IMPACT OF PATENT INCENTIVES ON INNOVATION PERFORMANCE OF TECHNOLOGY-BASED FIRMS: THE CASE OF METU TECHNOPARK

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ABSTRACT

IMPACT OF PATENT INCENTIVES ON INNOVATION PERFORMANCE OF TECHNOLOGY-BASED FIRMS: THE CASE OF METU TECHNOPARK

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Technoparks, as an area of innovation, are significant for the development of sustainability of the innovation of technology-based firms within it. Patents are the one of the factors that affect innovation performance of these firms. At this point, the main purpose of the thesis is revealing the actual impact of patent incentives on the innovation performance of technology-based firms. In order to measure the impact, the study field of the thesis is identified as the METU Technopark. The pioneering step of the thesis is taken by classifying 429 firms in total according to number of their registered patents. The target group with two and/or more than two patents are tagged as TG1 whereas TG2 refers to firms who has only one patent. To fulfill the thesis' aim, 36 semi-structured interviews are conducted. These qualitative data are supported by the official websites of METU Technopark and TürkPatent. The result of the analysis comes up with a finding that patent incentives do not have any significant effect on innovation performance of technology-based firms. However, they create educational,

structural and R&D-based behavioral changes. Besides, patents cause limitations on the firms related to commercialization and infrastructure deficiencies. Considering all the findings, two policy recommendations are presented specific to METU Technopark and Turkey's future patent policies. The primary policy recommendation offers a matchmaking mechanism that prioritizes university, industry, and government cooperation, while the secondary one focuses on the development of grants and procedures for commercialization, infrastructure, public information, education, and patent support programs.

Keywords: patent, innovation, firm, technopark, impact

ÖZ

PATENT TEŞVİKLERİNİN TEKNOLOJİ TEMELLİ FİRMALARIN İNOVASYON PERFORMANSINA OLAN ETKİSİ: ODTÜ TEKNOKENT ÖRNEĞİ

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Bir yenilik alanı olarak Teknokentler, bünyesindeki teknoloji temelli firmaların inovasyon ekosisteminin geliştirilmesi ve sürdürülebilir kılınması için oldukça önemlidir. Bahsi geçen firmaların, inovasyon performansına etki eden faktörlerden bir tanesi de patentlerdir. Bu tez çalışmasının asıl amacı ise, patent teşviklerinin teknoloji temelli firmaların inovasyon performansına olan etkisini ortaya koymaktır. Bu etkinin ölçümlenmesinde çalışma alanı ODTÜ Teknokent olarak belirlenmiştir. Çalışmanın öncül adımı, Teknokent bünyesindeki 429 firmanın tescillenmiş patent sayılarına göre sınıflandırılmasıyla atılmıştır. İki ve/veya ikiden fazla patent sayısı olan odak grubu TG1, sadece bir patenti olan odak grubu TG2 olarak sınıflandırılmıştır. Çalışmanın amacı doğrultusunda, toplamda 36 adet yarı-yapılandırılmış görüşme gerçekleştirilmiştir. Bu nitel veriler, ODTÜ Teknokent ve TürkPatent'in resmî web sitelerinde yer alan veri tabanlarıyla desteklenmiştir. Yapılan analiz sonucunda,

patentlerin firmaların inovasyon performansında radikal bir etkiye sebep olmadığı ancak eğitimsel, yapısal ve Ar-Ge temelli davranışsal değişiklikler yarattığı tespit edilmiştir. Bununla birlikte, patentlerin firmalar üzerinde yarattığı kısıtların ticarileştirme ve altyapı eksiklikleriyle ilişkili olduğu belirlenmiştir. Tüm bulgular göz önüne alınarak, ODTÜ Teknokent ve gelecek patent politikaları özelinde iki ayrı politika önerisi sunulmuştur. Birincil politika önerisi üniversite, sanayi ve devlet iş birliğini önceliklendiren bir eşleştirme mekanizması sunarken, ikincil politika önerisi ticarileştirme, altyapı, kamu bilgilendirmesi, eğitim ve patent destek programları hibeleri ve prosedürlerinin geliştirilmesine odaklanmaktadır.

Anahtar Kelimeler: patent, inovasyon, firma, teknokent, etki

To my family

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LIST OF ABBREVIATIONS

B2B	Business to Business
CEO	Chief Executive Officer
DNA	Deoxyribonucleic Acid
EPC	European Patent Convention
EPO	European Patent Office
GDP	Gross Domestic Product
GII	Global Innovation Index
IASP	International Association of Science Parks
ICT	Information and Communication Technology
IP	Intellectual Property
IPR	Intellectual Property Rights
IT	Information Technology
JPO	Japan Patent Office
KIPO	Korean Intellectual Property Office
KOSGEB	Small and Medium Enterprises Development Organization
KPI	Key Performance Indicators
METU	Middle East Technical University
NAWA	Northern Africa and Western Asia
OECD	Organization for Economic Co-operation and Development
P&D	Product Development
PCT	Patent Cooperation Agreement
QDA	Quantitative Descriptive Analysis
R&D	Research and Development
S&T	Science and Technology
SIPO	State Intellectual Property Office
SME	Small and Medium-sized Enterprise

STS	Science and Technology Studies
TL	Turkish Lira
TTO	Technology Transfer Office
TÜBİTAK	Scientific and Technological Research Council of Turkey
TürkPatent	Turkish Patent and Trademark Office
UKSPA	United Kingdom Science Park Association
USPTO	United States Patent and Trademark Office
WIPO	World Intellectual Property Organization

CHAPTER 1

INTRODUCTION

For centuries, human intellect has tended to produce or develop novel products to create better conditions and ways to live. As one of the intellectual property rights, a patent guarantees selling and protection of an invention. That is why benefiting from a patent is worth emphasizing when the matter is innovation. In other words, a patent as a granted right for the inventor to protect the invention is significant for innovation. Thus, patents are significant due to their capability to boost economic growth (Dereli, 2019). They accelerate technological progress by leading incentives to create more invention and turning these inventions into commercial products thanks to disclosuring inventions to the public (Eisenberg, 1996). Therefore, innovation is a hot topic and emerging culture in Turkey (Suh et al., 2010) when the matter is the economic development and growth of the country.

For this reason, Tübitak 1507 & 1602 Support Programs, KOSGEB Industrial Property Incentives and Tax Exemption are established by policymakers to develop country's innovation performance by encouraging real and legal entities to boost their R&D activities. In 2020, Turkey's IP office also have a growth of 22.1% besides China (+29%), Japan (+14.8%), and Spain (+25.1%) (WIPO, 2021b). Turkey is ranked fourth in 2021 among the top innovation economies in the Northern Africa and Western Asia (NAWA) region, after Israel (1st), Cyprus (2nd) and United Arab Emirates (3rd) (WIPO, 2021a). Besides, Turkey is one of the countries hosting emerging science and technology (S&T) clusters with significant technological development originating in İstanbul (WIPO, 2021a).

By considering these, it can be said that literature has a positive trend regarding Turkey's patent and innovation progress. Besides, a theory may offer valuable

implementations and solutions when became applicable in practice. That is why, patent incentives -as benefiting from a patent- need to be matched up with its practical outputs. Innovation conducts through two channels as firms and networks of innovators. Also, it needs to be recalled that firms are seen as the gatekeepers of innovation. At that point, technoparks are the areas of innovation that provide technical and knowledge-based infrastructure for firms' innovative activities (Teng et al., 2020). Additionally, technoparks would be vital for smart specialization (Nauwelaers et al., 2014). Smart specialization stimulates competitive advantage, regional and technological growth of the firms by promoting job opportunities, entrepreneurship, and collaboration between private and public sector (Nauwelaers et al., 2014). According to the Zamfir (Zamfir, 2020) knowledge transfer and exchange is significant for a firm when the issue is developing their learning models, partnership and reaching new databases. Also, reducing the dependency on tacit knowledge. According to Walter (Walter et al., 2007), technoparks are the proper places for intra and inter-firm networks which enables knowledge transfer. That is why, opportunity to transfer knowledge among firms within a technopark can be antidote for knowledge silos. Knowledge silo refers to knowledge and skills that are stuck within an organization or a group of individuals. It reduces knowledge sharing among individuals while also creating an isolation between them. Specifically for technology firms, it means interrupted learning cycles, innovation performance and motivation for self-improvement (de Waal et al., 2019). Thanks to technoparks, the risk of facing with lack of knowledge can be reduced. Besides, firms' collaborative operating models (integrated systems across units, standardized procedures, and roles etc.), collaborative environments (communication networks, open information flow systems etc.) and results (increased firm efficiency etc.) can be developed (de Waal et al., 2019). Addition to these, technoparks are the proper environment to increase industry, university, and government collaboration. That is why the best way to measure patents' impact on innovation is to study firms and the cluster that feed them are technoparks such as the METU Technopark.

1.1. About the Importance of the Study

1.1.1. The Origin of the Study

The study's origin refers to the birth of the research question and the whole thesis. According to personal research of the researcher and as mentioned in the following chapters, patents have become one of the boosters of innovation (Dereli, 2004). Besides, current STS (Science and Technology Studies) literature highlights that innovation is a hot topic in Turkey regarding economic development and the country's growth (Suh et al., 2010). Apart from this, the researcher thought that patents and innovation together would offer valuable implementations and solutions in practice. Also, it is noteworthy to recall that firms and the networks of innovators are the gatekeepers of innovation. Therefore, the researcher considers all of them since she wants to examine the interaction between patents and innovation. As a result, the study's research question revealed as "Does patent incentives in Turkey impact the innovative performance of technology-based firms?" The study is designed to answer this question. The basic logic for the study's origin can be found below.

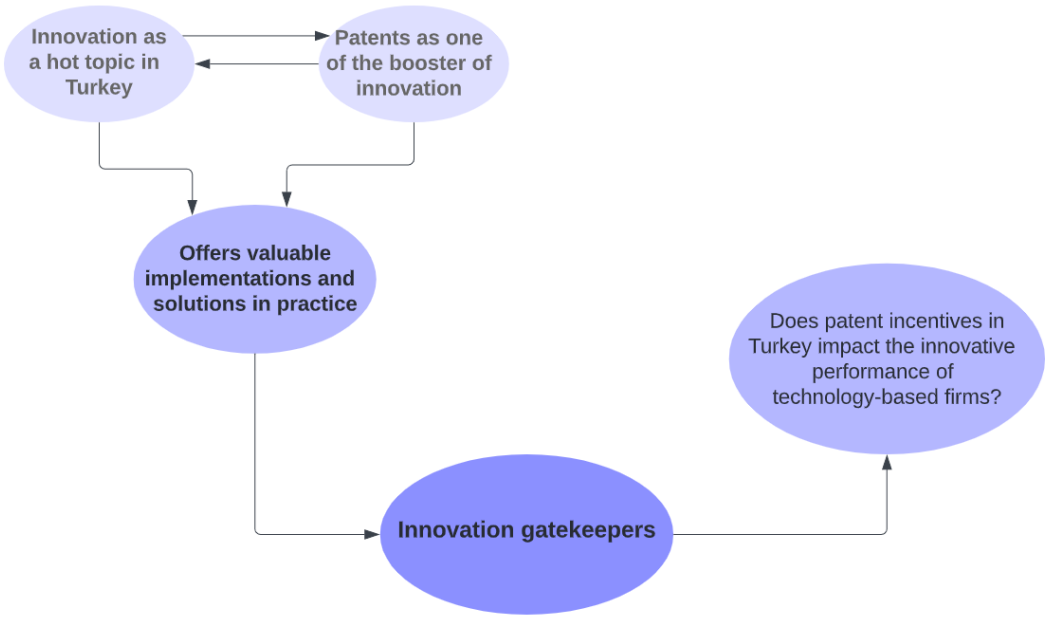

Figure 1: The origin of the study

1.1.2. Key Terms to Know

As clued in the research question, there are some key terms used in the study. They are important to know to avoid any misinterpretation and have better understanding on the research. These key terms can be classified in three as stated below.

- **Patent incentives;** means the benefits for firms that attained by exploiting a patent application. These benefits can be financial, educational, structural, R&D-based or infrastructural etc.
- **Technology-based firms;** represent the firms in METU Technopark from defense, ICT, life sciences, environment-energy and other sectors that aim technology development.
- **Innovation performance;** refers to changes and advancements in product, process, organizational, and marketing innovations of a firm. Changes and advancements include increase in patent applications for inventions, R&D projects and activities, firm's any additionality on innovation etc.

1.1.3. Aim of the Study

The study cares the significance of innovation for Turkey. It wants to reveal the actual impact of patents on the innovation performance of technology-based firms. Therefore, the study motivates by whether benefiting or not benefiting from a patent has a worthy impact on technology firms. Considering these, the study has two aims as below.

(a) Revealing firm's behavioral changes
(b) Proposing policy recommendation

The primary aim of the study is to reveal the behavioral changes that occur in technology-based firms after exploitation of a patent application. These possible changes may be educational, structural, infrastructural, or financial etc. However, the exact behavioral impacts revealed by the study is presented in Chapter 4.

The secondary aim is to provide recommendations for upcoming patent policies. Besides, the study aims to present a policy recommendation specific to METU Technopark to meet the needs of METU Technopark firms.

1.1.4. Significance of the Study

The academic literature on whether a patent encourages, or blocks innovation is massive and rooted. These encouragements highlight their economic, social, R&D and entrepreneurial aspects. According to Carpentier and Kultti (Carpentier & Kultti, 2003), patent stimulates innovation of industries (e.g., software) which are relying on cumulative innovation. Also, Ginarte and Park (Park & Ginarte, 1997) finds that impact of patent on innovation is one of the factors that affects the choice of policy makers in terms of patent protection level and incentives. On the other side, some scholars , such as Nicholas (Nicholas, 2013) and Lampe (Lampe & Moser, 2010), agree that patent hinders knowledge diffusion and transmission while also reducing the expansion of open innovation. In fact, Jaffe and Lerner (Jaffe & Lerner, 2006) argues that patenting stifles innovation. Merges and Nelson (Merges & Nelson, 1990) additionally highlights that patenting stifles innovation especially for some industries as airplane manufacturing and automobile. Supportively, some scholars argue that strict protection of intellectual property is not reinforcing innovation and novelty in patent-intensive industries (Mercan & Yalçıntaş, 2021). So, effect of patent on innovation is a frequently studied subject. However, literature has a gap regarding the behavioral changes of firms created by patents. Further, there is a lack of perspective on how the patent affects the innovation performance of technology development zone firms and how the innovation-patent interaction results. At that point, significance of the study derives from three distinct points. These are illustrated below.

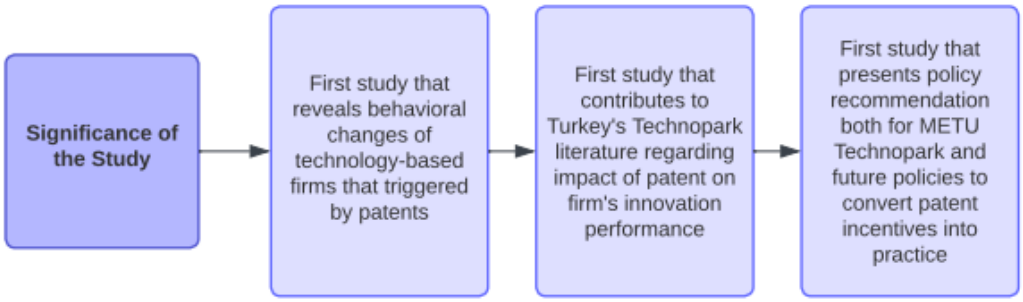

Figure 2: The significance of the study

So, the significance of the study originates from its contribution to filling this gap in the STS literature. This thesis contributes to Turkish policymakers at some points, as stated below:

- Firstly, bringing a new perspective towards patent-related behavioral changes of firm's regarding education, firm structure, and R&D activities
- Secondly, determining the limitations created by patents on technology firms within the technoparks
- Thirdly, providing policy recommendations at the micro and macro levels to strengthen patent incentives and support programs to accelerate the innovative ecosystem of both the technopark in particular and the country in general.

1.1.5. Significance of the Study Field

As mentioned in the Origin of the Study part, networks of innovators are significant for conducting innovation. They are important for the study since its aim is to explore the impact of patent incentives on technology firms' innovation performance. For this reason, the study predicates METU Technopark firms as the main network of innovators. Therefore, METU Technopark is the main study field of this thesis. This stems from several reasons as presented in the following figure.

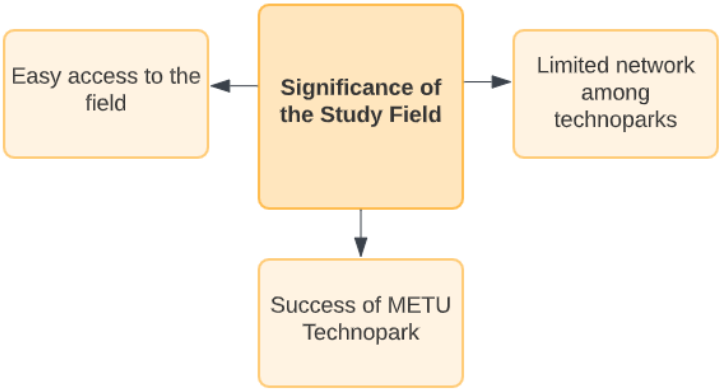

Figure 3: The significance of the study field

The study field is unique for the study in terms of easy accessing. The researcher is able to access easily to the technopark since she is a student in METU.

The technopark is also one of the most important one of its kind in its success and rich sources. According to an annual report of the Ministry of Industry and Technology, METU Technopark ranks as the first among seventy-eight technology development regions (T.C. Sanayi ve Teknoloji Bakanlığı, 2022) in 2022. Besides, The METU Technopark also has been among the most successful technoparks seven times in the Technology Development Zones Performance Index studies (ODTÜ Teknokent, n.d.).

Other technoparks in Ankara or other technoparks from distinct cities in Turkey is not included in the study. Besides, networks among different technoparks are also not considered. According to the researcher, it would be risky to include other technoparks since the coordination of them with each other remains a little limited.

1.1.6. Characteristics of the Study

Academic research is primarily referring to knowledge production (Islam & Samsudin, 2020). In this regard, the researcher deals with systematic research, data collection and data analysis to generate knowledge. They (Islam & Samsudin, 2020) states that the characteristic of an academic research consists of creation of a research question and adoption of a research methodology. Apart from this view, this section designed on

two sub-sections as the research question and the methodology of the study. These sections can be found as follows.

1.1.1 The Research Question of the Study

To serve the aim of the study, the thesis driven by the research question of "Does patent incentives in Turkey impact the innovative performance of technology-based firms?" as already stated.

1.1.2 The Methodology of the Study

In this study, mixed methodology is used. The primary data collection of the study bases on the qualitative method. As a pioneering step, all 429 METU Technopark firms were classified according to patent application totals and sectoral divisions. As a result of this research two distinct target groups are determined. They are tagged as TG1 and TG2. TG1 refers to the firms with two and/or more than two patent applications. TG2 represents firms with only one patent application. In the light of these, 36 semi-structured interviews are conducted in total. An expertise-based approach is adopted while selecting the interviewee groups. First contacts are made with the patent specialist (a patent engineer or IPR specialist etc.) of the firms. If there is such an expert employed within the firm and he or she agreed to meet, the interview is conducted. Interviews are conducted with other specialization branches (R&D or innovation unit manager etc.) in the absence of a patent specialist. As a last option, interviews were held with subject related and experienced employees (for example, business analyst). CEOs and co-founders are determined as the interviewees of TG2 since their units and expertise distributions are not very diverse as TG1. Interviews were established on 21 questions, consisting of 9 main and 12 sub-questions. These interviews lasted 46 minutes on average. The official website of TürkPatent and METU Technopark are used as secondary data source for qualitative data and classifier of TGs. Then, these secondary data are evaluated by combining them with the collected data. All interview transcriptions were coded in the QDA Minor Program as a final touch. In this way, the raw data is processed and made ready for the Findings and Discussion chapters.

1.1.3 Organization of the Thesis

The study is bases on six main chapters. Initially, the study starts with this introductory chapter to ensure its integrity and meaningful flow. In chapter 2, the literature review of the thesis is constructed. Firstly, a brief overview of the patent's nature is presented as its definition, impact, benefits, brief history, and current state in Turkey briefly, for general background. Secondly, the main study field of the thesis – the METU Technopark- is briefly mentioned under the concept of Technoparks to understand and evaluate the general structure of the study field. As a final point, the value of the study is emphasized by the argument that a paradigm shift may occur when patents and innovation embrace each other. Chapter 3 is designed as the methodology section. In addition to explaining the mixed methodology and interview design, the value of the METU Technopark as the study field is explained by the Triple Helix Model. In Chapter 4, findings generated from the interviews are presented. It is found that patent creates specific behavioral changes in firms regarding educational, structural, and R&D attributes. Additionally, limitations and the general opinion of TG1 and TG2 regarding patents are also represented to properly evaluate the actual impact of patents on a firm's innovation performance apart from these impacts. Chapter 5 proposes the key claim of the study as patent incentives have no significant impact on the firm's innovation performance in the METU Technopark to change its innovation ecosystem. However, they lead to behavioral changes that can be identified as educational, structural, and R&D changes. The study concludes with Chapter 6 by offering two policy recommendations.

CHAPTER 2

THEORETICAL BACKGROUND AND LITERATURE REVIEW

2.1. A Brief Overview of the Nature of Patent

A patent is a government-granted exclusive right that requires an innovative step and industrial usage of a novel invention (WIPO, 2018). It directly provides a territorial monopoly to the inventor of that invention for twenty years by any third parties' use (producing, using, selling, or importing) of the invention. Territorial right means disclosing the invention to the society by a detailed, correct, and well-specified document to be the owner of the invention within the geographical boundary of the relevant country or region (WIPO, 2018).

Patent has an impact on technological progress and innovation. Considering whether patents are destructive or constructive for technological progress is significant (Nicholas, 2013) because eventually, all countries are economically and technologically engaged with patents. Globally, 1,5 million patents are granted per year (WIPO, 2020). Nearly 10 million patents were granted only in the United States after the 1836 Patent Act (USPTO, n.d.). According to The Organization for Economic Co-operation and Development (OECD), a 1% change in a country's patent numbers is directly related to a 2,8% increase in foreign direct investment inflows(Benny, 2017). IPR-based industries contribute 38,6% to the GDP of the European Union (OECD, 2015). Thus, the conventional view believes that patents contribute to technological progress (Lee, 2004). Quantity of inventions increases by any investment to R&D expenditures then, productivity-level accelerates by increased numbers of inventions that concluded with more developed economic well-being (Oddi, 2014). Merges' and Nelson's race-to-invent theory argues that technological development occurs in industries with broader patent protection granted instead of

temporal developments (Oddi, 2014). It points out that monopoly power offers individuals an incentive for costly R&D spending to present new ideas to the market (Abramson, 2002). Therefore, patents encourage innovation via accelerating state of technology and science for public benefit (Lee, 2004).

Nevertheless, a patent may hinder or limit innovative activities. A patent does not favor innovation by limiting open sharing via overprotection of information (Belleflamme, 2006). Patent holders can intensify their position towards others by blocking the information. Thus, inventors are discouraged in producing the key technologies while also withdraw from free competition.

According to Mazzoleni, there are four theories regarding the benefits of patent, and they are as follows (Mazzoleni & Nelson, 1998):

(i) Theory one: Patents motivate inventions
(ii) Theory two: Patents contribute to development and commercialization of inventions
(iii) Theory three: Patents contribute to the disclosure of inventions
(iv) Theory four: Patents enable orderly development of broad prospects

The argument of Theory One tells that patent are needed to induce firms to invent, which rationalizes costs of the temporary monopoly right (Mazzoleni & Nelson, 1998). Inspired by that, some research is conducted to determine patents' place for the firms engaged in R&D activities. Scotchmer (Scotchmer & Green, 1990) says that having a broad range of patents by a single firm sometimes may result in hesitation of other firms inventing “in the neighborhood” In this way, a patent forces firms to invent alternatives to what has formerly been patented (Mazzoleni & Nelson, 1998). Data generation and novelty in invention become sustainable when firms try to step out of their comfort zone in R&D activities. Moreover, in high-technology industries, firms also embrace inventive indirect breakthroughs such as head-starter, early production, developed production and sale processes and accelerated learning curves to increase their R&D profit margin.

The capability to commercialize an invention leads to firm success (Cohen & Levinthal, 1990). Firstly, firms generally test theories regarding firm capabilities by

regression analysis since they are incapable of measuring invention commercialization (Nerkar & Shane, 2007). Therefore, proper testing of theories on firm capabilities necessitates evaluating the impact of the invention particularity on its commercialization (Nerkar & Shane, 2007). Secondly, firms prefer the commercialization of their inventions to ensure Schumpeterian rents as new services and products are created (Winter, 1995). Technological inventions which are used to make new products and services may result in first-mover advantage (Lieberman & Montgomery, 1998) and learning-curve advantages (Levin et al., 1987) that enable market domination. Generally, firms are encouraged to develop the outputs in basic research conducted in universities and turn them into an economic output that can be considered the first step to commercialization (Mazzoleni & Nelson, 1998). Theory Two suggests that patent offers an incentive to the original patent holder to push out its inventions to a firm capable of both advancing and commercializing them (Mazzoleni & Nelson, 1998). In other words, a patent means the success of a firm, which results from the commercialization impact of a patent.

Many decades earlier, the lifetime of an invention and its transmission to society were depending on the death of its inventor. However, a patent is the exact tool for disclosure, broader and faster diffusion of the technical knowledge to generate new inventions (Mazzoleni & Nelson, 1998) and sustain technology transfer. Inventors by themselves could not exploit all likely usages of the invention (Mazzoleni & Nelson, 1998). Disclosure of a patent captivates the interest of third parties who can use that invention thus, this may attract individuals to patent use (Mazzoleni & Nelson, 1998). Besides, firms rather than individuals, are the custodians of the inventions subject to the high-technology industry when the matter is speed, breadth and absoluteness of the disclosure (Mazzoleni & Nelson, 1998). Collaterally, Theory Three indicates that, especially commercially-oriented inventors are profit from new products and processes by pushing-up the knowledge to block imitation rapidness throughout using or producing the invention (Mazzoleni & Nelson, 1998). At the end, this encourages the inventor to disclose to the public via patenting.

A primary discovery or an invention paves the way for follow-on developments or inventions (Kitch, 1977). Additionally, a patent for the initial invention is necessary to

eliminate “wasteful mining of the prospect” and “overfishing of the pool”(Mazzoleni & Nelson, 1998). Theory Four claims that the contribution of an invention is the ability to make further inventions over and above developed products and processes for the final use (Mazzoleni & Nelson, 1998). In such a case, significance of cumulative systems occurs. In cumulative systems, technology advancement demands the usage of already existing components (Merges & Nelson, 1990) to create a novel one. In short, the development of technological progress and the majority of third parties following it will increase since an invention provides clues on how innovation proceeds.

2.2. A Brief History of Patents and the Current State of Patent Incentives in Turkey

The first legal regulation on patent protection is constituted in the Ottoman Period. The Patent Lease Act (İhtira Beratı Kanunu) of 1879 (Yalçıner & Köker, 2020) approves that the invention can only be the property of its creator. The first step for patents was taken in the first year of the Turkish Republic (1925) by the Paris Convention on the Formation of an International Union for the Protection of Industrial Property (TürkPatent, n.d.-c). Turkey became the signatory of the Patent Cooperation Agreement (PCT) in 1996 and to the European Patent Convention (EPC) in 2000 (Yalçıner & Köker, 2020).

A patent is solely valid for the country where it is issued. It is also subject to that country's patent laws and litigations in its national courts (OECD, 2004). Therefore, a patent system should be tailor-made to meet a country's specific needs regarding fostering economic benefits and eliminating deficiencies (WIPO, 1977) throughout stimulating patents. The Turkish Patent Institute was established in 1994 (TürkPatent, n.d.-b) to meet its nation-specific needs. The institution's name was changed to the Turkish Patent and Trademark Office in 2016 (TürkPatent, n.d.-c). Its short name is used as TürkPatent (TurkishPatent). TurkishPatent has several objectives that intend to be achieved between 2019 and 2023 (TürkPatent, n.d.-b); these are as follows:

- Increasing patent awareness of economic actors of the country,
- Increasing innovation infrastructure and capacity of SMEs,

- Strengthening cooperation among different stakeholders,
- Following emerging technologies in the international era and accelerating the competitiveness of the country among them,
- Transforming patent portfolios into a commercial value

According to Johnson, individuals do not create or invent anything without incentives (Johnson, 2012). Therefore, supporting inventors are essential to fulfill abovementioned goals. These support programs aim to increase the number of national and international patent applications and encourage individuals and legal entities to apply for a patent (Tübitak, n.d.-a). Boosting innovation by increasing R&D capacity and activities, increasing the competitiveness of private sector firms, and supporting SMEs are also deemed necessary (Tübitak, n.d.-b).

2.2.1. Tübitak 1507 - SME R&D Startup Support Program

It is a support program for SMEs and start-ups. It aims to make SMEs more competitive to perform systematic projects and develop high-added-value products. Besides, it includes supporting them by improving existing products regarding quality, standard, technique, and production technology by reducing costs. The support rate is 75%. The project's total budget that applied to the program is limited to 40,000 TL (Tübitak, n.d.-b).

2.2.2. Tübitak 1602 – Patent Support Program

It aims to support real and legal entities to increase the total number of national and international (PCT) patent applications. Support is provided based on the examination report fees to be issued by TurkishPatent, EPO, JPO, SIPO, KIPO, USPTO. Program supported 1,255 international research and examination requests in 2019: 1,385 in 2020, and 1,644 in 2021. All application fees are covered if TurkishPatent is preferred as the International Research and Examination Committee (TürkPatent, n.d.-b).

2.2.3. KOSGEB Industrial Property Incentives

It aims to escalate the role and operability of SMEs, increase their competitive capacity in the market, and supply industrial integration of SMEs to meet the country's socio-economic needs regarding patent applications. All expenses are covered if the registration document is obtained from TurkishPatent. However, the support rate is applied as 60% to the expenses of the patent attorney and brand attorney subject to the support. The upper limit of support has been determined as 30.000 TL. Support is non-refundable (TürkPatent, n.d.-a).

2.2.4. Tax Exemption on Industrial Property Rights

It provides tax exemption to corporations for the transfer, sale, and lease of patents regarding the earnings resulting from innovative activities. It provides an exemption from 50% of the corporate tax of all earnings obtained in the case of rental, transfer, sale, or marketing of inventions (TürkPatent, n.d.-a).

2.3. Technoparks & Firms

Innovation environments include areas of innovation. In basic, areas of innovation are "places that are designed and curated to attract entrepreneurial-minded people, skilled talent, knowledge-intensive businesses, and investments by developing and combining a set of infrastructural, institutional, scientific, technological, educational, and social assets together with value-added services, thus enhancing sustainable economic development and prosperity with and for the community" (Pique et al., 2019). Technoparks are noteworthy at this point, as they are one of the areas of innovation.

According to the International Association of Science Parks (IASP), technopark is an initiative led by entrepreneur professionals to support, develop, and enhance innovation and competitiveness of information and technology-based firms(IASP, n.d.). The United Kingdom Science Park Association (UKSPA) (ITU ARI Teknokent, n.d.) adds that a technopark requires interoperability between a university and a research center and offers a model of technology, innovation, and business

development to encourage the growth of its firms. According to Siegel (Siegel et al., 2003) technoparks are significant for their firms in the following sense:

- Supportive infrastructure for new technologies and knowledge
- Simplifying technology transfer
- Encouraging the firm's innovative and size-based growth
- Attracting the firms that are specialized on emerging and leading technologies
- Encouraging strategic alliances and networking

2.3.1. The METU Technopark

As an innovation area, the METU Technopark offers a super and infrastructure for its firms, researchers, and academicians to produce and develop technologies that will accelerate the country's competitiveness. It also matches university and industry for the collaboration. In the Technopark, 50% of firms are from software-informatics, 20% of them in electronics, 15% of them operating in machinery and design, 6% of them in medical technologies, 6% of them in energy and environment, while the remaining 3% of them operates R&D studies in other fields such as advanced materials, agriculture, food, aerospace and automotive.

Taking these into account, there are particular reasons to choose of METU Technopark as the study field. Firstly, it easier for the researcher to access the METU Technopark firms and patent experts of them to conduct interviews. Secondly, high numbered firms of the technopark and rich patent portfolios of them is quite significant and valuable for the study. Also, the importance of Metu Technopark for the study explained in detail under Why Does METU Technopark Matters section of Chapter 3.

2.4. Brief Overview on Innovation

A Latin-originated term derived from the word *innovare* means "into new" (Stenberg, 2017). Although innovation has numberless definitions in the multidisciplinary field, its scope becomes inclusive according to the discipline it belongs to. This study specifically is based on the concept of innovation in the Oslo Manuel.

> *"An innovation is a new or improved product or process (or a 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 actors who responsible for innovations (process)"*(OECD, 2018)

The term basically refers to either or both an activity and its result (OECD, 2018). This definition is adopted because it develops and functionalizes as a guide to the practices followed by the business sector. There are four types of innovation are defined product, process, organizational and marketing innovations, as stated below (TÜBİTAK, 2015):

Product innovations (OECD, 2018) refer new or improved good or services that notably differs from a firm's existing products.

Process innovations represent new or improved products and delivery methods.

Organizational innovations mean significant changes in the execution of new organizational methods. These may be changes in business practices, workplace organization, or external relation management.

Marketing innovations are implementing new or improved marketing methods in a firm. It refers to product design and packaging changes, product promotion and positioning, and pricing methods for goods and services.

2.5. What Patent and Innovation Mean to Firms?

According to the incentive theory of innovation (Johnson, 2012), firms have an instinct for creating and inventing, therefore innovating by an internal motivation. So, the sustainability of patent applications is dependent on the survival of firms. As a supporter of this, Salter (Salter & Alexy, 2015) argues that innovation conducts by firms -both large-scale and SMEs- and networks of innovators such as universities, government, suppliers, and users etc. In other words, firms are the key for patents and innovation activities in an innovation system. There is a mutual relationship between patents and innovation, which the firms are fed and driven. This interaction is presented in the figure below.

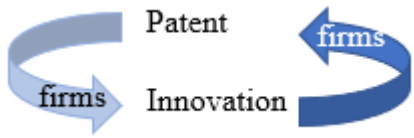

Figure 4: Patent and innovation interaction for firms

Source: Adopted by the researcher from Granstrand's (Granstrand, 2005) *study*

A strengthened patent portfolio demands innovation development, whereas an accelerated innovation system needs more exploited patents. Firms' intrinsic motivation leads to invention-creation even in the lack of any external incentive (Johnson, 2012). However, inventing process seen as extra costly, risky and time consuming (Costello & Prohaska, 2013) by firms, it is critical for them to implement reformer R&D projects and have competitive advantage in the market. The value of a patent also depends on its ability to link with other related patents. Simply, patents became a 'trading device' (Belleflamme, 2006) and 'commercial bargain' as long as a firm's patent portfolio and patent family became stronger. Vitally, commercialization means the survival of a technology firm. According to Datta (Datta et al., 2015), the ability of a firm to commercialize its invention refers to its diffusion to the market, creating a network externality and being its early adopter to eventually becoming a competing technology by also gaining a financial return. Wallsten (Wallsten, 2000) states that commercialized patents lead firms to diffuse existing or newly created markets and technologies to sustain their leadership and longevity regarding innovational improvements. Meyer (Meyer & Zucker, 1989) also adds that the global market puts pressure on firms to commercialize their products to keep inviting themselves to international competition. Chiesa (Chiesa & Frattini, 2011) further proclaims that the products of high technology firms have started to self-destruct because of the firm's lack of experience in the commercialization process.

2.6. What Happens If Patents and Innovation Embraces Each Other: Paradigm Shifts

Lee (Lee, 2004) argues that patents have an unexpected contribution to scientific and inventive activities. The mentioned paradigm shift is based on Kuhn's (Kuhn, 1970) famous view: a paradigm shift is the most radical type of scientific change. According to Lee, protecting "research tools" by a patent is vital to accelerate scientific experiences. The research tools are to patent physical artifacts that theory-associated technical subsidiaries that researchers and scientists need to theorize. So, of course, individuals cannot patent abstract theories such as the formula of mass-energy equivalence. However, they can have patented tools. Therefore, "patents on research tools earlier and earlier in the development chain thus raise the possibility of creating individual ownership in theories" (Lee, 2004).

As research tools become more advanced and customized, countless fields will become patentable. Patents will encourage individuals to try mainstream research tools that are available. Thus, individuals will produce and test further theories. The increase in alternative theories will mean an increase in patents. Endless theory production is a significant opportunity to replace existing paradigms with new ones. For example, physical artifacts reflect the theories on DNA regarding its nature and function. These lead scientists to discover DNA as a paradigm shift in genetics by testing, widening, and applying their theories. Thus, a paradigm shift may be the unexpected benefit of strong patent protection. That is why it is worth thinking about the impact of a patent on innovative and scientific activities.

As concluding remarks, this chapter presents a theoretical background on patents and innovation. It also prepares a base for the discussion chapter of the study by presenting the existing literature. This chapter can be wrapped up with the following figure.

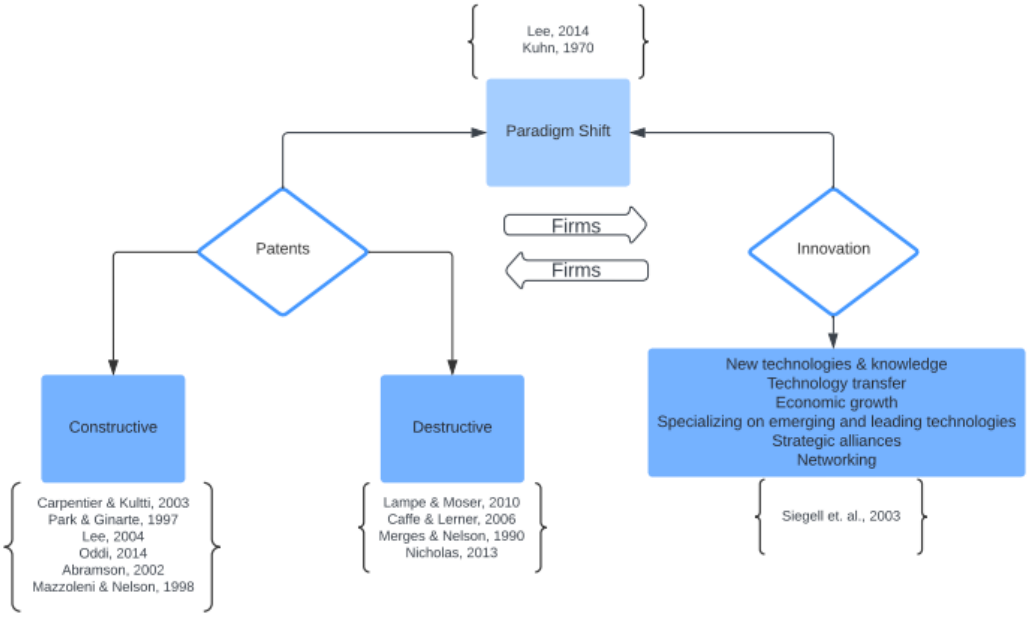

Figure 5: Basic framework of the theoretical background & literature review

Literature review of the study presents two dominant views regarding the effect of patents on innovation. Scholars like Carpentier, Park, Lee, Oddi, Abramson and Mazzoleni stick into the conventional view. They argue that patent contributes to innovation and its development. On the other hand, some scholars like Lampe, Caffe, Merges and Nicholas point out that patent may hinder or limit innovative activities by overprotection of information which enables limited open sharing. The existing literature is pro-conventional and emphasizes that patents motivate invention creation, commercialization of inventions and disclosure of them.

Some studies like Siegel at. Al., also reminds that innovation is significant for new technologies, technology transfer, economic growth, strategic alliances between distinct entities and establishment of new networks.

Also, there is a mutual relationship between patents and innovation that are fed and driven by firms since technology firms are the key for innovation and have an endless instinct to invent.

What makes interaction between patent and innovation significant and worth to mention is the possibility to reach - Kuhn's view of radical type of scientific change-

a paradigm shift. As physical artifacts become more customized and advanced, countless fields becomes patentable. This will encourage individuals to produce further theories and thus a chance to replace existing paradigms with new ones.

In conclusion, this literature review finds out signifying points that reflect to the methodology and analysis of the study. Considering the potential of patents as ability to create paradigm shifts and boost innovation, they are notable for developing countries like Turkey when the matter is any development in innovation and technology.

The steps taken throughout Turkey's patent history such as establishment of a patent law and patent incentives show the importance of patents and its acceleration for the country. Agenda of TürkPatent including supporting SMEs, increasing technological competition and commercialization also emphasizes why Turkey also attaches patents to boost technology firm's innovation performance.

However, the actual impact of patents on technology firms is lacking in Turkey's technopark and STS literature. So, this literature review leads the study and its methodology by highlighting METU Technopark and importance of its firms as a study field. Mapping and discussing the behavioral changes of firms in the technopark also paves a way to present policy recommendations specific to Turkey case.

CHAPTER 3

METHODOLOGY

This chapter presents the methodology of the study. It holds inductive approach since it has an exploratory nature. The methodology is divided into two main sub-sections as mixed-method and the study field. Qualitative data is originated from semi-structured interviews. They are the key for data collection. The official websites of TürkPatent and METU Technopark are the quantitative data sources. They are used as the classifier of the target groups. METU Technopark is determined as the main study field under Etzkowitz's Triple Helix Model. Interviews are conducted with two distinct target groups tagged as TG1 and TG2. Thirty-six interviews are conducted during the data collection phase. Overall, this chapter evaluates the methodology of the study in detail. It is designed to construct the thesis and interpret the findings to answer the research question.

3.1. Purpose and Rationale for the Study

As mentioned in the literature chapter, the importance of the study derived from its power to determine the significant impact of patent incentives on innovative performance of technology-based firms. Turkey's patent application numbers increased by 10.57% in the year between 2018 and 2019 also, WIPO reported that Turkey carried 1068 PCT applications after the 1602 program (TürkPatent, n.d.-b). However, there is no promising literature that manifests the actual impact and vivid outcomes of patent incentives on innovation behavior of the firms in METU Technopark. Besides, literature on this subject in Turkey remains limited. Thus, the study has two purposes: (a) filling the gap in the literature regarding the impact of patent incentives on innovation performances of technology-based firms (b) recommending a policy recommendation that converts patent incentives into practice

operatively. Identifying a research question is critical to fulfilling the purposes above. Therefore, the following section examines the research question before explaining the research design behind that.

3.1.1. Research Question

"Does patent incentives in Turkey impact the innovative performance of technology-based firms?" is the research question driving the whole study. The meaning of the terms used within the question are already stated in the introduction chapter to establish a better understanding of the thesis.

This research question aims to fulfill the purposes (a) and (b) (as stated in the introduction chapter) to explore the exact triggers of Turkey's patent incentives that impact firms' behaviors resulting in accelerated innovative performance. After determining the impact of patent incentives on the innovation behavior, the study is expected to come up with an answer to the research question.

Inherently, the study aims to create a theory as the result of the findings and to test it. Thus, inductive reasoning is determined as the research strategy of the study since the theory will be revealed by the outcome (Bryman, 2012) of data analysis.

3.1.2. Inductive Approach

In social research, there are two common methods of reasoning as inductive and deductive approaches (Burney & Saleem, 2008). The essential features of the deductive and inductive approach are illustrated in Table 1:

Table 1: Characteristic of inductive and deductive reasoning (Bryman, 2012)

Social Research Strategies	
Inductive Approach	• A theory as an outcome of the research • Participant observation and semi-structured interviewing as the research methodology to allow the researcher to have new concepts and hypotheses directly derived from the data • Theorizing and conceptualizing the qualitative data at the end of the study
Deductive Approach	• The theory that guides the research • Predetermined hypothesis based on known data for empirical testing • Direct connection between theory and the social research

Apart from this, the steps that configure the inductive approach in the study are shaped as follows:

1. Evaluating quantitative data to interpret qualitative data
2. Designing open-ended questions through integrated quantitative data
3. Analyzing interview outputs and gathering findings
4. Creating categories and concepts throughout the data analyzing process
5. Concluding with a theory or an output for the study

3.2. Research Methodology

The advancements of modern technology provide opportunities and chances for novel study designs and sophisticated techniques in social sciences(Creswell, 2014). The mixed-method is a research design for social sciences that combines quantitative and qualitative data by an exploratory approach(Davies, 2020). It is also one of the significant methods social researchers use to encourage innovative studies of social sciences by using two unique types of data (Almalki, 2016). As touched upon in the previous chapter, the study's theoretical background is based on mapping the direct and indirect impacts of patent incentives to reveal developments on innovation

performance of technology-based firms by studying target groups. Thus, the study aims to find an answer to practical feedback of patent incentives in technology regions where the government-led incentives are executed. Considering all these, conducting semi-structured interviews, and using secondary sources of Turkish Patent and Trademark Office, EPO, METU TTO, and WIPO throughout the study, makes the mixed method the most suitable study method.

Quantitative data can be used along with the qualitative data to elaborate and strengthen the qualitative data and its analysis. Hence, mixed method can integrate both qualitative and quantitative sampling methodologies with enough time and resources to use both (Patton, 2002). This method is integrated into the study due to the previously mentioned time and resource availability. The execution of the method can be found in Table 2.

Table 2: The function of mixed method in the study

Data	**Method**	**Function**
Quantitative	Numerical Analysis Statistical Analysis	Descriptive Illustrative
Qualitative	Semi-structural interviews	Interpretative Exploratory

Quantitative data is a dataset that includes numerical values, and it can be utilized for statistical analysis, allowing real-world decisions by the mathematical derivations (Australian Bureau of Statistics, n.d.). Statistical and numerical analyzes were made to illustrate the demographic background of the interviewees, to support the descriptive extent of qualitative data for learning how the collected data reflects in practice. Semi-structured interviews as the main data generation source of the study functions as interpreting the whole data to find an output. In detail, usage of both qualitative and quantitative data is also specified in the following chapters.

3.2.1. Quantitative Method and Data

The benefit of the quantitative method is allowing researchers to quantify the responses of a large number of individuals by a set of questions for easier comparison and statistical analysis of a dataset (Patton, 2002). So that generalizable and non-subjective collections of facts and descriptions can be evaluated(Patton, 2002) to solve a problem. Although secondary data is simply the analysis of data collected by others, these data need to be re-analyzed for unique study fields that have not been touched on before (Martins et al., 2018). Hence, secondary sources used in the study for finding a satisfactory answer to a novel research question.

The secondary sources of the study consist of two official websites: METU Technopark and Turkish Patent and Trademark Office Official websites. As the beginning step, Technopark's firm list was retrieved from METU Technopark's database. Then, the data necessitated the guidance of the Turkish Patent - Patent/utility model Research and File Tracking Database open-source to determine the total number of the patent application for each firm. Although both databases were reviewed chronologically, it would be beneficial to be informed about the study field.

3.2.1.1. Study Field: Why does METU Technopark matter?

According to Etzkowitz's Triple Helix Model (Razak & White, 2015), universities function as knowledge generators; industry is worth emphasizing its ability to transfer knowledge into practice, whereas government is the key to bridging technological know-how and industrial channels to establish a collaboration platform (Etzkowitz, 2002). Technoparks is the one that brings all of them together under a single roof to function. This makes technoparks a significant ecosystem that boosts R&D and innovation development driven by university-industry and government cooperation. That is why METU Technopark is chosen as the main study field since it provides a trio as mentioned above with:

- University; as METU
- Industry; as 429 technology-based firms of METU Technopark from five distinct sectors

- Government; as Turkish Patent and Trademark Office or other branches as patent policymakers

As a pioneering step, all 429 METU Technopark firms were classified according to patent application totals. These totals have been researched through the patent application portal of Turkish Patent. Patent application totals was searched by creating keywords sets (for example, one-word set, two-word set, three-word sets etc.) on legal firm names. The accuracy of the research was cross-checked by using different word sets. As a result, 54 firms in total have at least one patent application. 24 firms (≈6%) had 2 or more patent applications; 28 firms out of 429 firms (≈ 7%) had only one patent application whereas out of 377 firms (87.7%) did not have any patent application at all. Target groups for interviewing were determined according to these results. Simply, a comparative analysis between two distinct groups as higher-rated patent applicants versus lower-rated patent applicants was held. Accordingly, the primary target group with two and/or more than two patent applications is tagged as TG1 (target group 1), whereas firms with only one patent application are tagged with TG2 (target group 2). This comparative study aims to reveal the followings:

- Exact terms of patent incentives that impact patent application preferences of a firm
- Behavioral factors that created a gap between TG1 and TG2
- Behavioral factors which can reduce the gap between TG1 and TG2
- Possible ways to reduce the rate of 87.7% by proposing a policy recommendation

As a secondary and following step, all of the 429 firms – especially TG1 and TG2 – were evaluated on a sectoral and sub-sectoral basis to find any sectoral-based correlations. The summary can be seen in Table 3.

Table 3: Sectoral diversity of METU Technopark firms

Sector Name	Number of firms*	TG1	TG2
Defense	127	8	7
ICT	214	7	6
Life Sciences	49	4	1
Environment - energy	57	1	0
Other	90	0	1

* *According to the official website of Metu Technopark and the firm's official websites, firms defined their fields of activity with multiple sectors. For this reason, the sectoral and sub-sectoral distribution numbers include all sector types for each firm. However, in the sectoral distribution of TG1 and TG2, only the first tagged field of activity is considered.*

Table 3 shows the sectoral distribution of all firms in the technopark especially TG1 and TG2. Defense and ICT sectors are the pioneering ones of the technopark where firms in environment-energy sector remains quite low comparatively. In parallel with the sample population, they belong to, defense and ICT sector also leading fields in both target groups. Contrary to TG1 there is not any environment-energy sector in TG2 while the category of "others" not exist in the TG1. The ratios regarding defense and ICT sector are relatedly close each other. While the share of the defense sector in TG1 is 18%, the percentage in TG2 is 16% with a decrease of only 2%. Although the ratio of ICT sector in TG2 is 10%, it is only 5% less than TG1. This shows that there is no correlation between patent application numbers and sectors. At least, patent application numbers are not sector-dependent since the leading sectors of both groups is in a similar direction. Interestingly, there is a notable difference between TG1 and TG1 in terms of life sciences percentages. While the life sciences sector in TG1 is 10%, this rate is only 3% in TG2, which is remarkably low compared to TG1.

Table 4: Sub-sectoral diversity of METU Technopark firms

Sub-sector Name	Number of firms*	TG1	TG2
Nanotechnology	13	1	0
Advanced material technologies	32	2	0
Software	254	8	9
Biotechnology and genetics	15	0	0
Electric-electronic	113	5	2
Mechanics	61	3	4
Design	68	1	0
Others	53	0	0

* *According to the official website of Metu Technopark and the firm's official websites, firms defined their fields of activity with multiple sectors. For this reason, the sectoral and sub-sectoral distribution numbers include all sector types for each firm. However, in the sectoral distribution of TG1 and TG2, only the first tagged field of activity is considered.*

Although the firms in the technopark are information-based and defense-oriented firms, each of them has multiple sub-areas to operate in. Therefore, the sub-sectoral diversity of the firms and target groups are also represented in Table 4 to illustrate any semantic relation. Firms define themselves by 8 distinct sub-sectors. For both TG1 and TG2 the core field is software where its electric-electronic for TG1 and mechanics for TG2 comes after that. There is no operation on biotechnology-genetics and others for both groups. Although the sub-sectors of TG2 are only 3 out of 8, it is also relatively narrow in terms of diversity compared to TG1, which has 6 various sub-sectors. Overall, mechanics is the most activated sector just after mechanics, as in TG2. In conclusion, there is no significant correlation between the sub-sectors and patent incentives as there is no meaningful similarity or a particular gap among them.

3.2.2. Qualitative Data Collection

The essence of critical thinking is lies behind the capability of integrating and interpreting experience (Loevinger, 1976). The qualitative data collection process allows the researcher to design, interpret and gather the data by making researchers

also an instrument of that (Corbin & & Strauss, 2008). Inspired by that, data collection was conducted by semi-structured interviews as qualitative method of the study. Interviews are designed as the key for the data collection. Expectedly, quantitative data of the study used to prepare interview questions and to interpret and analyze correctly interview outputs in the data analysis chapter.

3.2.2.1. Interview design

Semi-structured interviews are designed to collect data through a set of questions. Questions are prepared in English. However, interviews were held in Turkish so, the interviewees could feel more comfortable while expressing themselves. Interviewee confirmation for the interview recording is also given in Turkish. Interview questions prepared to explore intra-firm behavioral changes and/or impacts that are triggered and led indirectly by patent incentives to boost in-house or collaborative R&D projects. To find these possible impacts, 21 questions (9 main & 12 sub-questions) are designed. The function and context of the questions are illustrated in Table 5.

Table 5: Aim of the semi-structured interview questions

Question Number	Questions	The Main Aim of the Question(s)
Q1 & Q2	- What comes to your mind when you think of patent incentives? - What do you think about patent incentives in Turkey?	- Getting to know the target audience: Learning common sense and informational background of interviewees in order to evaluate awareness on patent incentives in general
Q3 & Q4	- Is there a patent department in the firm? or do you have a patent specialist within the firm? - Do you have a policy regarding patent incentives in the firm?	- Mapping current patent-related set-up of firms to identify what kind of behavioral reflections are occurred on firm's culture

Table 5: Aim of the semi-structured interview questions (continued)

Q4.1 & Q4.2 & Q4.3	- 4.1. Are there any patent incentives that you have benefited from and/or intend to benefit from? - 4.2. If yes, how many patent incentives have you used in total so far? 4.3. What innovations did you apply for a patent?	- Obtaining descriptive data on the practical usage of patent incentives
Q4.4 Q4.5	- 4.4. What were the factors that motivated you to apply for a patent? - 4.5. If not, why didn't you apply for a patent? Have you encountered a negative result of not benefiting from any patent incentives?	- Understanding exact triggers to innovate and its protection - Discovering any type of functional glitches that encountered throughout a patenting process
Q5 & Q5.1 & Q5.2	- Are there any persons or organizations that you have partnered with for a patent application? - If yes, what were the reasons for you to prefer these people or organizations? - What effect did this partnership have?	- Seeing how university, industry, and government establish their innovative interactions and cooperation
Q6 & Q7	- Do patent incentives have an effect on innovation? What are these effects? If so, can you explain the reasons for the impact of patent incentives on innovation? Otherwise, why do you think patent incentives have no effect on innovation? - What was the effect of the patent incentive you benefited on the innovation performance of the firm?	- Learning how the interaction cycle between innovation, patents and patent incentives has circulated

Table 5: Aim of the semi-structured interview questions (continued)

Q7.1 & Q7.2 & Q7.3	- Did the patent incentive you benefit from increase the innovation performance of the firm as expected? - Did taking advantage of the patent incentive have any negative impact on the firm's innovation performance? - Even if you did not benefit from any patent incentives, would there be the same change in the innovation performance of the firm?	- Discovering whether patent incentives fulfill their purpose or not
Q8 & Q8.1 & Q8.2	- Do the patent incentive policies implemented in Turkey provide sufficient support to the companies? - Do patent promotion policies work in practice? What is your view from the perspective of the company? - What can be done to make the patent incentives in Turkey more effective for companies?	- Reviewing the adequacy of present policies - Determining the parameters that should be established to increase function and usability of patent incentives for innovation and R&D production centers
Q9	- If you were the decision-maker about patent incentive policies, what would you do?	- Designing a policy recommendation to increase the practical operability of patent policies in Turkey

Although TG1 was prioritized at the beginning, the interviews of TG1 and TG2 proceeded in an unordered manner just after the first interviewee due to the snowball sampling method. Interview requests and interview invitations were delivered via e-mail. Some of the interviewees prefer to participate in interviews with their colleagues or co-workers for better information providing. A summary of additional demographic information of mentioned participants can be found in the next section.

3.2.2.2. Characteristics of Target Sample

In this section, age and gender distribution, job-related professions and sectoral diversity of interviewees are specified. In this way, it was planned to see whether the patent experts working in technology-based firms embraced digital communication mediums as a practice to transfer professional know-how or whether to observe gender quality among patent experts within the informatics sector. As mentioned before, total of 36 firms are interviewed. Communication tools for interviewing are decided according to the preference of interviewees. The interviews are conducted online, with some exceptions because of half and/or full-time closures and remote working due to Covid-19 pandemics.

Interviewees are specified by the researcher. In general, interviews are conducted with a group of highly experienced employees. Preferably, IPR specialists or managers of the firms are selected and contacted. Patent and innovation-related departments are referred to reach in the absence of such firm personnel. Even it is not included in the target groups, one additional meeting is set up with METU TTO because of the need to learn the functionality and effects of the TTO on the firms regarding patent incentives to evaluate the literature and analyze the data accurately. Overall, the distribution of target respondents and related demographic information about them are shown detailed in Table 6.

Table 6: Demographic summary of interviewees

Interview ID	Target Group	Age Range	Gender	Job Title
1	TG1	30 - 39	Male	Patent Engineer in Chief
2	TG1	30 - 39	Female	Project & Contract Officer
3	TG1	20 - 29	Female	Software Engineer
4	TG1	50 - 59	Male	CEO
5	TG1	30 - 39	Female	Intellectual Property Management Specialist
6	TG1	20 - 29	Female	Technology and Innovation Management Engineer
7	TG1	30 - 39	Female	Senior Patent Specialist
8	TG1	50 - 59	Female	Corporate R&D Technology and Innovation Manager
9	TG2	30 - 39	Male	Chief of R&D Unit
10	TG1	20 -29	Male	R&D Incentives Management Consultant
11	TG2	30 - 39	Male	Design Manager
12	TG 1	30 - 39	Male	R&D and Innovation Unit Manager
13	TG2	60 - 69	Male	Co-founder
14	TG2	60 - 69	Male	CEO
15	TG1	30 - 39	Female	Technical Project Consultant
16	TG1	30 - 39	Male	Co-founder
17	TG1	40 - 49	Female	CEO
18	TG2	40 - 49	Male	CEO
19	TG1	50 - 59	Male	Industrial Safety and Production Coordinator
20	TG1	30 - 39	Male	Senior Software Developer
21	TG1	20 - 29	Female	Patent and Design Specialist
22	TG2	50 - 59	Male	Finance and Operations Director
23	TG1	30 - 39	Male	Patent Engineer
24	TG1	30 - 39	Male	Patent Engineer
25	TG2	30 - 39	Male	Founder
26	TG1	20 - 29	Female	Patent Specialist
27	TG2	40 - 49	Female	Business Analyst
28	TG2	50 - 59	Female	Deputy General Manager
29	TG2	30 - 39	Male	Engineering Director
30	TG2	40 - 49	Male	Analysis and Quality Unit Manager
31	TG2	40 -49	Male	Patent Specialist
32	TG2	30 - 39	Male	Intellectual Property Manager
33	TG2	30 - 39	Female	Project Manager
34	TG2	20 - 29	Female	Product Developer
35	TG1	30 - 39	Male	General Manager
36	TG2	30 - 39	Male	CEO

- The average age of the interviewees is 39. Considering the firm structures and age groups mentioned during the interviews, there is a correlation between age ranges and profession levels. CEOs, founders, co-founders, and general managers as senior managers is usually split into two groups as 30-39 and 50-59 and above. It seems that, the 50-59 age group and above, took over the firm after many years of experience and know-how in the field, whereas young management level as 30-39 age range has established start-ups and spin-offs with few years of working experience after graduation.
- The defense sector accounts for 42,8% where ICT and life sciences accounts for 37,1% and 14,2% of interviews respectively. The ratio of interviews from environment-energy and others are the same by 2,8% percent.
- Patent specialists in TG1 are generally in the 20-39 age range. Interviewees were patent specialist in 25% percent of TG1 firms that interviewed. In contrast, only 1 firm has a patent specialist in TG2. It shows that benefiting from patent incentives is directly proportional to employing a patent specialist.
- The rate of female patent-related specialists in the interview groups is 38,8% where males ≈ 61,1% in overall. In TG1, the number of male and female professionals is equal, at 10. In TG2, while only 20% of IT specialists are female, this rate is 80% for males. This can be interpreted as the firms that embrace patent incentives as a firm culture also adopting the culture of gender equality in the business field.

3.2.2.3. Interview Execution

After the interview design process is completed, interview questions are sent to interviewees via e-mail as advance notice. Four main communication mediums are used to conduct the interviews on a pre-set date and time zone: face-to-face meeting, phone call, written feedback and teleconferences via Zoom and Microsoft Teams meeting tools. Only one interview was held face-to-face in the interviewee's office by personal request. Three of the participants submitted written feedback and sent them through e-mail because of their time limitations and workload. Again, only 1 of the interviews was conducted over a phone call due to interviewee's overloaded work

schedule. All the 28 interviews were made through Zoom except for the remaining 3 which are held on the Microsoft Teams. Interviews conducted between the 2nd week of November 2021 and the 3rd week of January 2022. Additionally, only one interview was held in March 2022.

A total of 36 semi-structured interviews were conducted. 20 out of 24 TG1 firms and 15 out of 28 TG2 firms were interviewed. TG1 was considered as the priority group due to the higher number of patent applications and know-how on the subject. Therefore, the aim was to reach all of the firms and complete the interviews. However, four of the firms did not participate in the meeting because of firm's relocation, a direct rejection of meeting request and non-response to meeting invitations.

The interviews lasted 46 minutes on average. The longest interview was 1 hour, and 20 minutes and the shortest interview took 14 minutes. due to limited time of the participant. The duration of interviews is varied for two reasons: the type of communication tool and the target group. Teleconferences have an average of 46,5 minutes, where face-to-face and telephone meetings last 40 minutes on average. In written feedback, there are communication-medium-based limitations occurred because of lack of mutual interaction by blank questions and/or the absence of explanatory answers. To avoid this, the interviewer had to ask the re-elaboration of missing questions. Unfortunately, this resulted in a significant loss in time regarding data collection and a communication gap between the transmitter and receiver. Thus, digital tools were more operable and usable than traditional methods in communication regarding time and extent of response. Interviews with TG1 lasted 54,3 minutes on average where its 38,3 minutes for TG2. Interviews with TG2 is more limited regarding the duration due to more limited feedback on the study subject since interviewee's firm experienced only one patenting process. The 16 minutes difference between TG1 and TG2's interview average is significant considering duration of the shortest interview is 14 minutes. Seemingly, know-how and experience in patent process are related to the duration of knowledge exchange and extensiveness of the outputs derived from the interviews.

Another point of interest in the execution of interviews is the recording of the interviews. All interviewees approved the audio recording. The recording of the

interview was considered for analyzing the data. These records also include interviewee's verbal approval for audio recordings. Moreover, records are used to re-listen and evaluate interviewee responses as well as taking notes, interpreting the data, and preventing misinterpretation of the interviewee's answers. After a small talk as an introduction, interviews started just after the recording permission. Listening to the recordings retrospectively offered considerable freedom to the researcher regarding interpretation of the data. Besides, reflection notes taken continuously during the interview to not forget pop-up questions, clues and annotations. These notes and interview transcripts are merged to analyze later on.

Audio records are digitalized by transcriptions like handwritten reflection notes. Transcriptions uploaded to the QDA Minor software for coding. QDA Minor is a computer-assisted qualitative analysis tool that leads social researchers to organize and analyze their textual data such as semi-structured interviews, open-ended question sets and transcripts etc. (Provals Research, n.d.). It is used to map and analyze the raw data from the interviews by coding to generate the output of the data collection phase.

3.3. Concluding Remarks on the Chapter

In conclusion, semi-structured interviews were conducted to evaluate the practical operability of patent incentives and to learn how they affect technology-based firms. Secondary data were used to design the interviews. Covid-19 related communication limitations turned into an advantage as conducting interviews online eliminates the disadvantages of time and meeting place constraints. Following this, audio records were transcripted for coding to make data analysis. The codebook can be found in the appendix. The data analysis that collated with the literature review is examined in Chapter 4. The used methodology and outputs presented in the Chapter 4 also presented in Chapter 5.

CHAPTER 4

FINDINGS

In this part of the study, the findings obtained from the interviews are shared. These findings are analyzed based on "impact". These effects are classified as behavioral changes in educational, structural, and R&D attributes. Examination of the patent impacts on the firm is followed by descriptive findings. These reflect the limits faced by firms regarding patents and firms' view of patents and innovations. These findings are the basis of the discussion chapter where the data will be analyzed.

4.1. Impacts of Patent on TG1

This section outlines the impacts of patent exploitation on the TG1 group. These impacts are determined as educational, structural, and R&D impacts and presented respectively.

4.1.1. Educational Impact

Educational impact refers to the education-based effects that patents create on firms. In general, these represent additionalities such as in-house patent and IPR training, certification programs, training given by the patent attorneys, and the creation of personnel trainings. In the light of the interviews, two main educational additionalities were observed and explained patent know-how and patent education.

4.1.1.1. Patent Know-how

Having the know-how on a patent is quite significant for the firms to strengthen their firm's innovation ecosystem. TG1 (4) states that *"now, we have a bottom-up approach towards our patent know-how. After experiencing a bunch of patent application*

processes, we realized that every individual and every idea matters for our innovation. It is not only about self-empowerment of R&D personnel but also awareness of management level regarding patent and its benefits to us".

Patent know-how refers to knowing the nature of a patent, its advantages and disadvantages for a firm and the patent application process. Moreover, it accepts idea generation and patent application as a firm culture to improve innovation performance, competitiveness, and prestige. The reflection, as mentioned earlier, of the interviewees can be explained with the model below.

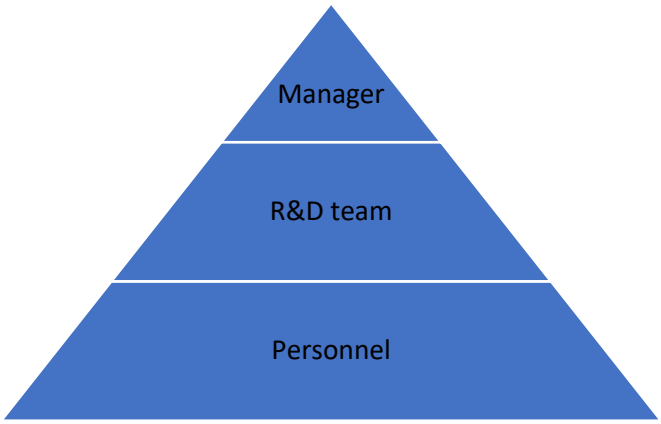

Figure 6: The Pyramid Model

The model's manager category represents directorships, headquarters, and technical project managers and their R&D goals. Managerial goals refer to the objectives that a manager sets for his or her team. The objectives can be specified as reaching annual patent application numbers, completing R&D projects accordingly to pre-determined deadlines, increasing the commercialization of products and ensuring the sustainability of R&D project's profit margin. Managers are accepted as the driving force of his/her teams' patent training and their dedication and motivation to assigned R&D projects. R&D team refers to people working in R&D projects or units. On the other hand, Personnel are individuals outside of the R&D department but who are involved in other R&D projects. As with those in the R&D unit, Personnel are also expected to have a basic level of patent literacy, awareness, or know-how. R&D department's activities

and projects improve by awareness and knowledge of Personnel. It paves the way for strengthened R&D that prioritizes patentable inventions that need to be supported by Managers.

Thus, indirectly, managers have to gain experience and knowledge about patent writing, database writing and patent incentives. The manager with more distilled knowledge and awareness of patent transforms into a patent-literated expert. In turn, that level can meet the financial and educational needs of both Personnel and R&D teams simultaneously and continuously. This creates a self-empowered firm regarding the innovation ecosystem from bottom to up.

4.1.1.2. Patent Education

Firms embrace patent education after realizing the need to compensate for the lack of knowledge of the firm and personnel on patent. The main purpose of the patent education systematics is to make patent education sustainable and digitalized. Another purpose of education is to motivate and increasing the number of self-educated individuals in the firm. Self-educated individuals train themselves on patents (patent writing, patent database usage, etc.) to produce ideas, projects, and products outside the job description but, in line with their interests and desire. An education system is considered significant for creating patent awareness. TG1 (12) stated the following about the issue:

> *"You cannot build on anything without a base. This base is the education for our patent awareness. Ability to do patent valuation, knowledge of patent database usage, knowing to protect a novel idea, how to commercialize a product and patent writing… you can't protect your idea without any of these. The patent does not serve its purpose. In this case, you can't talk about innovation".*

Trainings are assigned to each personnel by the human resources departments/units, considering the project and unit they are working for. These trainings are used as key performance indicators (KPI) of the personnel. These can be optional and compulsory. Voluntary participation in elective training is considered an extra KPI. Information

such as the deadlines for completion of training, type and length of the training are sent to the personnel as an automatic notification via the system. Trainings created are summarized in Table 7.

Table 7: Trainings for patent education

Type of training	Focus group of the training	Participation type	Frequency of trainings
Introduction to IPR	All personnel	must	once or twice a year
Introduction to patent	all technical staff and engineers	must	Twice a year
Intellectual and industrial property rights workshop	Interns and new recruits	must	depending on recruitment periods
Focus group trainings as; - Patent database usage workshops - Patent valuation workshops - Patent writing workshops	R&D team or unit that request the training	optional	Depending on the request
Introduction to incentive programs, grant programs and funding mechanisms	R&D team or unit who requests the training	optional	Depending on the request
Ethics in information technologies and R&D projects	R&D team Quality and management unit (if any) Innovation coordinator (if any) IT law department (if any)	must or optional (depending on the unit)	Once a year

4.1.2. Structural Impact

Structural impact means the firms' new policy additions regarding patent and innovation and the improvement in the firm's perspective on them. These impacts

reveal after exploiting a patent. These are also needed to improve firm's attitude towards patents and innovation. As a result of the interviews, it is revealed that there are mainly three main structural changes in the firms. These impacts are an idea pool, university-industry collaboration, and interdisciplinary patent unit.

4.1.2.1. The Idea Pool

The idea pool system originates from the logic that "every idea count". The theme's purpose is to create a pool for ideas and, if deemed appropriate, select patentable ones among them. Thus, it is designed to store and valuate inventions that can be patented, commercialized, leased, and licensed. TG1 (14) states that "we should not only be keen on radical innovation; there are thousands of incremental innovations in the firm waiting *to make a difference. The important thing is protecting them. We can only step out of the existing innovations by embracing and valuing incremental ones".* Briefly, the "idea pool" provides a digital infrastructure for "headhunting" inventions to be patented. TG1 (7) has a pro-argument to the previous one by:

> *"Innovation is first and foremost a culture. Therefore, invention disclosure needs to be seen as a habit rather than a burden. Gaining such a habit requires embracing every and each idea that generated within the firm. Also, they should be carefully evaluated. For this reason, a "pool of ideas" is a necessity. Such a system also keeps motivated the inventor while guaranteeing the continuity of innovation as a firm value and culture".*

The deciding mechanism regarding ideas includes the following steps:

1. Filling the invention disclosure form by the inventor. In particular, the following criteria are specified in this statement:
    1.1. The novel criteria of the invention
    1.2. Possible improvements on the invention for the next production step

2. Gathering a committee once a month for invention disclosure evaluation. The members of the Board must propose a representative from the following units:

2.1. Patent/ R&D unit or innovation coordinator

2.2. Human Resources

2.3. Law Department

2.4. Quality and business development department

2.5. Contract unit

2.6. Marketing and finance unit

3. Evaluation of all invention disclosure forms by the invention evaluation committee.

4. Requesting the elimination of formal defects from short-listed candidates

5. Announcement of committee evaluation results. Possible results are as follows;

5.1. Patent

5.2. PCT application

5.3. Commercialization of the product

5.4. Sale of the product

Besides innovation, open innovation needs to be considered on because open innovation also has an impact on firm performance. According to Bigliardi (Bigliardi et al., 2020) inclusion to open innovation practices accelerates firm's organizational culture, internal commitment, open innovation activities, accelerated automation, intelligent-data driven systems, value-chain systems, human resources, and innovation strategies. In this regard, patents are the important intellectual assets since open innovation driven by networking between firms, sharing and accessing outside information and technology (Kowalski, 2011), patents are important intellectual assets. It includes patent licensing, strategic alliances, and patent-based defense mechanism culture (Kowalski, 2011). Additionally, SMEs have a chance of access to, accelerate and integrate themselves into global innovation networks (Kowalski, 2011). For this reason, the creation of a pool of ideas within a firm also ensures the development of the firm's open innovation practice. In this way, a firm benefited from

new market opportunities by pulling out a patent from the pool to develop the open innovation.

4.1.2.2. University-industry Collaboration

University-industry cooperation refers to integrating academic knowledge, human source, and R&D potentiality with field expertise and financial self-dependency of the industry regarding acceleration of R&D activities. It represents a mutual advantage for firms. TG1 (18) adds as "*the reason behind the firms' efforts to increase university-industry cooperation is, first of all, a win-win situation: (a) the firm benefits from the know-how of the university and academicians, on the other hand (b) universities, find financial support for their R&D expenses, and feel secure while generation of ideas to be patented. This is especially critical in productions where the university provides the software and the hardware is provided by the firms, where simultaneous production of hardware and software is quite tough".* TG1 (9) also supports this by saying that "*any cooperation among university and industry is essential for knowledge exchange. This can be thought of as a kind of R&D mutualism in an innovation ecosystem".*

As mentioned above, university-industry cooperation has different advantages on the side of the firm and the university. These are briefly summarized in Table 8.

Table 8: The summary of mutual advantage of university-industry collaboration for firms

Industry side advantages	University side advantages
- Having a leading position in the market regarding competitiveness - Accelerating innovative activities by channeling human and financial resources to solution-oriented inventions - Rapidness in product development - Increasing in-house R&D projects - Developing production process of commercialization patents	- Development of problem-solving skills - Having financial support and grants for application fees - Meeting R&D needs as production and process management - Having guidance and mentorship in the case of any lack of information - Increasing know-how and awareness of the patent process and incentives

Source: Author's own compilation from the literature.

According to Senker (Senker & Senker, 1997), expectations of universities and industries from their collaboration differs. Firms expect to use their academic networks to help their growth regarding turnover and profitability (Valentin, 2000). On the other side, universities expect to accelerate training of their undergraduate and graduate students, disseminate knowledge by publications and increase involvement to the R&D projects (Valentin, 2000). Although, the expectations diverge, their collaboration ends with mutual benefiting. In line with the rapidness in product development, Dan (Dan, 2013) adds that university cooperation speeds-up the innovation process, enables reduction in the production stages (e.g., time between the idea creation and introduction to the market). Addition to increased patent know-how, universities focus on practice focused research (Dan, 2013). In this way, new research fields can be created for researchers, professors gain chance to test their results, methods, and techniques. From financial perspective, Ankrah (Ankrah & AL-Tabbaa, 2015)argues that collaboration refers cost reduction, shared budgetary risks, and increased public grants for industry whereas it means involvement to research programmes, increased salaries, and monetary sources for university. From strategic perspective, besides problem solving skills, collaboration means having managerial experience and scientific progress for universities (Valentin, 2000). For industry, it includes increasing the qualification and number of potential employees (e.g., interns come from university or new graduates) and the creation of strategic alliances (Valentin, 2000).

4.1.2.3. Interdisciplinary Patent Unit

According to the interviewees, the legal, economic, and administrative part of a patent process is substantial as the technical information. An interdisciplinary patent unit can resolve the knowledge gap between the inventor and the invention disclosure process. TG1 (3) defines this need as:

> *"An interdisciplinary patent unit may be the proper occasion to eliminate the knowledge gap among distinct experts. Creating an invention is valuable. However, it does not guarantee absolute success. An engineer with a strong technique may fail in the*

documentation. Nonetheless, disclosure of an invention by documenting it in a skilled and precise way is something quite beyond that"

An interdisciplinary team approach, different disciplines integrates and work together for a single consultation (Jessup, 2007). Therefore, methods and knowledge of separate disciplines integrates. Likewise, in here, diverse majors are needed in the unit.

Faculty of science graduated engineers are responsible for the entire hardware and software process. Law school graduated patent, or IT law experts monitor all requirements, laws, regulations and guidelines for government-led patent incentive policies and requirements. The expert leads any court process regarding the right of ownership. TG1 (17) agrees to TG1 (3) besides he or she brings out a further comment by saying, *"invention-creation is an extraordinary value to society. However, its value depends on how it's precisely and delicately explained… disseminate…Patent writing is a talent. An individual needs to be mastered on wide range of expertise to handle it".* Therefore, there is a need for additional personnel who can easily combine both perspectives. An economics and administrative sciences expert work on R&D management, patent process optimization, and university-industry collaboration management. In this way, he or she can eliminate the radical gap on literature and terminology among the technical and legal sides.

4.1.3. R&D Impact

This theme refers to the changes associated with the R&D activity. Basically, these impacts include general improvements such as increased in-house R&D projects, solution optimization, adaptation of and investment to product-oriented R&D projects, and a raise in product sales. However, there is a notable development for firms in their R&D process called product development (P&D).

4.1.3.1. Product Development (P&D)

The exploitation of a patent affects firm's P&D activities as well as R&D ones. According to the firms, P&D means competing in the international market by the

commercialization of products as the result of increasing efforts and projects on P&D that occurred spontaneously in the R&D process. TG1 (8) states that *"what matters is increasing incremental innovation throughout the R&D process. These incremental advancements directly improve our products, even we do not intend to do…P&D worth to consider for us to promote ourselves in the international market and increase the firm value…I guess acceleration on our P&D projects is the main reason for increased numbers of commercializable patents of the firm".*

4.1.4. Impacts of Patent on TG2

Patent has effects on firms that exploit a patent even once. These impacts originate from patent awareness and in-firm patenting changes. These impacts are presented below as educational and structural impacts and evaluated, respectively.

4.1.4.1. Educational Impact

Educational impact refers to the education-based effects of a patent on firms. It also refers to the same parameters with the TG1 (see section 4.1.). Unlike TG1, educational improvements in TG2 are highlighted only as patent awareness.

4.1.4.1.1. Patent Awareness

It refers to the firm's awareness, know-how, and experience that is required throughout a patent application. It includes R&D studies for patent protection and increasing innovations to be patented. It also symbolizes the learning circle that the firm's staff and manager holistically acquire in their R&D activities. According to the interviewees, there are some education-based impacts of patents worth considering, which is illustrated below.

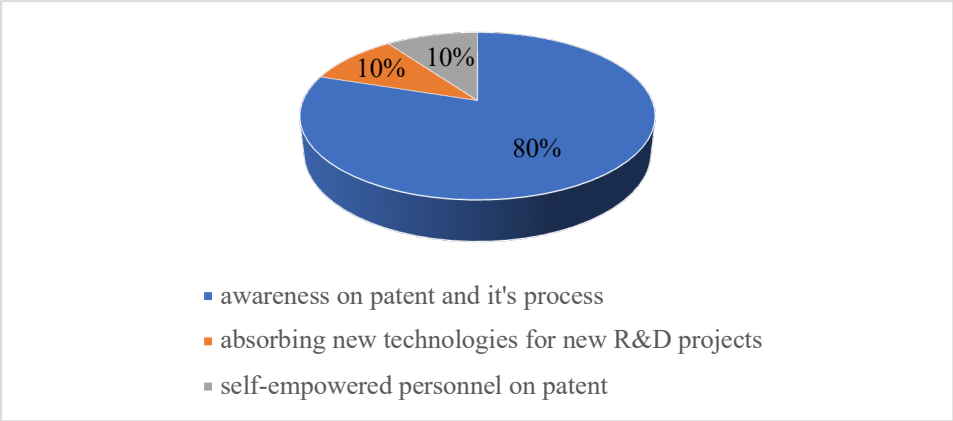

Figure 7: Educational impact of patent for TG2 firms

TG2 (5) states "*We understand what a patent really means for, and what needs to be mean to us after our patent applications. We are aware of its possible benefits and capabilities… We realized too late that we do not even know the basics as a high-tech firm. Our patent has been a great teacher to us".* TG2 (6) supported that by saying: "*It is extraordinary for us to see personnel who train themselves, keep motivated, and come up with new ideas. You can push your R&D team to be innovative, but that doesn't work well. The most valuable contribution of our patent to us is the self-motivated, triggered, and empowered personnel for the ongoing projects. Their enthusiasm for patenting their own product is the real improvement for us".* TG2 (2) also adds *"evaluating other people's patents also improves us technologically and technically and caring about our own patents. We can be aware of emerging technologies and market needs via that logic. In this way, we became able to dig into new technologies to adopt them in our ongoing R&D projects".*

4.1.4.2. Structural Impact

Structural impact means the firms' new policy additions regarding patent and innovation and improvements in its R&D activities. Structural impacts for TG2 represent the changes in their R&D activities and the establishment of a patent policy.

4.1.4.2.1. R&D Activities and Patent Policy

According to the TG2 interviewees, the firm's most significant changes are structural related to R&D activities and a patent policy. There are slight and short-term additions such as making "brainstorming" sessions and Hackathon camps for idea and project generation. Also, firms prefer having a rewarding systematic for in-firm inventors by creating a bonus chart. However, some particular impacts especially emphasized by interviewees are presented in the figure below.

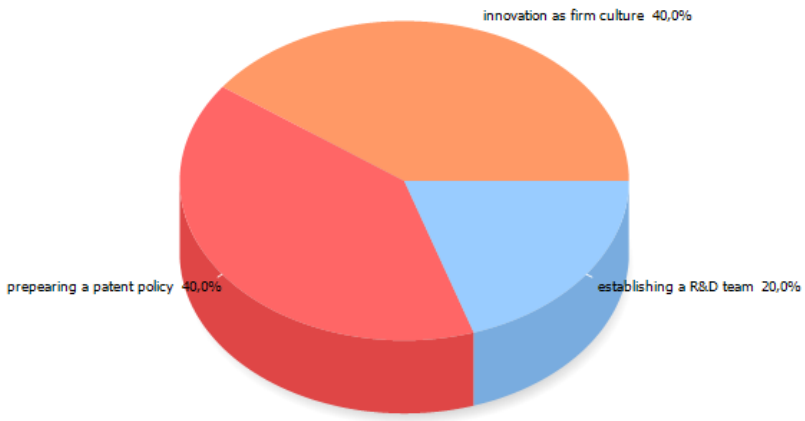

Figure 8: Structural impacts of patent on TG2 firms

Innovation culture emphasizes patent quality over its quantity. TG1 (10) says that:

> *"It is vital that our patent portfolio is powerful regarding its quality. What I mean by the quality here is prioritizing the commercialization of patents. Besides, the development of know-how of units as sales and product management and the creation of patent families are needed. The high number of patent applications should be proportional to the rate of its commercialization, sale, and leasing. Quantity of patents just a starting point to reach quality."*

Relatedly, interviewees state that systematization is a must to achieve sustainability of patent quality. TG2 (7) explains this situation: "we clearly saw that spontaneous moves are in*effective. We accept the significance of the patent culture and the necessity of a functional infrastructure for that, and*

that is our patent policy. We specify an annual target for our patent applications". TG1 (1) adds: *"increasing patent registrations also a target… mastering on patent writing and experiencing patent valuation someday as well…Therefore, we designed introduction to patent trainings once or twice a year. In my opinion, an R&D team dedicated only to patent application and production is meaningful strength stamina of our patent policy".*

4.2. Limitations of and General Perspectives on Patents by TG1 & TG2 Firms

As aforementioned above, there are some impacts of exploiting and benefiting from a patent on firms. However, both from TG1 and TG2's point of view, there are some limitations of a patent to accelerate innovation performance. As a result of interviews, some outputs are obtained about the firm's perspectives regarding patent's limitation and relevancy to innovation performance. The outputs on both can be seen in detail in the tables provided below.

Table 9: Limitations of patent on TG1 and TG2 firms

Limitations	**TG1 perspective**	**Does lack-of commercialization a limitation for your patent process?**	**TG2 perspective**	**Does lock of commercialization a limitation for your patent process?**
#1 Commercialization	Interviewee 4: "*There is no actually functioning government support to promote the commercialization, licensing, leasing and transfer of our patents"* Interviewee 6: *Our uncommercialized patents became just a "pile of patents"* Interviewee 15: *"The major obstacle for us is the insufficient commercialization incentives and marketing benefits"* Interviewee 19: *Unfortunately, we have to "kill" some of our patents due to lack of commercialization"*	Yes (82,7%) No (17,3%)	Interviewee 12: *"The reason we want to commercialize our patent is to ensure international competition, but current policies cannot support us in this regard"* Interviewee 14: *"Our survival as a start-up, I guess, depends on our capability to commercialize our patents but we couldn't feel supported about that"* Interviewee 1: *"Sometimes we think a lot on that: should I really invest that much for another patent application if I wouldn't easily lease, sell, and most importantly commercialize them."*	Yes (60,3%) No (39,7%)

Table 9: Limitations of patent on TG1 and TG2 firms (continued)

#2 infrastructure	**TG1 perspective**	**Do you think that the lack of infrastructure is a limitation for you?**	**TG2 perspective**	**Do you think that the lack of infrastructure is a limitation for you?**
	No impact	No impact	Interviewee 7: *"It is not enough to say that "you have to increase your patent application since you're an R&D center", we need the whole infrastructure to ensure this."* Interviewee 15: *"SMEs need SMES-based support programs above all."* Interviewee 13: *"Budget flexibility, more time, hardware and personnel are the all we need."*	Yes (81,7%) No (18,3%)

Table 9 represents the limits faced by both TG1 and TG2 firms. According to them, these limitations are also perceived as a significant disadvantage on their innovative activities. At this point, lack-of commercialization is a mutual limitation for both groups. Unlike TG1, TG2 has one additional burden regarding firm infrastructure. In here, firm structure refers to a firm's insufficiency in terms of budget, time, extra personnel, and hardware.

Before briefly elaborating the limitations, it can be helpful to explain the meaning of commercialization to clearly understand the issue. Sichelman (Sichelman, 2010) states that commercialization of a patent needs to be seen as any activity following the initial invention by developing, testing, manufacturing, and selling it. In this way, an

invention turns into a commercially available product and service in the market. This process, also includes licensing, leasing, and transferring a patent.

Regarding the literature, it supports firms' view on these limitations. According to Pellikka (Pellikka & Virtanen, 2009) especially small-sized technology-based firms faces with some challenges about commercialization of their innovations. This originates from four reasons as lack of infrastructure, marketing, financing, and internationalization (Pellikka & Virtanen, 2009). It can be assumed that TG2 is more disadvantaged than TG1 since the lack of infrastructure is one of the reasons behind commercialization limitation. Kelley and Rice (Kelley & Rice, 2002), Malecki (Malecki, 1997) and Dodgson (Dodgson, 2000) also share the same view with TG1 and TG2 firms. As the firms states and these researchers agree on availability and the extent of innovation support services for commercialization is problematic and not supportive as needed. Besides, for Abetti et al. (Abetti et al., 1988), Smilor et al. (Smilor et al., 1993) and Dodgson (Dodgson, 2000) there is a failure exists regarding providing efficient licensing and leasing incentives "piles" in firms' patent portfolios. Addition to these, reflection of non-commercialized patents in practice also worth to consider on it. In worldwide, 95% of the 2.1 million (approximately) patents are not licensed or commercialized (Walker, 2014). This results with some R&D-based obstacles for universities, and some financial pitfalls for firms. It is determined that more than 50,000 high-valued patents developed by universities remains non-licensed (Walker, 2014). Moreover, financial damages can reach up to one million dollars for technology firms because of non-commercialized intellectual property assets (Walker, 2014).

As final, like interviewed firms, Pellikka (Pellikka & Virtanen, 2009) believes that failure to have proper financial sources, lack of industrial and managerial experience, lack of time and insufficient public funding are the most outstanding infrastructure limitations for small technology-based firms.

Table 10: General perspective on patents by firms

Questions	TG1	TG2
Do you have a patent unit?	Yes (25%) No (75%)	Yes (0%) No (%100)
Do you have a patent expert?	Yes (31,7%) No (68,3%)	Yes (0%) No, but we get patent attorney support (64,3%) Others (35,7%)
Do you have a patent policy?	Yes (45,2%) No (54,8%)	Yes (16,7%) No (83,3%)
Are there any patent support programs or incentives exist you benefited from?	Yes (60%) No (40%)	Yes (22,2%) No (66,7%) No, but want to (11,1%)
Does a patent have an impact on your firm's innovation activities?	Yes (72,8%) No (27,2%)	Yes (58,8%) No (41,2%)
Type of your innovation?	Product innovation (85%) Process innovation (15%)	Product innovation (80%) Process innovation (20%)
Do patent policies support firms as you expected?	Yes (20%) No (80%)	Yes (36,4%) No (63,6%)

Table 10 consists of descriptive data obtained from the interviews. It reflects the general perspective of firms of TG1 and TG groups on patent and innovation performance. Firstly, the table describes the general structure of firms regarding the patent. Therefore, it can be seen whether firms have a patent unit, patent specialist or a patent policy. It shows whether there is any patent support program that firms benefit from and at what rate innovations based on products and processes are utilized. Finally, it reflects the view of the actual impact of patent policies on firms.

The functions of both Table 9 and Table 10 are as stated above, and a detailed analysis of what the data here means will be done in the following discussion section.

4.3. Concluding Remarks

In conclusion, the chapter presents the findings from the interviews of TG1 and TG2 to evaluate them in the following discussion chapter. Three different impacts of the patent have been found for TG1 firms as educational, structural, and R&D. Educational impact has two separate subcomponents: patent know-how and patent

education. Patent know-how represents the dissemination of all patent know-how to each level of a firm. Patent education describes in-firm trainings regarding patents. The structural changes consisting of university-industry collaboration and interdisciplinary patent unit which originates from mutual advantage and establishment of a patent unit. R&D impact was determined as P&D. The impacts identified for TG2 are similar to those for TG1. For the TG2, the educational impact is on patent awareness, while the structural impact is on R&D activities and the development of a patent policy. After these outputs, the chapter is concluded with the presentation of the limits specific to commercialization and the firm's technological infrastructure. As final, the firm's perspective on patent and innovation interaction is also presented for better evaluation in the next chapter.

In brief, stylized facts of the chapter can be summarized as follows.

- Patents create behavioral changes on technology-based firms as educational, structural and R&D.
- Educational and structural impacts apply to all technology-based firms in the METU Technopark. However, R&D is not available for SMEs since P&D is the result of accelerated R&D activities.
- Educational impact of patents on SMEs are identified as patent awareness.
- Patent awareness needs to be established to create patent know-how and education.
- Structural impact of patents on firms are revealed as creation of an idea pool, university-industry collaboration, and an interdisciplinary patent unit.
- Although patents enable behavioral changes on firms, it causes commercial and infrastructural limitations.

  Turkey's current patent incentives or patent support programs do not provide the expected support to technology-based firms.

In the light of these findings, the main outputs of the study are stated in the following discussion chapter.

CHAPTER 5

DISCUSSION

In the previous chapter, findings are represented through exploratory and descriptive analysis. Exploratory findings are represented by impacts, where descriptive findings are categorized as limitations and general perspectives. This chapter evaluates these findings under the abovementioned three categories to answer the research question. The findings are tabularized to comprehend and evaluate them easily. For a clear introduction to the chapter, a summary of all findings can be found in the table below.

Table 11: Summary for the findings of the study

Impacts			
	Educational Impact	**Structural Impact**	**R&D Impact**
TG1	➢ Patent know-how ➢ Patent education	➢ The idea pool ➢ University-industry collaboration ➢ Interdisciplinary patent unit	➢ Product development
TG2	➢ Patent awareness	➢ R&D activities & patent policy	➢ No impact

Limitations		
	Commercialization	**Infrastructure**
TG1	✓	✗
TG2	✓	✓

General Perspectives	
TG1 & TG2	➢ Existence of a patent unit ➢ Recruitment of a patent expert ➢ Existence of a patent policy ➢ Benefited support programs and/or patent incentives ➢ Impact of the patent on firm's behavior ➢ Type of the firms' innovation ➢ Turkey's patent policies' support to firms

To move forward, educational, structural, and R&D impacts are summarized and evaluated respectively.

5.1. Discussion on Educational Impacts

Table 12: Summary of educational impacts of patents on TG1 & TG2

Educational Impact		Key Findings about the Impact
TG1	**Patent know-how**	➢ Patent know-how is a significant impact of patents on TG1 firms ➢ Patent know-how empowers a firm's innovation ecosystem from the bottom to up ➢ Bottom-up approach toward patent know-how creates a self-sustained and empowered firm culture regarding innovation
	Patent education	➢ Patent education fills firms' lack of knowledge about patent process while making patent know-how sustainable. ➢ Patent education promotes self-motivation of firm personnel thus empowers firms' innovative activities
TG2	**Patent awareness**	➢ Patent awareness is an awakening for SMEs regarding their innovative capabilities ➢ Patent awareness is a starting point for establishing patent know-how within SMEs

Patent know-how is one of the TG1-specific impacts of patents. Considering that TG1 firms are generally large-scaled and corporated. Thus, they have extensive patent portfolios. Therefore, TG1 already have a basic patent awareness. Therefore, the significance of a patent originates from creating patent know-how beyond and addition to firm's patent awareness. In this way, firms' corporate memory and empowerment of their personnel start to depend on strength and sustainability of their patent know-how.

Patent know-how operates by the bottom-up principle. Although patent know-how forms at the individual level, it proceeds cumulatively. It results with a firm culture established by patent-literated individuals from all levels. The knowledge gap between the "bottom" and the "up" reduces when valuation of inventions increases. Then,

personnel, R&D team, and the management from the Pyramid Model help to increase of stamina of the firms' innovation performance.

Patent education as the second impact, can be considered as the result of patent know-how. Knowledge gap regarding patenting emerges while establishing know-how on it. Thus, education is the best way to understand, develop and sustain innovative and R&D activities of a firm. There are some benefits of patent trainings: providing self-motivation, educating personnel, and saving both cost and time throughout R&D projects. This also helps to reduce dependency to tacit knowledge while conducting R&D projects and enables knowledge dissemination. Instead, possibility to invent during R&D activities can be increased through more solution-oriented on the job trainings.

Patent awareness is the starting point of the learning cycles of TG2 regarding patents. In this regard, 80% of TG2 firms consider having a base knowledge on patent and patenting process are vital for them. During this learning process, possibility of producing patentable products increases thanks to their patent awareness. Self-empowered personnel who learn about the patent process and emerging technologies (values as 10% percent) also get a chance to boost their performance and innovative ideas in dedicated R&D projects. After the evaluation of this first impact, structural impacts are summarized and discussed as complementary. The summary of the structural impact is presented in Table 13.

5.2. Discussion on Structural Impacts

Table 13: Summary of structural impacts of patent on TG1 & TG2

Structural Impact		Key Findings about the Impact
TG1	**The idea pool**	➢ Every idea matters for innovation. ➢ An idea pool stores ideas until their mining is a necessity to patent, commercialize, lease, and license them
	University-industry collaboration	➢ University-industry collaboration is a worthy way of eliminating mutual lack of knowledge ➢ Financial self-dependency of universities and sectoral mentoring to the industry in R&D projects necessities the university-industry collaboration
	Interdisciplinary patent unit	➢ Evaluation and valuation of technical knowledge in patent requires distinct expertise. ➢ The knowledge gap between inventor and invention disclosure requires the interdisciplinarity of a firm.
TG2	**R&D activities & patent policy**	➢ Improvement of R&D activities and establishing a patent policy is vital to have patents that rich in quality

A patentable idea can be mined from the firm's idea pool when deemed necessary. Thus, the existence and value of ideas is not left to the memory of personnel and the institutions. Additionally, firm personnel are motivated to generate new ideas and bring them to firm value when they see that their ideas are constantly valued and protected. In this way, innovation culture of a firm can start to establish.

University-industry cooperation not only increases innovation performance of firms, but also boosts R&D studies in universities. Universities receive the budget, hardware and private sector support they need for R&D studies. In response, firms outsource the expertise of university academicians to reduce their knowledge gaps regarding technical knowledge. In this way, universities strengthen the R&D infrastructure while firms receive the academy's mentorship and consultancy. Thus, this impact is the provision of mutualism in the entire innovation ecosystem.

Interdisciplinary patent unit is the absorption of divergent expertise as law, ethics, engineering, administrative affairs, and procurement management. Therefore, an interdisciplinary approach is a robust approach to adopt when the issue is improving a firm's innovation performance. In this way, eliminating inventor bias, reducing ambiguity, and appreciating ethical issues are the base for strong innovation culture. The principles of innovation process are understood more accurately by reducing the information gap, misunderstanding, and ambiguity among different majors.

R&D activities and establishing patent policy is the only structural impact on TG2. 40% of TG2 firms have adopted innovation as firm culture, while 40% have started forming a patent policy. The remaining 20% created an R&D team. This shows that TG2 is beginning to develop itself structurally to reflect their patent awareness. This is the notable impact for TG2 that improves their structural system for innovation performance. The final impact of the section, the R&D impact, is defined in Table 14.

5.3. Discussion on R&D Impact

Table 14: Summary of R&D impact of patent on TG1 & TG2

R&D Impact		**Key Findings about the Impact**
TG1	Product development	An increase in patent commercialization reflects as boosted P&D The probability of P&D activities increases when the limited infrastructure of SMEs for R&D developed
TG2	No impact	No impact

In TG1, P&D emerges spontaneously during in-house R&D projects. Here, R&D needs to be considered as product generation and their financial contribution to firms. During these, TG1 gains an opportunity to update, improve and optimize their existing products. Reverse engineering is a frequently used method during P&D studies. Besides, Moser (Moser, 2011)argues that inventor prefer having a patent for the innovations that is easy to reverse engineer. According to TG1 firms, another effect of advanced R&D work is firms' chance to learn and develop their reverse engineering.

In this way, firms also learn where product development trend is headed. Thus, new production, design and management methods are also being developed. Additionally, their benchmarking and value engineering studies develops. All these improvements can be interpreted as the indirect reflection of patent know-how and training. It creates an opportunity and recognition to increase commercialization of their patents while pawing a way to sustainably develop P&D of TG1.

On the contrary, there is no R&D impact declared by TG2 firms. This is because patent awareness has just started establishing for them. In the long term, P&D activities are likely to increase as in TG1 when limited budget and human resource allocation of TG2 is eliminated. All the impacts have been discussed in this section so far. The following section examines the limitations of patents for TG1 & TG2.

5.4. Discussion on the Limitations of Patents for TG1 & TG2

According to the findings, there are two main limitations of patents for TG1 and TG2 firms as follows:

1. Commercialization
2. Infrastructure

Commercialization is a common limitation for both TG1 and TG2 firms. However, they differ in scope. TG1 does not refer to infrastructure as a limitation, unlike TG2. While 82.7% of TG1 firms see the lack of commercialization as a limitation, this is 60.3% for TG2.The summary of these limitations can be found below.

Table 15: Summary of the limitations of patents on TG1 & TG2

Limitations				
TG	**Commercialization**	**Meaning of the Limitation for TG**	**Infrastructure**	**Meaning of the Limitation for TG**
TG1	✓	profit	×	No impact
TG2	✓	survival	✓	sustainability

For TG1 firms, commercialization is seen as the firm's financial value growth. For this reason, patents are used as a bridge to ensure the commercialization, licensing, transfer, and leasing of the product. As some firms of TG state that their patent portfolios are nearly filled with non-commercialized patents. Thus, it reduces the value of their portfolios and blunts their ability to compete in the international market. No highlight to create incentives and supportive government policies is seen as the primarily reason for that. Therefore, for TG1 firms, commercialization incentives and supports became an urgent intervention to boost their visibility in the technology market and brand growth. Shortly, low rates of commercialized patents are seen as a prominent limitation that risks financial profits of firms. Thus, it needs to be reduced with well-established policies. In this way, TG1 can be empowered by eliminating limitations behind commercialized patents.

For TG2 firms, commercialization of their patents vital for the firms' entry, existence, and competition in the national and international market which TG1 firms have already experienced. Generally, TG2 consists of start-ups and SMEs. Unlike TG1 firms, TG2 firms generally use commercialization to preserve firm existence, become a competitive actor in the IT market, and strengthen the firm's brand. Therefore, the commercialization of their patents is a way to survive. Similar to TG1, TG2 firms express that government policies do not support commercialization of patents, especially if you are a SME. Particularly for TG2s with a limited budget, human capital and hardware, special supports and incentives needs to be arranged to guarantee their survival in the market competition.

As TG1 companies have reached a certain maturity regarding firm infrastructure, it is not a limitation for them. Conversely, 81.7% of TG2 firms count the lack of infrastructure as an obstacle. 18,3% of them states that they do not have any idea whether there is a limit for their firm's infrastructure. Especially the lack of human resource, budget and hardware, and limited fair participation, proxy consultancy, network and IT services, operating system, computing platforms, security tools, facilities, etc. needs to be considered when the word infrastructure was used as the limitation. This is an obstacle behind TG2 firms' sustainability in the high-technology R&D market. Above all, firms need to have basic infrastructural facilities to maintain

R&D projects, patent invention and develop innovation performance. However, for TG2 firms, existing patent support programs do not provide infrastructure support to TG2 as they needed. For this reason, there is a need for policies that can provide sufficient infrastructure for companies to maintain their R&D center status.

Thus far, the limitations of patents for TG1 & TG2 are discussed. In the upcoming section, General Perspectives on TG1 & TG2 Regarding Patent and Innovation as the last part of the chapter is reviewed.

5.5. Discussion on the General Perspectives on TG1 & TG2 Regarding Patent and Innovation

5.5.1. Existence of a Patent Unit

Although 75% of TG1 firms have a patent unit, none of the TG2 firms have a patent unit. This shows that the infrastructure limitation of TG2 firms creates a notable obstacle for TG2 firms to establish a patent unit.

5.5.2. Recruitment of a Patent Expert

While approximately 69% of TG1 firms have a patent expert, 31% of them do not recruit any of them. Instead, a patent attorney is outsourced, or R&D personnel are assigned from other units when needed. Similar to the patent unit case, none of the TG2 firms have any patent expert. This is because of their infrastructure limitation. However, approximately 65% of TG2 firms state that they will consider hiring a patent expert when enough budget is provided. Also, this shows the importance of solving the infrastructure limitation of TG2 to accelerate their structural changes for strengthen innovation culture. The main reason why about 35% of TG2 firms do not prefer to have a patent expert lies behind the fact that their patent portfolio is not wide enough and therefore easy to manage.

5.5.3. Existence of a Patent Policy

Nearly 55% of TG1 firms do not have an in-house patent policy. This remains low compared to the percentages of patent specialist and patent unit indicators. This is because patent know-how has just begun to show its effect. About 84% of TG2 do not have a patent policy. Unlike the patent specialist and the patent unit indicators, this rate is not zero but 16% percent. The main reason for this positive development is the patent awareness effect seen in TG2. Thus, it reflects to the structural impact of TG2.

5.5.4. Benefited Support Programs and/or Patent Incentives

60% of TG1 firms benefit from a patent support program or a patent incentive. In contrast, almost 67% of TG2 have never benefited from either of the two. This is due to the infrastructure limitation of TG2. In addition, nearly 12% of TG2 companies state that they would like to benefit from a patent incentive or support program. This can be considered as a positive result of their patent awareness. The reason why 40% of TG1 firms do not benefit from an incentive is to avoid dealing with long bureaucratic processes and not needing the financial support provided by the incentives.

5.5.5. Impact of the Patent on Firm's Behavior

About 73% of TG1 firms state that patent had an impact on their firm behavior. These are educational, structural, and R&D impacts as already stated. This rate is approximately 59% for TG2 firms. The reason for this is the short-term reflections of patent awareness and the creation of their patent policies. In overall, both TG1 and TG2 agree on the fact that patent has an impact on their firm behaviors.

5.5.6. Type of the Firms' Innovation

TG1 and TG2 companies define their innovation only as product and process. TG1's product innovation is 85%, compared to 80% of TG2. Such a high rate of product innovation in TG1 can be interpreted as contributing to the development of P&D. Quite close worth of TG2's product innovation to TG1's can be considered as a positive reflection of the structural impact of TG2.

5.5.7. Turkey's Patent Policies' Support to Firms

Both TG1 and TG2 firms share the same perspective towards the support of patent policies to firms. Both groups state that current patent policies do not provide the expected support to them. While the rate for this view is 80% for TG1, it is approximately 64% for TG2. Due to the patent know-how and education effect, TG1 firms have more information and view on the effect of policies on their firms. Hence, it is an expected result that this ratio is higher than TG2. In TG2, the rate of those who think that patent policies support companies to the expected extent is almost 36%. The reason for this is that firms of TG2 do not have information about patent incentive and support programs, either knowledge on that they have remains quite scarce.

5.6. Concluding Remarks

In this chapter, findings are discussed under three different sub-sections as impacts, limitations, and general perspectives of patents through TG1 and TG2. As a result, the discussion, it is revealed that patents create behavioral changes on firms. These changes form as educational, structural, and R&D impacts. Although there are educational and structural impacts in both TG1 and TG2, R&D impact is specific to TG1 only. This proves that patents have an impact on firm's behaviors as supportive and booster of their innovation performance. Though, patents have impacts on firms, they confront with the same limitations as lack of commercialization and infrastructure. This commercialization is a limitation for both TG1 and TG2 whereas lack of infrastructure in firm's R&D is specific to TG2.

In short, patent paves the way for educational, structural, and R&D impacts for firms as behavioral developments. However, firms' view states that patents do not make a remarkable contribution to firms' innovation performance in overall. Moreover, patent policies do not offer support and guidance to firms as expected. Considering these, answer to the research question (A2) can be specified as follows. The patent incentives have no specific contribution on the innovation performance of the firms in the METU Technopark to change its innovation ecosystem. However, patents lead behavioral changes on the firms in the base of education, structure, and R&D. In the following,

the whole study is finalized under the conclusion section. Policy recommendations are presented to offer a way to develop innovation performance of firms that also reduces the limitations.

CHAPTER 6

CONCLUSIONS AND POLICY RECOMMENDATIONS

6.1. Focusing on the Policy Recommendation

This chapter is established on the policy recommendations of the study. Accordingly, it consists of four sub-sections. The first two of them are about policy recommendations and split into two parts. The first of the recommendations is designed specific to the METU technopark. It suggests a matchmaking mechanism. The second policy recommendation has a general perspective, and it presents propositions to future patent solutions. The section also presents policy tools that can be used while reducing the limitations that the policy points out. In the third part of the chapter, the limitations of the study are explained. The chapter and the whole study are finalized with the conclusion part. So, chapter six is based on two sections as policy recommendations and conclusion. The policy recommendations are represented below.

6.1.1. Policy Recommendation for the METU Technopark

It is important to embrace commercializable patents, self-literated R&D personnel and projects to attain innovation culture and turn it into empowered innovation ecosystem. If the literature review of the study is recalled, technoparks syncretizes knowledge-intensive universities, talented firms, and value-added government policies. According to the Helix Model from the methodology chapter, cooperation of university, industry and government is considered as a viable way to enhance innovative activities. For this reason, a policy recommendation for the METU Technopark firms needs to mind connection of these three entities.

In addition, according to the general perspective of the firms (as stated General Perspectives in the Findings and Discussion chapters), lack of patent unit establishment for TG2 is parallel with their limitation in the firm infrastructure. Similarly, this limitations of TG2 are the reasons of their lack in patent expert recruitment. On the other side, while most TG1 firms already have a patent unit, they also have the capacity to outsource patent attorney when deemed necessary.

Establishment of a patent policy is more common behavior among TG1 firms than TG2 firms. This is because TG2 firms are in the early stage of their patent awareness. TG1 firms, on the other hand, take advantage of their patent know-how. These differences originate from the capabilities and opportunities that TG1 and TG2 have. This emerging gap shows that this could be fulfilled by a guidance and know-how exchange between TG1 and TG2.

Again, the findings from previous chapters show that lack of commercialization is related to profit and survival of TG1 and TG2. For TG1, lack of infrastructure is not a limitation where it refers to sustainability of TG2 firms. This also creates an obstacle to TG2 firms regarding benefiting from a patent support and/or incentive program. In addition to all these, both TG1 and TG2 firms agree that Turkey's current patent policies do not support them as they expected. Therefore, interest in benefiting from a patent support program and getting a government support remains low.

These gaps and gap-related facts can be summarized in the table below.

Table 16: The summary of the revealed gaps from general perspectives of TG1 & TG2 firms

The Parameter	TG1	TG2	Related Facts
Existence of a patent unit	75%	0%	infrastructure limitation
Recruitment of a patent expert	~69%	0%	patent attorney outsourcing infrastructure limitation
Existence of a patent policy	45%	16%	early phase patent know-how early phase patent awareness
Benefited support programs and/or patent incentives	60%	~33%	long patent application bureaucracy & financial support infrastructure limitation & early phase patent awareness
Impact of the patent on firm's behavior	~73%	~59%	early phase patent awareness creation of patent a patent policy
Type of the firm's innovation	product innovation (85%) process innovation (15%)	product innovation (80%) process innovation (20%)	development of P&D (+) reflection of structural impact of TG2
Turkey's patent policies' support to firms	20%	36%	reflection of educational impact early phase patent awareness

Filling these revealed gaps may require a policy recommendation that is able to respond them. The policy recommendation capable to do this would be a matchmaking mechanism. In this mechanism, TG1 can be thought as "donor" of strengths to a "receiver" (TG2). TG1 firms can be considered in a more supportive and guiding position. Meanwhile, TG2 firms get a chance to strengthen and eliminate their existing weaknesses and deficiencies. Thus, when firms are matched with each other, individual development of the firms and cooperation and interoperability between them can be increased. That is why, a technopark-specific matchmaking mechanism can be considered as a policy recommendation. In general, the purposes of establishing

such a mechanism are briefly summarized as follows and illustrated as in the following figure.

- Matching Technopark firms with each other and thus building joint R&D project consortiums among them
- Benefiting from university-industry cooperation in patent application and commercialization of patents
- Policy maker's involvement in the innovation ecosystem of the technopark firms to create more appropriate and supportive patent support programs to them
- Matching the METU Technopark with neighboring technoparks and other technoparks in the region and the country to enhance innovation networks

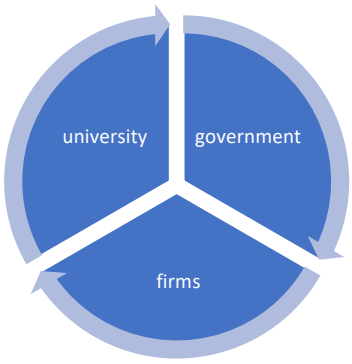

Figure 9: Basic logic of the matchmaking system

This mechanism can be considered as an innovation and patent-based adaptation of Horizon Europe B2B matchmakings. Its functionality depends on cooperation and interoperability of abovementioned entities. The working principle of the recommendation is summarized as follows.

- Matching large-scaled firms to SMEs. Thus, SMEs with few patents can benefit from the consultancy and hardware of their match. The match can complete lack of knowledge and experience of its peer regarding the patent process by channeling considerable knowledge spillovers and ensuring knowledge convergence in possible supply and value chains.

- Establishing a standardization for patent licensing, leasing, and transfer through a patent contract
- Matching academician's inventions (especially inventions with high product value as hardware etc.) with sector-related firms to prevent their lose in value.
- Providing sponsorship for the rapid production and commercialization of prototyped products.
- Offering consultancy and guidance for technology readiness level of firms to boost technology transfer among different technopark firms, common understanding on new and emerging technologies and production processes.
- Recognizing the infrastructure, R&D, and financial support needs of firms more easily by the government and providing policies that directly point to them.

This policy suggestion is presented by considering the innovation culture of Metu Technopark, its capabilities, and needs. It can be facilitated and designed by METU TTO. Also, it can be developed by TTO's network and expertise. It is noteworthy to consider this for all technoparks in Ankara and even in nation-wide. This mechanism can be adapted to all technoparks, considering their infrastructure, firm structure, and bureaucracy. It may contribute to the performance of nation-wide innovative activities.

6.1.2. Policy Recommendation for Future Patent Policies

In this sub-section, policy recommendations designed for future patent policies are presented. These are designed for policy makers who are responsible for establishing nation-wide patent policies. The proposed suggestions can be referred as development of incentive grants & procedures, education, public information, commercialization and infrastructure limitations, respectively. The relevant policies and the tools that can be used in these policies are listed in Table 17.

Table 17: Statement of policy recommendation for future patent policies

Limitation to consider	Policy Recommendation	Policy Tools to Use
Incentive grants and procedures	Offering SME-specific support programs and grants Creating sector-specific (i.e., health, software, or defense etc.) support/incentive programs with budget allocation	Supplying mentorship programs or patent consultancies Increasing the upper limits of incentives
Education	Having Patent Engineering majors in universities, adding patent lectures in higher education curriculum as must or elective courses.	Focusing on higher education curriculum and graduation projects of engineering, informatics, and law students
Public information	Increasing awareness on patent and patent support programs	Accelerating international and/or national patent fairs, hackathons, seminars, collaborative projects and projects contests Creating fields of study and recruitment slots for patent engineering graduates
Commercialization	Boosting commercialization of patents	Formulating new patent support or incentive programs, regulations to compete in the international and/or national technology market Creating a commercialization culture and standardization, certification programs etc.
Infrastructure	Improving firms' infrastructure for R&D activities and patent applications	Forming grants programs to receive academician consultancy or outsource patent experts Increasing participation to interdisciplinary projects to enhance university-industry cooperation (i.e., EU Horizon calls)

Patent incentive programs are significant to raise the awareness of firm personnel on patents and intellectual property rights (Sosnin, 2000) in general. That is why grants and procedures of patent incentives need to be improved in future patent policies. To overcome the first limitation, a policy recommendation may focus on SME-based and sector-specific support programs and/or grants. According to Thomas (Thomas, 2015)some sectors may stand-alone, autonomous (e.g., regarding R&D expenditures and budget) and more advanced (e.g., regarding technique and human source). On the other hand, some sectors cares and focus to cumulative innovation and consistent

progress (Thomas, 2015). The second type may need to be supported by inventions and patents that are already created and have by other individuals (Lemley, 2012). These can be considered as TG2 of the study whereas TG1s are more suited to the autonomous ones. Also, the term of the patent protection may change among different technologies depending on their pace of innovation (Thomas, 2015). So, it is not surprising to assume that TG1 firms are more advantageous than TG2 when the issue is the strength of their patent protection. Therefore, offering SME-based patent incentive grants and programs could be the proper policy solution to empower TG2. Moreover, the number of patented products can differ among industries (Thomas, 2015). For instance, the number of patented products, parts and systems is excessive in the electronics sector while patents in the pharmaceuticals is few and only valid for a limited number of medications (O'Connor, 2012). That is why, tailored policies for distinct sectors are a necessity since they have unique behaviors and capabilities.

Kassiri (al Kassiri & Čorejová, 2015) argues that assigning patent-related projects to higher education students can result with graduates and future employees who are expert on intellectual property rights and innovation. Furthermore, engineering projects that are based on innovation and start-ups pave the way for reduced unemployment rates and increased foreign investments in the long-term (al Kassiri & Čorejová, 2015). This also shows that patent education-oriented policies are significant for innovative and financial reconstruction. Sullivan agrees with Kassiri's view and takes is further. According to Sullivan (O'Sullivan et al., 2020) inclusion of patent courses to higher education curriculums comes with two advantages. Firstly, engineers and science and technology students graduate with patent awareness and basic level of patent know-how. Secondly, they became patent-literated by learning and examining available patents (e.g., past, active, and expired ones). These advantages lead educational impact of patents that are mentioned in the findings section. In this way, they also contribute to the pyramid model mentioned under the Chapter 3. Patent based intellectual property courses also can be a mediator for students to discover their talent and interest towards patent, R&D projects, and academic professions. Therefore, they become proper candidates for the idea pool and patent education, which are one of the revealed impacts of the study. It is therefore

notable to design policy recommendations that focus to embed patent lectures to higher education curriculums.

Moser (Moser, 2011) argues that inventions presented in patent fairs are more likely to be patented. He also adds that these exhibitions are a chance to announce prizes for inventors, quality of innovations and available inventions. For this reason, informing the public on patents should not only be seen only as patent awareness but also as a patent know-how and education at the basic level. In fact, in IPR and patent seminars, the main themes are chosen among emerging technologies. Therefore, it is appropriate to improve firms' production process and technological progress. That is why, patent policies that are based on informing the public needs to be considered for accurate patenting process.

As mentioned in the Findings chapter, lack of commercialization is a common limitation for both TG1 and TG2. However, they differ in content. Acceleration of commercialized patents means increased economic growth and firm value for TG1. For TG2, it directly related to the survival of firms. Therefore, there is a need to establish commercialization policies that will encourage firms of both groups. Finally, the lack of infrastructure applies only to TG2, as presented in the Findings and Discussion chapters. For this, future policy recommendations need to provide extra budget and funds for SMEs for their participation into international seminars, fairs, and project B2Bs.

6.2. Limitation of the Study

All interviews of the study are conducted during the period of Covid-19 pandemic. Covid-19 related restrictions as semi-closures and time restrictions on curfew leads change in communication mediums. This also affects planning and management of semi-structural meetings. Generally, interviewees prefer to conduct interviews via online teleconferences (Zoom, Microsoft Teams etc.) instead of face-to-face meetings. Although that makes interviews faster, easier to manage and able to not affect by physical conditions (arranging a meeting place, logistics, social distance, weather conditions, etc.), it causes some difficulties. Most of the interviewees are working remotely or in a hybrid way so, their meetings are held online. It results with

overlapped meetings regarding their date, time, and duration. That is why, the interviews of the study had to be changed, rearranged, or postponed quite frequently. This limitation is resolved by the researcher through preparing a thesis-specific interview agenda. The detailed recording of the interviews (regarding dates, interviewee information, time, duration etc.) make it possible to instantly update interview days/dates. Besides, it minimizes the negative impact of this problem.

Another limitation of the study is related to patent policy-associated interview questions. Interviewees sometimes hesitate and feel nervous to express their true opinions when the matter is evaluating adequacy and impact of existing patent policies, they fear that this would be perceived as criticizing actions of government. This creates the risk that the data on the policy part is limited. To prevent this, it is frequently explained to the interviewee by the researcher that interviewee's view would remain anonymous. Additionally, the entire thesis does not point directly to any individual or firm. The significance of the inclusion of cons as well as pros are also emphasized. Thus, this limitation is minimized.

6.3. Concluding the Thesis

This thesis explores the effect of patent incentives on the innovative performance of technology-based firms. To reveal this, the study uses METU Technopark as the study field and conducts semi-structured interviews for data collection. Interviewees are identified as TG1 (firms with more than one patent) and TG2 (firms with only one patent) accordingly to the extent of their patent portfolios. The study uses the mixed methodology while having inductive approach. Therefore, the theory of the study is revealed just after collection and evaluation of the data.

The density of innovation activities has a potential to boost patenting. The key motivation of firms is to follow emerging technologies for accelerating their R&D projects to become a strong and well-known competitor in the market. The following motivation is converting their interventions to marketable products. Exactly at that point, patenting becomes significant. In other words, patents are preferred and increased by numbers because of firms' developed innovation activities. That makes innovation the primary purpose but, not patenting. Briefly, patents do not accelerate

innovation but it emerges as a result of R&D activities. Thus, patent incentives do not lead to significant changes on innovation performances of technology-based firms. Uttermore, patents create behavioral impacts on firms. These effects occur in three different ways as educational, structural, and R&D. Benefiting from a patent affects both TG1 and TG2 educationally and structurally. However, R&D impact of patents only valid for TG1.

Although patents impact firms in a variational way, it also causes some limitations on them. These limitations are based on commercialization and infrastructure. Number of commercialized patents is relatively low compared to the existing patents of firms' hold. It became an obstacle for TG1 firms regarding their financial growth while it prohibits TG2 firms to exist and compete in the market. Besides, lack of infrastructure is seen as only TG2-spesific limitation because SMEs are more disadvantaged in terms of infrastructure deficiencies (lack of budget, human allocation etc.). Firms agree on that existing patent incentives or support programs do not support (regarding grant, consultancy support etc.) them as they expected because of these limitations. Therefore, patent incentives do not have vivid and totally improving effect on firm's innovation performance. Nevertheless, it paves the way for behavioral changes as "impacts" like mentioned in previous chapters. From this point of view, the answer for "Does patent incentives in Turkey impact the innovative performance of technology-based firms?" can be answered as the patent incentives have no significant impact on the innovation performance of the firm in the METU Technopark to change its innovation ecosystem.

Apart from that, this thesis presents two-sided policy recommendations. The first of them is structured as a policy recommendation specific to the METU Technopark. It offers bringing university-industry and government together in a matchmaking mechanism. This cooperation and interoperable based mechanism aim to strengthen innovation ecosystem by increasing mutual advantages among the three entities. In secondary policy recommendation, some suggestions are presented regarding the development of patent incentives, grants and bureaucracy, patent education, public information, commercialization of patents and firm infrastructures. It offers some baselines as increasing the upper limits of incentives, creating fields of study and

recruitment slots for patent engineering graduates, and establishing a commercialization culture and standardization, certification programs etc. to consider on it.

As concluding remarks, the thesis is the first academic study that explores the actual impact of patent incentives on technology-based firms which also offers a related policy recommendation for upcoming efforts. Thus, it can be considered as a guidance for future studies that are capable to improve possible patent incentives, innovation policies, and innovative performance of technology firms.

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APPENDICES

APPENDIX A: CODEBOOK

1. General Opinion
    - What do you think about patent incentives?
        - I do not know much
        - Encouraging individuals for patents
        - KOSGEB
        - Tübitak
        - Ministry of Industry supports for patents
2. Impacts
    - Educational Impact
        - Educational Impact (TG1)
            - Patent know-how
            - Patent education
        - Educational Impact (TG2)
            - Patent awareness
            - Awareness on patent and it's all related process
            - Absorbing new technologies to create new R&D projects
            - Creation of self-empowered personnel on patent
    - Structural Impact
        - Structural Impact (TG1)
            - Idea pool
            - University-industry collaboration
            - Interdisciplinary patent unit

- Structural Impact (TG2)
    - Preparation of a patent policy
    - Creating a firm culture on innovation
    - Creation of a R&D team

- R&D Impact
  - R&D Impact (TG1)
    - P&D
    - Reverse engineering in P&D

3. Sub-sections of Educational Impact
   - TG1
     - Sub-sections of patent know-how
       - Manager level
       - R&D team of the firm
       - Firm personnel
     - Sub-sections of patent education
       - Introduction to IPR trainings for all personnel
       - Introduction to patent trainings for technical staff
       - Introduction to patent trainings for engineers
       - IPR workshops for interns and/or new recruits
       - Focus group trainings on request
       - Trainings regarding incentive programs/ grants/ fundings for R&D team
       - Ethics trainings for R&D team
4. Sub-sections of Structural Impact
   - TG1
     - Sub-sections of idea pool
       - Invention disclosure filling
       - Gathering the committee
       - Evaluation of invention disclosure forms
       - Forming the short-listed candidates
       - Announcement of committee evaluation results
     - Sub-sections of university-industry collaboration

        - Advantages for industry
        - Advantages for university
        - Win-win situation
    - Sub-sections of interdisciplinary patent unit
        - Engineering
        - Law
        - Administrative sciences
- TG2
    - Sub-sections of R&D activities & patent policy
        - Innovation as a firm culture
        - R&D team establishment
        - Patent policy preparation

5. Limitations
    - Limitations of patents on both target groups
        - Limitations based on commercialization
        - Limitations based on infrastructure
        - Limitations based on bureaucracy
        - Limitations based on SMEs
6. General Reviews
    - Some questions on general reviews of the firms
        - Do you have a patent unit?
        - Do you have a patent expert?
        - Do you have a patent policy?
        - Are there any patent support programs or incentives exist you benefited from?
        - Does a patent have an impact on your firm's innovation activities?
        - What is the type of your innovation?
        - Do patent policies support firms as you expected?
7. What can be done for firms?
    - A matching system
    - More collaboration between university & industry

- Extra budget for SMEs
- Sector-based incentives/ supports
- More information that given by government
- Mentorship supports for SMEs
- Increasing participation to international fairs
- Budget support

APPENDIX B: INTERVIEW QUESTIONS / MÜLAKAT SORULARI

1. Patent teşviki denilince aklınıza neler geliyor?
2. Türkiye'deki patent teşvikleri hakkında neler düşünüyorsunuz?
3. Firma içerisinde bir patent birimi var mı? Ya da firma içerisinde bir patent uzmanı istihdam ediyor musunuz?
4. Patent teşviklerine ilişkin herhangi bir firma politikanız var mı?
   4.1. Yararlandığınız ve/veya yararlanmayı düşündüğünüz patent teşviki/leri var mı?
   4.2. Varsa, bugüne kadar toplamda kaç adet patent teşvikinden yararlandınız?
   4.3. Patent başvurusunu yaptığınız yenilikleriniz nelerdi?
   4.4. Patent başvurusu yapma konusunda sizi motive eden unsurlar nelerdi?
   4.5. Yoksa, neden patent başvurusu yapmadınız? Herhangi bir patent teşvikinden yararlanmamanın doğurduğu olumsuz bir sonuçla karşılaştınız mı?
5. Patent başvurusunda ortaklık kurduğunuz kişi ya da kuruluşlar var mı?
   5.1. Varsa, bu kişi ya da kuruluşları tercih etmenizdeki sebepler nelerdi?
   5.2. Kurulan bu ortaklığın nasıl bir etkisi oldu?
6. Patent teşviklerinin inovasyon üzerinde etkisi var mıdır? Bu etkiler nelerdir? Varsa, patent teşviklerinin inovasyon üzerindeki etkisinin nedenlerini açıklar mısınız? Yoksa, neden patent teşviklerinin inovasyon üzerinde bir etkisi olmadığını düşünüyorsunuz?
7. Yararlandığınız patent teşvikinin firmanın inovasyon performansı üzerindeki etkisi ne oldu?
   7.1. Yararlandığınız patent teşviki firmanın inovasyon performansını beklenen ölçüde arttırdı mı?
   7.2. Patent teşvikinden yararlanmak, firmanın inovasyon performansı üzerinde herhangi bir olumsuz etki yarattı mı?
   7.3. Herhangi bir patent teşvikinden yararlanmasaydınız da

firmanın inovasyon performansında aynı ölçüde değişim olur muydu?

8. Türkiye'de uygulanan patent teşvik politikaları firmalara yeterli desteği sağlıyor mu?

   8.1. Patent teşvik politikaları pratikte işliyor mu? Firma perspektifinden görüşünüz nedir?

   8.2. Türkiye'deki patent teşviklerinin firmalara daha çok etki etmesi için neler yapılabilir?

9. Patent teşvik politikaları hakkında karar verici olsaydınız nasıl bir yol izlerdiniz?

10. Eklemek istediğiniz herhangi bir şey var mı?

APPENDIX C: INTERVIEW QUESTIONS (ENGLISH)

1. What comes to your mind when you think of patent incentives?
2. What do you think about patent incentives in Turkey?
3. Is there a patent department in the firm? or Do you have a patent specialist within the firm?
4. Do you have a policy regarding patent incentives in the firm?
    - 4.1. Are there any patent incentives that you have benefited from and/or intend to benefit from?
    - 4.2. If yes, how many patent incentives have you used in total so far?
    - 4.3. What innovations did you apply for a patent?
    - 4.4. What were the factors that motivated you to apply for a patent?
    - 4.5. If not, why didn't you apply for a patent? Have you encountered a negative result of not benefiting from any patent incentives?
5. Are there any persons or organizations that you have partnered with for a patent application?
    - 5.1. If yes, what were the reasons for you to prefer these people or organizations?
    - 5.2. What effect did this partnership have?
6. Do patent incentives have an effect on innovation? What are these effects? If so, can you explain the reasons for the impact of patent incentives on innovation? Otherwise, why do you think patent incentives have no effect on innovation?
7. What was the effect of the patent incentive you benefited on the innovation performance of the firm?
    - 7.1. Did the patent incentive you benefit from increase the innovation performance of the firm as expected?

7.2. Did taking advantage of the patent incentive have any negative impact on the firm's innovation performance?

7.3. Even if you did not benefit from any patent incentives, would there be the same change in the innovation performance of the firm?

8. Do the patent incentive policies implemented in Turkey provide sufficient support to the companies?

8.1. Do patent promotion policies work in practice? What is your view from the perspective of the company?

8.2. What can be done to make the patent incentives in Turkey more effective for companies?

9. If you were the decisionmaker about patent incentive policies, what would you do?

10. Is there anything you would like to add?

APPENDIX D: APPROVAL OF THE METU HUMAN SUBJECTS ETHICS COMMITTEE

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

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İlgi : İnsan Araştırmaları Etik Kurulu Başvurusu

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Danışmanlığını yürüttüğünüz İrem İÇİN'in "Impact of Patent Incentives on Innovation Performance of Turkey: The Case of METU Technopolis" başlıklı araştırmanız İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve **311-ODTU-2021** protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız.

Prof.Dr. Mine MISIRLISOY
İAEK Başkan

APPENDIX E: TURKISH SUMMARY / TÜRKÇE ÖZET

PATENT TEŞVİKLERİNİN TEKNOLOJİ TEMELLİ FİRMALARIN İNOVASYON PERFORMANSINA OLAN ETKİSİ: ODTÜ TEKNOKENT ÖRNEĞİ

Giriş

Yüzyıllar boyunca insan zekası, daha iyi koşullar ve yaşama biçimleri yaratmak için yeni ürünler üretme veya geliştirme eğiliminde olmuştur.Fikri mülkiyet haklarından biri olan patent ise, bir buluşun satışını ve korunmasını garanti eder. Bu nedenle konu inovasyon olduğunda, patentler düşünmeye değerdir. Diğer bir deyişle, buluş sahibine buluşu koruma hakkı olarak verilmiş bir patent, yenilik için önem arz eder. Bu nedenle, ekonomik büyümeyi arttırma ve teknolojik ilerlemeyi hızlandırma yetenekleri nedeniyle patentler oldukça önemlidir. Konu ülkenin ekonomik kalkınması ve büyümesi olduğunda, inovasyon Türkiye için gelişmesi önemsenen bir kültürdür.

Bu göz önünde bulundurularak, gerçek ve tüzel kişilerin Ar-Ge faaliyetlerinin arttırılmasının teşvik edilmesi, böylece ülkenin inovasyon performansının geliştirilmesi için Tübitak 1507 & 1602 Destek Programları, KOSGEB Sınai Mülkiyet Teşvikleri ve Vergi Muafiyeti uygulanmaktadır. İnovasyonun Türkiye'deki yansıması ise dikkate değerdir. Türkiye, 2020 yılında, Çin (+%29), Japonya (+%14,8) ve İspanya'nın (+%25,1) hemen ardından %22,1'lik bir artışla fikri mülkiyet ofislerinde en yüksek büyümeyi gerçekleştiren dördüncü ülke olmuştur (WIPO, 2021b). Ülke 2021 yılında, Kuzey Afrika ve Batı Asya (NAWA) bölgesindeki en büyük inovasyon ekonomileri arasında İsrail (birinci sıra), Kıbrıs (ikinci sıra) ve Birleşik Arap Emirlikleri'nden (üçüncü sıra) sonra dördüncü sırada yer almaktadır (WIPO, 2021a). Ayrıca, ülkenin inovasyon performansı onu, Küresel İnovasyon Endeksi (GII) 2021'e göre "gelişmişlik düzeyine uygun inovasyon performansına" (WIPO, 2021a) sahip bir

ülke konumuna getirmektedir. Ek olarak Türkiye, İstanbul kaynaklı önemli teknolojik gelişmelere sahip yeni gelişen bilim ve teknoloji (B&T) kümelerine ev sahipliği yapan dünya şehirlerinden bir tanesi de sayılmaktadır (WIPO, 2021a).

Tüm bu veriler göz önüne alındığında mevcut literatürün, Türkiye'nin patent ve inovasyon ilerlemesine ilişkin olumlu bir eğilim gösterdiği söylenebilir. Bununla birlikte, bir teori, pratikte uygulanabilir hale geldiğinde değer kazanır. Bu nedenle patent teşviklerinin -bir patentten yararlanma durumunun- pratik çıktıları ile uyumlu hale getirilmesi gerekmektedir. İnovasyon ise, firmalar ve yenilikçi ağlar olmak üzere iki kanal üzerinden yürütülmektedir. Bir yandan, firmaların inovasyonun koruyucuları *(gatekeepers)* olarak görüldüğünü de hatırlamak gerekmektedir. Bu noktada teknoparklar, firmaların yenilikçi faaliyetleri için teknik ve bilgiye dayalı altyapı sağlayan en dikkate değer yenilik alanlarıdır. Ayrıca sanayi, üniversite ve devlet işbirliğini artırmak için de oldukça uygun ortamlardan bir tanesidir. Bu nedenle patentlerin inovasyon üzerindeki etkisini ölçmenin en iyi yolu, firmaları ve onları besleyen ODTÜ Teknopark gibi teknoloji ekosistemleridir.

Çalışmanın Amacı

Bu çalışma, inovasyonun Türkiye için önemi ve ifade ettiği değerleri önemsemektedir. Bunun yanında, ilgili çalışma patent ve inovasyonun birbirini nasıl ettiğini de merak etmektedir. Bu nedenle tez çalışması, bir patentten yararlanmanın veya yararlanmamanın teknoloji firmaları üzerinde kayda değer bir etkisi olup olmadığını araştırmaktadır. Asıl motivasyonunu buradan almaktadır. Tezde, bir patentten yararlanıyor olma durumu patent teşviki olarak adlandırılmaktadır. Temelde, bir firmanın inovasyon performansını olumlu veya olumsuz yönde etkileyebilecek mikro tetikleyicileri ve olası etkileri ifade etmektedir. Bu noktada çalışmanın asıl amacı, patent teşviklerinin teknoloji temelli firmaların üzerindeki asıl etkisini araştırmak ve ortaya çıkarmaktır. Bunun için çalışma, alana kolay erişim imkanı, zengin teknolojik ve bilimsel boyutu sebebiyle ODTÜ Teknopark firmalarını asıl araştırma sahası olarak kullanmıştır. Bu nedenle, tez öncelikle bir inovasyon ekosistemi için patent teşviklerinin anlamını öğrenmeyi amaçlamaktadır. Tamamlayıcı olarak, herhangi bir etki varsa, patentlerin firmaların davranışlarını nasıl değiştirdiğini öğrenmeyi hedeflemektedir.

Çalışmanın Önemi

Patentlerin inovasyonu teşvik ettiği ya da engellediğine ilişkin oldukça köklü ve geniş bir literatür bulunmaktadır. Patentlerin inovasyonu teşviki genellikle ekonomik, sosyal, Ar-Ge ve girişimcilik perspektifinden ele alınmaktadır. Diğer yandan bazı akademik çalışmalar patentin bilgi yayılımını ve iletimini engellediğini, aynı zamanda açık inovasyonun önünde de bir engel teşkil ettiğini kabul etmektedir. Ancak bunun ötesinde, patentlerin firmaların üzerinde yarattığı davranışsal değişimlere ilişkin bir literatür eksikliği bulunmaktadır. Ek olarak, patentin özellikle Teknopark firmalarının inovasyon performansını nasıl etkilediğine ve bu firmalarda inovasyon-patent etkileşiminin nasıl sonuçlandığına ilişkin bir odak eksikliği de mevcuttur. Bu çalışmanın önemi, bahsi geçen literatür eksikliğinin tamamlanması için sunduğu katkıdan kaynaklanmaktadır. Bununla birlikte çalışma, aşağıda belirtilen bazı konularda Türk politika yapıcılarına da katkı sağlamaktadır.

- Firmaların eğitim, firma yapısı ve Ar-Ge faaliyetlerine ilişkin patentle ilgili davranış değişikliklerine yeni bir bakış açısı getirmek
- Patentlerin teknokent bünyesindeki firmalar üzerinde oluşturduğu limitleri belirlemek
- Hem ODTÜ Teknokent'in hem de ülkenin inovasyon ekosistemini geliştirmek adına oluşturulan patent teşviklerini ve destek programlarını güçlendirecek politika önerileri oluşturmak

Çalışmanın Akışı

Çalışma toplamda altı ana bölümden oluşmaktadır. Anlam bütünlüğünü ve akışını sağlamak için çalışma, giriş bölümü ile başlamaktadır. Bölüm iki, tezin literatür taramasından oluşmaktadır. Bu bölümde çalışma konusuna ilişkin genel bir altyapı oluşturmak adına okuyucuya, patentin tanımı, etkisi, faydaları, kısa tarihçesi ve Türkiye'deki mevcut durumuna ilişkin genel bir bakış açısı sunulmaktadır. İkinci olarak, bir firmanın yenilikçi performansı için inovasyon alanlarının mantığını anlamak için tezin ana çalışma alanı olan ODTÜ Teknopark'a Teknoparklar kavramı altında kısaca değinilmiştir. Çalışmanın önemi, patentlerle inovasyonun birleşmesi sonucunda bir paradigma değişiminin meydana geleceği argümanıyla

vurgulanmaktadır. Bölüm üç, çalışmanın metodoloji bölümü olarak tasarlanmıştır. Bölümde, çalışmanın metodolojisi olan karma yöntem açıklanmıştır. Bunun yanında, yarı-yapılandırılmış görüşmelerin tasarım ve uygulanma sürecine değinilmiştir. ODTÜ Teknokent'in çalışma alanı olarak ifade ettiği değer ise Üçlü Helix Modeli ile açıklanmıştır. Dördüncü bölümde, yarı-yapılandırılmış görüşmelerden elde edilen bulgular sunulmaktadır. Bu bölümde, patentin teknoloji temelli firmalar üzerinde oluşturduğu etkiler ve limitler belirtilmektedir. Ek olarak, firmaların patente ilişkin genel bakış açısı sunulmaktadır. Beşinci bölümde ise, Bölüm dörtte elde esilen bulgular değerlendirilmiş ve çalışma sorusunun cevabı bulunmuştur. Patentin teknoloji temelli firmaların inovasyon performansı üzerinde dikkate değer bir etkiye sebep olmadığı ancak eğitim, firma yapısı ve Ar-Ge çalışmaları temelinde davranışsal değişikler yarattığı belirlenmiştir. Çalışma, ODTÜ Teknokent ve gelecek patent politikları özelinde oluşturulan politika önerilerini kapsayan Bölüm altı ile sonlanmaktadır.

Çalışmanın Metodu

Bu tezde karma yöntem kullanılmıştır. Araştırmanın birincil veri kaynağı nitel yönteme dayanmaktadır. Metodoloji kapsamında ilk olarak ODTÜ Teknokent'te year alan 429 adet firmanın tamamı patent başvuru sayıları ve sektörlerine göre sınıflandırılmıştır. Bu sınıflandırma sonrasında firmalar TG1 ve TG2 olarak ayrılmıştır. TG1, iki ve/veya ikiden fazla patent başvurusu olan firmaları, TG2 ise sadece bir patent başvurusu olan firmaları temsil etmektedir. Buradan hareketle toplamda 36 adet yarı yapılandırılmış görüşme gerçekleştirilmiştir. Görüşmeler 9 ana ve 12 alt soru olmakla birlikte toplamda 21 sorudan oluşmaktadır. Bu görüşmeler ortalama 46 dakika sürmüştür. Kullanılan nicel yöntem, nitel verileri tamamlayıcı olarak kullanılmıştır. Araştırmanın nicel verilerini ODTÜ Teknopark ve Türk Patent ve Marka Kurumu'nun resmi web siteleri oluşturmaktadır. Bahsi geçen ikincil veriler, sahadan toplanan verilerle birlikte değerlendirilmiştir. Görüşmeden elde edilen veriler QDA Minor Programında kodlanmıştır.

Bölüm 2: Literatür İncelemesi

Patent, yeni bir buluşun yenilikçi bir adımını ve endüstriyel kullanımını gerektiren, devlet tarafından verilen özel bir haktır (WIPO, 2018). Patentler, buluşu herhangi bir üçüncü kişinin kullanması (üretmesi, kullanması, satması veya ithal etmesi) yoluyla, bu buluşun mucidine yirmi yıl boyunca doğrudan bölgesel tekel sağlamaktdır. Bölgesel hak, ilgili ülke veya bölgenin coğrafi sınırları içinde buluş sahibi olmak için buluşun ayrıntılı, doğru ve iyi tanımlanmış bir belge ile topluma açıklanması anlamına gelmektedir(WIPO, 2018).

Bir inovasyon alanı olarak ODTÜ Teknokent, firmalarına, araştırmacılarına ve akademisyenlerine ülkenin rekabet gücünü hızlandıracak teknolojiler üretmeleri ve geliştirmeleri için teknolojik altyapı sunmaktadır. Teknokent ayrıca, üniversite-sanayi işbirliğini sağlar. Teknokent'teki firmaların %50'si yazılım-bilişim, %20'si elektronik, %15'i makine ve tasarım, %6'sı tıp teknolojileri, %6'sı enerji ve çevre, kalan %3'ü ise ileri malzeme, tarım, gıda, havacılık ve otomotiv gibi diğer alanlarda Ar-Ge çalışmaları yürütmektedir. ODTÜ Teknopark, Teknoloji Geliştirme Bölgeleri Performans Endeksi çalışmalarında da yedi kez en başarılı teknoparklar arasında kabul edilmiştir. Bunlar dikkate alındığında, çalışma alanı olarak ODTÜ Teknopark'ın seçilmesinin belirli nedenleri bulunmaktadır. İlk olarak, araştırmacı tarafından ODTÜ Teknokent firmalarına olan erişim daha kolaydır. İkinci olarak, teknokent bünyesinde yer alan firmaların halihazırda zengin olan patent portföyleri çalışma için oldukça değerli ve kıymetlidir.

Çalışmanın inovasyon ile olan bağlantısı ise oldukça önemlidir. Terim, temel olarak, bir faaliyete ve onun sonucuna atıfta bulunur b(OECD, 2018). This definition was adopted because it developed and functionalized as a guide to the practices followed by the business sector. There are four types of innovation are defined product, process, organizational and marketing innovations, as stated below. Bu tanım, iş sektörünün izlediği uygulamalara bir rehber olarak geliştirilip işlevselleştirildiği için benimsenmiştir. Aşağıda belirtildiği gibi ürün, süreç, organizasyon ve pazarlama inovasyonları olmak üzere dört tür inovasyon vardır(TÜBİTAK, 2015): Çalışma bu inovasyon sınıflandırması üzerinden ilerlemektedir.

Ürün yenilikleri (OECD, 2018)bir firmanın mevcut ürünlerinden önemli ölçüde farklı olan yeni veya geliştirilmiş mal veya hizmetleri ifade eder.

Süreç yenilikleri, yeni veya geliştirilmiş ürünleri ve teslimat yöntemlerini temsil eder.

Örgütsel yenilikler, yeni örgütsel yöntemlerin yürütülmesinde önemli değişiklikler anlamına gelir. Bu, iş uygulamalarında, işyeri organizasyonunda veya dış ilişkiler yönetimindeki değişiklikler olabilir.

Pazarlama yenilikleri, bir firmada yeni veya geliştirilmiş pazarlama yöntemlerinin uygulanmasıdır. Ürün tasarımı ve ambalaj değişiklikleri, ürün promosyonu ve konumlandırması ile mal ve hizmetler için fiyatlandırma yöntemlerini ifade eder.

Bölüm 3: Metodoloji

Bu bölümde çalışmanın metodolojisi sunulmaktadır. Öncelikle araştırma sorusu ve çalışmanın terminolojisi belirlenmiştir. Çalışmanın metodolojisi olarak karma yöntem benimsenmiştir. Çalışmanın verisi yapılan yarı yapılandırılmış görüşmeler sonrasında elde edilmiştir. Nitel veriler açıklayıcı olsa da kullanılan ikincil veriler tanımlayıcı olarak kullanılmıştır. Çalışmanın ikincil verisi ise ODTÜ Teknokent ve TürkPatent'in resmi web sitelerinde oluşmaktadır. Görüşmelerden elde edilen veriler ise QDA Minor programında kodlanmıştır. Bu kodlar, ikincil verilerle harmanlanarak değerlendirilmiştir. Çalışma sorusu Türkiye'deki patent teşvikleri teknoloji tabanlı firmaların yenilikçi performansını etkiler mi? olarak belirlenmiştir. Bu soru, tüm çalışmayı yönlendiren asıl sorudur. Metodoloji bölümü genel olarak iki ana bölümde sunulmuştur. İlk olarak, çalışmanın metodolojisi olarak karma yöntem değerlendirilmiştir. İkinci bölümde ise nitel metod detaylı bir şekilde incelenmiştir. Bu kapsamda, görüşme sorularına, geörüşmelerin nasıl tasarlandığına ve görüşülen odak grubu bilgilerine yer verilmiştir. Daha sonra çalışma alanı olan ODTÜ Teknopark'ın çalışmada yeri ve önemi sunulmuştur. Bu nedenle, bölüm, araştırma sorusuna bir cevap ortaya çıkarmak için bulguların üretilmesi ve yorumlanması için teorik bir arka plan sağlamıştır.

Bölüm 4: Bulgular

Çalışmanın bu bölümünde görüşmelerden elde edilen bulgular paylaşılmıştır. Bu bulgular "etki" temelinde analiz edilmiştir. Bahsi geçen bu etkiler, eğitimsel, yapısal ve Ar-Ge özelindeki davranış değişiklikleri olarak sınıflandırılmaktadır. Patentin teknoloji temelli firmalar üzerindeki etkilerinden sonra, patentin firmalar üzerinde yarattığı limitler de belirtilmektedir. Bunun yanında, görüşme yapılan firmaların patentlerin inovasyon perfromanslarına olan genel etkisi, patent ve inovasyon hakkındaki görüşleri gibi çıktılara da yer verilmektedir. Elde edilen ve sunulan tüm bu bulgular, Bölüm 5'teki tartışma bölümünün altyapısını oluşturmaktadır.

Temel bulgular olarak, patentin TG1 firmaları üzerinde oluşturduğu üç ana etki belirlenmiştir. Bunlar eğitimsel, yapısal ve Ar-Ge olmak üzere üç farklı kategoride sunulmuştur. Eğitimsel etkinin iki ayrı alt bileşeni vardır: patent bilgisi ve patent eğitimi. Patent bilgisi, patente ilişkin bilgi birikiminin bir firmanın tüm seviyesine yayılmış olması anlamına gelmektedir. Patent eğitimi, patentlerle ilgili firma içi eğitimleri ifade etmektedir. Belirlenen bir diğer etki ise yapısal olarak belirlenmiştir. Bahsi geçen etkiler, fikir havuzu, üniversite-sanayi iş birliği ve disiplinlerarası patent birimi olarak adlandırılmıştır. Üçüncü ve son etki olan Ar-Ge etkisi ise ürün geliştirme olarak belirlenmiştir. TG1 için tanımlanan etkiler TG2 ile eğitim ve yapı kıstaslarında benzerlik göstermektedir. Bunun yanında patentin teknoloji temelli firmalar üzerinde yarattığı bazı limitler belirlenmiştir. Bunlar patentlerin ticarileştirilmesinde ve altyapı teminindeki eksiklikler olarak belirlenmiştir.Bölüm son olarak, firmaların patent ve inovasyona olan bakış açılarının sunulmasıyla tamamlanmıştır.

Özetle, bölümden elde edilen ana çıktılar aşağıda belirtildiği gibi özetlenebilir:

- Patentler, teknoloji tabanlı firmalar üzerinde eğitimsel, yapısal ve Ar-Ge olarak davranış değişiklikleri yaratmaktadır.

- Eğitimsel ve yapısal etkiler, ODTÜ Teknokent'teki tüm teknoloji tabanlı firmalar için geçerlidir. Ancak, Ür-Ge, hızlandırılmış Ar-Ge faaliyetlerinin bir sonucu olduğu için KOBİ'ler için geçerli değildir.

- Patentlerin KOBİ'ler üzerindeki eğitim etkisi, patent farkındalığı olarak tanımlanmaktadır.

- Patent know-how ve eğitiminin oluşturulması için patent bilincinin oluşturulması gerekmektedir.

- Patentlerin firmalar üzerindeki yapısal etkisi, fikir havuzu oluşturulması, üniversite-sanayi işbirliği ve disiplinler arası bir patent birimi olarak ortaya çıkmaktadır.

- Patentler firmalar üzerinde davranış değişikliğine olanak sağlamakla birlikte ticari ve altyapısal sınırlamalara neden olmaktadır.

- Türkiye'nin mevcut patent teşvikleri veya patent destek programları teknoloji tabanlı firmalara beklenen desteği sağlamakta yetersiz kalmaktadır.

Elde edilen tüm bulgular, takip eden analiz bölümünda değerlendirilmektedir.

Bölüm 5: Analiz

Bu bölümde bulgular, TG1 ve TG2 üzerinden patentlerin etkileri, sınırlamaları ve genel bakış açıları olmak üzere üç farklı alt bölümde tartışılmıştır. Yapılan analiz sonucunda patentlerin firmalar üzerinde çeşitli davranışsal değişikler oluşturduğu fark edilmiştir. Bu değişiklikler eğitimsel, yapısal ve Ar-Ge etkileri olarak belirlenmiştir. Hem TG1 hem de TG2'de eğitimsel ve yapısal etkiler olmasına rağmen, Ar-Ge etkisi yalnızca TG1'e özgüdür. Bu, patentlerin, firmaların inovasyon performanslarını destekleyen ve artıran davranışları üzerinde bir etkisi olduğunu da kanıtlamaktadır. Patentlerin firmalar üzerinde etkileri olmasına rağmen, ticarileştirme ve altyapı eksikliği ile aynı sınırlamalarla karşı karşıya kalmaktadırlar. Kısacası patent, davranışsal gelişmeler olarak firmalar için eğitici, yapısal ve Ar-Ge etkilerinin önünü açmaktadır. Ancak firmaların görüşü, patentlerin genel olarak firmaların yenilik performansına kayda değer bir katkı sağlamadığını belirtmektedir. Ayrıca, patent politikaları firmalara beklendiği gibi destek ve rehberlik sunmamaktadır. Sonuç olarak patent teşviklerinin, ODTÜ Teknokent'teki firmaların inovasyon performanslarının geliştirilmesinde ve inovasyon ekosistemlerinin güçlendirilmesinde dikkate değer bir katkısı yoktur. Ancak patentler firmalarda eğitim, yapı ve Ar-Ge bazında davranış değişikliklerine yol açmaktadır. Yapılan analizden elde edilen bu çıktılar sonuç

bölümü kapsamında sonuçlandırılmaktadır. İlgili bölüm ayrıca, firmaların inovasyon performanslarının geliştirilmesi adına iki adet politika önerisi sunmaktadır.

Bölüm 6: Sonuç ve Politika Önerileri

İnovasyon kültürünün kazanılması ve güçlendirilmiş inovasyon ekosistemine dönüştürülmesi için ticarileştirilebilir patentler, kendi kendini yetiştirmiş Ar-Ge personeli ve projeleri benimsemek önemlidir. Çalışmanın literatür taraması hatırlatılacak olursa, teknokentler bilgi açısından zengin üniversiteleri, yetenekli firmaları ve katma değer sağlayan devlet politikalarını sentezlemektedir. Metodoloji bölümünde ayrıca yer verilen Helix Modeline göre, üniversite, sanayi ve hükümet işbirliği, yenilikçi faaliyetleri geliştirmenin uygun bir yolu olarak görülmektedir. Bu nedenle, ODTÜ Teknokent firmaları özelinde hazırlanacak bir politikada bu üç etmenin birbiri ile olan işbirliğini göz önünde bulundurmak dikkate değerdir. Bunu sağlayabilecek politika önerisi bir eşleştirme mekanizması olabilir. Böyle bir mekanizmanın kurulmasının amaçları aşağıda kısaca özetlenmiştir.

- Teknopark firmalarının birbirleriyle eşleştirilerek aralarında ortak Ar-Ge proje konsorsiyumlarının oluşturulması

- Patent başvurusu ve patentlerin ticarileştirilmesinde üniversite-sanayi işbirliğinden yararlanılması

- Politika yapıcıların teknopark firmalarına daha uygun ve destekleyici patent destek programları oluşturmak için inovasyon ekosistemine dahil olması

- ODTÜ Teknokent'i bölgedeki ve ülkedeki komşu teknoparklar ile eşleştirerek inovasyon ağlarının geliştirilmesi

Bu mekanizma, Horizon Europe B2B eşleştirmelerinin inovasyon ve patent temelindeki uyarlaması olarak düşünülebilir. Bu mekanizmanın işlerliği, üniversite, sanayi ve devlet işbirliğine ve birlikte çalışabilirliğine bağlıdır. Bahsi geçen önerinin çalışma prensibi ise aşağıdaki gibi özetlenmiştir.

- Büyük ölçekli firmalar ile KOBİ'leri eşleştirmek. Böylece, sınırlı sayıda patenti olan küçük ölçekli firmalar, büyük ölçekli firmaların danışmanlığından ve donanımından yararlanabilirler. Eşleştirme, önemli bilgi yayılmalarını kanalize ederek ve olası

tedarik ve değer zincirlerinde bilgi yakınsamasını sağlayarak, emsalinin patent süreciyle ilgili bilgi ve deneyim eksikliğini tamamlayabilir.

- Bir sözleşme yoluyla, patent lisanslama, kiralama ve devri için standart bir prosedürün oluşturulması

- Akademisyen buluşlarının (özellikle donanım vb. ürün değeri yüksek buluşların) sektörle ilgili firmalarla değer kaybetmelerini önlemek için eşleştirilmesi.

- Prototip ürünlerin hızlı üretimi ve ticarileşmesi için sponsorluk sağlanması.

- Farklı teknopark firmaları arasında teknoloji transferini, yeni ve gelişen teknolojiler ve üretim süreçlerinde ortak anlayışı artırmak için firmaların teknoloji hazırlık düzeylerine yönelik danışmanlık ve rehberlik sağlanması

- Firmaların altyapı, Ar-Ge ve finansal destek ihtiyaçlarının devlet tarafından daha kolay fark edilmesi ve doğrudan onlara yönelik politikaların sağlanması.

Bu politika önerisi, ODTÜ Teknopark'ın inovasyon kültürü, yetenekleri ve ihtiyaçları göz önünde bulundurularak sunulmuştur. Bunu Ankara'daki ve hatta ülke genelindeki tüm teknoparklar için düşünmek dikkat çekicidir. Bu mekanizma, altyapıları, firma yapıları ve bürokrasileri dikkate alınarak tüm teknoparklara uyarlanabilir. Ülke çapında yenilikçi faaliyetlerin yürütülmesine katkı sağlayabilir.

İkinci politika önerisi, politika yapıcıları için sunulmuştur. Sunulan politika önerisi sırasıyla patent teşvik hibeleri ve prosedürlerinin geliştirilmesi, eğitim, kamu bilgilendirmesi, ticarileştirme ve altyapı sınırlamaları temelinde geliştirilmiştir.

Çalışmanın Sonlandırılması

Bu tez, patent teşviklerinin teknoloji tabanlı firmaların inovasyon performansı üzerindeki etkisini araştırmaktadır. Bunu öğrenmek adına çalışma alanı ODTÜ Teknopark olarak belirlenmiştir. Veri toplamak için ise çalışma alanında yer alan firmalarla yarı yapılandırılmış görüşmeler gerçekleştirilmiştir. Görüşülen kişiler, patent portföylerinin kapsamına göre TG1 (birden fazla patenti olan firmalar) ve TG2 (tek patenti olan firmalar) olarak belirlenmiştir. Çalışma, tümevarımsal yaklaşımı benimsemektedir. Bahsi geçen tümevarımsal yaklaşım sebebiyle, çalışmanın teorisi,

verilerin toplanması ve değerlendirilmesinden hemen sonra ortaya elde edilmiştir. Yapılan literatür çalışmasından edinilen çıktılara göre, inovasyon faaliyetlerindeki artış, buluşların patentlenmesini arttırma potansiyeline sahiptir. Bu noktada, teknoloji temelli firmaların temel motivasyonu, gelişen teknolojileri takip ederek Ar-Ge projelerine hız vermek, pazarda güçlü ve bilinen bir rakip haline gelmektir. Patentin gözettiği amaçlardan birtanesi, firmalarda varolan ürünleri pazarlanabilir ürünlere dönüştürmektir. Bu açıdan bakıldığında patent, teknoloji firmaları için önem teşkil etmektedir. Başka bir deyişle, firmanın geliştirdiği inovasyon faaliyetleri nedeniyle patentler daha tercih edilir bir hale gelmekte ve firmaların patent başvuru sayıları da dolaylı olarak artış göstermektedir. Bu ise, patenti inovasyonu geliştirmek için bir araç haline getirmektedir. Böylece, patentlerin firmaların inovasyon hızını arttığından ziyade, Ar-Ge faaliyetleri sonucunda ortaya çıktığı görüşü bulunmaktadır. Dolayısıyla patent teşvikleri, teknoloji tabanlı firmaların yenilik performanslarında radikal değişikliklere yol açmamaktadır. Ancak, patentler, firmalar üzerinde davranışsal etkiler yaratmaktadır. Bu etkiler eğitimsel, yapısal ve Ar-Ge olmak üzere üç farklı şekilde ortaya çıkmaktadır.

Bahsedildiği üzere patentler, firmalar üzerinde davranışsal değişimlere sebep olmakla birlikte beraberinde, bazı sınırlamalara da yol açarlar. Bu sınırlamalar ticarileştirme ve firma altyapısı ile ilgilidir. Ticarileşme limiti, ticarileşen patent sayısının, firmaların sahip olduğu mevcut patentlere göre nispeten düşük olmasından kaynaklanmaktadır. Bu durum, TG2 firmalarının piyasada var olmasını ve rekabet etmesini engellerken, TG1 firmalarının finansal büyümesi karşısında zorluk yaratabilmektedir. Ayrıca KOBİ'ler nedeniyle sadece TG2'ye özgü bir sınırlama olarak görülen altyapı eksikliği, rekabet edilebilirlik açısından TG2 firmalarını dezavantajlı konuma düşürebilmektedir. Burada bahsi geçen altyapı eksiklikleri ise bütçe yetersizliği, insan tahsisi vb. olarak düşünülmelidir. Buradan hareketle firmalar, bu sınırlamalar nedeniyle mevcut patent teşviklerinin veya destek programlarının (hibe, danışmanlık desteği vb. konusunda) kendilerini bekledikleri gibi desteklemediği konusunda da fikir birliği göstermektedir. Bu nedenle, patent teşviklerinin firmanın yenilik performansı üzerinde tamamen iyileştirici bir etkisi bulunmamaktadır. Ancak, önceki bölümlerde bahsedildiği gibi patentler "etkiler" olarak adlandırılan davranışsal değişikler

yaratmaktadır. Bu noktada, “Türkiye'de patent teşvikleri teknoloji tabanlı firmaların inovasyon performansını etkiler mi?” sorusuna cevap verilmektedir. Bu sorunun cevabı, patent teşvikleri ODTÜ Teknokent’te yer alan teknoloji temelli firmaların inovasyon ekosistemine ve performansına radikal bir etkisi bulunmamaktadır şeklinde olabilir. Görüşmeler sonucunda elde edilen bulgular ve yapılan değerlendirmeden sonra çalışma, iki adet politika önerisi sunmaktadır. Bunlardan ilki, ODTÜ Teknokent’e özgü bir politika önerisi olarak yapılandırılmıştır. Bu politika, üniversite-sanayi ve devleti bir eşleştirme mekanizması bünyesinde bir araya getirmeyi ve birlikte işlerliğini sağlamayı hedeflemektedir. Bu işbirliği ve birlikte çalışabilirlik tabanlı mekanizma, üç kuruluş arasında karşılıklı avantajları artırarak inovasyon ekosistemini güçlendirmeyi amaçlamaktadır. İkincil politika tavsiyesinde, patent teşvikleri, hibeler ve bürokrasi, patent eğitimi, kamuoyu bilgilendirme, patentlerin ticarileştirilmesi ve firma altyapıları ile ilgili bazı öneriler sunulmaktadır. Teşviklerin üst sınırlarının artırılması, patent mühendisliği mezunları için çalışma alanları ve işe alım yuvalarının oluşturulması ve üzerinde düşünülmesi gereken bir ticarileştirme kültürü ve standardizasyon, sertifika programları vb. çözümler de ayrıca belirtilmektedir. Sonuç olarak, tez, patent teşviklerinin teknoloji tabanlı firmalar üzerindeki fiili etkisini araştıran ve aynı zamanda gelecekteki çabalar için ilgili bir politika önerisi sunan ilk akademik çalışmadır. Bu nedenle, teknoloji firmalarının olası patent teşviklerini, inovasyon politikalarını ve inovasyoni performanslarını iyileştirmeye yönelik gelecekteki çalışmalara yol gösterici olarak değerlendirilebilir.

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