has shown a decrease in values of this indicator from 2011 to 2016. In 2016, the EU's performance is about 42% lower than Turkey (Table 16).

- ***SMEs innovating in-house as % of SMEs:***
  For the years of 2017 and 2018, due to there is no data available for both Turkey and EU, data from 2016 are used for the last two years. In Turkey, more than 40% of SMEs innovating in-house whereas this share is just 28,1% in the EU. Turkey’s performance has strongly increased at the rate of 55% compared to the year 2011. Unlike Turkey, the EU has shown a decrease by 12% from 2011 to 2016.

  It must be pointed out that, while Turkey’s performance was below the EU in 2011, performance values became reversed in the year 2016 (Table 16).

5.1.3.2. Linkages

- ***Innovative SMEs collaborating with others (% of SMEs):***
  For the years of 2017 and 2018, due to there is no data available for both Turkey and EU, data from 2016 are used for the last two years. Even though Turkey's performance has shown a decrease for the next two years after 2011, performance has been recovered in the year 2014 and has increased the performance by 250% after 2015. On the other hand, the performance of EU has steadily increased from 2011 to 2016. The gap between Turkey and the EU is considerably high during 2012 - 2016. Overall, Turkey’s performance slightly reached the performance of EU in 2016 (Table 16).

- ***Public-private co-publications per million population:***
  It is obviously seen that there is a significant difference between EU and Turkey, with more than 81 public-private scientific co-publications per million

population in EU. According to the Table 30, score is less than 9 public-private scientific co-publications per million population in Turkey (Table 16).

- ***Private co-funding of public R&D expenditures (percentage of GDP):***
  Due to the no data availability in 2017 and 2018 for Turkey and EU, data of 2016 are used for the last 2 years. Turkey's highest performance is in 2015 at 0,0067% but there is a decline in 2016. On the other hand, the EU also had a decline after 2014. For all years, Turkey has performed below the EU (Table 16).

5.1.3.3. Intellectual Assets

- ***PCT patent applications per billion GDP (in PPS):***
  In Turkey, applications for PCT patents per billion GDP is 0,67, while it is 3,53 in the EU. Turkey performs well below the EU for seven years. For both Turkey and EU, there is no noticable change in performance during 2011 to 2016 (Table 16).

- ***Trademark applications per billion GDP (in PPS):***
  For both Turkey and EU, there is no noticable change in performance during 2011 to 2018 and Turkey performs well below the EU during these years (Table 16).

- ***Design applications per billion GDP (in PPS):***
  Turkey's performance in design applications is quite lower than the EU. From 2011 to 2018, the decrease in the number of design applications in Turkey is almost the half. The EU's performance has also decreased by 7 % during these years but it is still higher than Turkey at the rate of 97% (Table 16).

Table 16 : Innovation Activities Indicators

		2011	2012	2013	2014	2015	2016	2017	2018
Innovators									
SMEs introducing product or process innovations as % of SMEs	EU	33,5	30,6	30,6	30,9	30,9	34,3	34,3	34,3
	TR	32,5	24,0	24,0	31,5	31,5	41,7	41,7	41,7
SMEs introducing marketing or organisational innovations as % of SMEs	EU	39,8	36,2	36,2	34,9	34,9	35,6	35,6	35,6
	TR	42,0	43,2	43,2	40,5	40,5	50,4	50,4	50,4
SMEs innovating in-house as % of SMEs	EU	31,6	28,7	28,7	28,8	28,8	28,1	28,1	28,1
	TR	26,4	22,5	22,5	22,5	22,5	41,0	41,0	41,0
Linkages									
Innovative SMEs collaborating with others (% of SMEs)	EU	8,9	10,3	10,3	11,2	11,2	11,8	11,8	11,8
	TR	6,2	4,2	4,2	6,3	6,3	10,5	10,5	10,5
Public-private co-publications per million population	EU	70,0	76,2	77,1	79,3	80,3	82,8	83,3	81,7
	TR	4,5	5,0	5,8	6,2	6,7	8,0	8,4	8,6
Private co-funding of public R&D expenditures (percentage of GDP)	EU	0,0510	0,0515	0,0516	0,0519	0,0494	0,0493	0,0493	0,0493
	TR	0,0050	0,0055	0,0045	0,0058	0,0067	0,0060	0,0060	0,0060
Intellectual Assets									
PCT patent applications per billion GDP (in PPS)	EU	3,86	3,75	3,79	3,70	3,55	3,53	3,53	3,53
	TR	0,46	0,57	0,61	0,69	0,71	0,67	0,67	0,67
Trademark applications per billion GDP (in PPS)	EU	6,9	7,2	7,4	7,5	7,4	7,5	7,8	7,9
	TR	1,14	1,19	1,33	1,43	1,35	1,25	1,25	1,27
Design applications per billion GDP (in PPS)	EU	4,52	4,54	4,57	4,53	4,34	4,32	4,42	4,17
	TR	0,23	0,21	0,22	0,27	0,21	0,13	0,11	0,11

5.1.4. Impacts

5.1.4.1. Employment Impacts

- ***Employment in knowledge-intensive activities (% of total employment):*** Due to there is no data available for both EU and Turkey in 2018, data from 2017 is used repeatedly. In Turkey, the share of employment in knowledge intensive activities is 6,7% while this share is 14,2% in the EU. The performance of Turkey has improved from 2011 to 2017 but it is quite below the EU for all years (Table 17).

- ***Employment in fast-growing enterprises (% of total employment):*** There is no data available for Turkey.

5.1.4.2. Sales Impacts

- ***Exports of medium and high technology products as a share of total product exports:***
  Both Turkey and the EU have no considerable change from 2011 to 2018. The performance of Turkey is around 50% lower than the EU for all years (Table 17).

- ***Knowledge-intensive services exports as % of total services exports:***
  In Turkey, 37,4% of total services exports are knowledge intensive while this share is 68,4% in the EU. Turkey's performance has increased by 43% from 2011 to 2018 while the EU's performance has increased by 1% during the same period. However, the EU's performance is quite higher than Turkey (Table 17).

- ***Sales of new-to-market and new-to-firm innovations as % of turnover:***
  Due to there is no data of EU and Turkey available for the years 2017 and 2018, data from 2016 is used for these years. Turkey's performance has significantly changed from 2011 to 2016. In 2011, While Turkey's average sales share of new-to-market and new-to-firm innovations was 33,6% , it has decreased to 10,5% in 2016. This means there has been a decline by 68%. For the EU, there is no noticeable change in the performance from 2011 to 2016, but at the end of investigated years EU's performance is higher than Turkey's (Table 17).

Table 17 : Impacts Indicators

		2011	2012	2013	2014	2015	2016	2017	2018
Employment Impacts									
Employment in knowledge-intensive activities (% of total employment)	EU	13,7	13,8	13,9	13,9	14,1	14,2	14,2	14,2
	TR	5,7	5,7	5,7	5,7	6,2	6,6	6,7	6,7
Sales Impact									
Exports of medium and high technology products as a share of total product exports	EU	53,6	53,5	53,1	54,3	56,2	57,1	56,7	56,3
	TR	37,7	34,1	36,7	36,6	36,3	37,5	39,3	39,3
Knowledge-intensive services exports as % of total services exports	EU	67,2	67,8	67,4	68,3	68,8	68,7	68,4	68,4
	TR	26,0	27,0	29,0	30,3	30,9	32,2	37,4	37,4
Sales of new-to-market and new-to-firm innovations as % of turnover	EU	13,4	12,3	12,3	13,4	13,4	13,0	13,0	13,0
	TR	33,6	33,6	33,6	10,5	10,5	10,5	10,5	10,5

After examination of EIS data, it seems that variables related to SME innovativeness are the most important, fast-moving, dynamic and supportive tool of Turkey. Especially, for development of innovative capacity among all designated indicators, Turkey's performance is quite high with respect to the EU in this segment. Therefore, it is deduced to make a detailed examination on related variables to understand Turkish SMEs' profile and to analyse the degree to which they are able to affect innovative performance of Turkey.

In the second part of the analysis, beginning by general profiles of the 248 sample firms test results are evaulated in a way to understand how the variables differ according to firm scale.

5.1.5. Firm-based analysis' findings

5.1.5.1. Firm Profiles

At first, industry distribution of 248 firms is analysed. Those 248 firms are operating in 14 different industries. Firms operating in machinery and electronics industries hold the biggest share with a percentage of 18.55 and least common industries are mining and furniture with the rate of 0.81 %. Distribution chart is shown in Figure 8.

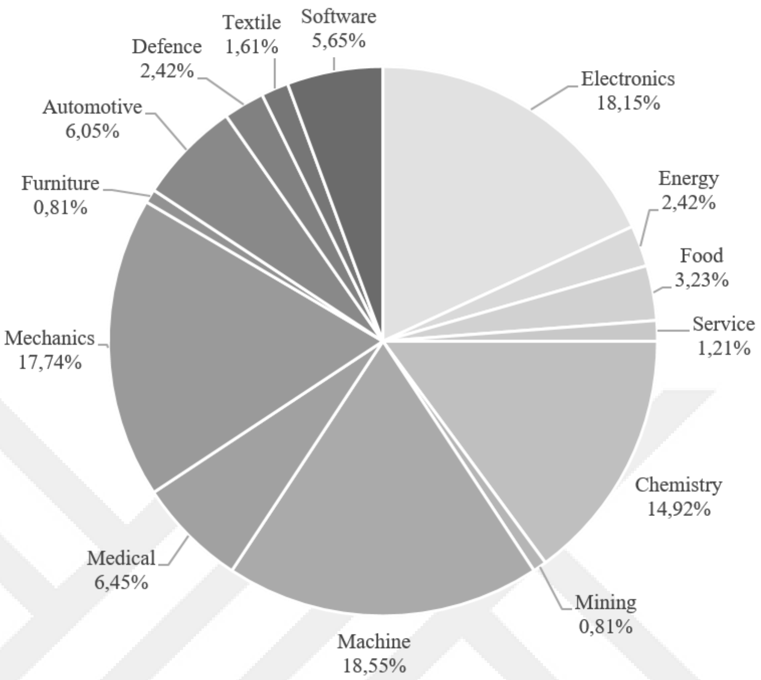

Figure 8 : Firm Industiral Distribution

The number of employees varies from 3 to 2000 among all 248 firms. The oldest firm was established in 1950 and the youngest firm was established in 2018. Average firm age is around 20 years (Table 18).

Table 18 : Various Firm Descriptives

	N	**Minimum**	**Maximum**	**Mean**	**Std. Dev.**
Number of employees	248	3	2000	83,37	144,594
Establishment date	214	1950	2018	1999,09	15,511
FirmAge	214	2	70	20,91	15,511

The ownership status of 89 firms are sole proprietorship, 134 of them are partnerships, and for 25 of them there is no data available about the ownership status (Table 19).

Table 19 : Firm Ownership Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Sole	89	35,9	39,9	39,9
	Partnerhsip	134	54,0	60,1	100,0
	Total	223	89,9	100,0	
Missing	99	25	10,1		
Total		248	100,0		

Among the firms in question, 74,20 % of those are categorized as Small and Medium Enterprises whose number of workers are less than 250 and 25.80 % of those are large scale firms (Table 20).

Table 20 : Firm Scale

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	**Small**	184	74,2	74,2	74,2
	Other	64	25,8	25,8	100,0
Total		248	100,0	100,0	

In terms of having a production facility or being a service provider, it observed that 93.15% of those 248 firms are processing the production facility and performing manufacturing activities, while the others are just service providers. 98.80 % of those firms have operations both in Ankara and countrywide as having branch, sales offices, production facilities etc (Table 21).

Table 21 : Firms Branch Activiy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ankara Oth.	245	98,8	100,0	100,0
Missing	99	3	1,2		
Total		248	100,0		

80.20 % of those 248 firms are located in Organized Industrial Zone (OIZ) and the rest 19.80 % of those are located in Technoparks (Table 22).

Table 22 : Firm Location

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	TDZ.	49	19,8	19,8	19,8
	OIZ	199	80,2	80,2	100,0
Total		248	100,0	100,0	

Based on the field of operation and the characteristics of goods and services produced, technology levels are determined. As it can be seen in Figure 9, 60.89 % of those firms are producing with medium high technology, 18.15 % of high technology, 12.10 % of medium low technology and 8.87 % of low technology.

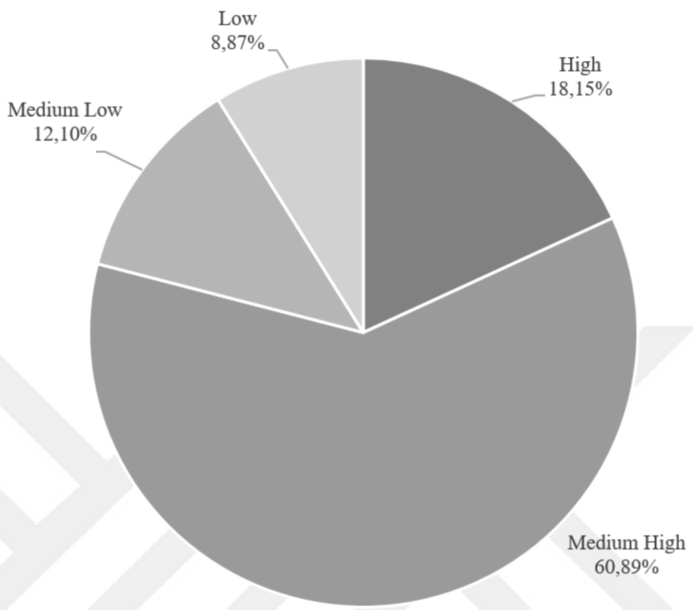

Figure 9 : Firm Technology Level

Among the 248 firms under consideration, the rate of having R&D activity is 92.70% which is quite higher than the absence of R&D activities. This proves that almost all firms are aware of the importance of R&D activities (Table 23).

Table 23 : Firm R&D Activity

		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	None	18	7,3	7,3	7,3
	Yes	230	92,7	92,7	100,0
Total		248	100,0	100,0	

From those 248 firms, 71.40% of them make and use their own design capability in production (Table 24).

All 177 firms with their own designs are also R&D performers at the same time. Here, it might be assumed that having R&D capability drives firms for being creative in production and creating their unique design (see Appendix 1).

Table 24: Firm Design Activity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	71	28,6	28,6	28,6
	Yes	177	71,4	71,4	100,0
Total		248	100,0	100,0	

Out of the 248 firms, only 10.10% of them have patented products, while 89.90% of them are not patent holders (Table 25). Those 25 firms that are patent holders also have design capability. This might be considered as a hint that having design talent set the stage for patent applications (see Appendix 1).

Table 25: Firm Patent Ownership

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	223	89,9	89,9	89,9
	Yes	25	10,1	10,1	100,0
Total		248	100,0	100,0	

Firms with export activities hold a higher rate with 56.00% with regard to firms only operating in local markets (Table 26). As an additional information, most of the firms, which are categorized in the high technology and medium high technology segment, are involved in export activities and their number adds up to 120 out of 196. From the medium low and low technology segment, only 19 firms out of 52 are involved in export activities (see Appendix 1).

Table 26: Firm Export Activity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	109	44,0	44,0	44,0
	Yes	139	56,0	56,0	100,0
Total		248	100,0	100,0	

Due to the fact that innovation is perceived as highly related with R&D and design activities, patent ownership, and export activity, it has been investigated whether firm size creates a difference on some of the activities related to innovation.

In order to do this, the sample of the firms that are involved is mainly selected as the ones who had been involved in R&D and Innovation Support Programme

5.1.5.2. Independent Sample T-Test Results

Table 27: Levene's Test for Equality of Variances (Variances Assımed)

	F	Sig
R&D	009,659	0,002
Est.After Support	088,182	0,000
Design	058,749	0,000
Patent	005,750	0,017
Export	204,142	0,000
Tech. Level	001,071	0,302

Test results reveal that, with respect to firm size, there is a statistically significant difference among firms in terms of R&D, design, patent and export capability while technology level is not affected by firm size (Table 27) .

As is the case with the results in Table 27, R&D capability indicates a significant difference at the 0.002 level of significance ($p<0,05$). 91% of 184 SMEs (168 out of 184) have R&D effort while larger size firms which is categorized as ‘other’ also seem quite active in R&D, as 97% of them have R&D activities in their facilities (Table 28).

Table 28: Group Statistics for R&D

		N	Mean	Std. Deviation	Std. Err. Mean
R&D	Small	184	0,91	0,283	0,021
	Other	64	0,97	0,175	0,022

Therefore, since the focus of this thesis is mostly on observing SMEs innovation performance, and collected data proves that most of SMEs play a dynamic role in R&D, the importance of support programs cannot be underestimated. Due to the fact that performing R&D activities requires financial resources, subisidies provided by external channels has an extreme importance to encourage small firms who are willing to carry out R&D but have limited financial opportunity.

Moreover, as the data indicates, the number of firms benefited from "R&D and Innovation Support Programme" is 106 out of 248 enterprises. That number corresponds to 42.74% of total. 56 of those 106 enterprises have benefited from the "Industrial Application Support Programme" at the same time. It can be can considered that right after those 56 enterprises came up with a product, they moved to the serial production stage with the help of related support programs provided by KOSGEB (see Appendix 1).

As is the case with the results in Table 27, establisment after support indicates a significant difference at the 0.000 level of significance ($p<0,05$). 23% of 184 SMEs (43 out of 184) have benefited from "R&D and Innovation Support Programme" provided by KOSGEB, while this rate is 3% for larger firms (Table 29).

Table 29: Group Statictics for Establisment After Support

		N	Mean	Std. Deviation	Std. Err. Mean
Est.After Support	Small	184	0,23	0,421	0,031
	Other	64	0,03	0,175	0,022

Overall, 44 of those 248 firms corresponding 17% were established right after KOSGEB announced the 'R&D and Innovation Support Programme' in 2010. This allows us to make an interpretation that support programs encourage SMEs to enter into business.

Therefore, it can be deduced that although firm size creates a significant difference in R&D capabilities of the firms, it can also be deduced that small firms are closely as capable as larger firms in terms of R&D. This also underlines the fact that R&D supports mainly serves to small firms.

Rather like R&D, there is also a significant difference between the firm size and design activities of firms. As shown in Table 27 design capability indicates significant difference at the 0.000 level of significance ($p<0,05$) with respect to firm size. 66% of 184 SMEs (122 out of 184) carry out design process while 86% of larger firms (55 out of 64) make their own design (Table 30).

Table 30: Group Statistics for Design Activity

		N	Mean	Std. Deviation	Std. Err. Mean
Design	Small	184	0,66	0,474	0,035
	Other	64	0,86	0,350	0,044

This data might show that larger firms attach more importance for improving their design capability, and allocate resources accordingly and are thus more prone to proceed design activities than SMEs.

Design capability can be perceived as an integral part of R&D activity, and mostly it can be interpreted that if a firm does not have any R&D activity, design activity might not exist as well. Data of sample firms is consistent with this result (see Appendix 1). Therefore, it might be supposed that R&D effort leads creativity and design capability from the findings.

Design activity can be considered much more complex than R&D and requires time, money, effort, and even professional expertise. From the findings, since larger firms are more active in design activity, it might be deduced that larger firms might have more opportunity to allocate resources for design activities.

As shown in Table 27 patent ownership indicates a significant difference at the 0.017 level of significance ($p<0,05$) in relation to firm size. 9% of 184 SMEs (16 out of 184) , and 14% of 64 (9 out of 64) larger firms are patent holders (Table 31).

Table 31: Group Statistics for Patent Ownership

		N	Mean	Std. Deviation	Std. Err. Mean
Patent	Small	184	0,09	0,283	0,021
	Other	64	0,14	0,350	0,044

Even the performance of larger firms is better than small and medium sized firms, general performance in patent activity seems quite weak overall. Here it should be noted that EIS data also verified the weakness of Turkish firms in terms of patent applications.

In the data of sample firms (see Appendix 1), total number of patent holders (25 firms) make their own designs at the same time. Therefore, it can be suggested that design is an important driver for being a patent holder. The essential point here again comes to the crucial role of financial support.

As shown in Table 27 export behavior indicates a significant difference at the 0.000 level of significance (<0,05) in relation to firm size. According to the results, 45% (85 out of 184) of SMEs have export propensity while this rate is 88% (55 out of 64) for larger firms. Findings show that the larger the firm size, the more likely to carry our export activities (Table 32).

Table 32: Group Statistics for Export Activity

		N	**Mean**	**Std. Deviation**	**Std. Err. Mean**
Export	Small	184	0,45	0,499	0,037
	Other	64	0,88	0,333	0,042

Since internationalization requires resources in many ways like financial, personnel, training etc., the main reason for higher export capability of larger firms might lie under these scarce resource problems of smaller size firms.

Data of sample firms is consistent with this view that most of the exporting small firms produce high and medium-high technology based products (77 out of 85) (see Appendix 1).

Meanwhile, findings possess that technology level is not associated with the size of the firm. As shown in the Table 48 technology level does not indicate difference at the 0.302 level of significance (p>0,05) in relation to firm size. This underlines the fact that regardless the size of the firm; smaller firms might produce advanced technology in their production processes. 78% of 184 SMEs and 81% of 64 larger firms perform higher level technologies (Table 33).

Table 33: Group Statistics for Technology Level

		N	Mean	Std. Deviation	Std. Err. Mean
Tech.Level	Small	184	0,78	0,414	0,030
	Other	64	0,81	0,393	0,049

It can be assumed that due to the common characteristics of smaller firms are more entrepreneurial oriented, flexible to adapt new technologies, prone to innovations, quick responsiveness to change, they have advantages to obtain technological advancements in their business activities.

CHAPTER VI

CONCLUSION

Prior studies have noted the important role of having innovation capability with the interaction of R&D, design, patent, export patterns of firms. Many studies also proved R&D activity is one of the most effective drivers of innovation, and countries benefit from the advantages of being innovative by absorbing the positive effects of increasing export activity. Lastly, patents are considered as the most visible output of innovative activity in the literature.

In this research, the aim was to assess whether firm size differs in terms of innovation capability and the extent to which support programmes encourage firms' innovative activities. The reason for selecting the SME context is that, after comparison of Turkey's performance with EU's performance by examining the EIS data, it has been observed that Turkey performs well in the "Innovators" segment under the title of "Innovation Activities" in the study of European Commission.

From this point of view, 248 firm profiles have been observed from the monthly magazines of KOSGEB, and descriptive and innovation related information is collected being as; the number of employees, firm age, foundation year, field of activity, technological level, ownerships structure, branch existence, location (OIZ or TDZ), the existence of R&D, design, patent and export activities.

Following to this, the differences between firms based on scale in terms of innovation related performance like R&D, design, patent and export behavior have been examined in a way to distinguish small-medium and big sized firms, the former constituting the backbone of Turkish economy. The "firm size" concept is approached by using "number of employee" data of all those firms. By using the Levene's Test for Equality of Variances, an analysis has been conducted by choosing -R&D, Design, Export, Patent, and Establishment after support- as independent variables, and -firm size- as comparing variable.

An implication of the findings is that there are statistically significant differences among firms in terms of R&D, design, patent and export capability while technology level is not affected by firm size. According to the analysis results, it has also been observed that KOSGEB's "R&D and Innovation Support Programme" which is intended for stimulating R&D activities of enterprises has contributed SMEs more than larger firms.

The results suggest that SMEs are able to produce technology based products, and even if the intensity of R&D and design activity is lower than larger firms, they seem that they have remarkable effort in R&D and design activities. These results, indicate that firm size should not be considered a major barrier in undertaking R&D and design activity. Yet, they relatively have poor performance in export and patent activities with respect to larger firms.

There might be several possible explanations of the findings. Since R&D, design, export and patent attempts require a fair amount of financial resource, lack of financial resources might be a drawback of small firms. SMEs might be considered as much more vulnerable than larger firms to access required resources and handle with such barriers due to their sizes, which restrain their development.

Summary of common variables of EIS indicators and selected variables of firm based analysis is shown in Table 34. It clearly indicates that Turkey's worst part with respect to EU is design performance. Patent and export performance follows design performance respectively.

Table 34: Summary of Common Variables

	SAMPLE FIRMS	**TURKEY'S PERFORMANCE WITH RESPECT TO EU**
Design	71% of 248 sample firms are dealing with design activities 66% of SMEs 86% of Larger firms	97% lower
Export	56% of 248 sample firms have export propensity 45% of SMEs 88% of Larger firms	30% lower
Patent	10% of 248 sample firms are patent holder %9 of SMEs %14 of Larger firms	81% lower

While the variables selected for firm based analysis are more than just design, export and patent, due to there is no direct comparison data in EIS analysis regarding to other variables of Levene's Test ; R&D, Technology Level, Establishment After Support , just common ones are summarized and compared in this table.

Our intepretations seem consistent with earlier studies. Özden and Reyhanoğlu (2004) found a positive relationship between the size of the firm and innovation activities in their research. They attributed this to their access to capital and information, qualified employees, and resources arising from cooperation. Napier, Serger and Hansson (2004:67) suggested that the lack of financial source is the main barrier of smaller firms and the sensitivity of firms to cash needs increases as firm size gets smaller. Likewise, Beck, Demirguc, Maksimovic (2005) underlined the effect of financial and political constraints at the firm level, and observed that small firms are much more damaged than larger firms in terms of access to financial resources and this negatively affects their development. Veugelers (2008) asserted that the smaller firms are more likely to suffer from lack of financial resources which is accepted as an important driver of R&D context, and to enter global markets due to the high costs. Moen (1999) suggested that as much as the larger firms, small firms with the advantage of competitive product and technology might show a great success in international markets. Calof (1994) proposed that even if there is a relation between firm size and export behavior, and smaller firms have some disadvantages in terms of international knowledge, managerial attitudes, hiring international personnel and taking some risks. In this context, smaller firms still might be successful on export performance due to small organizations have some advantages in terms of having easier adaptation to new strategies as long as they are assisted by external bodies. The study carried out by Guan and Ma (2003), was based on a sample of 213 Chinese industrial firms, proved that firm size and export propensity is highly correlated with each other, which is also stated because of the fact that the high cost of entry barriers to international markets, smaller firms prefer home market over international markets. In the paper studied by Lanjouw and Schankerman (2004), based on collected information from patent office of United States during the period 1978-1999, they concluded that smalller firms face greater difficulties to protect their intellectual property than larger firms due to the high costs of patent enforcement resulting from legal practices. World Bank (2011) proposed a similar conclusion that SMEs are constrained to access resources in order to invest in R&D, product development, design and other enhancements for upgrading their businesses.

This is where the superior role of government subisidies comes into play. Financial support programmes not only have a positive direct impact on innovation performance, but also encourages new start ups to enter into the market with unexpressed innovative ideas. Veugelers (2008) emphasized the importance of channeling subsidies towards smaller firms to eliminate the obstacles that small firms encounter in the way of R&D. Branstetter and Sakakibara (1998) found out that firms located in Israel and Japan, benefiting from the government subsidies achieved higher levels of performance in innovation spillovers.

In general sense, the most important limitation that should be mentioned in this study is that, the data sources in this field are very dispersed and limited. Although innovation measurement systems are greatly useful in seeing the cross effects of variables, within the context of Turkey, Turkey's performance stays slightly behind the EU mean in data collection and dissemination. Even the EIS data that we relied on, stated that the data availability of Turkey is around 66% while most of the countries range around 75% and above (European Commission,2019:14). Since EIS analysis is based on the annual data of countries, it allows to make comparisons between countries. Therefore, another inadequacy of using EIS is that the underlying reasons of weak or strong performances , meaning causality interpretions can not be made.

Additionally, initial intention of this study was to analyse more than 248 firms that we investigated on and obtaining more reliable information directly from the firms themselves and from KOSGEB. However, since this initiative fall flat, we had to proceed with the maximum information we could obtain through the websites of the firms and the magazines published by KOSGEB every month. Another limitation is due to the sector-based differences of the firms included in the analysis. Since they are operating in different industries where technology levels vary as an example, the effect of the external environment on the innovation is omitted in the study.

Despite all limitations this study contributes to the innovation literature by enhancing our understanding of the relationship between policy instruments and innovation performance of SMEs in Turkey. It is obvious that EU's method of innovation performance measurement in the country level has a paramount importance, yet this study made a different contribution to the literature by reducing the EIS study from the country basis to the firm level.

REFERENCES

- Acar, S. (2008). Ulusal teknoloji politikalarındaki yeni gelişmeler ışığında Türkiye'nin teknoloji politikasının bir değerlendirmesi(Doctoral dissertation, DEÜ Sosyal Bilimleri Enstitüsü).
- Acs, Z., D. Audretsch, M. Feldman. (1991). Real effects of academic research: comment, American Economic Review 81, 363-367.
- Acs, Z. J., & Audretsch, D. B. (1989). Patents as a measure of innovative activity. Kyklos, 42(2), 171-180.
- Ak, M. Z., & Gülmez, A. (2004). Atıf indekslerine göre Türkiye'nin bilimsel yayın performansının analizi: 1980-2003. İçinde Torlak, Ö.(ed.), 3.
- Alkibay, S., Orhaner, E., Korkmaz, S., & Sertoğlu, A. (2012). Üniversite Sanayi İşbirliği Çerçevesinde Teknoparklar. Yönetimsel Sorunları Ve Çözüm Önerileri, Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi, 26(2), 65-90.
- Atalay, M., Anafarta, N., & Sarvan, F. (2013). The relationship between innovation and firm performance: An empirical evidence from Turkish automotive supplier industry. Procedia-social and behavioral sciences, 75(3), 226-235.
- Atkinson, R. D. (2013). Competitiveness, innovation and productivity. The Information Technology & Innovation Foundation.–August, 2-7.
- Ayar, B., & Erdil, T. S. (2018) İNOVASYON VE AR-GE FAALİYETLERİNİN İHRACAT PERFORMANSINA ETKİSİ: TÜRK İŞLETMELERİ ÜZERİNE ALGISAL BİR ARAŞTIRMA. Öneri Dergisi, 13(49), 45-68.
- Ayhan, A. (2002). *Dünden bugüne Türkiye'de bilim-teknoloji ve geleceğin teknolojileri*. Güriş Holding.
- Babacan, M. (1995). Dünyada ve Türkiye'de Teknoparklar. İzmir: Dokuz Eylül Yayınevi.

- Barca, M., Döven, S., Taşkın, K. (2006) Uluslararası Pazarlarda Türk Gıda Sektörünün Rekabet Gücü Ve ihracatta Aranan Kriterler / Karşılaşılan Engeller, İstanbul, İstanbul Ticaret Odası projesi.
- Baykara, T. (2006). 21. yüzyılda teknoloji, teknoloji yönetimi ve gelecek. Tübitak Marmara Araştırma Merkezi.
- Bayraktutan, Y., & BIDIRDI, H. (2015). Türkiye'de Teknolojiye Dair Politika Perspektifi ve Kalkınma Planları. Kocaeli Üniversitesi Sosyal Bilimler Dergisi, (29), 37-55.
- Beck, T., Demirgüç-Kunt, A. S. L. I., & Maksimovic, V. (2005). Financial and legal constraints to growth: does firm size matter?. The journal of finance, 60(1), 137-177.
- Bhasin, K. (2012). This is the difference between invention and innovation. Business insider. Available at : https://www.businessinsider.com/this-is-the-difference-between-invention-and-innovation-2012-4
- Bilbao-Osorio, B., & Rodríguez-Pose, A. (2004). From R&D to innovation and economic growth in the EU. *Growth and Change*, *35*(4), 434-455.
- Bor, J.Y., Chuang Y.C., Lai, W.W., Yang, M.C. (2012). OECD A dynamic general equilibrium model for public R&D investment in Taiwan. Economic Modelling 27, 171-183.
- Bovée, C. L., & Thill, J. V. (2014). Business in action. Pearson Higher Ed.
- Bozkurt, C. (2015). R&D expenditures and economic growth relationship in Turkey. International Journal of Economics and Financial Issues, 5(1), 188-198.
- Branstetter, L., & Sakakibara, M. (1998). Japanese research consortia: a microeconometric analysis of industrial policy. The Journal of Industrial Economics, 46(2), 207-233.
- Braunerhjelm, P. (2010). Entrepreneurship, Innovation and Economic Growth-past experience, current knowledge and policy implications.
- Brian, K. (2007). OECD Insights Human Capital How what you know shapes your life: How what you know shapes your life. OECD publishing.

- Cann, O. (2017). What exactly is economic competitiveness? Retrieved from https://medium.com/world-economic-forum/what-exactly-is-economic-competitiveness-c3a0d899cb65
- Cohen, Wesley, and Daniel Levinthal. (1989). "Innovation and Learning: The Two Faces of R&D." Economic Journal 99 (397): 569–96.
- Comanor, W. S., & Scherer, F. M. (1969). Patent statistics as a measure of technical change. Journal of political economy, 77(3), 392-398.
- Çiftçi, N. (2008). İçsel Büyüme Teorileri Çerçevesinde Ar-Ge Harcamalarının Dış Ticaret ve Büyüme Üzerine Etkileri. Dumlupınar üniversitesi Sosyal Bilimler Enstitüsü, Kütahya.
- Çivi, E., Erol, İ., İnanlı, T., & Erol, E. D. (2008). Uluslararası rekabet gücüne farklı bakışlar. AİBÜ-İİBF Ekonomik ve Sosyal Araştırmalar Dergisi.
- Devlet Planlama Teşkilatı. (1985). Beşinci Beş Yıllık Kalkınma Planı, 1985-1989. TC Başbakanlık, Devlet Planlama Teşkilatı.
- Devlet Planlama Teşkilatı (2014) Onuncu Beş Yıllık Kalkınma Planı, 2014-2018. TC Başbakanlık, Devlet Planlama Teşkilatı.
- Eaton, J., & Kortum, S. (1999). International technology diffusion: Theory and measurement. International Economic Review, 40(3), 537-570.
- Ekizceleroğlu, C. (2008). Bilgi ekonomisinin dış ticaret içindeki yeri: Türkiye örneği.
- Elçi, Ş. (2006). Inovasyon: Kalkınma ve rekabetin anahtarı. Ankara: Nova Yayınları.
- Erdoğan, S., Canbay, Ş. (2016). İktisadi Büyüme-Araştırma ve Geliştirme (Ar-Ge) Harcamaları İlişkisi Üzerine Teorik Bir İnceleme. Anemon Muş Alparslan Üniversitesi Sosyal Bilimler Dergisi, 4(2), 29-43.
- Erkan, H., & Erkan, C. (2004). Bilgi Ekonomisinde Teori ve Politika, 3. Ulusal Bilgi, Ekonomi ve Yönetim Kongresi, 25-26.
- Etzkowitz, H. (1993). Technology transfer: The second academic revolution. Technology Access Report, 6(7).
- Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: from National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. Research policy, 29(2), 109-123.

- Etzkowitz, H., & Ranga, M. (2015). Triple Helix systems: an analytical framework for innovation policy and practice in the Knowledge Society. In Entrepreneurship and Knowledge Exchange (pp. 117-158). Routledge.
- European Commission. (1995). Green Paper on Innovation. Office for Official Publications of the European Communities.
- European Commission. (2003) Commission Recommendation 2003/361/EC
- European Commission. (2019). 2019 SBA Fact Sheet Turkey, retrieved from https://ec.europa.eu/neighbourhood-enlargement/sites/near/files/sba-fs-2019_turkey.pdf
- European Parliement. (2017) EU framework programmes for research and innovation. Evolution and key data from FP1 to Horizon 2020 in view of FP9.
- European Commission. (2014) Fifth RTD Framework Programme, 1998- 2002 https://cordis.europa.eu/programme/id/FP5
- European Commission. (2014) Multiannual Framework Programme 2002-2006 of the European Community for research, technological development and demonstration activities aimed at contributing towards the creation of the European Research Area https://cordis.europa.eu/programme/id/FP6
- European Commission. (2020). The Entrepreneurship 2020 Action Plan retrieved from https://ec.europa.eu/growth/smes/promoting-entrepreneurship/action-plan_en
- Falk, M. (2007). R&D spending in the high-tech sector and economic growth. Research in economics, 61(3), 140-147.
- Gittelman, M. (2007). Does geography matter for science-based firms? Epistemic communities and the geography of research and patenting in biotechnology. Organization Science, 18(4), 724-741.
- Godin, B., & Gingras, Y. (2000). The place of universities in the system of knowledge production. Research policy, 29(2), 273-278.
- Gökmenoğlu, S. M., Akal, M., & ALTUNIŞIK, R. (2012). Ulusal Rekabet Gücünü Belirleyen Faktörler Üzerine Değerlendirmeler. Competition Journal/Rekabet Dergisi, 13(4).
- Griliches, Z. (1990), “Patent Statistics as Economic Indicators: A Survey”, Journal of Economic Literature, No. 28, pp. 1661-1707.

- Guan, J., & Ma, N. (2003). Innovative capability and export performance of Chinese firms. Technovation, 23(9), 737-747.
- Gül, T. G., & Çakır, S. (2014). Teknoparklar ve Teknoloji Üretimi: İzmir Teknoloji Geliştirme Bölgesi Örneği. Bilgi Ekonomisi ve Yönetimi Dergisi, 9(1), 79-90.
- Gülmez, A., & Yardımcıoğlu, F. (2012). OECD Ülkelerinde Ar-Ge Harcamaları ve Ekonomik Büyüme İlişkisi: Panel Eşbütünleşme ve Panel Nedensellik Analizi (1990-2010). Maliye Dergisi, 163(1), 335-353.
- Gürpınar, K., & Barca, M. (2007). Türk Mobilya Sektörünün Uluslararası Rekabet Gücü Düzeyi ve Nedenleri. Eskişehir Osmangazi Üniversitesi İİBF Dergisi, 2(2), 41-61.
- Hatzichronoglou, T. (1997). Revision of the high-technology sector and product classification. STI Working Paper 1997/2. OECD, Directorate for Science, Technology, and Industry, Paris.
- Holcombe, R. G. (1998). Entrepreneurship and economic growth. The Quarterly Journal of Austrian Economics, 1(2), 45-62.
- Hollanders, H., & van Cruysen, A. (2008). Rethinking the European innovation scoreboard: A new methodology for 2008-2010. Inno-Metrics Publication. Brüssel.
- Hugo, H, Nordine, E., and Iris, M. (2019). European Innovation Scoreboard 2019.Availableonline: https://ec.europa.eu/docsroom/documents/38781/attachments/1/translations/en/renditions/native.
- Işık, N., & Kılınç, E. C. (2012). İnovasyon-Güdümlü Kalkınma: Avrupa Birliği Ülkeleri ve Türkiye Üzerine Bir İnceleme. Girişimcilik ve İnovasyon Yönetimi Dergisi, 1(1), 31-68.
- Jones, G. R., & George, J. M. (2014). Essentials of contemporary management. McGraw-Hill Education.
- Kao, J. J. (1989). Entrepreneurship, creativity & organization. Prentice Hall.
- Kaufmann, A., & Tödtling, F. (2002). How effective is innovation support for SMEs? An analysis of the region of Upper Austria. Technovation, 22(3), 147-159.

- Ketels, C. H., & Memedovic, O. (2008). From clusters to cluster-based economic development. International journal of technological learning, innovation and development, 1(3), 375-392.
- Kim, L.W. (2011). The Economic Growth Effect of R&D Activity in Korea. Korea and the World Economy, 12(1), 25-44.
- Kirbach, M., & Schmiedeberg, C. (2008). Innovation and export performance: adjustment and remaining differences in East and West German manufacturing. Econ. Innov. New Techn., 17(5), 435-457.
- KOSGEB.(2005) https://www.kosgeb.gov.tr/site/tr/genel/detay/5560/mevzuat
- Koç, K., & Mente, A. (2007). İNOVASYON KAVRAMI VE ÜNİVERSİTE-SANAYİ-DEVLET İŞBİRLİĞİNDE ÜÇLÜ SARMAL MODELİ.
- Kok, W. (2009). Facing the challenge: the Lisbon strategy for growth and employment/report of the High Level Group chaired by Wim Kok. Luxembourg: Office for Oficial Publications of the European Communities, 2004.
- Korkmaz, S., Ermeç, A., & Yücedağ, N. (2009). İşletmelerin yenilikçi kabiliyetleri ve ihracat performanslarına etkileri.
- Kuriakose, S., I. Goldberg, and C. Zhang. (2011). Fostering Technology Absorption in Southern African Enterprises. Washington, DC: World Bank.
- Kuriakose, S. (2013). Fostering Entrepreneurship in Georgia. Washington, DC: World Bank.
- Kuswantoro, F., Rosli, M. M., Abdul, R., & Ghorbani, H. (2012). Impact of distribution channel innovation on the performance of small and medium enterprises. International Business and Management, 5(1), 52-61.
- Lanjouw, J. O., & Schankerman, M. (2004). Protecting intellectual property rights: are small firms handicapped?. *The journal of law and economics*, *47*(1), 45-74.
- Lederman, D. & Saenz, L. (2005). Innovation around the world, 1960-2000, World Bank Policy Research Working Paper 3774, The World Bank, Washington DC.
- Leontief, W. (Ed.). (1986). Input-output economics. Oxford University Press.
- Lichtenberg, F. R. (1992). *R&D investment and international productivity differences* (No. w4161). National Bureau of Economic Research.

- Lundvall, B. Å., & Borrás, S. (2005). Science, technology and innovation policy. The Oxford handbook of innovation, 599-631.
- Mahdjoubi, D. (1997). Schumpeterian Economics and The Trilogy of Invention-Innovation-Diffusion. UT School of Information.
- Meredith, G. G., Nelson, R. E., & Neck, P. A. (1982). The practice of entrepreneurship (Vol. 30, No. 760). International Labour Organisation.
- Metcalfe, J. S. (1994). Evolutionary economics and technology policy. The economic journal, 104(425), 931-944.
- Mudambi, R., & Swift, T. (2012). Multinational enterprises and the geographical clustering of innovation. Industry and Innovation, 19(1), 1-21.
- MÜSİAD, (2012), Küresel Rekabet İçin Ar-Ge ve İnovasyon: Stratejik Dönüşüm Önerisi, Araştırma Raporları 76, İstanbul.
- Napier, G., Serger, S. S., & Hansson, E. W. (2004). Strengthening innovation and technology policies for SME development in Turkey. Policy report, International Organisation for Knowledge Economy and Enterprise Development.
- OECD (1999), Managing National Innovation Systems, Paris: OECD Publications.
- OECD. (2008). OECD Patent Statistics Manual. OECD Publishing, Paris.
- OECD (2014), OECD Science, Technology and Industry Outlook 2014. OECD Publishing.
- OECD. (2015). Frascati Manual 2015. Guidelines for collecting and reporting data on research and experimental development.
- OECD. (2015). Patent Manual 1994. USING PATENT DATA AS SCIENCE AND TECHNOLOGY INDICATORS
- OECD (2000). Science, Technology and Innovation in the New Economy.
- OECD. (2005) OECD SME and Entrepreneurship Outlook: 2005, OECD Paris.
- OECD (2009) Measuring Entrepreneurship: A Collection of Indicators 2009. Paris: OECD.
- OECD. (2012). OECD Science, Technology and Industry Outlook 2012.
- OECD Publishing. (2018). *Oslo Manual 2018: Guidelines for collecting, reporting and using data on innovation*. Organisation for Economic Co-operation and Development OECD.

- OECD (2018) Developing entrepreneurship competencies. In: SME Ministerial Conference, 2018 Feb 22–23; Mexico City. Available from: https://www.oecd.org/cfe/smes/ministerial/documents/2018-SME-MinisterialConference-Parallel-Session-3.pdf
- Öcal, T., & Uçar, H. (2011). Kümelenmelerde Yapısal Değişim ve Rekabet Gücü. Sosyal Siyaset Konferansları, (60), 1.
- Örücü, E., Kılıç, R., & Savaş, A. (2011). KOBİ'lerde inovasyon stratejileri ve inovasyon yapmayı etkileyen faktörler: bir uygulama.
- Özer, M., & Çiftçi, N. (2009). Ar-Ge tabanlı içsel büyüme modelleri ve Ar-Ge harcamalarının ekonomik büyüme üzerine etkisi: OECD ülkeleri panel veri analizi.
- Özden, A. K. I. N., & Reyhanoğlu, M. (2014). İşletme büyüklükleri bağlamında Türkiye'nin inovasyon portresi (2002-2008 dönemi). Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, 16(1), 23-51.
- Özsağır, A., & Çütçü, İ. (2015). İNOVASYON–DIŞ TİCARET ARASINDAKİ NEDENSELLİK İLİŞKİSİ: VEKTÖR HATA DÜZELTME MODELİ İLE TÜRKİYE ANALİZİ (1980-2013). Bilgi Ekonomisi ve Yönetimi Dergisi, 10(2).
- Pakes, A., & Griliches, Z. (1980). Patents and R&D at the firm level: A first report. Economics letters, 5(4), 377-381.
- Petrariu, I. R., Bumbac, R., & Ciobanu, R. (2013). Innovation: a path to competitiveness and economic growth. The case of CEE countries. Theoretical & Applied Economics, 20(5).
- Pol, E., & Carroll, P. G. H. (2006). An introduction to economics with emphasis on innovation.
- Porter, Michael E. (1990). *The Competitive Advantage of Nations*. New York (NY): Free Press.
- Porter, M. E. (1998). Clusters and the new economics of competition (Vol. 76, No. 6, pp. 77-90). Boston: Harvard Business Review.
- Porter, M. E., & Stern, S. (1999). *New challenge to America's prosperity*. Council on competitiveness.
- Porter, M. E. (2001, August). The competitive advantage of Singapore: Transition to the innovation stage. In New Economy Conference, Singapore.

- Porter, M. (2001). Innovation and competitiveness: findings on the Netherlands. Lecture on Organizing Innovation in the Knowledge-Based Economy, The Hague, The Netherlands, 3.
- Porter, M. E., & Schwab, K. (2008). The global competitiveness report 2008-2009. In World Economic Forum.
- Razak, D. A., Abdullah, M. A., & Ersoy, A. (2018). Small medium enterprises (SMES) in turkey and malaysia a comparative discussion on issues and challenges. International Journal of Business, Economics and Law, 10(49), 2-591.
- Roediger-Schluga, T., & Barber, M. J. (2006). The structure of R&D collaboration networks in the European Framework Programmes.
- Rogers, M. (1998). The definition and measurement of innovation.
- Romer, P. (1990). Endogenous technological change. Journal of Political Economy 98.
- Rodríguez-Pose, A., & Refolo, C. (2000). The link between clusters of SMEs and public and University Research in Italy.
- Roper, S., & Love, J. H. (2001). The determinants of export performance: panel data evidence for Irish manufacturing plants. NIERC.
- Salur, M. N., Demirci, M. N., & KESEN, B. (2018). KOBİ'lerde Halka Açılmanın Finansal Performansa Etkisi: BİST Gelişen İşletmeler Piyasasında Bir Uygulama1. İşletme Araştırmaları Dergisi.
- Sarıdoğan, E. (2010). Mikroekonomi ve makroekonomi düzeyinde küresel rekabet gücünü etkileyen faktörler ve stratejiler. İTO.
- Schmoch, U. (2008). Concept of a technology classification for country comparisons. Final report to the world intellectual property organisation (wipo), WIPO.
- Schmoch, U., Laville, F., Patel, P., & Frietsch, R. (2003). Linking technology areas to industrial sectors. Final Report to the European Commission, DG Research, 1(0), 100.
- Schumpeter, J., 1934. The Theory of Economic Development. Transaction Publishers, New Brunswick.
- Shiv Nadar University, 2019. Retrieved August 25, 2020 from https://aic.snu.edu.in/blogs/entrepreneurship-and-innovation

- Smit, A. J. (2010). The competitive advantage of nations: is Porter's Diamond Framework a new theory that explains the international competitiveness of countries? Southern African Business Review, 14(1).
- Smith, D. (2010). *Exploring innovation*. McGraw-Hill Higher Education.
- ŞAHBAZ, A., & TANYERİ, M. (2017). Küçük ve orta büyüklükteki işletmelerde inovasyona yönelik tutumlar ve inovasyon engelleri: Çanakkale ilinde KOBİ'ler üzerine bir araştırma. Çanakkale Onsekiz Mart Üniversitesi Uluslararası Sosyal Bilimler Dergisi, 3(2), 233-263.
- Targan, Ü. N. A. L., & Seçilmiş, N. (2013). Ar-Ge Göstergeleri Açısından Türkiye ve Gelişmiş Ülkelerle Kıyaslaması. İşletme ve İktisat Çalışmaları Dergisi, 1(1), 12-25.
- T.C Bilim, Sanayi ve Teknoloji Bakanlığı (2015). "Türkiye Sanayi Strateji Belgesi 2015-2018"
- TC Sanayi ve Teknoloji Bakanlığı,2020 https://www.sanayi.gov.tr/arge-ve-teknoloji-merkezleri
- Terziovski, M. (2010). Innovation practice and its performance implications in small and medium enterprises (SMEs) in the manufacturing sector: a resource-based view. Strategic Management Journal, 31(8), 892-902.
- Tiryakioğlu, M. (2009). Schumpeter, yenilik ve yaratıcı yıkım. Retrieved from http://www.iktisadiyat.com/2009/03/18/schumpeter-yenilik-ve-yaratici-yikim/
- Trajtenberg, M. (1990). Economic analysis of product innovation. Cambridge: Cambridge University Press
- Turanlı, R., Sarıdoğan, E., & Hiperlink (Firm). (2010). Bilim- teknoloji-inovasyon temelli ekonomi ve toplum. İstanbul: Hiperlink. Retrieved from http://www.cankaya-elibrary.com
- TÜBİTAK -BTP, (1999), Türkiye'nin Bilim Ve Teknoloji Politikası, Ankara, Ocak 1999.
- TÜBİTAK, (2012) Department of Science, Technology, and Innovation Policy, Science, Technology, and İnnovation in Turkey,2013.
- TÜBİTAK (1993). Türk Bilim ve Teknoloji Politikası: 1993-2003, Mayıs 1993 https://www.tubitak.gov.tr/tr/kurumsal/bilim-ve-teknoloji-yuksek-

kurulu/toplantilar/icerik-bilim-ve-teknoloji-yuksek-kurulu-2-toplantisi-3-subat-1993

- TÜBİTAK (1997). Türk Bilim ve Teknoloji Politikası, Ağustos 1997 https://www.tubitak.gov.tr/tr/kurumsal/bilim-ve-teknoloji-yuksek-kurulu/toplantilar/icerik-bilim-ve-teknoloji-yuksek-kurulu-3-toplantisi-25-agustos-1997
- TÜBİTAK (2014). Faaliyet Raporu https://www.tubitak.gov.tr/sites/default/files/tubitak_2014_faaliyet_raporu.pdf
- TÜBİTAK (2019). Faaliyet Raporu https://www.tubitak.gov.tr/sites/default/files/18842/tubitak_2019_yili_faaliyet_raporu.pdf
- UNESCO. (2010). UNESCO science report 2010: The current status of science around the world. United Nations Educational, Scientific and Cultural Organization.
- UNCTAD (2016). Entrepreneurship for development Report of the Secretary-General https://unctad.org/meetings/en/SessionalDocuments/a71d210_en.pdf
- Veugelers, R. (2008). The role of SMEs in innovation in the EU: a case for policy intervention?. Review of business and economics, 53(3), 239-262.
- Viale, R., & Etzkowitz, H. (2005, May). Third academic revolution: polyvalent knowledge; the DNA of the triple helix. In Fifth Triple Helix Conference (pp. 18-21).
- Wakelin, K. (1998). Innovation and export behaviour at the firm level. Research policy, 26(7-8), 829-841.
- World Bank. 2011b. "Turkey Improving Conditions for SME Growth Finance and Innovation." Washington, DC. Report No. 54961-TR https://openknowledge.worldbank.org/handle/10986/12211
- World Intellectual Property Organization. (2004). WIPO intellectual property handbook: Policy, law and use (Vol. 489). WIPO.
- Yıldırım, E., & Kesikoğlu, F. (2012). AR-GE HARCAMALARI İLE İHRACAT ARASINDAKİ NEDENSELLİK İLİŞKİLERİ: TÜRKiYE ÖRNEĞİNDE PANEL NEDENSELLİK TESTİ KANITLARI. MU Iktisadi ve Idari Bilimler Dergisi, 32(1), 165-180.

- Yıldırım, S., & Kostakoğlu, S. F. (2014). Bilgi Ekonomisinde Schumpeterci Yaratıcı–Yıkım Çerçevesinde İstihdamın İncelenmesi: Türkiye’de Ulaşım ve Haberleşme Sektörüne Yönelik VAR Analizi. Bilgi Ekonomisi ve Yönetimi Dergisi, 9.
- Yoo, S. H. (2008). High-technology exports and economic output: an empirical investigation. Applied Economics Letters, 15(7), 523-525.
- Yülek, M., & Daş, G. S. (2016). KOBİ’lerin Yenilikçilik Kapasitelerini Geliştirecek Desteklerin Tasarımına Yönelik Kavramsal Bir Model Önerisi: Yenilikçilik Profillerine Dayalı Bir Yaklaşım. Ege Akademik Bakış, 16(3), 161-176.
- Zachariadis, M. (2003). R&D, innovation, and technological progress: a test of the Schumpeterian framework without scale effects. Canadian Journal of Economics/Revue canadienne d'économique, 36(3), 566-586.

APPENDIXES

APPENDIX 1: Detailed Firm Profiles

Firm ID	Sector	Establishment	Employee	R&D	Design	Patent	Export	Location	Tech. Level	Activity	Owenership	Branch	Est. After Support
001	Medical	NA	35-50	Y	X	X	X	OIZ	MH	MNF	NA	NA	N
002	Electronic	1994	400-450	Y	Y	X	Y	TDZ	MH	MNF	PRT	ALL	N
003	Machine	2008	50-75	Y	Y	Y	X	OIZ	MH	MNF	PRT	ALL	N
004	Medical	NA	50-75	Y	Y	Y	Y	OIZ	MH	MNF	PRT	ALL	N
005	Food	NA	50-75	X	X	X	X	OIZ	L	MNF	NA	ALL	N
006	Food	NA	35-50	X	X	X	X	OIZ	L	MNF	NA	NA	N
007	Machine	1978	300-350	Y	X	X	Y	OIZ	MH	MNF	PRT	ALL	N
008	Machine	1980	50-75	Y	Y	Y	Y	OIZ	MH	MNF	PRT	ALL	N
009	Machine	2000	35-50	Y	Y	X	X	OIZ	ML	MNF	PRT	ALL	N
010	Mechanic	1991	350-400	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
011	Machine	2011	200-250	Y	X	X	Y	OIZ	MH	MNF	PRT	ALL	N
012	Software	2010	50-75	Y	Y	X	X	OIZ	H	SRV	PRT	ALL	N
013	Machine	1991	150-200	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
014	Energy	1993	35-50	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
015	Automotive	1950	400-450	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
016	Electronic	1994	100-150	Y	Y	X	Y	OIZ	H	MNF	PRT	ALL	N
017	Medical	1997	50-75	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
018	Electronic	2011	35-50	Y	Y	X	Y	TDZ	MH	MNF	PRT	ALL	N
019	Automotive	1986	300-350	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
020	Automotive	2011	50-75	Y	Y	X	X	OIZ	ML	MNF	PRT	ALL	N
021	Electronic	2004	250-300	Y	Y	Y	Y	OIZ	H	MNF	PRT	ALL	N
022	Defence	1993	350-400	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
023	Mechanic	1979	35-50	Y	X	X	X	OIZ	MH	MNF	PRT	ALL	N
024	Mechanic	2012	35-50	Y	X	X	X	OIZ	ML	MNF	PRT	ALL	Y
025	Electronic	2011	10-20	Y	Y	X	Y	TDZ	H	MNF	PRT	ALL	Y
026	Electronic	NA	35-50	Y	Y	X	X	TDZ	H	MNF	NA	NA	N
027	Electronic	2011	35-50	Y	Y	X	X	OIZ	H	MNF	PRT	ALL	Y
028	Energy	2010	10-20	Y	Y	X	Y	TDZ	MH	MNF	PRT	ALL	Y
029	Machine	1954	500-600	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
030	Mechanic	1981	250-300	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
031	Electronic	2006	50-75	Y	Y	Y	Y	OIZ	MH	MNF	NA	ALL	N
032	Chemistry	1995	250-300	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N

Firm ID	Sector	Establishment	Employee	R&D	Design	Patent	Export	Location	Tech. Level	Activity	Owenership	Branch	Est. After Support
033	Mechanic	2009	35-50	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
034	Medical	2011	35-50	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	Y
035	Chemistry	2015	50-75	Y	Y	X	Y	OIZ	ML	MNF	PRT	ALL	Y
036	Mechanic	2016	35-50	Y	Y	X	X	OIZ	ML	MNF	PRT	ALL	N
037	Electronic	2011	35-50	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	Y
038	Chemistry	2013	35-50	X	X	X	X	OIZ	ML	MNF	PRT	ALL	N
039	Software	2006	35-50	Y	Y	X	X	TDZ	H	SRV	PRT	ALL	N
040	Electronic	2012	150-200	Y	X	X	Y	OIZ	MH	MNF	PRT	ALL	Y
041	Machine	1974	300-350	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
042	Chemistry	1993	250-300	Y	Y	Y	Y	OIZ	ML	MNF	PRT	ALL	N
043	Automotive	1978	150-200	Y	Y	Y	Y	OIZ	MH	MNF	PRT	ALL	N
044	Food	2017	35-50	X	X	X	X	OIZ	L	MNF	PRT	ALL	N
045	Mechanic	1989	300-350	Y	Y	Y	Y	OIZ	ML	MNF	PRT	ALL	N
046	Automotive	1978	150-200	Y	Y	Y	Y	TDZ	MH	MNF	PRT	ALL	N
047	Machine	1973	350-400	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
048	Software	2013	0-10	Y	Y	X	Y	TDZ	H	SRV	PRT	ALL	N
049	Automotive	1984	350-400	Y	Y	Y	Y	OIZ	MH	MNF	PRT	ALL	N
050	Mechanic	1979	1000-1200	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
051	Energy	1986	150-200	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
052	Chemistry	NA	35-50	Y	X	X	X	OIZ	MH	MNF	PRT	ALL	N
053	Machine	1974	75-100	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
054	Electronic	1993	1000-1200	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
055	Mine	2008	500-600	X	X	X	X	OIZ	MH	MNF	SOL	ALL	N
056	Mechanic	1974	350-400	Y	Y	X	Y	OIZ	ML	MNF	SOL	ALL	N
057	Mechanic	1998	35-50	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
058	Chemistry	1996	150-200	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
059	Chemistry	1993	200-250	Y	X	X	X	OIZ	ML	MNF	PRT	ALL	N
060	Energy	NA	35-50	X	X	X	X	OIZ	MH	MNF	SOL	ALL	N
061	Service	1986	150-200	X	X	X	X	OIZ	L	SRV	PRT	ALL	N
062	Machine	NA	150-200	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
063	Software	NA	10-20	Y	Y	X	Y	TDZ	H	SRV	PRT	ALL	N
064	Furniture	2013	35-50	X	X	X	Y	OIZ	L	MNF	SOL	ALL	N
065	Automotive	2013	350-400	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
066	Mechanic	2012	35-50	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
067	Mechanic	2014	35-50	Y	Y	X	X	OIZ	ML	MNF	SOL	ALL	N
068	Textile	2012	250-300	Y	Y	X	Y	OIZ	L	MNF	PRT	ALL	N
069	Chemistry	2012	35-50	X	X	X	X	OIZ	L	MNF	SOL	ALL	N
070	Furniture	2012	35-50	X	X	X	X	OIZ	L	MNF	SOL	ALL	N
071	Service	2012	10-20	Y	Y	X	X	TDZ	H	SRV	PRT	ALL	N
072	Medical	NA	35-50	Y	X	X	X	OIZ	ML	MNF	PRT	ALL	N
073	Mechanic	2013	150-200	Y	Y	X	Y	TDZ	H	MNF	PRT	ALL	N
074	Mechanic	NA	250-300	Y	Y	X	Y	TDZ	MH	MNF	SOL	ALL	N
075	Chemistry	NA	35-50	Y	Y	Y	X	TDZ	MH	MNF	SOL	ALL	N
076	Chemistry	2009	35-50	Y	Y	X	Y	OIZ	ML	MNF	SOL	ALL	N
077	Electronic	NA	35-50	Y	Y	X	X	TDZ	H	MNF	SOL	ALL	N
078	Electronic	2003	35-50	Y	X	X	X	OIZ	H	MNF	SOL	ALL	N

Firm ID	Sector	Establishment	Employee	R&D	Design	Patent	Export	Location	Tech. Level	Activity	Owenership	Branch	Est. After Support
079	Software	2012	10-20	Y	Y	X	Y	OIZ	H	SRV	PRT	ALL	Y
080	Chemistry	2004	50-75	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
081	Machine	2014	35-50	Y	Y	X	Y	TDZ	MH	MNF	PRT	ALL	Y
082	Electronic	2014	10-20	Y	Y	X	Y	TDZ	H	MNF	PRT	ALL	Y
083	Electronic	2015	35-50	Y	Y	X	Y	TDZ	MH	MNF	PRT	ALL	Y
084	Automotive	1996	350-400	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
085	Automotive	1986	300-350	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
086	Chemistry	1993	150-200	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
087	Mechanic	1976	350-400	Y	X	X	Y	OIZ	MH	MNF	PRT	ALL	N
088	Medical	1982	200-250	Y	Y	Y	Y	TDZ	MH	MNF	SOL	ALL	N
089	Machine	1973	250-300	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
090	Medical	NA	350-400	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
091	Chemistry	2002	35-50	Y	Y	X	X	OIZ	MH	MNF	SOL	ALL	N
092	Mechanic	1995	250-300	Y	Y	X	Y	OIZ	ML	MNF	SOL	ALL	N
093	Mechanic	1984	150-200	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
094	Electronic	1976	75-100	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
095	Medical	1968	150-200	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
096	Chemistry	1970	300-350	Y	X	X	X	OIZ	MH	MNF	SOL	ALL	N
097	Machine	2013	350-400	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
098	Mechanic	2013	35-50	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
099	Mechanic	NA	150-200	Y	X	X	X	OIZ	MH	MNF	NA	ALL	N
100	Mechanic	2013	35-50	Y	Y	X	X	OIZ	ML	MNF	SOL	ALL	N
101	Chemistry	2010	35-50	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
102	Machine	1973	350-400	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
103	Software	2013	35-50	Y	Y	X	X	TDZ	H	SRV	PRT	ALL	N
104	Food	2013	75-100	Y	Y	X	Y	TDZ	L	MNF	PRT	ALL	N
105	Chemistry	2014	35-50	Y	Y	X	X	TDZ	MH	MNF	PRT	ALL	N
106	Service	2013	50-75	Y	Y	X	Y	TDZ	MH	SRV	PRT	ALL	N
107	Electronic	2012	20-30	Y	Y	X	Y	OIZ	H	MNF	PRT	ALL	N
108	Machine	2015	35-50	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	Y
109	Chemistry	1995	250-300	Y	Y	Y	Y	OIZ	H	MNF	PRT	ALL	N
110	Electronic	1980	100-150	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
111	Food	NA	35-50	Y	Y	Y	X	TDZ	L	MNF	PRT	ALL	N
112	Textile	1982	100-150	Y	Y	X	X	OIZ	L	MNF	PRT	ALL	N
113	Software	2010	35-50	Y	Y	X	Y	TDZ	H	SRV	PRT	ALL	Y
114	Machine	1980	150-200	Y	Y	Y	Y	OIZ	MH	MNF	PRT	ALL	N
115	Machine	1999	150-200	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
116	Medical	2011	35-50	Y	Y	Y	Y	OIZ	MH	MNF	SOL	ALL	Y
117	Electronic	1989	350-400	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
118	Electronic	1968	250-300	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
119	Machine	1986	250-300	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
120	Chemistry	2016	35-50	Y	X	X	X	OIZ	MH	MNF	SOL	ALL	Y
121	Electronic	2011	350-400	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	Y
122	Machine	2000	35-50	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
123	Machine	1994	150-200	Y	Y	Y	Y	OIZ	MH	MNF	PRT	ALL	N
124	Electronic	1999	35-50	Y	Y	Y	Y	OIZ	MH	MNF	PRT	ALL	N

Firm ID	Sector	Establishment	Employee	R&D	Design	Patent	Export	Location	Tech. Level	Activity	Owenership	Branch	Est. After Support
125	Machine	1997	10-20	Y	X	X	X	OIZ	MH	MNF	PRT	ALL	N
126	Software	2007	0-10	Y	Y	X	X	TDZ	H	SRV	SOL	ALL	N
127	Mechanic	2006	35-50	X	X	X	X	OIZ	MH	MNF	PRT	ALL	N
128	Mechanic	1998	250-300	Y	Y	X	Y	OIZ	ML	MNF	SOL	ALL	N
129	Mechanic	2014	35-50	X	X	X	X	OIZ	L	MNF	SOL	ALL	N
130	Electronic	2011	10-20	Y	Y	X	X	OIZ	H	MNF	PRT	ALL	Y
131	Machine	1967	150-200	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
132	Food	NA	35-50	Y	X	X	X	OIZ	L	MNF	NA	ALL	N
133	Electronic	1995	350-400	Y	Y	X	Y	TDZ	H	MNF	PRT	ALL	N
134	Mechanic	1980	35-50	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
135	Electronic	2015	50-75	X	X	X	X	OIZ	MH	MNF	SOL	ALL	N
136	Electronic	99	1000-1200	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
137	Chemistry	2003	350-400	Y	X	X	Y	OIZ	MH	MNF	NA	ALL	N
138	Software	2014	35-50	Y	Y	X	X	OIZ	H	SRV	NA	ALL	Y
139	Chemistry	2015	35-50	Y	X	X	X	TDZ	MH	MNF	NA	ALL	Y
140	Electronic	1975	150-200	Y	Y	X	X	OIZ	H	MNF	SOL	ALL	N
141	Mechanic	2011	250-300	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
142	Machine	1990	250-300	Y	Y	Y	Y	OIZ	ML	MNF	PRT	ALL	N
143	Software	2015	35-50	Y	Y	X	Y	OIZ	H	SRV	SOL	ALL	Y
144	Medical	2009	35-50	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
145	Automotive	1980	150-200	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
146	Automotive	2004	75-100	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
147	Machine	2007	250-300	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
148	Automotive	2010	10-20	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	Y
149	Textile	1959	250-300	Y	Y	Y	Y	OIZ	L	MNF	SOL	ALL	N
150	Machine	2010	150-200	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	Y
151	Electronic	1978	75-100	Y	Y	X	X	OIZ	MH	MNF	PRT	ALL	N
152	Medical	2007	35-50	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
153	Mine	NA	350-400	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
154	Mechanic	1993	250-300	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
155	Mechanic	2007	35-50	Y	X	X	X	OIZ	ML	MNF	SOL	ALL	N
156	Machine	2003	150-200	Y	Y	X	Y	OIZ	MH	MNF	NA	ALL	N
157	Defence	2012	35-50	Y	Y	X	X	OIZ	L	MNF	SOL	ALL	N
158	Chemistry	2007	35-50	Y	X	X	X	OIZ	H	MNF	SOL	ALL	N
159	Chemistry	2005	150-200	Y	X	X	X	OIZ	H	MNF	PRT	ALL	N
160	Defence	2007	35-50	Y	Y	X	X	OIZ	MH	MNF	SOL	ALL	N
161	Machine	2012	100-150	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	Y
162	Chemistry	2014	35-50	Y	Y	X	Y	TDZ	MH	MNF	PRT	ALL	Y
163	Chemistry	2017	35-50	Y	X	X	Y	OIZ	H	MNF	PRT	ALL	N
164	Energy	2014	35-50	Y	Y	Y	X	TDZ	MH	MNF	SOL	ALL	Y
165	Machine	2011	150-200	Y	Y	X	X	TDZ	MH	MNF	SOL	ALL	Y
166	Mechanic	1972	35-50	Y	Y	X	X	OIZ	MH	MNF	SOL	ALL	N
167	Mechanic	2005	35-50	Y	X	X	X	OIZ	ML	MNF	SOL	ALL	N
168	Electronic	2017	35-50	Y	Y	X	Y	TDZ	H	MNF	SOL	ALL	Y
169	Machine	2017	35-50	Y	X	X	X	OIZ	MH	MNF	SOL	ALL	N
170	Mechanic	2013	250-300	Y	X	X	Y	OIZ	ML	MNF	SOL	ALL	N

Firm ID	Sector	Establishment	Employee	R&D	Design	Patent	Export	Location	Tech. Level	Activity	Owenership	Branch	Est. After Support
171	Chemistry	1996	250-300	Y	Y	X	Y	OIZ	ML	MNF	SOL	ALL	N
172	Mechanic	NA	100-150	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
173	Mechanic	NA	35-50	Y	X	X	X	OIZ	MH	MNF	SOL	ALL	N
174	Energy	2009	35-50	Y	X	X	X	OIZ	ML	MNF	PRT	ALL	N
175	Machine	NA	250-300	Y	Y	Y	Y	OIZ	MH	MNF	NA	ALL	N
176	Electronic	1978	150-200	Y	Y	X	Y	OIZ	H	MNF	SOL	ALL	N
177	Medical	NA	35-50	Y	Y	X	Y	TDZ	MH	MNF	NA	ALL	N
178	Chemistry	2015	35-50	Y	X	X	X	TDZ	MH	MNF	NA	ALL	Y
179	Chemistry	2005	75-100	X	X	X	Y	OIZ	MH	MNF	PRT	ALL	N
180	Chemistry	2006	35-50	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
181	Machine	1955	250-300	Y	X	X	X	OIZ	MH	MNF	SOL	ALL	N
182	Electronic	1996	450-500	Y	Y	X	Y	OIZ	ML	MNF	SOL	ALL	N
183	Electronic	NA	35-50	Y	X	X	X	OIZ	H	MNF	SOL	ALL	N
184	Machine	1994	150-200	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
185	Machine	1980	35-50	Y	X	X	X	OIZ	MH	MNF	SOL	ALL	N
186	Electronic	1996	200-250	Y	Y	X	Y	OIZ	H	MNF	PRT	ALL	N
187	Automotive	1974	150-200	Y	Y	X	X	OIZ	MH	MNF	SOL	ALL	N
188	Chemistry	NA	35-50	Y	X	X	X	OIZ	L	MNF	NA	ALL	N
189	Mechanic	1985	200-250	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
190	Machine	NA	35-50	Y	Y	X	X	OIZ	MH	MNF	SOL	ALL	N
191	Electronic	2008	35-50	Y	X	X	X	OIZ	H	MNF	SOL	ALL	N
192	Medical	2007	250-300	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
193	Chemistry	NA	35-50	Y	X	X	X	OIZ	ML	MNF	SOL	ALL	N
194	Software	2005	75-100	Y	Y	X	Y	TDZ	H	SRV	PRT	ALL	N
195	Medical	1988	250-300	Y	Y	Y	Y	OIZ	MH	MNF	PRT	ALL	N
196	Mechanic	1969	150-200	Y	X	X	X	OIZ	MH	MNF	PRT	ALL	N
197	Electronic	NA	200-250	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
198	Chemistry	NA	150-200	Y	Y	X	X	OIZ	MH	MNF	NA	ALL	N
199	Machine	2007	350-400	Y	Y	X	X	TDZ	H	MNF	PRT	ALL	N
200	Mechanic	1979	150-200	Y	Y	X	Y	OIZ	ML	MNF	PRT	ALL	N
201	Machine	2006	250-300	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
202	Software	1992	150-200	Y	Y	X	Y	OIZ	H	SRV	PRT	ALL	N
203	Food	1992	350-400	X	X	X	Y	OIZ	L	MNF	SOL	ALL	N
204	Electronic	1986	150-200	Y	Y	Y	Y	OIZ	H	MNF	PRT	ALL	N
205	Medical	NA	35-50	Y	Y	X	Y	OIZ	MH	MNF	NA	ALL	N
206	Chemistry	2014	35-50	Y	Y	X	X	OIZ	L	MNF	SOL	ALL	N
207	Software	2016	10-20	Y	Y	X	X	TDZ	H	SRV	SOL	ALL	N
208	Defence	1999	150-200	Y	Y	X	X	TDZ	H	MNF	PRT	ALL	N
209	Automotive	1960	350-400	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
210	Electronic	2007	150-200	Y	X	X	X	OIZ	MH	MNF	SOL	ALL	N
211	Defence	2005	350-400	Y	Y	X	X	TDZ	H	MNF	PRT	ALL	N
212	Machine	2000	35-50	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
213	Machine	2017	35-50	Y	X	X	X	OIZ	MH	MNF	SOL	ALL	Y
214	Defence	1990	150-200	Y	Y	X	X	OIZ	MH	MNF	SOL	ALL	N
215	Automotive	1991	150-200	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
216	Chemistry	2008	35-50	Y	X	X	Y	OIZ	H	MNF	SOL	ALL	N

Firm ID	Sector	Establishment	Employee	R&D	Design	Patent	Export	Location	Tech. Level	Activity	Owenership	Branch	Est. After Support
217	Machine	2000	35-50	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
218	Machine	1991	35-50	X	X	X	Y	OIZ	MH	MNF	PRT	ALL	N
219	Mechanic	1995	250-300	Y	X	X	Y	OIZ	MH	MNF	SOL	ALL	N
220	Electronic	2013	35-50	Y	Y	X	X	TDZ	H	MNF	SOL	ALL	Y
221	Chemistry	2011	35-50	Y	X	X	X	TDZ	MH	MNF	PRT	ALL	Y
222	Electronic	2018	10-20	Y	Y	X	X	TDZ	MH	MNF	NA	ALL	Y
223	Electronic	2016	35-50	Y	Y	Y	Y	OIZ	MH	MNF	PRT	ALL	Y
224	Textile	2008	200-250	Y	X	X	Y	OIZ	L	MNF	PRT	ALL	N
225	Machine	1976	150-200	X	X	X	X	OIZ	ML	MNF	NA	ALL	N
226	Electronic	2013	35-50	Y	Y	X	X	TDZ	MH	MNF	PRT	ALL	N
227	Electronic	1991	250-300	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
228	Software	2014	10-20	Y	Y	X	X	TDZ	H	SRV	SOL	ALL	Y
229	Mechanic	2018	35-50	Y	Y	X	X	OIZ	MH	MNF	SOL	ALL	Y
230	Medical	2018	35-50	Y	X	X	Y	TDZ	MH	MNF	PRT	ALL	Y
231	Electronic	2016	10-20	Y	Y	X	X	TDZ	H	MNF	PRT	ALL	Y
232	Mechanic	2015	35-50	Y	Y	X	X	OIZ	ML	MNF	SOL	ALL	Y
233	Mechanic	1993	350-400	Y	Y	X	Y	OIZ	MH	MNF	NA	ALL	N
234	Electronic	1984	150-200	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
235	Chemistry	2013	35-50	Y	Y	X	Y	TDZ	L	MNF	PRT	ALL	Y
236	Machine	1978	2000-2500	Y	Y	X	Y	OIZ	MH	MNF	SOL	ALL	N
237	Machine	NA	250-300	Y	Y	X	Y	OIZ	MH	MNF	NA	ALL	N
238	Mechanic	2015	35-50	Y	Y	X	X	OIZ	MH	MNF	SOL	ALL	Y
239	Mechanic	NA	35-50	Y	Y	X	X	OIZ	L	MNF	NA	ALL	N
240	Chemistry	2006	35-50	Y	Y	X	X	OIZ	ML	MNF	SOL	ALL	N
241	Mechanic	2017	35-50	Y	X	X	X	OIZ	ML	MNF	NA	ALL	Y
242	Machine	1979	150-200	Y	Y	X	X	OIZ	MH	MNF	SOL	ALL	N
243	Mechanic	NA	35-50	X	X	X	X	OIZ	ML	MNF	NA	ALL	N
244	Mechanic	1993	350-400	Y	Y	X	Y	OIZ	MH	MNF	PRT	ALL	N
245	Chemistry	2014	10-20	Y	Y	X	Y	TDZ	MH	MNF	PRT	ALL	Y
246	Machine	NA	35-50	Y	Y	X	X	TDZ	MH	MNF	PRT	ALL	N
247	Food	2018	35-50	Y	X	X	X	OIZ	L	MNF	NA	ALL	Y
248	Electronic	1998	50-75	Y	Y	X	Y	TDZ	H	MNF	PRT	ALL	N

- **NA:** Not Available
- **Y:** Yes
- **N:** No
- **OIZ:** Organized Industrial Zone
- **TDZ:** Technology Development Zone
- **L:** Low Technology
- **ML:** Medium-Low Technology
- **MH:** Medium-High Technology
- **H:** High Technology
- **MNF:** Manufacturer
- **SRV:** Service
- **PRT:** Partnership
- **SOL:** Sole Property
- **ALL:** All Around Turkey

RESUME

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