ASSESSMENT OF TECHNOLOGY TRANSFER IN UNIVERSITY INDUSTRY COLLABORATION: CASE OF TURKEY

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Approval of the Graduate School of Social Sciences

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science.

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This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science.

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ABSTRACT

ASSESSMENT OF TECHNOLOGY TRANSFER IN UNIVERSITY INDUSTRY COLLABORATION: CASE OF TURKEY

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In this thesis, a survey was conducted to academicians from 10 university who were ranked in the top 50 universities in the Entrepreneurial and Innovative University Index announced in 2012 and supported by TUBITAK 1513 Technology Transfer Offices Support Program". In addition, interviews were conducted with 9 TTO and 2 TUBITAK managers in Ankara. In this context, (i) the perspectives of academics to university-industry collaboration and where they are involved in technology transfer, (ii) the role of TTOs, which are considered as an interface mechanism in ensuring this collaboration, were investigated. In the light of the data obtained from the questionnaire and face-to-face interviews, the validity of two hypothesis was examined. (i) Some researchers are willing to take part in university-industry collaboration, even if they aim only for teaching and seek resources for scientific purposes. (ii) Even though TTOs stated that they were well known in the interviews, TTOs have not been sufficiently active in the process of collaboration when the results

of the survey and TÜBİTAK interviews are evaluated together. Finally, policy recommendations were made on the basis of national, university and TTOs.

Keywords: Technology transfer, Technology Transfer Office (TTO), entrepreneurship, university-industry collaboration.

ÖZ

ÜNİVERSİTE-SANAYİ İŞBİRLİĞİNDE TEKNOLOJİ TRANSFERİNİN DEĞERLENDİRİLMESİ: TÜRKİYE ÖRNEĞİ

Maviş, Belkız

Yüksek Lisans, Bilim ve Teknoloji Politikaları Çalışmaları Bölümü

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Bu tezde, 2012 yılında açıklanan Girişimci ve Yenilikçi Üniversite Endeksi'nde ilk 50 üniversite sıralamasında yeralan ve TÜBİTAK 1513 'Teknoloji Transfer Ofisleri Destekleme Programı" ile destek alan 10 üniversitenin akademisyenlerine anket yapılmıştır. Ayrıca Ankara'da bulunan 9 adet TTO ve 2 adet TÜBİTAK yöneticisiyle yüzyüze görüşmeler gerçekleştirilmiştir. Bu kapsamda, (i) akademisyenlerin üniversite sanayi işbirliğine bakış açıları ve teknoloji transferinin neresinde yer aldıkları, (ii) bu işbirliğini sağlamada bir arayüz mekanizması sayılan TTO'ların rolü araştırılmıştır. Anket ve yüz-yüze görüşmeler sonucunda elde edilen bilgiler ışığında, iki adet önermenin geçerliliği incelenmiştir. (i) Her ne kadar bazı araştırmacılar sadece öğretimi amaç edinmiş ve bilimsel amaç için kaynak arıyor olsalar da üniversite-sanayi işbirliğinde yer almaya isteklidirler. (ii) Yapılan mülakatlarda TTO'lar kendilerinin yeterince iyi tanındığını düşünse de, anket sonuçları ve

TÜBİTAK mülakatları değerlendirildiğinde TTO'ların işbirliği sağlama sürecinde yeterince aktif olamadıkları görülmüştür. Son olarak, ulusal, üniversite ve TTO'lar bazında tavsiyelerde bulunulmuştur.

Anahtar Kelimeler: Teknoloji transferi, Teknoloji Transfer Ofisi (TTO), girişimcilik, üniversite sanayi işbirliği.

To my daughter and son…

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I have completed the “Science and Technology Policy Studies” graduate program, to which I was accepted when pregnant to my first child, as a mother of two children. In the process of completing my thesis, I tried to provide the attention that my daughter Deniz and my son Kağan required to the best of my ability. I wish Deniz and Kağan will be individuals who love to read and learn passionately and who have desire to be productive throughout their lives.

In this challenging process, I would like to thank my thesis supervisor Prof.Dr. Erkan Erdil who enabled me to improve myself academically and guided me with his valuable knowledge and experience. Also, I would like to thank Prof. Dr. Ahmet Yozgatlıgil, Vice President for Research and Innovation, whom could consulted on any matter and who shared his invaluable opinions with me and never refrained from supporting me in this process.

Finally, I would like to thank my parents who always wanted me to be successful and my mother in-law who provided support in taking care of my children.

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LIST OF ABBREVIATIONS

BTYK	Supreme Council of Science and Technology
EIUI	Entrepreneurial and Innovative University Index
EU	European Union
ICT	Information and Computing Technology
IP	Intellectual Property
IPR	Intellectual Property Rights
ITU	İstanbul Technical University
KOSGEB	Small and Medium Industry Development Organization
METU	Middle East Technical University
NIS	National Innovation System
OECD	Organisation for Economic Cooperation and Development
PR	Policy Recommendation
R&D	Research and Development
RIS	Regional Innovation System
SIS	Sectoral Innovation System
TEKMER	Technology Development Centers
TH	Triple Helix
TIS	Technological Innovation System
TÜBİTAK	Scientific and Technological Research Council of Turkey
TÜBİTAK BİLGEM	TÜBİTAK Informatics and Information Security Research Center
TT	Technological Innovation
TTO	Technology Transfer Office
UIC	University Industry Collaboration

CHAPTER 1

INTRODUCTION

When we look at the evolutionary process of the universities from the first university established in the modern sense to the present day, we see that education is the primary mission and research mission is added to this mission over time. Thus, the understanding of today's university has started to form under the leadership of basic principles such as the production, dissemination, presentation and protection of knowledge to the society (Oosterlinck, 2006). With the globalization, universities have begun to contribute to the economic and social development, which made a great contribution to universities' entrepreneurial role (Norman & Eisenkot, 2017; Sakınç & Bursalıoğlu, 2012). In today's knowledge society, universities have become the main source of knowledge and science and technology-producing institutions.

The missions and responsibilities of the universities have increased due to the religious, economic developments and wars experienced in the world. In addition to the increase in the demand for population and education, but the insufficient public resources to meet these responsibilities, it is inevitable for universities to diversify their sources of income and to collaborate with the industry, which can be considered as the most important stakeholder, in particular (Higher Education Council, 2007; Meissner, 2018; Sakınç & Bursalıoğlu 2012; Scott, 2006). Thus, while industry expects universities to produce science and technology for themselves, universities also expect to provide financial resources. In addition, factors such as commercialization of knowledge and gain reputation play an important role in this collaboration (D'este & Perkman, 2010).

One of the most important interfaces that will strengthen the university-industry collaboration mechanism is Technology Transfer Offices (TTOs). This is because Technology Transfer Offices play a key role in licensing and commercializing research, identifying potential researchers, creating new connections, and transferring

technology transfer from university to industry (Graff, Heiman & Zilberman, 2002; Khademi et al., 2014). In this way, TTOs are the best mediators for which company can use the knowledge created in universities or which researcher will find the knowledge requested by the industry.

When we look around the world, the US pioneered the world by introducing The Bayh-Dole Patent and Trademark Amendments Act in 1980 in order to promote the patent activities of the universities and commercialization of the products and enabled other countries to adopt similar laws. With this law, it is aimed to increase the production and commercialization of the knowledge by ensuring that the inventor is entitled in the commercialization process of the inventions. In this way, it is aimed to contribute to technology transfer (Levenson, 2005; Merhacı, 2015). After this law, there was a need to establish TTOs. With the establishment of TTOs, academics stepped into entrepreneurship, universities developed their entrepreneurship skills and TTOs have been started to spread rapidly (Bucsai, 2013; Etzkowitz, 2001; Friedman & Silberman, 2003; Rogers, Yin & Hoffmann, 2000).

When we look at the process of establishment of TTOs in our country, it is seen that the first structures are at Sabancı University, Middle East Technical University and Hacettepe University. In 2013, a support program was established in order to improve university-industry collaboration with TÜBİTAK 1513 “Technology Transfer Offices Support Program”. After this program, the establishment of TTOs accelerated in Turkey. Together with this support program, it is aimed to promote the development of university-industry collaboration, technology transfer and commercialization in order to encourage academic entrepreneurship. Within this scope, ten TTOs, which were listed in the Entrepreneurial and Innovative University Index for the first time in 2012, were entitled to non-refundable support for 10 years.

In today's world, where competitiveness is increasingly measured by human capital, universities produce new knowledge and transfer this knowledge. On the other hand, industry, which is the other party in this collaboration, wants to increase its competitiveness by using this knowledge. Therefore, the efficiency of TTOs that bring these two different cultures together is also a matter of debate. In this context, some

studies have been conducted in the literature regarding the success of TTOs and how well technology transfer can be achieved in university-industry collaboration. The subject of this study is assessment of technology transfer in university-industry collaboration and to investigate the role of TTOs in this collaboration. The research questions asked for this purpose are as follows:

1- What is the view of academicians about university-industry collaboration?

2- Where are academics involved in technology transfer in university-industry collaboration?

3- What is the role of TTOs, which is the interface mechanism in university-industry collaboration, in ensuring technology transfer in this collaboration process?

Since the TTOs do not have a long history in a developing country including Turkey and the entrepreneurship activities do not practised widely, the following hypotheses have been formed:

1- Academicians do not intend to actively participate in university-industry collaboration.

2- Relatedly, TTOs have not revealed their potential in terms of contributing to university-industry collaboration.

Within the scope of this research, 48 questions (including closed and open ended) were asked to academicians who made projects with TTOs affiliated to universities that were supported by TÜBİTAK 1513 'Technology Transfer Offices Support Program". In addition, interviews were conducted with 9 TTO managers in Ankara. Besides, face-to-face interviews were conducted with 2 managers from TÜBİTAK. The results of the survey were analyzed by using the qualitative research method with SPSS Statistics 25 program.

This has given a new perspective to the literature by conducting a questionnaire to academicians and providing the interviews with TTO and TUBITAK managers. Findings of this study were supported by previous studies in the literature. Similarly, it is seen that there are limited number of relevant studies in Turkey and focus on the

factors affecting the obstacles faced by the TTOs or the factors affecting their performance, and only TTOs are interviewed (Curi, Daraio & Llerena, 2012; Değerli, 2017; Graff et al., 2002; Güler, 2018; Khademi et al., 2014; Muscio, 2010; Üstündağ, Uğurlu & Kılınç, 2011; Xu et al., 2011;). In this context, there is no such study which determines the point of view of these three different sides to each other and especially to TTOs. In this sense, the role of TTOs in bringing the university and industry together is aimed to be understood, the views of all stakeholders are evaluated and the points where each other is overlapping and conflicting of these parties. Policies have been developed at country, university and TTO level in order to overcome these problems. In order to obtain more clear results; it is recommended that the number of responses to the surveys to be conducted will be higher, the diversity of the city and the region will increase in the interviews with TTO employees, and that large and small scale firms should be included in the interviews by the industry.

This thesis has five parts. Firstly, there is a general information about this thesis. In the second part of the study, starting from the purpose of establishment of universities, how the entrepreneurship mission evolved was started. In this context, the importance of knowledge is explained and the commercialization process and its results are emphasized. In the collaboration between universities and industry, information was given about the role of the government and Triple Helix and Quadruple Helix model are discussed.

In the third chapter, the definition of technology transfer, why it is important and the reasons that push countries to transfer technology are given. In this context, the process of the emergence of The Bayh-Dole law in America first and how it affects all the countries of the world is mentioned. The activities, objectives, and structure of TTOs are explained around the world. Starting of university-industry collaboration process in Turkey and its process of coming to date has been explained and 1513 'Technology Transfer Office Support Program" is discussed in detail. Detailed information about Entrepreneurial and Innovative University Index is given. In addition, in this section, literature on performance of TTOs reviewed.

The fourth part of this study consists of Scope, Methodology and Analysis of Findings. Therefore, the subject of this study, why and how it is done, research question, limitations and ethics, contribution to the literature, novelty and the limitations of the study are explained, including the methodology of the study. A detailed analysis of the surveys and interviews is given and their results are evaluated. In the last chapter of the study, the findings in the analysis section are presented and policies are presented to them at micro, meso and macro level.

CHAPTER 2

FROM PAST TO PRESENT UNIVERSITY UNDERSTANDING

In this section, the evolutionary process of the universities starting from the first modern university has been expressed. In this process, why and how the universities, whose first mission was only education, gained their research and entrepreneurship missions over time were emphasized.

2.1 Modernization of University Mission

> In the past, countries with raw material resources and capital accumulation were countries with power and control. Today, countries that have knowledge and control it are powerful countries.[1]
>
> Lester Thurow

Founded in 1088 in the West, the University of Bologna is the first university established in the modern sense. Its financing and management were undertaken by the students. At the same time, students also had roles such as appointing the rector and setting salaries for teaching members. Established after the University of Bologna in 1160, the Paris University, which aims to educate the Clergy, was a teacher-led institution, and this structure was influential on the universities to be established (Kılıç, 1999). Oxford University which is the third university founded in 1167, was

[1] https://docplayer.biz.tr/7403168-Sinai-mulkiyet-haklari-onemi.html

established with government support and the teacher salaries were paid by the state (Antalyalı, 2007).

With the interactions of Medieval Europe with other civilizations, the number of universities established has increased steadily, and until the end of the 15th century, it reached sixty three. It is seen that the basic mission of the universities established in this period is education and it does not reflect the current mentality of the university. It is intended to convey the knowledge of the lecturers and to make the students good repetition and good speech habits (Antalyalı, 2007). According to Oosterlinck (2006), professors of medieval universities were not a researcher, but they were only a scholar.

Towards the end of the Middle Ages, along with political and religious changes, universities began to be seen as a tool in sectarian dissemination activities. More importantly, increasing financial needs increased the dependence of universities on local forces (Antalyalı, 2007). In conjuction with the 18th century, although the number of universities increased, the quality of education of universities and the number of students gradually decreased (Scott, 2006). Thus, in the Renaissance period, a university mission began to form, aimed that served the state and contributed to the formation of national culture and value.

Together with the Napoleonic era the national value mission in university structuring began to become more apparent. This mission became a part of the national education system, clad in a hierarchical structure and seen as part of national education policy (Antayalı, 2007).

After the Napoleonic period Wilhelm von Humboldt who established the Berlin University in Germany in 1809, thougt that a university should produce knowledge scientifically, not reproduce it (Oosterlinck, 2006). With the establishment of the University of Berlin, "research" has become one of the functions of the university and

the research and teaching unity principle has permanently influenced today's modern university structure (Fallis, 2004; Gürüz et al., 1994; Scott, 2006).

Since the USA do not have a strong tradition of state and strong professional associations throughout history, it has been a country where more democratic and non conservative universities are established. These universities have been shaped by the demand that have been open to the needs of the community and the market and could benefit everyone (Antalyalı, 2007).

In the 19th century universities began to form the concept of "modern university" by taking the basic concepts such as "production of knowledge, spreading of knowledge and presentation of knowledge" as a principle (Oosterlinck, 2006). As much as protecting the knowledge and producing it, the presentation also came to the forefront. Today, all universities of the world are established for the same purposes and ideals in general sense and they are taken as examples from the western tradition (Antalyalı, 2007).

After the Second World War, the tendency to the basic issues needed for the nation, especially defense, health, energy and economic growth, increased. Universities have thus started to serve the state and industry more (Antalyalı, 2007; Scott, 2006). With this war, service to the state and public, and academic research mission came to a fixed position among the universities' mission. As a result, through external service activities universities transmit knowledge to the public (Scott, 2006). The use of science and technological developments in the solution of the problems caused by war has made major structural changes in universities and the research activities have become institutionalized (Gürüz et al., 1994). These activities have influenced the implementation of technology transfer by undertaking an entrepreneurial role for universities (Meissner, 2018).

According to Fallis (2004), because of the rapidly changing nature and demands of the society, the mission of the university should be defined in each age. Thus, as we are in a knowledge-based society and post-industrial society, it is possible for universities to take an initiative in this direction. As one can see, the basic mission of the universities was initially education, but research mission together with the industrialization process and then contribution to economic and social development with increasing globalization have been among the missions of the university (Norman & Eisenkot, 2017; Sakınç & Bursalıoğlu, 2012). Universities which are pioneers of the improvement of democratic principles and free thinking are the center of change that lead to social transformation. They lead to scientific research and provide solutions for the problems countries face (Özdem, 2011; Westhead & Storey, 1995). Universities contribute to socio-economic development by adding vitality to the commercial life of the region where they are established. Thus, they meet the needs of the qualified labor force of countries (Sargın, 2007). Today, universities are not only responsible for the public and humanity, but are also responsible for the state and the market. Universities whose primary purpose is education are in the course of time engaged in activities such as conducting scientifically-applied research, consulting, and dealing with industrial development (Kılıç, 1999).

2.2 Why Has There Been a Need For Entrepreneurial University?

> *In the past, scientists' inventions were either in their books or in the publications of academies, and industrialists were not aware that they could use these scientific developments in production processes. Today, very close relations have been established between scientists and industrialists consulting the scientists and these two groups are sweeping together on the way to industrial excellence.*[2]

[2] Jean-Antoine Chaptal, De L'Industrie Française, 1819 cited in Gürüz et al., 1994, p. 34

According to Gürüz et al. (1994, p.34) "*Science is to understand; technology is to make; industry is to produce shortly*". The progress of science produces new technologies and new technologies provide new products. As the progress of a country in science and technology has already become a policy tool, and at the same time developments in science and technology create new policy and institutional structures, universities can not act separately from these policy and institutional structures (Gürüz et al., 1994). Similarly, according to Oosterlinck (2006), "Capital and labour are no longer the dominant production factors. They have been superseded by knowledge." He also summarizes the basic components of a modern university that provides "knowledge creation, knowledge dissemination and academic service to society." Likewise, for example, Bonnor (2014, p.3), draws attention to University of Houston's mission: "create and disseminate knowledge"; "research"; "nation's premiere public urban university"; and "expertise." As it is seen, because of the increasing importance of knowledge, individuals' economic power is measured with knowledge and education levels and countries competitiveness is measured with human and social capital. Thus, it becomes clear that today the concept of knowledge is very important for the universities. As knowledge society enables new knowledge to be produced and disseminated, universities have begun to be transformed into international forms. The fact that universities are the pioneers in the production and sharing of knowledge has led to an increase in expectations (Sakınç & Bursalıoğlu, 2012; Yüksek Öğretim Kurumu, (YÖK), 2007). However, public institutions are increasingly inadequate to meet the demand for increased population and higher education only with public resources. This situation has led to a change in the structure of higher education that should be offered as a public service. Efforts have been made to increase the income sources of universities by resorting to solutions such as increasing the number of private education institutions, giving more autonomy to universities, meeting expenses by other stakeholders and diversifying the income sources of higher education institutions. In this way, the universities are targeted to be more productive and the

universities have obtained an entrepreneurial identity and become institutions that provide education accordingly (Sakınç & Bursalıoğlu, 2012; YÖK, 2007). Universities are looking for new sources of income, ranging from industrial companies, local governments and philanthropic organizations to royalty income from intellectual property rights, income from campus services, student fees and donations of graduates (Clark, 1998). However, all these measures are not sufficient in today's conditions and the necessity of becoming an entrepreneur university by turning to projects in order to provide resources emerges. In this direction, the support of the industry (university-industry collaboration), which is the stakeholder of higher education institutions, has come to the forefront in meeting research expenses. Thus, universities have adopted an entrepreneurial culture in the main academic areas of education and research (Caloghirou, Protogero & Vonortas, 2018).

According to Siegel, Walsman and Link (2003), there are three stakeholders in university/industry technology transfer. These are University scientists, TTO and Firms/entrepreneurs. If such collaboration mechanisms are productive, they will make a positive contribution to the process of knowledge creation and entrepreneurial role of universities (Erdil, Meissner & Chataway, 2018). Potential risks must be well defined by adopting the appropriate approach for this (Samsom & Gurdon, 1993).

According to Meissner (2018, p.41):

> *Entrepreneurial university is understood as a university which engages in the commercialization of its services in education and research, hence delivering its own innovations or significantly contributing to innovations by companies and spin-offs from the universities.*

In this regard, they need to become faster, more flexible and more focused to increase and different demands (Clark, 1998). According to Etzkowitz and Zhou (2017), an entrepreneurial university does not only cooperate between university and industry to assist existing firms or create new ones but also collaborates with other actors to further

regional innovation. This regional development is ensured the dissemination of knowledge in universities, commercialization of researches and increase in number of firms by through human resources and new ideas. Thus, academics has become a part of entrepreneurial process. A vision of future entrepreneurial university is to be a self-generating business that creates income and employment. In this way, they will become institutions that are not dependent on other institutions, have a wider social field, and have an increasing role in local economies over time (Etzkowitz, 2001).

In brief, although the main mission of universities is to produce and disseminate knowledge in order to provide social welfare, universities can not be isolated from this process of change. As a result, universities are becoming more entrepreneurial. This leads to changes in their structures, strategies and perspectives. However, as the commercial environment and the market change very rapidly, it is difficult to keep up with this situation, especially in the developing countries. Therefore, establishing a healthy balance between the classical and the new innovative mission of the universities is crucial and it is very important in terms of protecting academic freedom (Erdil et al., 2018).

Since financial gain is important for firms and entrepreneurs, university-based technologies are advocated. These entrepreneurial firms want to have patent control over a technology that can be developed and reward timeliness, speed, and flexibility (Siegel et al., 2003). While companies are expecting technology from universities, universities are expecting financial support from companies. This change provided the participation of universities and scientists to the working areas of the companies (Richter, 1986). According to D'este and Perkman (2010), academics engage with industry to commercialize their knowledge and academic research activities. They also want to gain reputation amongst their academic and industry-related communities. According to their survey results, there are four main motivations between academics and industry collabaration: 1) commercialization; 2) learning 3) access to funding; and

4) access to in-kind resources. Another factor in the entrepreneurship of academics is that they have easier access to market and technology opportunities and entrepreneurship programs (Caloghirou et al., 2018). According to Perkmann et al. (2012), academics tend to pursue goals that can offer their own expertise rather than academic publishing activities, or they may get non-financial benefits or materials for academic research projects or intellectual input. The process of personal contact and therefore seniority affects this collaboration process in the positive direction. More experienced researchers have larger networks and potential partners. They showed in their study that industry-based academics choose projects with commercial potential to apply rather than the long-term benefits of basic science in their research choices. However, these academicians also support more students.

The success, quality, productivity of creat resources and scientific productivity of scientists also influence industrial participation positively (Perkmann et al., 2012). However, Meissner and Erdil (2018) emphasize that the university can reward successful staff performances for bonus payments, while they take precautions for unsuccessful performance. However, it will adversely affect by the entrepreneurial support of developing countries because of preventing creativity. Furthermore, there is a clear change in scientific culture, and while intellectual contribution comes from fewer participants, more technical studies based on experiment and data analysis are becoming more and more common. Similarly, According to Perkmann et al. (2012), faculty members who collaborate with the industry publish at many as scientific papers compared to their colleagues.

In addition, Meissner and Erdil (2018) argue that the miscarrying of university research and education can stem from the global university rankings that cause social exclusion, because global university rankings ignore the social aims of higher education.

Collaboration between universities and companies can be protected by IP or other mechanisms in the early stages of research (Chataway, Parks & Smith, 2018; Perkmann et al., 2012). Patenting gives the firm the right to use the invention for commercial purposes, while academics are entitled to financial prizes by making use of invention. Strong competition and a rigid environment influence the commercialization of university inventions (Perkmann et al., 2012). Publication of a research paper in a well-known journal may benefit the company in terms of funding. However, when this research is converted into instrument as an intellectual property, to have been published in journals or to have been presented at conferences may cause 'limited privacy'. This situation may lead to delayed publication as long as the university does not insist (Etzkowitz, 2007). This so-called 'closed partnerships' has provided companies with a way of financing companies, but it limits the capability of firms and may lead scientists to restrict their research (Chataway et al., 2018). These academic researchers' knowledge of the high degree of secrecy may prevent the accumulation of public knowledge and may slow the unencumbered diffusion of academic knowledge (Perkmann et al., 2012). At earlier stages in the research process when open science[3] is concerned, researchers are communicating more freely and transparently, and generate new ideas, find collaborators, remove disciplinary barriers and encourage greater interaction between science and society, build research tools and analyse their results, earlier identification of problems, and better and faster development of research tools. But how to share the benefits of open science is a problem (Chataway et al., 2018).

According to Galan-Muros et al. (2015), it is necessary for universities to be able to make quick decisions or to cope with the difficulties that may arise during the

[3] Open science: how research is conducted and the results disseminated, open access to scientific publications and research results that is freely available, without access fees and fewer copyright and licensing restrictions

commercialization process. The necessity of changing the organizational structure and practices of the universities in the traditional structure which is not suitable for this situation is a matter of debate. Accordingly, it is necessary for universities to have long-term strategies that include well-defined, comprehensive and direct collaboration activities. At this point, the university administration directly; whereas the state will have indirect policies. Therefore, there can be a member or a vice-rector who can discuss the collaboration process in the top management of the university. But these people should include academics and students in this process. It is emphasized that in this collaboration process, academicians can be more productive by creating incentive programs of universities rather than by their own initiatives. The resources to be created with this incentive should be less money support and more qualified support staff and training. As another solution to improve the collaboration mechanism, it is necessary to create offices (like TTO) that will provide collaboration. It is necessary that collaboration should be placed at the center of the mission of the university and importance should be given to promoting this collaboration in the media. Universities located in areas where larger, high-tech firms are concentrated have a more sophisticated technology transfer policy, and their curricula are more likely to pass hands-on research. Galan-Muros et al. (2015) supported the accuracy of the highlighted points with the works and surveys they conducted.

Consequently, there are some conflicts of interest that need to be watched and managed in this business union mechanism. How much time will it take for the university to work out to the academics, how much the academics can renounce from their academic position, profitability is basis for the firm, and how the management of conflicts that can occur in the case of innovation and discovery for the academics can occur. In addition, personal interests may come to the forefront when seeking to take advantage of the respect and prestige of the university to which academicians are affiliated, and the results may be contrary to public benefit and impartiality (Norman & Eisenkot,

2017). The university bureaucracy needs to pay attention to the fact that the basic freedoms of academics are not restricted during these entrepreneurial activities (D'Este & Perkman, 2010; Erdil et al., 2018). Otherwise, academic entrepreneurship creates a source of income, which can lead to commercial exploitation of research (Caloghirou et al., 2018).

2.3 Commercialization of Knowledge and Its Social Causes

Today, it is considered as a knowledge age and there is a great share of universities in the production, dissemination and protection of knowledge. Because the knowledge contributes to the innovation system through technological change. The powers that hold the knowledge provide a competitive advantage and mediate the production of new technologies by producing them based on knowledge. In this context, the return of the investment to this resource will be a high return because the creator of the innovation is the human being. Thus, the amount of output taken with the investment in human beings will increase and as this knowledge is shared, it will provide an increasing return as it is processed. Therefore, these societies are considered as knowledge society because the importance of qualified labor force is increasing in today's developed societies. However, when we consider underdeveloped countries as societies that cannot produce knowledge, we can say that these countries will remain in the vicious circle and stay in the previous economic wave as knowledge becomes increasingly important. Since these countries can not produce knowledge, they will remain dependent on consumer and external. Because today, hosting technology and knowledge means being in a strong position.

As we mentioned above, this process has led to the need for new resources and sponsors to be found with decreasing state support. Thus, the university-industry collaboration process is strengthened and become compulsory. Universities now have the role of contributing to social and economic development as well as their traditional

duties such as education, training, research or publication. The access of universities to external sources and facilities and the access of industry to research and researchers of universities which are sources of knowledge are ensured by the transfer of knowledge. However, in this transfer process, these institutions, which have different missions, should cooperate on the basis of mutual trust.

The core components in university– industry connections are "sponsored research[4], licenses, hiring of students, spin-off firms and serendipity" (Bercovitz & Feldman, 2006). Process of knowledge commercialization is an important input. A sponsored research approve researches through the university and aid resources for foundation, graduate students for faculty members. From the point of view of organizations, supporting exploration extends likewise gives a system to impact the preparation of cutting edge studies while additionally watching and screening the studies for potential future work. University licenses provide the right for companies and others to use university intellectual property in the codified form of either patents or trademarks. These technology transfer mechanisms provides universities a quid pro quo purposed to supply funding while transferring knowledge and intellectual property rights to firms. Serendipity is additionally included as a casual component that may be utilized to start a relationship, which hence creates through different systems. University spin-offs are viewed as a way to change local economies and an instrument which gives an approach to catch the advantages of vicinity to research universities.

In the process of commercialization of knowledge, the encouragement of faculty members by their personal initiatives or the institution plays an important role. However, the process negatively affects the researcher himself / herself, because he / she does not find appropriate commercial activities and reluctant to spend time in

[4] Sponsored research is defined as a contract between the academic entity and the firm (Bercovitz and Feldman, 2006, p.177).

applied R & D research. The faculties may also not wish to disclose the inventions required for the patent application. The social norms, organizational structure, promotion and tenure of the faculties also affect the commercialization process of science. The policies developed in this direction increase the university funding and contribute to the regional economy. Mechanisms such as patent and copyright policies of the university and incentives for technology transfer offices will also be effective in evaluating the intellectual property application of the researcher individually. The stronger the university-industry collaboration relationship, the stronger the degree of centralization of the funding system. This relationship is positively influenced by skilled labor and proximity to sources of knowledge. Research has shown that labor mobility is one of the instruments of knowledge transmission. Social connection, local networks, and individual correspondence also affect the knowledge spillovers positively.

In the process of commercialization of knowledge, the knowledge produced at the university, especially through commercialization such as technoparks, is becoming more and more commercialized. However, this process of collaboration may bring some negative problems with competition coming to the forefront or overdoing. The need for life-long learning for the society has arisen due to the multiplicity, rapid change and increasing knowledge. It may be necessary to have a system that needs to be constantly active by losing traditional and routine importance in business life. In this way, the problem of developing labor force will emerge due to the fact that economic systems are increasingly based on knowledge. As a result, knowledge-based and qualified but less labor will be needed. As the person who produces, manages and transmits knowledge, the person with the knowledge will have power. When socially evaluated, there will be a knowledge-based struggle for the societies that hold the knowledge, and because of the necessity of ensuring the continuity of this, a global cold war period may be experienced. This may cause the universities to increase their

collaboration with industry, but to leave academics away from education and attempt to commercialize the knowledge in hand. Therefore, it is very important to establish a good balance.

In particular, developing countries such as Turkey, to succeed in global markets and improve the competitiveness can develop "National Innovation System" related policies. In this sense, universities, government institutions and private research institutions and companies should cooperate effectively. The transformation of the national economy into the knowledge economy should be ensured. In order to provide collaboration, it should be avoided from difficulties as much as possible and administrative and legal arrangements should be made. In order to increase competitiveness, regional development should be given importance besides national development. Thus, regional innovation systems are also important. Public should be able to emphasize the models that bring the university and industry together. In this sense, it will be useful to focus on the Triple Helix Model, which was introduced by Etzkowitz (2007) in the next sub-section.

2.4 Triple Helix Model

The Triple Helix (TH) model was introduced by Henry Etzkowitz and developed by Loet Leydersdorff. The aim of this model is to provide new and innovative organizational designs and social interactions between universities that produce and disseminate knowledge, industry that aims to use and develop this knowledge and policy makers. Innovation requires an increasing process of interaction of different institutions. Therefore, in order for this model to work well, the university industry and the public must cooperate continuously. In the end, the aim is to eliminate each other's deficiencies and support their development in this mutual collaboration. In today's world, where knowledge and science are the driving forces of the economy, the financial support of the public is aimed at ensuring the formation of new companies

and thus the use of the knowledge produced by the industry. The successful interaction of these three groups is a prerequisite for knowledge-based economy (Kuş, 2017).

Assessing industry or university separately is not possible in a knowledge-based economy. While universities are developing technology, companies better know how this knowledge can be used and applied in industry. The involvement of the public in university-industry collaboration allows for greater technology transfer with the increase in public research, bigger autonomy, and commercialization. Universities also need to support their own policies and activities in order to increase their commercialization activities. It will be beneficial to motivate staff and students as well as organizational arrangements. It is also important to make training programs in order to create an entrepreneurship culture.

With the globalization, the countries where the boundaries have disappeared are moving towards a direction where the consumption of goods and services is fast, especially developing countries should establish their national and international policies in this direction by guiding innovation economies.

Etzkowitz (2007) mentions three ways of university industry and public collaboration in the TH model. These are as follows:

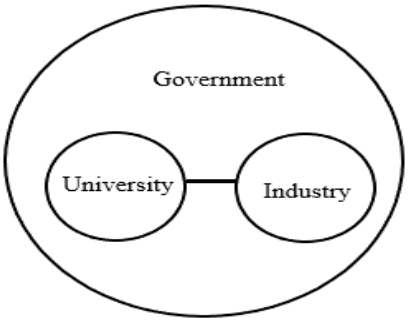


Figure 1. The Statist Model

1- The Statist Model: In this model, the government plays the dominant role, and the industry and the university are weaker institutional entities that are more controlled and coordinated. In this model where there is a hierarchical structure, the distance between centralism and university industry is high.

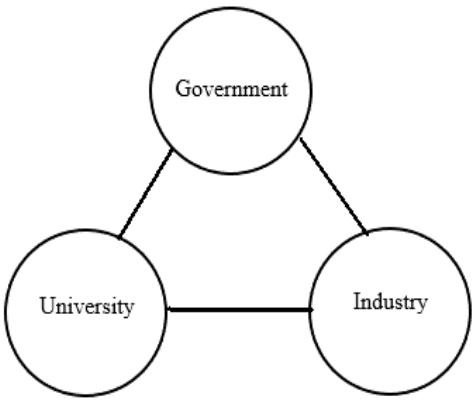


Figure 2: The Laissez-faire model

2-Laissez-Faire: It is a model in which the public has only limited regulation and whose role is limited. While the university is an institution that conducts research and educates the public and produces knowledge, the industry is focused on selling products with the effect of competition. It is a model where three institutions are free.[5]

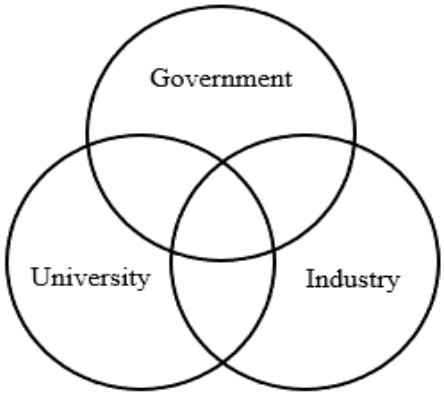


Figure 3: Balanced Model

3-Balanced: In addition to the traditional roles of all actors, it includes a model in which all three groups interact intensively with each other. While the academician undertakes the role of entrepreneur with this research and technology, industry can use the university laboratory or, if necessary, take part in the TTOs together or with the academy alone. Public researcher can also take part in enterprises (Kuş, 2017). As can be understood, this model is an intensely cooperative model that contributes most to the creation of innovation. In this model, it is a completely "take the role of the other" with the definition of Etzkowitz

[5] Figures 1, 2, 3 and 4 are quoted from the article of Kuş (2017).

because the roles are intertwined (Etzkowitz, 2001, 2007). This situation provides for continuous renewal of university, industry and government collaboration and to increase innovation. Thus, with the Triple Helix system, the risk will be reduced, while higher economic returns, new markets and jobs will be accelerated.

In order to achieve a stronger innovation output, these three institutions must actively interact with each other, and universities must become more and more entrepreneurs, and a commercialized academy.

National innovation system (NIS), regional innovation system (RIS), Technological innovation system (TIS) or Sectoral Innovation System (SIS) come to the forefront while trying to cooperate between these three institutions. RIS can be more effective, especially in developing countries, since each region's economic, political and cultural levels are different from each other. Because of existence of regional disparities, each region's competitiveness and technological capability are different. The collaboration of these three institutions on a regional basis can provide a more balanced regional distribution of innovation and technological developments.

Today, countries with sufficient infrastructure to use knowledge are in an advantageous position and can obtain technological power. However, adoption is a difficult and slow process, although technological output has a huge impact. Therefore, in order to sustain the technological innovation system, in addition to technical changes, social arrangements such as user-practices, regulation and industrial networks are essential. In this way, necessary infrastructure systems for rapid technological transformation will be provided. Countries that possess the knowledge and equipment to enable technological change will be able to achieve the best innovation output if they support it with their own innovation policies. The technological development of a country will increase the competitiveness of the

country nationally or globally. Therefore, for the technological innovation system, from the smallest entrepreneur to the largest institutions, the same direction and purpose should be followed. This change can only be achieved by establishing a good network between institutions (Hekkert et al., 2007).

The industry consists of large firms with greater competitiveness both at national and global levels, and small firms that are more regional. Therefore, these companies that make up the industry have different capabilities and performances. Thus, in the sectoral innovation system, the excess of competitive relations in the said environment is remarkable. In addition to inter-firm competition, SIS also has different inter-sectoral innovation performance. In short, SIS is the active involvement of companies in the system through interaction, collaboration or competition in the innovation process and output production (Breschi & Malerba, 1997). Thus, the necessity of developing technology policies according to the dynamics of each sector comes to the forefront. In this way, policies and ways to increase the superiority of sectors which may be highly competitive (such as structure and boundaries, dynamics, interaction of companies forming the group) can be followed.

Developing countries targeting knowledge-based development aim to develop a good research infrastructure, qualified workforce and innovative businesses to create a stronger competitive advantage. It can be added to collaboration with multinational companies, proximity to the source of knowledge and regional technology strategies and plans (Ranga & Etzkowitz, 2013).

What should we discuss about TH model is whether this model works? Is the interactive process valid for a tripartite collaboration model that includes complex process when there is not complete infrastructure or enough knowledge capacities? Because successfull collaboration requires mainly mutual trust and undestanding. This is more reliable and feasible in the case of technologically developed countries. What

happens when this collaboration is in inflaxible structure, internal policy like strict bureaucracy or absence of abilities?

Acording to Abd Razak and White (2015), there are some barriers about Triple Helix of the overall findings. Firstly relationship between these three spheres are important. Weakness of the link and relations between these three institutions result in deficiency of effort science and technology research, lack of knowledge production and failure of huge funding from grantor or governments. In terms of universities, powerless scholastic research capacity, absence of commercialization capability of the universities, commercialization abilities and foundation negatively affect collaboration in this model. In terms of government, absence of national approaches for the assignment of human resources, poor local integration of knowledge, the nonattendance of strategies for the insurance of protected innovation and inappropriate arrangements set by government can hinder this model. They define this model as "theoretically vague" and think that has not provided examples or proposals and need more description.

Besides, according to Etzkowitz (2007), after the research center, TTOs are mediators with these three groups. TTOs play an important role in the commercialization of research, identification of potential customers and licensing of academic research.

Therefore, I will refer to the Quadruple Helix Model in the next sub-section. Then, I will discuss what the Office of Technology Transfer in Chapter 3 is and where it is located in the University Industry collaboration mechanism worldwide.

2.5 Quadruple Helix Model

In the Triple Helix model, the universities motivated by science and the industry motivated by the profit come together thanks to the public and have a triple interaction. In addition to providing financial support, the public undertakes tasks such as

encouraging this collaboration through programs, developing policies for the elimination of barriers, and direct collaboration. In short, it provides a regulatory and funding role. However, in this model, only these three institutions are emphasized and, as citizens, an important part of the country is ignored. According to Afonso, Monterio & Thompson (2012), civil society plays a role in the consumption of innovative products and services because it demands and takes part in the consumption activities of the economy. In this way, society is the party that accelerates growth and commercialization and undertakes financing of these institutions through consumption. According to some authors in the literature, ignoring citizens is of the view that the TH model is not sufficient when it comes to innovative growth (Lijemark, 2004; Khan Al-Ansari, 2005 cited in Afonso et al. 2012). There is also insufficient level of innovation, GDP development and employment in TH model. (Asheim & Coenen, 2005; McAdam, Miller & McAdam, 2012 cited in McAdam and Debackere 2017).

In addition, in the literature civil society can be used many different meanings such as citizens (users), madia-based and culture-based public or innovation. The term citizens is intended to mean users with information about their needs and experiences. The media-based and culture-based public includes meanings of such as media, arts, culture, value, way of life, imagination, expressions. Civil society also includes artistic research or independent and non-profit organisations that search funds from government. Innovation generated by society is focused on most of the proposed QH approaches (Cavallini, Soldi & Volpe, 2016). According to Göksidan, Erdil and Çakmur (2018), QH model better clarifies UI collaborations by the advancement of society with new innovation based firms (start-up companies). Because that organizations are made by organizations that included scholastic or (previous) studies from different zones and cultures within their universal initiatives.

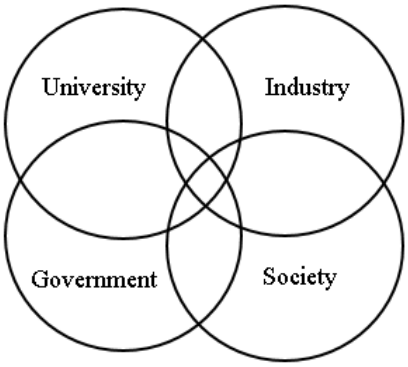


Figure 4: Quadruple Helix Model

The aim of the QH model is to integrate the people into the innovation system by using and applying knowledge. Thus, branches such as science and art will be integrated into the system through public without considering them separately and will contribute to the innovation system (Ivanova, 2014). This is why the Quadruple Helix model has been accepted as civil society fourth helix. Civil society is also an active part of the innovation system and should not be considered as end-users who use only information (Cavallini, 2016).

In fact, the aim is to ensure the participation of the public in this collaboration system in order to increase innovation. In addition, the aim is socially oriented and user-centered and creativity-guided production of knowledge. Civil society is the party that interacts with the university, industry, and government trio, demands innovation, uses, gives feedback, and thus contributes to the development of the product, and increases the creativity and knowledge. It will be more effective when a efficient economic policy is "people-centred". Therefore, structures, meshanisms and processes that are suitable for better communication and interactions should be chosen among these collaborations. However, better results can be obtained for a better innovation output.

2.6 Concluding Remarks

The primary purpose of the first universities established in modern sense was only education and this mission changed in time and nationalization became more prominent as the newly established universities became dependent on local powers; service to the state and national culture. With the establishment of the University of Berlin, the mission of research has come to the forefront and this mission has become

the main mission of today's universities. With the Second World War, universities started to serve the state and industry more and the mission of serving and researching the state and public became the permanent mission of the universities. The fact that universities that produce technology and knowledge in order to compensate for the post-war devastations are more intertwined with the state and industry has led to the role of entrepreneurship. In this way, the concept of knowledge has become very valuable for universities, which are the sources from which knowledge can be produced and distributed, and the countries that hold this knowledge become more powerful economically, technologically and politically. Therefore, underdeveloped countries, which cannot produce knowledge, are dependent on other developed countries and in particular are technologically underdeveloped.

The active use of the knowledge depends on the commercialization of this knowledge. In the process of commercialization, universities should cooperate with industry. The government, on the other hand, plays a major role in ensuring this collaboration by bringing universities and industry together. In this context, when we consider the Triple Helix model proposed by Henry Etzkowitz (2007), we see that the collaboration between university, industry and the state should be continuous and be based on mutual trust. This is a prerequisite for a knowledge-based economy. Universities will play a role in the production of knowledge and companies will be involved in how best to integrate this knowledge into industry. The government can accelerate this collaboration process by making arrangements, funding or incentives to make collaboration more efficient. Thus, the process of innovation creation will be accelerated. Innovation systems such as NIS, RIS, TIS and SIS appear in this process of collaboration. Each country should be able to address one or more of these, taking into account its own dynamics. However, the QH Model was developed with the view that growth and commercialization would be faster with the participation of citizens in this collaboration process. According to this model, society, which plays a major role

in consumption, will contribute to employment and GDP development by accelerating the growth and commercialization process by playing a role in the use and application of knowledge.

Briefly, I have mentioned about how universities have reached their entrepreneurial role, knowledge that the most important source of innovation and technology of today, how universities produce it and how universities can cooperate with the government, especially industry, and what is the role of civil society in this collaboration.

In this context, in the next section, we will address technology transfer in order to make the university industry collaboration process more efficient and to accelerate the process of innovation creation and we will analyze TTOs which will enable technology transfer between these institutions.

CHAPTER 3

TTOS AS A TOOL IN UNIVERSITY-INDUSTRY COLLABORATION

In the previous section, I have mentioned that universities are in the process of university industry collaboration in order to contribute to the economic development and create new resources with the gradual decrease of the resources given to the universities by the government. In this direction, I will mention significance of the missions of TTOs in university-industry collaboration after I will evaluate the establishment process of TTOs around the worldwide in this section.

3.1 Technology Transfer

> *If you are a company operating in a country connected with the rest of the world, you are obliged to cooperate with the universities. There are four reasons for this. The two primary reasons are that technology develops faster in every field, faster than ever before, and competition increases. If you are not faster than your opponents in the same field, you can lose lots of patentable technology to your rivals. This means that your competitiveness will disappear within a few years. To avoid such an end, all companies have to take advantage of the potential of universities to produce knowledge and technology. Another important reason for the university-industry collaboration is money. No company can do research in basic science anymore. The rapid development in science such as physics and chemistry has created special fields. Finding a human resource that can do research on these issues and investing in laboratories is costly for a company. Lastly, students do not want to graduate by getting only theoretical knowledge from universities. They want to get closer to the business world, get the results of their research quicker, and see what they have created and changed in society.*[6]

After the addition of the "research" mission to the "education" mission, which is the first mission of the universities, "knowledge transfer" has become a third mission of

[6] Dr. Katsuhiko Yamashita, November 2007, New Era Magazine cited in Kiper 2010 ÜSAMP

universities today. Thus, under pressure from governments, universities have become institutions that contribute to the social and economic development of the region and affect innovation ecosystems. This has enabled the collaboration to become organized and strengthening cooperative partnerships such as TTOs and incubators. Since such centers seem to be the main place that any invention would be disclosed for the first time, they play a critical role in technology transfer (Khademi et al., 2014).

Particularly with globalization, countries have come to the fore with a worldwide competition, and this competition has required a constant innovation. As a result, technology and knowledge transfer from universities to industry have gained speed. Policy makers encourage the commercialization of scientific research at universities as they will provide competitive advantage and greater returns with technology transfer. In this context, the encouragement of entrepreneurship has become a new policy instrument and it has been expected that universities, like other institutions, should act as entrepreneurs. In this regard, it is aimed to provide technology transfer by creating a knowledge base for human capital. This has led to the curriculum change and the commercialization of ideas by investing in technology transfer of universities. Therefore, more research should be done to increase the efficiency of technology transfer, policies should be developed in order to ensure transfer of technology between university administrators and the government and balanced knowledge dissemination (Audretsch, Lehmann & Wright, 2012). Because a successfull TT process with industry provides university to have more opportunities for new research collaborations and funding for the exchange of materials, knowledge and personnel. Thus, discoveries, inventions or new science applications lead to useful products and services for the public (Norman & Eisenkot, 2017). Thus, under pressure from governments, universities have become institutions that contribute to the social and economic development of the region and affect innovation ecosystems (Audretsch et al., 2012).

There are many various and different definitions of technology in the literature. As it may be the process of producing objects consisting of physical components like

products, tooling, equipments, blueprints, techniques, and processes, it may be knowledge components like know-how in management, marketing, production, quality control, reliability, skilled labor and functional areas. If we include the recognition that technology includes knowledge that is not easily reproducible and can not be transferred, we can say that technology is as tacit knowledge. In this case, the technology is using tacit knowledge for obtaining certain result and resolving certain problems. The transfer of technology, which is a tangible asset based on company routines and containing a gradual learning process, is not easy because transferring knowledge is costly. Depending on the definition of technology, the definition of technology transfer also varies (Wahab, Rose & Osman, 2012). In the most general sense, technology transfer is the movement of know-how, skills, technical knowledge or technology from one organizational environment to another (Zuniga & Correa, 2013). If we go down a little more specifically, we may encounter many different definitions. Technology includes definitions such as the process by which ideas and concepts are moved from the laboratory to marketplace, application of scientific principles to solve practical problems, transferring cultural skills accompanying physical components, transferring technical information that can be used in production. For a successful technology transfer, the technology customer must also include and assimilate the technology into the production function. Thus, it is expected that there will be a wider knowledge accumulation as a result of successful technology transfer. In summary, the concepts of technology and technology transfer vary according to researchers, developers and users, and include many different interpretations and views depending on the aim of a firm or the field of research (Wahab et al., 2012). But the term 'technology transfer, as used in this thesis, refers to the processes of academic findings and inventions into marketable products and services (Khademi et al., 2014).

According to Guimon (2013), technology transfer is less in developing countries due to the low quality of education and lack of financing, and the capacity of universities to join the industry is inadequate due to limited experience. Thus, the university

industry collaboration process in these countries are limited to the internships, consulting or recruitment of graduates, rather than spin-offs or patents. It results in poor IP due to insufficient infrastructure and human capital.

In order to create a systematic process of technology transfer, both developed and developing countries should maximize the public investment in research and innovation for economic growth. Thereby, productivity is raised, better job opportunities are created, and societal challenges are addressed. It creates economic value and industry development. But there are several factors that hinder the process of technology transfer. One of these is the high risk involved and the lack of investment due to the uncertainty of the proceeds of inventions developed by universities and research institutions. Another is the failure of collaboration and impedement of the transfer of technology due to problems that may arise with the intellectual property rights. Because, there are discrepancies between expectations and interests between scientist and investor. While the industry focuses on ready-to-use technologies that can generate revenue through patents that will generate profits in the short term, scientists can move to more research-focused studies that attach importance to reputation and career. This causes scientists to be confronted with a lack of commercial experience and skills. On the other hand, legal and operational deficiency, problem in finding the right partner, inefficient management of the intellectual property, or the fact that the researchers do not allocate resources for the commercialization efforts also have a negative effect on the technology transfer (Guimon, 2013; Zuniga & Correa, 2013). Besides, commercialization does not an easy process because of common results of technology transfer that are invention disclosures, patent filed, patents issued, licenses executed, and number of spin-off companies generated, among others etc. (Khademi et al., 2014).

During the business collaboration, both sides should support their mission and focus on the benefit of both parties, focusing on long-term collaboration. The public can develop policy on funding R & D projects, encourage and support to create awareness or find partners. University curriculum should be developed to encourage higher

quality graduates to increase their collaboration with the industry. The government may add the number of consulting or R&D contracts with industry, income from patent licensing, number of spin-offs, number of start-ups by university faculty or graduates, and so to improve the co-operation and technology transfer to the universities. In this sense, most OECD countries are implementing applications such as income from patent licensing, and participation in spin-offs or start-ups to encourage collaboration and reward researchers. For example, the governments of the United Kingdom, Canada, India and Singapore offer additional funding to universities if they contract the industry with spin-off or start-ups at a certain level (Guimon, 2013).

The United States, along with the Bayh-Dole Act, pioneered the promotion of the patent activities of universities and the commercialization of research products. After this act, similar laws were introduced in most OECD countries in the 1990s, and after 2000s, many low- and middle-income countries such as China, Brazil, Mexico, South Africa, Malaysia and the Philippines were also stepping in. This has created and expanded the creation of Technology Transfer Offices to assist researchers in explaining their findings and helping them obtain license fees or copyrights, to search for common and financial resources, to facilitate the technology transfer cycle, and to support the university industry collaboration process (Guimon, 2013).

For this reason we will discuss the TTOs once we have addressed the Bayh-Dole Act and its impacts.

3.2 The Bayh-Dole Patent and Trademark Amendments Act

With the progress of technology, the recognition of universities as a source of knowledge for innovation has increased the interaction between university-industry and government (Göktepe-Hulten, 2010; Yalçıntaş, 2014). The creation of publicly funded interfaces in the process of transforming this knowledge into practice has facilitated and encouraged the university industry collaboration process (Yalçıntaş, 2014). Because of the fall of academics' interact with industry through direct

collaborative channels or informally, need for a technology transfer organizations to create an entrepreneurial environment and facilitate the use of research.

After World War II, the US has begun work to stimulate the economy. Prior to this act, ownership of all patents of invention granted using government money were accepted as belonging to the government. This situation led to the inability of the inventions to reach industry and public so this inventions couldn't commercialize. Accordingly, for research to produce an invention, Bayh-Dole Act lets a university, small business, or non-profit institution using federal funds. It is aimed to be entitled to the inventions resulting from these investigations, to commercialize these inventions by transferring them with license agreements and to obtain a certain income (Levenson, 2005; Merhacı, 2015). By the initiation of TTOs and Bayh-Dole Act (1980) technology transfer from universities to industry has been illustrated in USA. As a result of the Bayh-Dole Act, the number of patent applications and license contracts made especially in universities has increased. The technology transfer process accelerated and the number of new companies established rapidly increased. However, regardless of whether they are domestic or foreign, it is criticized that federally funded inventions can be transferred to companies with the highest prices. Another criticism is that federal sources fed by taxes do not open the public interest in the use of these inventions for profit (Merhacı, 2015). According to Levenson (2005), after this act, research tendencies have changed and conflicts of interest, especially in the biomedical field, have begun to occur. Universities avoid from basic research that produce less patents and applicable inventions, and care about applied research to gain more royalties from patenting.

According to Mowery and Sampat (2005), there were strong incentives for faculty and academics to cooperate with the industry long before the Bayh-Dole act, and this act enabled a transition to a stronger intellectual property right. With this act, the participation of universities in patent and licensing management increased and they established technology transfer systems in order to manage them. Thus, it is claimed that Bayh Dole's Act is a catalyst in the technology transfer process. MIT and the

OECD have published explanations in this direction (Mowery & Sampat, 2005). However, according to Mowery and Sampat, this act only provided additional support for technology transfer and commercial development on behalf of patents and licensing. This situation, as I mentioned in the previous section, is repeated that open science affected negatively, causing publications to be delayed or concealed. This can also prevent sub-research and product development. But in many OECD countries, the Bayh Dole Act has been endorsed and supported.

Aiming to have close relations with university and faculty, many OECD countries formed several types of TTOs (Göktepe, 2010; Merhacı, 2015). Japan was the country most affected by Bayh-Dole Act. Before the act, the inventions that emerged as the result of state-sponsored R&D activities belonged to the state, but now the right owner of these inventions are research institutes and universities. Moreover, they have regulated not only patent rights, but also other intellectual and industrial property rights, and without exception any profit-making institutions or small business distinctions in the Law. But, as in the Bayh-Dole Act, the state has been given the right to intervene and to have the right to own the invention. In Germany, arrangements have been made taking into account the constitutional rights granted to the German university system and its teaching members. Moreover, as in the Bayh-Dole Law, not only did the findings come from state-sponsored research, but the regulations on rights ownership over all inventions were made (Merhacı, 2015). Under the title of "professor's privilege", researchers have been given priority responsibility and rights in patenting. All public research organizations' inventions included the all rights of universities funded by the Ministry for Research and Technology in Denmark in 1999. In France, It has been explained that the creation of technology transfer and the creation of policies for the granting of rights to employees are suggested in 2001 by Ministry of Research. The Canadian prime minister has also found favorable advice in this regard and stated that the benefits to be gained from the inventions must be at the highest level. However, contrary to the Bayh-Dole law, all policies established in the mentioned countries and others (e.g., Austria, Ireland, Spain and especially Japanese)

are focused on changing the employment law. In short, when it comes to IP, it is stated that the main aim is to transfer the university to itself from university professors who are individual inventors. Thus, such employment regulations and IP policies aim to stimulate the organization and activity of technology licensing offices which have encouraged the formation of external ‘‘technology licensing organizations’’ in the Swedish, German, and Japanese governments (among others) (Mowery & Sampat, 2005).

According to Etzkowitz (2001), almost all the universities soon developed the ability to identify and market intellectual property because of the revenue opportunity to be gained by licensing intellectual property along with the Bayh-Dole law. In the long term, increasing significance of science and economic development led academicians to take steps in entrepreneurship. These have also enabled the establishment of technology transfer offices in universities, enabling scientists to direct and encourage business activities and discoveries about financial potential values. As a result, entrepreneurship culture became more organized and widespread. The purpose of this office is to find out what university researchers are doing, inviting their company advisors to the university, and providing the university with knowledge. This contributes to the realization of the transferred knowledge and the realization of the transfer of technology by producing commercialized and patentable technologies by embodying the researches.

Similarly, according to Friedman and Silberman (2003), technology transfer at universities is based on the Bayh-Dole law. According to a 1991 report cited in Friedman and Silberman (2003), on the technology transfer of the Association of University Technology Managers, invention disclosures increased by 79 percent patent applications increased by 230 percent licenses executed increased by 159 percent, and gross license income increased by 611 percent. This growth was interpreted as a sign of the contribution of the economy from technology transfer to the economy and in the face of diminishing support the university was seen as a potential source for revenue. This has led to a debate about the curriculum change or

the need for academics to spend less time teaching and service. On the other hand, it is also discussed the negative contribution of open science, as we have said before, and the decrease in the quantity and quality of basic research.

To sum up, university technology transfer became official and functioning mediators with the Bayh-Dole law, which was effective in the United States firstly and then all over the world, and laid the foundation for the construction of TTOs (Bucsai, 2013).

3.3 Technology Transfer Offices

In a knowledge-based economy, it is necessary to be in a business alliance to successfully commercialize the research results of the university and industry, which are science and technology resources. When we look at the industry, most SMEs, even large corporations, have insufficient R&D resources. This means insufficient innovation and market loss for a company, so collaboration with universities will save time and cost, allowing short-term solutions to technical and technological problems. In the long term, it can create a stable scientific background. For universities, more independent from the state, new industrial partners and students will gain competitive advantage (Bucsai, 2013).

Interfaces were set up to commercialize the knowledge produced in this collaboration process, to preserve the existing ones, to establish new connections and to transfer the transfer of industrial technology to universities. Technology Transfer Offices (TTO) have been established in order to encourage entrepreneurial behaviors in line with these aims. The TTOs, which are described as the gateway to university inventions, serve as "translator" for both sides. According to OECD (2011) and Khademi et al. (2014) the main tasks of TTOs are:

- “They build personal connections with faculty members to inform them about university policy changes, government policy trends and industry technology requirements (i.e. licensing demand).

- handling and stimulating patent application issues and whether the technology seems commercializable or not,
- educating and encouraging faculty members about patenting opportunities,
- managing licensing and all other patents related legal tasks,
- introducing and reinforcing university intellectual policy"
- labor assistance on multifarious paperwork (Khademi et al., 2014)
- "establishing relationships with firms and community actors;
- generating new funding support from sponsored research or consulting opportunities;
- providing assistance on all areas related to entrepreneurship and intellectual property (IP);
- facilitating the formation of university-connected companies utilising PRO's technology (start-up) and/or university people (spin-off) to enhance prospects of further development; and
- generating net royalties for the PRO and collaborating partners.
- In order accomplish its assigned roles, the TTO carries out a very variable range of activities relating to different channels of knowledge and technology transfer that involve a contract between the PRO and a third party. These channels may include: collaborative research, contract research, consultancy, spin-off and start up companies, incubator facilities, licensing, and patenting" (OECD, 2011)

TTO has always the objectives of public benefit, economic development and national and regional policies and development targets, but also commercialization and income generation. Targets which are at the forefront determine how the TTO is structured and operated. First of all, the quality of the personnel required when a TTO is established is very important. They should consist of flexible people who are able to communicate with people at every level, have the ability to understand the potentials of proposals, and communicate well with both industrial managers and academics. Managers who are competent in how an operator is managed, who can evaluate opportunities, and who can gain the trust of the people are needed. While these people

need to actively work to understand the market needs and turn proposals into opportunities on the one hand, they have to spend time with the academicians and define them as to which values they can direct on the other hand. A complementary team is required that can use the technical language with these two groups and have expertise in IP rights and commercialization. They should be able to provide training to academics when necessary and should include issues such as disclosure, confidentiality, protection and awareness of IP rights processes, how to deal with the industry and how to act as a consultant. But recently, expert advice, such as patent and legal counsel, can also be obtained from outside. In addition to this, free business advice can also be taken from peers (Campell, 2007). Available or new technologies may be published or mailed to specific companies who fit the profile of potential licensees by TTOs. Publication in a high-impact journal, or a university's public relations departments, and trade shows or professional association meetings and most importantly long-standing personal contacts within the TTO or with the inventor, face-to-face meetings, teleconferencing, and invitations to visit university laboratories are used for the best advertisement. TTOs have a critical role in disseminating and commercializing discoveries (Norman & Eisenkot, 2017). Muscio's (2010) survey data showed that academic researchers had greater confidence in TTO and TTO usage in TTOs managed by industry-based professional staff. However according to Göktepe Hulten (2010), besides all these features that should be in TTOs, TTO should realise the importance of less experienced scientists or scientists without industrial contacts and female scientists and help them to commercialise their research results. Activities of TTOs are mainly shaped by its relation to the university researchers. They can focus very much on the well-known scientists. Instead of doing so, TTOs utilise and learn from the experiences of that inventors. Actually, this group is not in need of TTOs they have been either involved in university-industry collaboration platforms or have industrial networks.

In a successful collaboration process, TTO's mission should not be only parallel to its university mission, but also to support its industry mission and motivation. At this

point, there are aspects in terms of university, such as easy access to funding sources, access to industrial empirical data, improvement of education. There are other aspects in terms of industry such as access to university facilities and equipment for industry, reduction of R&D costs and inclusion of skilled workers into their own work (Guimon, 2013). In order for the new product or technology to be an entrepreneur who will create value as an integrated economy, scientists and technology people need to be able to cooperate.

According to Campell (2007), Technology Transfer ensures IP and license rights through TTOs. In this process, there must be an adequate budget to cover what elements are to be preserved, how to prepare the patent file, or where the application is to be made and the subsequent activities require financial resources. Accountability must be clear and report to the senior university employee and form annual reports. TTOs need to make long-term plans in order to be successful. Its mission, approach and activities must be appropriate to the corporate mission and add value. It must be agreed with in providing social welfare, in creating new labour and employment, and in the points that can be of value to the university. The management of the host university must understand the institutional relationship with the transfer of technology and should be encouraged in this regard. In this way, academicians can be encouraged to participate in technology transfer and TTO can be an organic part of the university. How they relate to stakeholders (academics, representatives of the business and user community, and regional and governmental offices) is also a factor affecting the success of TTOs. Understanding the needs of partners is a necessary component of technology transfer.

To sum up, as mentioned above, there is much work to TTO staff to understand such willingness and to make good communication between the parties. Likewise issues such as IP assets, licensing, contract laws and conflicts between its internal activities and the academic and public require a successful TTO management. In the commercialization process, academic researchers and universities are directly participated in the target of the net profit motive of corporations and make a profit.

Any conflict of interest arising there from must be properly managed by the TTOs. University faculty members should not prioritize their academic work and should not seek direct personal financial interest and research on their work in external affairs using the university's reputation (Norman & Eisenkot, 2017).

TT process begins dicslosing an invention to the university by the inventor. Firts of all TTO determines whether the invention is patentable or how patent application file and search the availability of funds. Although the patent application criterion varies with each university, it is important whether the discovery has a sufficient commercial potential and substantial additional investment is required. The extent to which the patent can be applied, the licenses and the benefits to be obtained from it also affect the application criteria and process of TTO. In the license negotiations, TTOs are paying attention to the type of technology, the current stage of development of the discovery, the size of the potential market, the anticipated profit margin, the perceived risk of the technology, cost of bringing a product to market and known royalty rates for comparable inventions etc. Once a new invention is patented, intellectual property rights are owned by university. In fact, without a patent, inventions can be also licensed (Friedman & Silberman, 2003; Norman & Eisenkot, 2017).

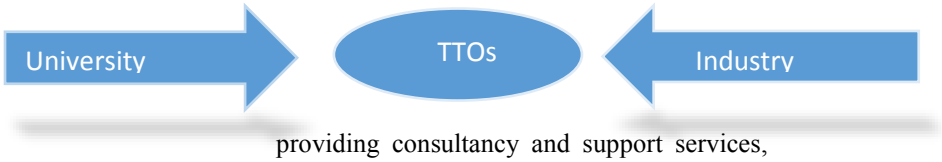
According to Friedman and Silberman (2003), higher faculty quality tend to produce more inventions with bigger commercial viability. Because of gradual diffusion of technology, younger TTOs tend to earn less license earnings relative to older TTOs. Otherwise, personal relationships and networking are important in the technology transfer and they ocur with time and experience. Thus, the older TTOs have more personal relationships and less cultural barriers. According to Göktepe Hulten (2010), TTOs should have open source and collaborate with other TTOs. Their program and accomplished stories should be published in the university’s in-house publication. They can train students or post-docs interested in technology transfer that communicate with the TTO and the faculty.

We can summarize the purpose, result and tasks of the TTOs in the following table.

Table 1

University-Industry Collaboration in the Technology Transfer Process

Reasons for University-Industry Collaboration in the Technology Transfer Process		**Results of University-Industry Collaboration in the Technology Transfer Process**	
In terms of university	**In terms of industry**	**positive results**	**negative results**
social pressure on the transformation of research into newness	patent control	reputation and career growth	prevent creativity
reduction in government support	reduction of R&D costs	becoming entrepreneur instiurions	least scientific articles
technological competition	inadequate R&D resources	more revenue with patent control	less open science
financial difficulties in the transformation of knowledge into service	inadequate innovation and market loss	time and cost saving	IP problems
access to financial resources/support	access to university facilities and equipment	solution to technical and economic problems	discrepancies in expectations and interests
new industrial partners	inclusion of talented employees in their employees	stable scientific background	decline in quantitative and qualitative research
discovery of new information	commercialization of new technology		less time spent on teaching



providing consultancy and support services, putting research results into practice, earning income, establishment of new start-up companies, education and awareness, managing licensing, Networking, connection between faculty members and industry, generating funding, providing assistance on IP and fair distribution of royalty income

Source: Compiled by the author

3.4 Literature Review about Assessment of University Technology Transfer in University-Industry Collaboration

After giving general information about Technology Transfer process and Technology Transfer Offices in the previous section, it will be appropriate to include research related to this subject in the literature. But first of all we should give examples of the studies in the literature about how a university and/or technology transfer should be more effective. In these studies, key words such as licensing, industry, importance of mission, rewards or social capital come to the fore:

According to Rogers et al. (2000), after 1980 Bayh-Dole Act, technology licensing offices have been established by almost all US research universities in order to facilitate technology transfer (TT) to private companies. Therefore they developed six item scale to measure technology transfer effectiveness for 131 U.S. research universities. As a result, in the case of technology transfer, more effective universities are defined by "1-higher average faculty salaries, 2- a larger number of staff for technology licensing, 3- a higher value of private gifts, grants and contracts, and 4- more R&D funding from industry and federal sources."

Friedman and Silberman (2003), examine the determinants of technology transfer with the most recent data used regression analysis. According to their research universities that have clear mission and provide bigger rewards, have high concentration of technology firms and industry research generate more licenses and license income.

Dalga (2016), interviewed with 14 participants from 10 different universities and interviewed with TTO office managers and employees in his qualitative thesis study with content analysis. These selected TTOs are TTOs, which were established by universities and received project support by TÜBİTAK 1513. The aim of this study is to determine the obstacles faced by TTOs within the scope of university-industry collaboration and the solution proposals to overcome these obstacles. As a result of this study, it is concluded that the policies of universities regarding technology transfer and commercialization are insufficient. He concluded that an information management

system is necessary to enable the TTOs to be more efficient and meet the needs of the industry and to see the possibilities of the university.

Fenga et al. (2012), builds up a hypothetical model to clarify the relationships among scholarly capital, inquire about results, and TT performance, exploring the functions of university TTOs in the process of innovation. The creators analyzed these connections by inspecting 49 Taiwanese university inside a 2-year time span. It is reasoned that colleges with particular university TTOs to be sure advance TT performance in view of university–industry collaboration. Besides, the outcomes demonstrate that human capital is decidedly connected with research results and social capital. The more noteworthy the measure of social capital, which speaks to the level of university–industry collaboration, the more critical is the beneficial outcome on research results and Technology transfer performance. The more research results are delivered, the more scholarly research and patent innovation will be exchanged to industry.

The studies on how TTOs should be and how they are to be successful are as follows:

York and Ahn (2012) reviews the literature (data from AUTM and 48 University TTO websites) based on semi-structured interview. They determine factors effects the success of university technology transfer offices. According to the results of this research organisational culture, Intellectual property protection, business strategy and marketing, focus of revenue generation, relationship etc. affects success of TTO's.

Üstündağ et al. (2011), explore the causal connections among the components affecting the Technology Transfer Offices' (TTOs) performance. The discoveries from this exploration is that TTO HR, industry inquire about interest, R&D spending plan of university and financial vulnerability are the most powerful factors on the performance of TTOs. The execution yields which are for the most part influenced are the elements, licenses, patents, built up spin- offs, industry research contracts and counseling pay.

According to Fiaz and Rizran (2011), the observational research demonstrates that how slants were changed from Industry-Industry coordinated effort to University-Industry joint effort. In the literature by different authors, innovation, firms size, openness of the firms, A&D capacity of the firms provide better collaboration. On the contrary, lack of trust, competencies and oppenness, lower R&D activities, poor communication, bypassing professional ethics etc. affect badly collaboration.

Graff et al. (2002), in their study examining universities and TTOs in the United States, argue that TTOs play a significant role in the inclusion of research results into the collaboration process and in the protection of intellectual property. But they argue that this should not be a matter of mutual interest. It emphasizes the importance of TTOs, particularly in terms of lack of encouragement and overcoming barriers to collaboration and knowledge flow. They argue that the patents given at the universities will increase gradually even though they are small compared to the sector and will probably proceed in this direction. As the waves of new technology emerged, the technology transfer activities, in which the role of the university would increase, would become increasingly widespread. They suggested that TTOs of smaller universities with less inventions could come together and achieve more efficient results.

Xu et al. (2011), inspect faculty disclosure of innovations, which is a vital antecedent of university licensing. They speculate that invention disclosure (ID) is an expanding capacity of R&D consumptions, workforce measure, personnel quality, sovereignty offer, and technology transfer office (TTO) freedom from university funding. The creators likewise contend that, on the grounds that TTO estimate is a proportion of TTO operator inquire about mastery, substantial TTOs ought to have the capacity to construct more grounded associations with a more extensive scope of staff, which ought to draw in more resources to reveal developments. Furthermore, the production of such solid TTO-workforce connections requires tacit knowledge of staff abilities, premiums, and inspirations, and the obtaining of this knowledge requires significant investment. Consequently, TTO age ought to likewise emphatically impact ID. Examination of information from 123 TTOs shows that the quantity of IDs is decidedly

related with government R&D uses and TTO measure, and contrarily related with TTO financing freedom. Conversely, workforce estimate, sovereignty offer to innovators, and TTO age are emphatically and essentially corresponded with the quantity of IDs just among colleges with little TTOs, while staff quality is decidedly and altogether associated with the quantity of IDs just among colleges with substantial TTOs.

Muscio (2010), interviewed with 197 university departments in Italy. According to his study, Scholastics' trust in TTOs drives university utilization of TTOs. Academic investigate execution drives academics' utilization of TTOs. At the point when TTOs are overseen by Professional staff with industry foundation, scholastics will probably work together with them.

Sellenthin (2009), investigates the variables that affect on the choice of researchers to patent their examination results. Specific accentuation is put on the job of Technology Transfer Offices. It expands on an overview of university professors in Sweden and Germany. The relapse results demonstrate that scientists that got help from the general population framework and specialists that have involvement with the licensing framework-through possess past licenses or joint patent applications with firms-are significantly more prone to apply for licenses.

Stadler et al. (2007), build up a hypothetical model to clarify the explicit job of Technology Transfer Offices in licensing university inventions. In their research, they showed that TTOs could combine innovations with research centers at the university and develop their capacities by building the infrastructure and utilizing their reputation. In this way, the buyer's belief in getting a quality output will be increased. In this case, even if there is less innovation, it can be sold at a higher price because it is more valuable.

Değerli (2017) has determined the critical success factors for TTO and other interfaces in university-industry collaboration. For this purpose, he applied a questionnaire study to 230 TTO personnel after a comprehensive literature review. As a result, 11 basic

critical success factors and 67 items related to factors were determined for TTO and derivative organizations and the relationships between this feature and the factor were determined.

Some researches on TTOs and their results are as follows:

Another study about TTO belongs to Khademi et al. (2014). They had face to face interviews. They used case study approach and qualitative research methods. According to their findings, based on the interview, TTO accelerates the university-industry commercialization process by facilitating IP application issues, motivating academic, coordinating licensing, organizing spin off company, and marketing the inventions. TTOs play the key role in the industry sector and academia.

In the survey conducted by Özdemir (2017) with 50 company representatives in Gaziantep Technopark, it is concluded that there is a close relationship between Gaziantep University benefiting from TTO and exchange of knowledge and technological innovation between enterprises.

Güler (2018), who examined the impact of TTOs on innovation-based entrepreneurship and Intellectual Property Rights, contacted 55 TTOs and conducted surveys for 20 senior executives. According to the results of his study, TTOs played a major role in their role as bridges between the university industry. This has revealed a direct and positive contribution to collaboration.

The paper of Curi et al (2012) displays the primary appraisal of the proficiency of the innovation exchange worked by the French university framework and its fundamental determinants. The examination depends on a database of 51 TTOs sorted by the kind of college to which they have a place, for the period 2003–2007. Examination of the determinants demonstrates that the productivity of French TTOs depends principally on the idea of the classification (with universities had practical experience in science and building being most proficient), and on institutional and ecological attributes. Both the age of the TTO and the span of the university have a constructive outcome. As far

as natural factors, the power of R&D movement (both private and open) has a positive effect; notwithstanding, regarding development rate, private R&D action is by all accounts the fundamental driver. Ultimately, they find that the nearness of a university related healing center is unfavorable to productivity.

Tünen (2011), who examined the impact of innovation policies on SMEs in the context of Konya Organized Industrial Zone, conducted interviews with 353 companies in total. Only 24 of the companies participating in the survey were found to collaborate with universities and research institutions and R&D. One of the reasons for not cooperating is that they do not have enough information about universities and research institutions and do not know their own needs. For this reason, a meaningless relationship was found between the company's need to develop new products and collaboration with or support from universities and research institutions. Similarly, no significant relationship was found when they applied for innovation, receiving support or performing R&D activities and applying for registration. Only a positive and meaningful relationship was found in case of innovation and R&D support.

I will complete this sub-heading by including articles on the effects of mechanisms such as patent, licensing and innovation on TTO or the public.

Seki (2017), according to the random coefficient method and empirical analysis has explored the role of universities in innovation generation process in Turkey. As a result, the level of innovation has come to the conclusion that public universities, technology development centers and technology development zones have a positive impact. Moreover, he found that the higher education sector contributed more than other factors.

Gurmu, Black and Stephan (2010), estimate a knowledge creation work for university patenting utilizing an individual impacts negative binomial model. They control for Research and Development uses, explore field, and the nearness of a Technology

Transfer Office. They locate that patent yield relates emphatically and essentially to the supply of R&D uses and the nearness of a Technology Transfer Office.

3.5 University-Industry-Government Collaboration in Turkey

With the increasing resources allocated to universities throughout the world, the need to fund the universities themselves has been instrumental in commercializing them. This situation has changed in a similar way in Turkey. For this reason, it has become necessary for universities to cooperate with industry in order to create a source of funding and to keep up with technological change and to lead the production and dissemination of knowledge. The inclusion of the government in this process strengthens collaboration and ensures better results.

The fact that universities focus more on scientific projects and that they are supported by the state will both provide financial resources and more prestige to them and collaboration with industry will be ensured through such projects.

In this tripartite co-operation model, the roles of different talent and competing groups are intertwined. Schumpeter (1934) emphasized the importance of the role of the entrepreneur for a successful innovation result. For example, universities provide incubation services and thus enable the creation of new companies. The change in legislation or financial support of the government in this direction will be beneficial in terms of innovation activities, technological development or the level of development in the country. Thus, the participation of firms with a stronger infrastructure in the industry will be more beneficial. For this reason, the increase in innovation is not only achieved by the successful collaboration of these trio, but also by means of communication with one another. Therefore, a sense of mutual trust and collaboration can lead to successful innovation.

In this sense, both national and especially a regional innovation system should be given more importance. This is because each region has advantages or disadvantages in

itself. By recognizing them, a method to highlight the advantages in each region should be followed.

In Turkey, the first regulations on university-industry collaboration in terms of science and technology policies start with the establishment of the State Planning Organization and the creation of the the first Five-Year Development Plan (1963-1967). In this plan, studies on research and researchers were conducted and providing the necessary environment, hardware and organization, and training of staff were discussed. TÜBİTAK was also established in this period. In the second Five-Year Development Plan (1968-1972), the active participation of the private sector in R&D activities, arrangements to encourage researchers in universities were planned but no result could be obtained as no university industrial collaboration could be established. In the third Five-Year Development Plan (1973-1977), technology transfer came to the fore but the desired results could not be reached due to the lack of infrastructure to transfer knowledge and technology between the university and the industry in Turkey, which is rather an agricultural society not yet industrialized. In the fourth Five-Year Development Plan (1979-1983), more importance is attached to technology transfer; however it is noteworthy that we are not producing technology, but rather we are using it. Therefore, there has been no significant development in the name of university-industry collaboration. Since we are unable to produce technology in this plan, reference was made to the inadequacy of the transfer of technology and the lack of resources to produce and absorb technology. However, in this period, Supreme Council of Science and Technology (BTYK) was established and a study titled as "1983-2003 Turkish Science Policy" was prepared. This study focuses on a technology producing model. In the fifth Five-Year Development Plan (1985-1989), no other emphasis was placed on the technology transfer. However, this plan can be seen as the first concrete step towards university-industry collaboration in order to mitigate problems in technology infrastructures and to establish technoparks and to encourage universities to collaborate with industry and to specialize in areas where they are stronger (Erdil et al., 2013; Tatar, 2016).

In the sixth Five-Year Development Plan (1990-1994), five technoparks and two advanced technology institutes were established to support the previous development plan. The objective of developing and expanding the tripartite collaboration was again included in this plan (Kiper 2010 cited in Erdil et al., 2013). In the seventh Five-Year Development Plan (1996-2000) the situation was determined for the previous plans and the issues discussed were indirectly with regards to the university-industry collaboration. In the eighth Five-Year Development Plan (2001-2005), direct university-industry collaboration was aimed by using expressions such as the establishment and support of new technopark and technology institutes and increasing the dissemination of collaboration. In the ninth Five-Year Development Plan (2007-2013) decisions were taken to improve university-industry collaboration to support the use of university infrastructure and manpower by the private sector, and to complete the infrastructures of technology development zones. It has been stated that the channeling of the universities to the society and the business world will be ensured and the sectoral organized industrial zones will be implemented in the regions to this end (Erdil et al., 2013).

Some institutional interface mechanisms, such as TTO, have been set up to promote university, industry and government collaboration. In this regard, technoparks are treated as ideal places. Since technoparks are established regionally, they are the corporate interfaces that first aim to contribute to the region's economic development. According to Law No. 4691 on Technology Development Zones in our country in 2001, it is called technology development zone and established to enable companies which will produce advanced technology to benefit from the facilities of the universities/institutes and to produce a technological invention and to commercialize it.

Incubators are another interface mechanism. It is aimed to support new technology-oriented companies and ensure that their initiatives can continue. In addition to granting capital support to newly established firms, administrative support can be provided as well as a physical infrastructures.

3.6 Academic Entrepreneurship in Turkey and Technology Transfer Offices

The process of adapting to the trends of innovation and entrepreneurship in Turkey and in the world began with the transformation of the well-established and developed universities into the entrepreneurial structure. The development that played a key role in this innovative entrepreneurship was possible with the establishment of KOSGEB in 1990. In 1992, Technology Development Centers (TEKMER) were established in order to increase university industry and public collaboration in Middle East Technical University (METU) and Istanbul Technical University (ITU). TEKMERs have played a role in the beginning of academic entrepreneurship with the onset of KOSGEB's providing qualified staff and financial support and with the universities showing physical facilities. In 2001, with the Technology Development Zones Law No. 4691, technoparks, an important interface mechanisms, started to be established in universities and the entrepreneurship activities of academicians in technoparks and the establishment of companies became legal (Tekneci & Cansız, 2016; Dalga, 2016).

Turkey's first technology commercialization company based on academic entrepreneurship and innovative technology is Inovent A.Ş. founded by Sabancı University. The goal is to create an ecosystem based on innovative entrepreneurship, especially start-ups.[7]

In 2013, METU TTO, which was supported by TÜBİTAK 1513 "Technology Transfer Offices Support Program", was established in 2007 and undertook an interface task to develop university-industry collaboration (UIC). The main duties of METU TTO are to match 'researchers and industrial companies' requests and to provide consultancy

[7]For more information see: http://www.inovent.com.tr/tr/biz-kimiz.html

services by managing the application and registration processes of inventions that may be patentable.[8]

In 2009, Hacettepe Technopark Technology Transfer Center was established by Hacettepe University in order to "transfer academic and technical know-how in universities to the industry, as an interface among universities, industry and international technology networks". It provides service for academicians, industrialists and investors.[9]

With the establishment of TÜBİTAK BİLGEM in October 2012, a Technology Transfer Office has been established in its entirety. The mission of this office is to "encourage the transfer of products, technologies and inventions of TÜBİTAK BİLGEM for the benefit of domestic companies and the public and to carry out their transfer operations". The main tasks of TTO are defined as investor information, market coordination, collaboration development, planning of new technology companies, protection, marketing, selling and management of sales income of intellectual property rights." [10]

> *In Turkey TTOs or derivative organizations provide service to and carry out activities in the university/research organizations-manufacture/industry collaboration and ensure the transfer and commercialization of knowledge, innovation and/or technology to the industry*.[11]

It is possible to consider TTOs in four main categories in terms of their legal personality. These are as follows:

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[8] For more information see: https://pdo.metu.edu.tr/system/files/odtu_ar-ge_faaliyetleri_raporu_-_2016.pdf

[9] For more information see: https://www.hacettepettm.com/hakkimizda/

[10] For more information see: http://tto.bilgem.tubitak.gov.tr/?page_id=6

[11] TÜBİTAK 2012 cited in Değerli 2016

- The unit established for TTO activities within the body of higher education institution,
- The company established for the activities of TTO, which is a partner of the higher education institution,
- The technology development region is the managing company,
- The company that is established for TTO activities and in which the manager of the technology development zone is a partner (TÜBİTAK 2012).

3.7 TUBITAK Technology Transfer Office 1513 Support Program Supported the Promotion of TTO in Turkey and Current Status of TTOs

According to the decision taken on December 27, 2011 by BTYK at the 23rd meeting of 2011/104:

> *In order to trigger innovation and entrepreneurship in universities, it was decided to carry out the following activities in the first stage:*
>
> *Support of Technology Transfer Offices: To enable researchers to participate effectively in the process of creating value-added in the economy and to stimulate academic entrepreneurship; Making Technology Transfer Offices more functional and widespread as an interface to contribute to the development of industrial collaboration, to support the technological commercialization process, to provide logistical support for academic research, It was decided that the Ministry of Science, Industry and Technology, the Ministry of Finance, the Ministry of Development and the Turkish Patent Institute should make the necessary planning in the co-chair of YÖK and TÜBİTAK and that the applications should be passed on in accordance with this plan and the developments reported to BTYK meetings.*

According to the decision taken in subparagraph C of the relevant meeting:

Creating Entrepreneurial and Innovative University Indices:

> *- Measuring the entrepreneurship and innovation performance of the universities,*
> *- Increased entrepreneurship and innovativeness-focused competition among universities and*
>
> *- In order to indirectly contribute to the development of innovation and entrepreneurship, a working group has been formed in collaboration with TUBITAK-YOK-TUIK and it has been decided to create Entrepreneur*

> *University and Innovative University Indices and to be shared with the public once a year.* (BTYK, 2011)

Thus, in 2012, TÜBİTAK created "1513 Technology Transfer Offices Support Program" and the spread of TTOs throughout the country has been accelerated. With the announcement of the Entrepreneurial and Innovative University Index announced for the first time in 2012, ten universities (METU, Boğaziçi University, Ege University, Gazi University, Hacettepe University, Koç University, Özyeğin University, Sabancı University, Selçuk University, Yıldız Teknik University) included in this list were supported. In the call announcement of 1513 Technology Transfer Offices Support Program 2012:

> *1513 - Technology Transfer Offices Support Program is being implemented by TUBITAK in order to support the Technology Transfer Offices (TTO), which aim to provide university-industry collaboration, to benefit from the national and international support mechanisms of universities, to encourage entrepreneurship and to manage the intellectual and industrial property rights in universities.*
>
> *Within the program; working in collaboration with universities and industry in the fields of R&D project creation, development and support activities, registration and commercialization of intellectual and industrial property rights, establishment of incubator center for entrepreneurs, providing business guidance, consultancy and training services and activities to raise awareness in these fields and projects submitted for the development of transfer offices are supported as non-refundable (grants).*

In this context, following five sections (modules) are identified. It is stated that the Technology Transfer Offices which are making at least three of these modules and aim to make one or two more modules in addition to the project applied and existing modules may apply to this call.

- Awareness, promotion, information and education services (Module 1)
- Services for benefiting from the support programs (Module 2)
- Project development/management services (university-industry collaboration services) (Module 3)

- Intellectual (industrial) property rights (IPR) management and licensing services (Module 4)
- Spin-off and entrepreneurship services (Module 5)

The project support period is no more than 5 years from the project start date with no repay. However, this period may be extended for a maximum of 5 years by the decision of the Executive Committee and the approval of the President. The upper limit of the support amount is 1,000,000.-TL per year and it is in the form of a grant. Project budget, provided that it is accepted by TUBITAK:

- Personnel expenses
- Transportation, subsistence and accommodation expenses,
- Purchase of tool, equipment, software, publication rights,
- Service procurement (including domestic and foreign consultancy and training),
- Meeting, promotion and organization expenses,
- Sworn fiscal consultancy fees determined by the Ministry of Finance according to the wage schedule that is valid for the R&D aids in the transactions carried out by TUBITAK, which are included in the sworn financial advisory minimum wage tariff published every year,
- General expenses

After 2010, the number of TTOs increased significantly in terms of quality and quantity and reached around 75 with the contribution of TUBITAK (Çiftçi, 2017). Given the assessment by managers of TÜBİTAK on the performance of TTOs, we see that the results of the survey conducted by 25 universities supported by the 1513 program show that the resources allocated to the universities are increasing but a large amount is publicly funded. When the research budget is taken into consideration based on the number of academicians, it is seen that there is a big difference between the research budget per academician and the patent productivity. More than half of the TTOs have not yet achieved international patent registration. Howeverwhen it comes to national patent registration, it is thought that it tends to increase within the support

process. The income that can cover the operational costs cannot be obtained by the majority of TTOs.

According to Kiper (2010), innovation activities in the world economic system are becoming increasingly complex and interactive, involving all sectors. Therefore, measures related to the innovation become crucial that the countries gain both knowledge production and economy are gaining importance. The last two Innovation Scoreboards of the EU Innovation Scoreboard have 25 indicators in total under 5 different headings. While 15 applications gathered under Innovation Determinants, Knowledge Generation, Innovation and Entrepreneurship titles are used as input, 10 indicators gathered under Applications and Intellectual Property titles are used as output. But Turkey can not provide the most of the data and can be located in the last row if can provide. The data on patent, license revenue, spin-off and contractual research outputs that may arise from the university research results in our country are not comparable to other countries even if they are not healthy. In accordance with decree-law about number of 551 on the Protection of Patent Rights, inventions have been defined in two different ways as inventions in the public sector and universities. By reason of the fact that the inventions obtained as a result of scientific studies made by the academicians are considered to be free inventions, the university does not have any right on this invention. If the university has provided specific tools and equipments for the research that results with an invention, may request a certain amount from researcher provided that the expenditure is not exceeded. In order for this request to be made, the researcher must have informed the university that it has been evaluated and the university should have made this request within three months. Until 2005, while the patent right arising from the researches carried out with the support of TUBITAK belongs to the institution, with the new law the statement of "The rights on possible mental products that arise during the realization of the projects based on the contracts that the entity is a party to are regulated by the contract" the rights arising from the projects can be owned by the invention together with the contract. However, when it is an institute or center employee in TÜBİTAK this statement differs from and

it is TÜBİTAK who has a right. If income is earned, at most half of income is given to the product owner.

We can summarize the suggestions of Kiper (2010) for the deficiencies of TTO and other interfaces as follows:

- When we look at the developed countries in the transformation of knowledge into capital, they have a more regular and effective legislation because the data about intellectual rights and the outputs have increasingly prevalent. Thus, the system of intellectual property should be well organized. The existing patent regime does not allow much to produce, develop, assimilate and sell technology. In terms of the use of most of the existing technologies, our country is a passive user. Each country must go arrangement to adapt to their competitive advantage in the foreground holding TRIPS and other international agreements. However, the number of inventions can be increased in this way.
- Current legal regulations and practices make it more difficult for institutional structures to be established by universities and for academics to participate in this process. Universities should be able to make decisions about their own policies and practices.
- The R&D support systems in the collaboration period can also increase the activities.
- In addition to looking after the country and society interests, universities will be able to contribute to the development of that region by identifying and supporting their priority areas.
- Due to the lack of human resources that can carry out the technology transfer activities and management, programs should be organized in order to overcome these deficiencies and a network should be established so that people can share their experiences by providing communication all over the world.
- Institutions like KOSGEB and TÜBİTAK provide support for some of the expenses such as patenting expenses. In addition, support such as patent protection and legal advice costs should be available. This will make the technology transfer process easier.

- The existence of guidance and referral documents for intellectual property law and practice will be helpful to the academicians who are far from the subject, to make the process easier and more understandable.
- Since the identification of violations and disputes in patent rights or license agreements is a very difficult and complex situation, it is necessary to design and implement mechanisms to manage such processes. Experts and sufficient and competent specialists are required to serve on the court.

3.8 Evaluation of Entrepreneurial and Innovative University Index by Years

With the Entrepreneurial and Innovative University Index, entrepreneurship ecosystem is aimed to be improved by increasing competition between universities. In this context, the universities in this list are not selected according to their educational standarts, but according to their competitiveness in their entrepreneurship and innovative attempts.[12]

According to the indicator set published in 2013, EIEI consists of five dimensions. The names of dimensions and their respective weights in the construction of the index are as follows:

1- Scientific and Technological Research Competence (20%)
2- Intellectual Property Pool (15%)
3- Collaboration and Interaction (25%)
4- Culture of Entrepreneurship and Innovation (15%)
5- Economic Contribution and Commercialization (25%)

In 2018, some changes were made to ensure that university performances were more output and impact oriented. Dimension for "Culture of Entrepreneurship and Innovation" was excluded from the list since it was already assumed that all the

[12] For more information see: http://www.tubitak.gov.tr/sites/default/files/gyue_2013_bilgi_notu.pdf

universities achieved this end. The proportion of this dimension is divided equally to the remaining 4 dimensions. Under this heading, there were indicators such as:

- the existence of TTOs,
- the number of TTO employees and other collaboration mechanisms,
- the number of courses on entrepreneurship and innovation given at universities,
- the number of training provided to support entrepreneurship and innovation outside the university.

With the exclusion of this dimension from the index, the index now consists of 4 dimensions. Dimensions, their subcategories and new weights are as follows:

1- Scientific and Technological Research Competence (23,75%): Number of scientific publication, number of citation, number of project, amount of funds obtained from projects, number of national / international science awards, number of doctoral graduates.
2- Intellectual Property Pool (18,75%): Number of patent applications, number of patent documents, number of utility model / industrial design documents, number of international patent applications.
3- Collaboration and Interaction (28,75): The number of projects carried out in cooperation with industry, the amount of funds obtained from projects with industry collaboration, the number of projects carried out with international collaboration, the amount of funds obtained from international projects, the number of teaching staff / students in circulation.
4- Economic Contribution and Commercialization (28,75%): Number of academician firms, number of students / graduates firms, number of people employed in academician firms, number of patent / utility model / industrial designs licensed.

In accordance with the below information, Table 2 shows the ranking of the top twenty universities in 2012 according to the Entrepreneur and Innovative University Index. The universities marked in bold are the ones that received the

support of TÜBİTAK 1513 Technology Transfer Offices Support Program in 2012 with the announcement of this index.

Table 2

Ranking in Entrepreneurial and Innovative University Index, 2012-2018

Universities	2012	2013	2014	2015	2016	2017	2018
Sabancı University	**1**	**2**	**2**	**1**	**1**	**1**	**3**
Middle East Technical University	**2**	**1**	**1**	**2**	**2**	**2**	**1**
İhsan Doğramacı Bilkent University	3	3	4	4	3	6	4
Özyeğin University	**4**	**7**	**6**	**7**	**8**	**9**	**14**
İstanbul Technical University	5	5	7	6	4	4	2
Boğaziçi University	**6**	**4**	**3**	**3**	**5**	**5**	**5**
İzmir Institute of Technology	7	6	9	8	9	8	9
Koç University	**8**	**8**	**5**	**5**	**6**	**7**	**11**
Gebze Institute of Technology	9	13	12	11	7	3	7
TOBB Economy and Technology University	10	9	8	9	11	11	15
Hacettepe University	**11**	**10**	**14**	**14**	**17**	**16**	**8**
Ege University	**12**	**14**	**15**	**15**	**13**	**14**	**10**
Erciyes University	13	21	21	13	14	18	17
Süleyman Demirel University	14	22	20	28	35	45	30
Gazi University	**15**	**28**	**16**	**18**	**21**	**21**	**13**
Selçuk University	**16**	**11**	**10**	**12**	**12**	**17**	**19**
Çankaya University	17	19	22	20	18	34	39
Bahçeşehir University	18	24	27	36	36	43	44
Yıldız Technical University	**19**	**15**	**11**	**10**	**10**	**10**	**6**
Çukurova University	20	17	18	22	28	31	27

Source: Compiled by the author

Appendix A, B, C, D, E, F, G, H, I and J show the scores of 10 universities that received 1513 support in 2012 according to the total and index dimensions they received between 2012 and 2018. When we consider 2012 as our base year, there are only SABANCI University and METU with scores above 80. For this reason, we found it

appropriate to consider these two universities as the entrepreneurial universities (3rd generation university) that we mentioned earlier. We evaluated the remaining eight universities as research universities (2nd generation universities). All other universities below the 20th rank will be called first generation universities that have undertaken the mission of education.

In the light of the Appendix A and B, the first two universities with the highest scores are entrepreneurial universities SABANCI University and METU. In 2018 alone, SABANCI University retreated to the third place with a significant decline especially in the Scientific and Technological Research Competence dimension. METU ranked second with 83 points in 2012 and managed to get into this index. At the end of 6 years, METU showed a significant improvement in all dimensions with an increase of 10 points.

Considering the second generation universities, Özyeğin University, which was ranked 4th in 2012 and received 1513 support, reached its lowest rank in 2018, ranking 14th on the list (Appendix C). However, in general terms, except for 2018, it showed a decline, but did not experience a significant decrease in scoring, and remained behind due to the higher scores of other universities. One of the other notable university is Gazi University (Appendix H). During the six-year period (2012-2018), it fluctuated a lot. Similarly, while 6 years did not experience huge leaps in the overall rating except for 2018, the ranking of Gazi University declined due the higher scores of other ranked universities. When these two universities as considered, this support given by TÜBİTAK did not cause any significant increase in their performance. Yıldız Technical University ranked 19th when it is selected as are of the supported universities (Appendix J). However, it became a better ranking university and performed very well and ranked 6th in 2018. In 2012, Yıldız Technical University as it ranked 19th was supported with 41 points, making a significant progress and ranked 6th in 2018 with 81.40 points. Thus, Yıldız Technical University became one of the university TTOs in which the support of 1513 showed as the best functioning university.

When we look at the other 2nd generation universities (Boğaziçi University, Koç University, Hacettepe University, Ege University and Selçuk University), we see a more balanced distribution and a steady increase. However, in 2018, there are big differences in the ranking or scoring of all universities. Although it is stated that the canceled dimension was distributed equally to the others in 2018, it is estimated that the subcategories calculated under the dimensions differ from the previous years. However, no details have been published by TUBITAK.

The other universities in the lower ranks of the list are first generation universities with the mission of education. Compared to the second and third generation universities, these universities are significantly behind in all dimensions which are indicative of entrepreneurship and innovation.

Eventually, this index is used as a tool for universities to become more entrepreneurial. In this way, with the support of 1513, to accelerate the structuring of TTOs is aimed. What is important now is the strengthening of university-industry collaboration, entrepreneurship and innovation activities and increasing output. In this context, this index should be seen as an important step for our country.

3.9 Concluding Remarks

In this section, I mentioned what technology transfer means and its importance. It is seen that countries that give importance to technology and work in this field have better economic power. Multiplicity of the source of finance and higher quality in the developed country ensure knowledge production in the universities and participation of the universities in industry. Thus, innovation and technological production are more advanced than the less-developed countries. The inclusion of the government and the channeling of its investments in this direction have increased the economic growth and productivity. In this context, the establishment of technology transfer offices to support the flow of knowledge at universities has been supported. Bayh Dole Law led the increase of patent activities at universities and the enactment of this law all over the world. With this law, the patent rights that were once the property of the university

passed to researchers. The aim of this practice was to to increase the commercialization and patent activities, which would lead an increase in university-industry collaboration.

With the increase of patent and commercialization activities, TTOs are needed. Hereby, became intermediaries to ensure the sustainability of this activity and to promote entrepreneurship. Therefore, It is very important for TTOs that function as a bridge between university and industry, to be able to be comprised of expert staff who can communicate well with both sides, gain confidence and have knowledge and experience in patenting.

When we look at the university, industry and government collaboration in our country, we see that initiatives started through development plans, but generally all development plans have not gone beyond being repetitive and staying on paper. In a country that has no infrastructure built up, mentioning great technological innovations remain as political discourses. However, it is a fact that an innovative and technology-based development model cannot be considered without collaboration today. In fact, this collaboration should now be routinely interconnected. Priority should be given to the development goal in a knowledge-based economy by giving due consideration to the development objective. In this sense, the awareness of industry and university should be increased and the university should be directed towards science production through necessary policies, incentives and training programs. The industry should also play an intermediary role in ensuring collaboration with the university or should be able to activate interfaces effectively. For example, the government should be able to provide support by means of incubation centers for the technologically-intensive companies that do not have capital accumulation. According to Göksidan et al. (2018), indigenous technological capabilities are very important in a dynamic economic network. This is because they can produce value-added output. Therefore, business networks and innovation capacity among collaboration ensure the establishment of start-ups. Start-up firms is one of the most intermediary for technological and innovative capacities.

The commercialization activities in Turkey do not date back a long time. After the establishment of KOSGEB and TEKMERs in the 1990s, with the TUBITAK 1513 program, the establishment of TTOs has been supported and disseminated. As of 2012, according to the entrepreneurial and innovative university index, the above mentioned TTOs were entitled to receive support. In this context, it is again possible to talk about university-industry-public collaboration. Although this tripartite collaboration has grown rapidly over the last decade through TTOs or other interfaces, we see that this collaboration has been based on a recent past. It is also necessary to work more efficiently and effectively to close this gap. First of all, the TTO employee should be composed of experts who can communicate well with both industry and academic staff and know the technical language of both parties and bring these two groups together and have the ability to understand the potentials of the proposals quickly. All studies show that communication and network facilitate and strengthen collaboration. The university should engage academicians to engage in entrepreneurial activities.

In the next section, I will address the scope, methodology and analysis of findings which are the main structure of my thesis.

CHAPTER 4

SCOPE, METHODOLOGY AND ANALYSIS OF FINDINGS

This section consists of how the research carried out in the thesis process is based on the method and the scope and the subheadings related to them. At the same time, the results of the surveys and interviews will be discussed separately and in sub-headings. Comparisons of the results will also be included and their assessment will be made.

4.1 Scope

4.1.1 Problem Identification

As the economies of countries are increasingly based on knowledge, the importance of universities, which are the source of knowledge, has increased. For this reason, universities have started to transform into the institutions that produce and commercialize knowledge besides their entrepreneurship mission. In this context, the necessity for the universities to be commercialized and transformed into a product has to be in collaboration with the industry and, if necessary, with the public. It is observed that TTOs have a big share in the collaboration with the university, which is the source of the knowledge, and with the industry that leads the knowledge and transformation into the product. Indeed, TTOs seem to be obliged to ensure that both sides can be brought together, that the expectations of the parties can be met and that the collaboration made in the transfer of technology from the university to the industry can run smoothly.

At this point, the definition of the underlying problem of my research is to assessment of technology transfer in university-industry collaboration and to reveal the role of TTOs in this process.

4.1.2 Subject of the Research

The aim of the research is to assessment of technology transfer in university-industry collaborations and to investigate the contribution of Technology Transfer Offices which are institutional interfaces in this process.

4.1.3 Research Question

The following questions are formulated in this research:

Research question 1: What is the view of academicians about university-industry collaboration?

Research question 2: Where are academics involved in technology transfer in university-industry collaboration?

Research question 3: What is the role of TTOs, which is the interface mechanism in university-industry collaboration, in ensuring technology transfer in this collaboration process?

Since the TTOs do not have a long history in developing countries including Turkey and the entrepreneurship activities are not practised widely, the following hypotheses have been formed:

1- Academicians do not intend to actively participate in the university-industry collaboration.

2- Relatedly, TTOs have not revealed their potential in terms of contributing to the university-industry collaboration.

4.1.4 Limitations and Ethics

In this research, a questionnaire[13] was conducted to 10 university TTOs (Middle East Technical University, Boğaziçi University, Ege University, Gazi University, Hacettepe University, Koç University, Özyeğin University, Sabancı University, Selçuk University, Yıldız Teknik University) which were among the top 50 universities in the Entrepreneurial and Innovative University Index in 2012 and received TÜBİTAK 1513 program support. In addition, face-to-face interviews were conducted with two TUBITAK managers and the director or the university-industry collaboration experts of TTOs (METU, Ankara University, Atılım University, Başkent University, Çankaya University, Hacettepe University, Bilkent University, TOBB Etu University, Türk Hava Kurumu University) in Ankara. The scope of the study was limited to these surveys and interviews. Table 3 shows the types and coding of universities.

Table 3

University Coding[14]

University Codings	Type of Universities
University A	Foundation University
University B	Public University
University C	Public University
University D	Public University
University E	Foundation University
University F	Foundation University
University G	Foundation University
University H	Foundation University

[13] This survey questions are inspired of "Knowledge and technology transfer between universities and the business sector in Switzerland-KOF Konjunkturforschungsstelle der ETH Swiss Institute for Business Cycle Research" and "Survey public−private knowledge transfer-Ministry of Economic Affairs and NWO/ The research team TU/e, TU Delft and Dialogic"

[14] One of the TTOs is not included in the table because it answers the questions in writing.

As the TTOs did not share the names and e-mail information of the researchers in accordance with the Personal Data Protection Act, the questionnaire link was sent to the TTOs and they were expected to share the questionnaire with the researchers. The TTOs shared the survey link with the researchers who were involved in the project, and the participation in the survey was voluntary. In the survey, personal information is not included and the principle of confidentiality has been observed. This issue is stated in the approval of the ethics committee. Besides, Ethics Committee approval is obtained and sent to the universities by e-mail.

In open-ended interview questions, attention is given to the fact that sincerity is not misused in the light of possible negative answers.

4.1.5 Contribution of the Research to the Literature and Novelty

In this study, assessment of technology transfer is tried to be measured in the university industry collaboration process. In this process, a comprehensive national and international literature review was conducted and all the studies close to the subject were carefully examined and discussed. In addition, a questionnaire was sent to the academicians of 10 university TTOs with 1513 support. On the other hand, face-to-face interviews were conducted with two managers of TÜBİTAK and the TTOs of 9 universities in Ankara. In the study, three methods were used at the same time and a comparison method was used in the evaluation. As there are not enough studies on the assessment of technology transfer in the university-industry collaboration, the study is believed to make an additional contribution to the literature.

In this context, the academicians' view of the technology transfer process, the role of TTOs in this process and the opinions of TUBITAK managers will make an additional and new contribution to the literature.

4.1.6 Limitations of Research

The questionnaire link was shared with 10 TTOs with 1513 support. It was expected that the questionnaire link would be shared with the academicians who carried out projects with these TTOs. However, the TTO of the two universities did not view my thesis work positively and refused to share the questionnaire with the academics. In this context, the survey link was shared with 8 universities and 375 academics. However, the number of responses to the questionnaire was limited to 40. Although it was declared that TTOs of 8 universities shared the questionnaire with the instructors, it was observed that 40 of the surveys were received from 5 different universities but the majority of them consisted of Middle East Technical University and Sabancı University academicians.

In terms of face-to-face interviews with TTOs, a public university did not consider the study positive and rejected the interview.

4.2 Methodology

The method used in the present scientific research should be selected carefully as it is used to express the purpose and result of the research. While the qualitative research tries to interpret the meaning of the data, quantitative research is based on a more testable approach that examines the relationships between variables. Regularly, the refinement between qualitative research and quantitative research is encircled as far as utilizing words (qualitative) as opposed to numbers (quantitative), or utilizing closed (quantitative speculations) as opposed to open-ended questions (qualitative inquiries questions). The mixed method approach brings together the quantitative and qualitative data to enable the research to be more complete and better understood (Creswell, 2015).

In the qualitative analysis method, interviews, document analysis methods and comprehension and interpretation methods are used in the analysis of the data obtained. The qualitative analysis method is appropriate when the course of this study

and the way of reaching the results are examined. Therefore, qualitative analysis method is also applied in this study.

4.2.1 Data Collection

The questionnaire consists of 48 questions. Some of these questions are open-ended questions, while others include questions that were created to determine how much the researchers agree or not. The questions in the questionnaire with ratings were asked in detail. There are 183 questions in total when considered as separate questions. It is presented in Appendix A and B. The survey takes about half an hour.

There are 7 main headings in the survey. These topics include:

A. Information about the researcher

B. Information about your organization

C. Technological Area

D. Collaboration with Other Organizations

E. Knowledge Transfer Channels for Universities

F. Barriers to collaboration with the sector

G. Policies for public-private sector knowledge transfer

Interviews on TTOs consist of 16 open-ended questions. The surveys lasted from 45 minutes to one and a half hours. The questions were answered by the directors of the TTOs or by experts from the university-industry collaboration. The questions are about the structure, functioning and activities of the TTOs, and they also include the obstacles and motivations in bringing together the researchers and industry units at the university and ensuring the transfer of technology. The interview questions are presented by Appendix C and D.

4.2.2 Data Analysis and Report

In the survey questions, all the variables and answers were first transferred from Google Drive to Excel. Then, the data were analyzed by using SPSS Statistics25, one of the licensed programs of METU. Through this program, similar data were collected and compared, allowing an analysis to be performed. Thus, it is possible to reach qualitative results.

In the analysis of the results of the interviews with TTOs and TUBITAK managers, the different answers given to each question were clustered and in general. In order to see whether the findings support each other, explanations are made by comparing.

4.3 Analysis of Findings

4.3.1 Information about Researchers

Given the return rate of the survey on the basis of universities, it is seen that 2/3 out of 40 participants are METU and Sabancı University academicians. 43% of these researchers are professors, 25% are associate professors and 25% are assistant professors. The remaining 3% is in the other group.

90% of the survey participants are faculty members of the Faculty of Engineering and 88% of them are male. However, we also asked TTO managers the faculty and gender distribution of the instructors working with them. We see that there is a 60% male-weighted distribution in general, but in university TTOs with a Faculty of Medicine, this ratio has fallen to 50%. 35% of the researchers have been working in the same university for up to 9 years and 43% of them stated that they have been working for 10-19 years. The remaining 22% is composed of the academicians working for 20 years and over.

30% of the respondents stated that they are in the Knowledge and Communication Technologies Department and 33% of the respondents stated that they are in the departments related to mechanical engineering. However, when it is asked about the

department where researchers are employed, we see that only 15% of them are in Computer and 17% are in Mechanical Engineering departments. Apart from their main research areas, it is seen that they are working in different sectors.

Half of the researchers have already stated that they work for another employer with more than 250 employees. The remaining 35% stated that they are working in non-large enterprises or other institutions (public institutions, universities), while the remaining 15% stated that they do not work for another employer. In the same way, the industry of half of the researchers who work for other institutions consists of Machinery and ICT.

In Table 4, when the mean age is considered, it is seen that 28% is in the age group of 25-39 years, 35% is in the age group of 40-49 years, and 37% is in the age group of 50 years and over. When we look at the number of SCI, we see that 2 people have no SCI, 17 people between 1-19, 11 people between 20-39, 1 person between 40-59 and 9 people over 80. There are 9 researchers with more than 80 SCI papers and 8 of them are over 50 years old. Total number of academicians over 50 years old is 15. As the age increases, the number of papers increases.

Table 4

Comparison between the SCI Papers and Ages

	SCI							
age	0	1-9	10-19	20-39	40-59	80-99	100-+	Total
25-29	1	0	0	0	0	0	0	1
30-34	1	2	1	0	0	0	0	4
35-39	0	2	0	4	0	0	0	6
40-44	0	2	2	2	1	0	1	8
45-49	0	1	3	2	0	0	0	6
50-54	0	0	1	2	0	**1**	**2**	6
55-59	0	1	1	0	0	0	**4**	6
Total	2	9	8	11	1	1	8	40

Considering Table 5, we see that half of the research universities and about 1/3 of the entrepreneurial universities are inventors in any patent. These rates are sufficient for the 2nd generation universities, but not for the 3rd generation universities, which we call entrepreneurial universities. Universities and TTOs that will lead the way should be more active in this regard.

Table 5

Participating as an Inventor in a Patent

Did you participate as an inventor in a patent obtained between 2007 and 2017?	3rd Generation University	2nd Generation University	Total
Yes, individual	0	1	1
Yes, both individually and in partnership	1	1	2
Yes, in a partnership	12	2	14
No	19	3	22
unanswered	0	1	1
Total	32	8	40

4.3.2 Information about Organization

We asked the researchers which types of research are more time consuming. As can be seen from Table 6, the most time consuming research type is the applied research, while the least time is spent on basic research.

Table 6

Time Spent by Researchers on Research Types

	min	**max**
Basic Research	**13**	24
Applied Science	4	**36**
Experimental Science	10	28

In Table 7, a comparison is made between the SCI numbers, ages and the researchers who stated that they devoted the most time to applied research. It can be seen that the ages of researchers who spend the most time on applied research vary widely. 22 of the 36 researchers who spend most time on applied research are under the age of 50 and their SCI papers are fewer. 8 of 14 academics aged 50 and over have more than 80 SCI papers. The others have between 1 and 60 SCI papers. Consequently, the number of SCIs tends to increase with age but generally, it can be concluded that there is not much increase in the number of papers of academicians who turn towards the industry. According to Perkman et al. (2012), researchers who collaborate with industry publish the least number of scientific papers compared to their colleagues, which is not supported by the present study. This is because the process of technology transfer in Turkey does not go back a long way. Moreover, most of the researchers do not want to push their academic identity into the backgroud. For most academics, science has a higher priority and therefore publishing is always a top priority. Thus, the number of publications increases with age, even among researchers who are the most oriented towards applied research.

Table 7

Comparison between the SCI Papers, Ages and the Researchers

max applied science		age								
		25-29	30-34	35-39	40-44	45-49	50-54	55-59	60+	Total
SCI	0	**1**	**1**	0	0	0	0	0	0	2
	1-9	0	**1**	**2**	**2**	**1**	0	0	**1**	7
	10-19	0	**1**	0	**2**	**1**	**1**	1	0	6
	100-+	0	0	0	**1**	0	**2**	**4**	**1**	8
	20-39	0	0	**4**	**2**	**2**	**2**	0	**1**	11
	40-59	0	0	0	**1**	0	0	0	0	1
	80-99	0	0	0	0	0	**1**	0	0	1
	Total	1	3	6	8	4	6	5	3	36

When we consider Table 8, we can see that the number of participants from 3rd generation university academicians is 32 and the number of participants from 2nd generation university academicians is 8. When we look at the number of SCI articles above 80, we see that 9 out of 10 belong to 3rd generation universities. Almost all of the 2nd generation universities and about 2/3 of 3rd generation universities have a SCI number of less than 40. Thus, it is seen that 9 out of 10 SCI articles over 80 belong to 3rd generation universities. In this context, when Table 8 and Table 7 are evaluated together, it is concluded that the number of articles is not related to the university type but the age of the academician.

Table 8

Comparison between Science Citation Index Papers, the Entrepreneurial and Research Universities

Total number of SCI (Science Citation Index)	3rd Generation Universities	2nd Generation Universities	Total
0	1	1	2
1-9	8	1	9
10-19	4	4	8
20-39	9	1	10
40-59	1	0	1
80-99	1	0	1
Total	32	8	40

4.3.3 Techological Field

When researchers are asked to evaluate each scientific discipline separately, 38% of them considered that the fields of medicine and biological sciences are insignificant, 50% of them considered the fields of Economics and Administrative Sciences and Psycholinguistics/Cognitive Studies and 60% of the other Social Sciences area are insignificant. While 50% of the same participants considered Mechanical Engineering significant, 60% of them considered Computer Science as the most important

discipline. Although the minority of the researchers consist of Computer and Mechanical Engineers, most of the participants considered these research areas important. When it comes to the technology transfer process and given that most of the researchers are of engineering background, it is likely that social sciences, chemistry, medicine and biological sciences are not considered significant.

75% of the respondents stated that the knowledge can be expressed primarily in scientific documents. 60% of the respondents did not agree with the the difficulty in transferring knowledge to written documents and the fact that there is embedded knowledge. 80% of the respondents stated that they are expecting big technological developments in the next five years, and they agreed positively. 43% of the respondents stated that they were able to express knowledge in grey literature such as patents and industrial reports, while 38% stated that they abstain and remain neutral. 78% of the respondents stated that knowledge and technology transfer to the private sector is a very important part of their work.

Table 9

Comparison between the Participants who rated Whether TT is an Important Part of Their Work and Those who rated Their Orientation to Applied Research

	Applied research		
importance of TT	max.	min.	Total
little important	5	**2**	7
very important	**30**	1	31
unimportant	1	**1**	2
Total	36	4	40

In Table 9, a comparison is made between the participants who rated whether technology transfer is an important part of their work and those who rated their orientation to applied research. As can be seen from Table 9; 30 out of 36 people who are oriented to applied research stated that TT activity is an important part of their

work. In 3 out of 4 people who are the least oriented to applied research, they found this activity to be insignificant or less important. In other words, there is a consistency between the researchers indicating that they are oriented to applied research and stating that TT is an important part of the work.

Table 10

Importance of Knowledge and Technology Transfer to the Private Sector

Do you see the knowledge and technology transfer to the private sector as an important part of your business?		3rd Generation University	2nd Generation University	Total
unimportant		2	0	2
little important		7	0	7
important		13	5	18
very important		9	3	12
	unanswered	1	0	1
	total	32	8	40

In Table 10, we asked how important they found the knowledge and technology transfer to the private sector. When we consider the results, it is noteworthy that almost 1/3 of entrepreneurial university researchers find this transfer insignificant or less important, while all academicians in research universities find it important or very important. However, in general, 4/3 of all researchers find this transfer important. Even the 3rd generation university, most of the researchers do not want to push their academic identity into the background. In this sense, Table 10 supports Table 7.

4.3.4 Collaboration with Other Organizations

When the researchers are asked how often they collaborate with other organizations, 80% of them expressed that they often collaborate with other departments in their organization. However, the majority of the respondents (45%-60%) stated that they frequently collaborate with the government, non-profit private research institutions, other universities and R&D enterprises. 60% of the participants stated that they did not

collaborate with manufacturers or service providers and private consultancy firms and only a few of them stated that they made coincidental collaborations. Researchers seem to be more inclined to do business among themselves. There are few academicians who provide consultancy directly to the industry. It is concluded that they tend to collaborate with the public or other universities after their own institutions.

4.3.5 Knowledge Transfer Channels for Universities

One of the most important subheadings of this survey is the questioning of knowledge transfer channels. Each question contains a very detailed set of options, and asked how important they are for them. When we consider the most striking results, we see:

90% of the participants find it very important to make scientific publications in journals or books. 70% of the university graduates, especially doctoral graduates find participation in the industry important. Even though they are in collaboration with the industry, it is seen that these researchers have a high level of academic identity and they care about scientific publications and they support their graduates. Within the scope of common R&D, EU framework programs, carrying out projects with the sector, conducting other R&D projects with industry, consulting with industry, financing of doctoral projects by industry and personal contacts with university staff are important at 70-75%. A communication that can be established through the graduates or through the students working as an intern in the sector is 63%. 50% of the participants do not find this issue very important when it comes to transferring knowledge within the patent texts of the patent offices or in the patent database. As a source of knowledge, only 50% of the researchers find knowledge transfer activities organized by university TTOs, spin-offs, licensing, granting industry know-how and licenses important. Since these mechanisms provide great funding to researchers and the university, they have been asked in similar ways on different topics. However, only half of the researchers stated that they found these mechanisms important.

Table 11

TT Organised by the University's TTOs

Importance of knowledge and technology transfer activities organised by the university's Technology Transfer Offices	3rd Generation University	2nd Generation University	Total
unimportant	1	0	1
little important	1	2	3
important	20	0	20
very important	7	6	13
unanswered	3	0	3
Total	32	8	40

When we look at Table 11, we see that 4/3 of entrepreneur and research university researchers find the activities carried out by university TTOs important. Thus, we can conclude that the researchers trust their university's TTOs. In this context, it is seen that TTOs are following a good way to gain this trust and they should be in the forefront of mediating TT activities.

We asked if academics are involved in spin-off and start-up activities and wanted to know how much they care about spin-offs. As can be seen from Table 12, we found that an academician who participates in any spin-off activity does not see this mechanism as insignificant, but those who do not participate in this mechanism find it insignificant. We also see that some of the researchers who set up start-ups find spin-offs insignificant. On the other hand, the number of researchers who do not set up any spin-off but find this mechanisms barely important seems quite high.

Table 12

Comparison between Academics Involved in Spin-off or Start-up Activities and How Much They Care About Them

	importance of spin-offs					
involvement in a spin-off	unanswered	unimportant	little important	important	very important	Total
yes	1	**0**	0	5	4	10
no	1	**4**	12	9	3	29
unanswered	0	0	0	1	0	1
Total	2	4	**12**	15	7	40

	importance of start-ups					
involvement in a start-up	unanswered	unimportant	little important	important	very important	Total
yes	2	**3**	1	5	3	10
no	0	**1**	11	9	4	29
unanswered	0	0	0	1	0	1
Total	2	4	**12**	15	7	40

Table 13, distinguishes according to category of entrepreneurs or research universities whether the researchers participate in any spin-off or start-up activity. Almost all of the university academicians that we have included in the research university category do not take part in any spin-off or start-up activities. On the other hand, we see that about 1/3 of the academicians working at entrepreneurial and innovative universities have spin-off and about half of them have start-up activities. These results also support the Table 13. These mechanisms are not found important although it is considered an important criterion in the EIUI, it is seen that even the 3rd generation university is not active enough.

Table 13

Involvement in a Spin-off and a Start-up Business

Have you had any personal involvement in a spin-off business during the past 10 years?	3rd Generation University	2nd Generation University	Total
Yes, I became a partner in a spin-off company	9	1	10
No, it didn't.	22	6	28
unanswered	1	1	2
Total	32	8	40

Have you had any personal involvement in a start-up business during the past 10 years?	3rd Generation University	2nd Generation University	Total
Yes, I became a partner in a start-up company	14	0	14
No, it didn't.	17	7	24
unanswered	1	1	2
Total	32	8	40

It is seen that 73% of the participants do not have any partnership in any spin-off activities, while 63% of them are not involved in start-up activities, only 35% of them are partners in a start-up company. In the interviews with TTOs, it is observed that researchers cannot take part in mechanisms that enable technology transfer such as spin-offs and start-ups. In university TTOs, the number of these mechanisms involving academics is either insufficient or most of the existing ones are inactive. Spin-off and start-up activities, which are the basic mechanism of technology transfer, are not used sufficiently in our country. However, according to Göksidan et al. (2018) start-up firms is one of the most intermediary for technological and innovative capacities. Furthermore, most OECD countries are implementing applications such as income from patent licensing, and participation in spin-offs or start-ups to encourage

collaboration and reward researchers. They offer additional funding to universities if they contract the industry with spin-off or start-ups at a certain level (Guimon 2013).

Table 14

Comparison between Academics Involved in Spin-off or Start-up Activities and the Importance of Patent Licensing the and Giving the Know-how Licenses to the Industry

	patent licensing and giving know-how to the industry					
involvement in a spin-off	unanswered	unimportant	little important	important	very important	Total
unanswered	0	0	1	0	0	1
yes	1	**0**	1	4	4	10
no	1	**3**	13	8	4	29
Total	2	3	15	12	8	40

involvement in a start-up	unanswered	unimportant	little important	important	very important	Total
unanswered	0	0	1	0	0	1
yes	2	**2**	1	5	4	14
no	0	**1**	13	7	4	25
Total	2	3	15	12	8	40

Similarly, we asked researchers the importance of patent licensing and giving the know-how licenses to the industry. We have come to the conclusion that there are very parallel results with the Table 13, and most of those who do not engage in any spin-off or start-up activities find these unimportant.

Table 15

Comparison between Academics Involved in Spin-off or Start-up Activities and Knowledge Transfer Activities Organized by TTOs

	Knowledge transfer activities organized by TTOs					
involvement in a spin-off	unanswered	unimportant	little important	important	very important	Total
unanswered	0	0	1	0	0	1
yes	1	**0**	**1**	3	5	10
no	1	**4**	**12**	8	4	29
Total	2	4	14	11	9	40

involvement in a start-up	unanswered	unimportant	little important	important	very important	Total
unanswered	0	1	1	0	0	1
yes	2	**2**	**4**	3	3	14
no	0	**2**	**9**	8	6	25
Total	2	4	14	11	9	40

Finally, when the same researcher group is asked about the knowledge transfer activities organized by TTOs, the results are very parallel with the Table 14. All academics with spin-off partners consider the transfer of knowledge made by TTOs important. However, some of academics who have a partnership in the start-up activity find transfer of knowledge made by TTOs unimportant. Similarly, 1/3 of these two groups do not find this knowledge transfer sufficiently important.

We asked the academics how they carry out technology transfers and how important it is for them. 82.5% of the researchers stated their PhD projects are in collaboration with the sector; 77.5% stated that thesis projects and long-term research contracts with the sector are the most important methods. Half of the researchers do not consider it important to attend private sector workshops, conferences or training programs, to read or cite academic publications of research laboratories, and to organize joint laboratory

or teaching courses and programs with the industry. Consultancy, informal contacts, usage of technical facilities or research centers in the R&D departments of the business sector, student participation in private sector, communication with former staff and research consortia, etc. are found important only by about half of them. They also stated that they use these mechanisms.

Table 16

Comparison between Age and Informal Contacts with the Private Sector

	importance of informal contacts with the private sector				
age	unanswered	unimportant	little important	very important	Total
25-29	0	0	**1**	0	1
30-34	1	0	**1**	2	4
35-39	1	**1**	0	4	6
40-44	0	0	**2**	5	8
45-49	1	**1**	**3**	2	6
50-54	1	0	**2**	3	6
55-59	3	0	**3**	0	6
60+	0	**1**	0	2	3
Total	7	3	12	18	40

According to Table 16, informal contacts with the private sector were found to be significant by about half of the researchers. Only 5 of the 14 academicians who stated that they were insignificant or less important were 50 years old or older. This result supports the argument by Perkmann et al. (2012) suggesting that it affects personal contacts and seniority.

After informing that knowledge and technology transfer could be from industry to university, it was asked how much this method is used by the researchers. 30% of the researchers stated that they never used the knowledge and technology transfer from industry to university, 38% of the researchers have used merely, and only 20% of them stated that they have used it mostly.

Table 17

Comparison between Researchers' Age and Participation in Private Sector Activities

	Participation in private sector activities (workshop, conference etc.)				
age	unanswered	unimportant	little important	very important	Total
25-29	0	0	**1**	0	1
30-34	1	0	**2**	1	4
35-39	1	**1**	**1**	3	6
40-44	0	**1**	**4**	3	8
45-49	1	**1**	**2**	2	6
50-54	0	0	**5**	1	6
55-59	0	0	**3**	3	6
60+	0	0	**1**	2	3
Total	3	3	19	15	40

Table 17 shows that any work or knowledge transfer that may be received by the industry is not considered enough. Approximately half of the participants find it less important, or some of them find it unimportant.

In the question of the importance of interface mechanisms or tools in the transfer of knowledge and technology, it is seen that all the tools in the options are given importance. 80% of these researchers find patents and TTOs important, 78% of them find academic publications and technoparks important. Licenses, spin-offs and start-ups are found technology transfer mechanism the least important. Moreover, these questions support the tables above and these mechanisms are not very important. Technology Transfer offices are considered important but it is understood that there is a problem in the way of transferring knowledge.

When it is asked how often universities used their TTO in the last ten years, only 45% of the respondents respond frequently, 30% responded occasionally, and 15% said they rarely used or did not use it at all.

It was concluded that the researchers are informed about the rules and processes of the principles of 1513 support, and 1/3 are partially informed and the rest are not aware. Similarly, the answers to the question of whether they found this program supportive or not are in parallel with the question.

When it is requested to assess knowledge/technology transfer activities in their universities, more than 70% of the participants find it successful. The result is expected to be positive as almost all of the participants who answer this question are from SABANCI University and METU.

When we ask academicians about their goal in making technology transfers, it is understood that the most important goal for 83% of them is seeking resources to develop research opportunities. This finding overlaps with the finding by Perkman et al. (2012) suggesting that academics tend to collaborate for the goals where they reveal their expertise rather than being involved in publishing activities. 68% of respondents state that they have an aim to have cost savings and additional funding to expand basic research and university mission, and to provide practical experience for staff and/or students. Commercial success, the performance of the image of science, the dissemination of R&D findings among the public, to promote the dissemination of a certain technology, to provide job opportunities for students and/or institution personnel in the private sector, to obtain patents, licenses, to have understanding of additional research, to exchange ideas with industrial researchers, and to have new research targets such as the incentives and the performance of some projects in collaboration with the industry are in the range of 45% - 55%.

Half of the respondents thought that access to the technological equipment of the private sector or specialized technologies was important, while the other half stated that it was not important. 48% of the respondents find the collaboration with the private sector for more public funding and the access to certain capabilities for completion of expertise in the institution insignificant, while only 35% pointed out that those are important. 45% of the researchers considered the transfer of technology in order to

gain practical and useful knowledge for curriculum important, while 35% considered it insignificant. In order to obtain knowledge about the practicality of the curriculum, 45% of the purpose of the technology transfer was considered important and 35% stated that it was not important.

We can see that academics do not have any concern for curriculum in technology transfer and they are not very open to access to any equipment / technology that may come from the industry.

Only 48% of the researchers think that their research is turned partially into value through publication, while 30% do not think that they turn into value. Almost all of the researchers paid attention to scientific publications, but the fact that half of these publications did not turn into any value may have caused them to be more oriented towards university-industry collaboration.

Only 28% of the participants stated that the commercialization activities were an important part of the business and 33% of them gave a partial answer to this question, while20% of them answered no. Only 40% of the participants have stated that they are considering making an attempt to commercialize their research. We now know that 78% of researchers think that technology transfer is an important part of their business. However, we see that they do not adopt commercialization activities and only 40% of researchers think about commercialization. In this sense, it is understood that academicians are open to collaboration but need support for commercialization. Therefore, TTOs have a big and critical role in this sense. Given the perspectives of academicians, we are of the opinion that they are not adequately supported by TTOs. That's why half of the respondents believe that commercialization activities should be encouraged and just half of the participants state that their universities have a policy/strategy for commercialization activities. When academics are asked whether they think the university administration gives importance to commercialization activities, 37.5% of them give a positive answer and 35% of them give a partial answer.

As a result of technology transfer, 35% of respondents point out that their financial status has not changed and that nearly half of them (48%) have obtained additional resources for research.

As a result of the technology transfer, 38% of the researchers observed that the research orientation did not change and 53% of the researchers were more interested in applied research. As a result of technology transfer in parallel to and supportive of this response, 45% of the participants received in-house training activities for more applications and this situation did not change for 40% of them. As a result of the technology transfer, these institutions have a better scientific reputation than their counterparts. These results support the answer to the high number of applied research when asked which research field they are in.

4.3.6 Barriers to Collaboration with the Sector

This section is of great importance in seeing the problems that can be experienced with industry in the process of technology transfer from the eyes of academicians and taking the relevant measures.

In fact, the researchers have participated in the 80% of the industry's lack of interest in scientific projects and 72.5% in the difficulty of acquiring knowledge about research activities in the private sector. At this point, TTOs should also take the lead and be able to take actions by raising awareness of the deficiencies in ensuring collaboration. Only through TTOs that serve as bridges for both sides, this collaboration can be sustained efficiently.

In this section, the difficulty of finding suitable partners in the private sector, insufficient equipment (lack of TTO capacity), lack of qualified personnel in the industry, and very low R&D budgets of potential business partners are stated as significant obstacles at 67.5%. In the range of 55% - 65%, such obstacles include requiring a lot of time for teaching, lack of academic experts for knowledge and technology transfer, not receiving enough attention from the research industry,

uncertainty of R&D results, different expectations of the sector in terms of costs/efficiency, lack of confidence, excess of procedure and legal restrictions. Academics did not consider impeding the activities of academic publications as an obstacle. In terms of their own institutions, both positive and negative answers have been given to the question whether there are inadequate research areas in the private sector and whether the staff of the institution is sufficiently entrepreneurial. Half of the participants stated that the technical facilities of the companies are insufficient, and they do not have the opportunity to commercialize their findings. We also undestood that their institutions are not supportive in the commercialization of the findings and there were problems of property rights. Again, half of them stated that project management support is inadequate.

The lack of sufficient time for commercialization activities due to the intensity of academic activities, the lack of public support to promote commercialization (content, application requirements, evaluation processes, accessibility, service quality, etc.), insufficient public budget support to encourage commercialization, lack of knowledge and experience on commercialization and the inadequacy of commercial activities in the academic promotion and incentives, the reluctance of the private sector for R&D activities, the inadequacy of the knowledge of the companies, the different institutional culture of the parties, the economic risks of commercialization, the inadequacy of intellectual property rights legislation and the problems that may be experienced in this regard are listed as important obstacles. 1/3 of the researchers do not participate in the options that the supports are more oriented towards research and development and do not adequately cover the commercialization phase and the institutional structures (TTO, patent offices) to mediate the commercialization activities are not sufficient, while 1/3 of them are undecided. 33% of the researchers agreed with the opinion that universities do not offer sufficient support and the use of the products resulting from R&D activities if regarded risky by the private sector while 40% of them abstained. Half of the academicians agree with the option of lack of practical research, while the other half disagreed. According to Norman and Eisenkot (2017), it

is important that the university supports its academicians in their activities towards collaboration.

60% of academicians reported that the active enterprises in their discipline used very little of the knowledge available at the university. The options that the industry is not interested in the knowledge produced at the university and the universities are not willing to spend time and money on transferring knowledge to the industry have come to the forefront.

4.3.7 Policies for Public-Private Sector Knowledge Transfer

When asked how the researchers were funded during the knowledge and technology transfer process, we see that they are financed directly by government, commercial financing (contracted), grant-based indirect government financing, private non-profit research institutions based on financing and EU, other European projects.

When asked about the tools to improve the collaboration of the state within the scope of the research; prominent options include preparing university programs for the research and awarding of the research outputs, giving financial and other support to TTOs, using tax policies such as tax deductions on R&D, giving support in the start-up phase of the new technological enterprises, support to organizations that are bridges for R&D, providing support to organizations and establishing policies to improve the entrepreneurship climate at universities.

The researchers were asked what mechanisms the government should have to promote collaboration with industry as an open-ended question. Within the framework of the expertise of the universities, there are some suggestions such as developing incentive mechanism for the appropriate industrial organizations, enabling the lawsuits are finalized in a shorter time, the creation of consortium calls, not only financial support but also the training of expert staff and the adoption of approaches to accelerate the conduct of research projects.

4.4 Evaluation of Interviews with TTOs

4.4.1 The Structure and Personnel of TTOs

In this section, I will analyze the status of TTOs, as well as the sources and staff of finance.

We see that TTOs are established in the form of an administrative unit, a unit within a foundation, and a unit in Teknocity Inc. or as a Joint Stock Company. The number of personnel they have ranges from 2 to 22. Before mentioning funding resources, it is useful to note: In addition to the support of 1513 program in all TTOs except METU, TÜBITAK projects, Revolving Fund projects, Development Agency supports, revenues from industrial projects, commercialization revenues, University-Industry collaboration revenues, guidance provided to other TTOs, support provided by the university, and academic consultancy services are carried out through these TTOs. However, in METU, revolving fund projects, EU projects and TUBITAK projects are assigned to different offices.

We see that there is no financial incentive system for the personnel working in TTOs, (only at the end of the year there may be an additional raise at the university A and at the university D) but there is an opportunity to participate in the training and to be encouraged to them. However, this can be attributed to the necessity of training in 1513 support.

When asked about the existence of the risk management in TTOs and whether they have mission definitions, we often find that they cannot be answered directly because they are either written on paper or on websites. In particular, we see that risk management exists on TÜBİTAK's request but there is no sanction. However, according to Galan-Muros et al. (2015), it is emphasized that the mission definition should be based on collaboration. When the mission is seriously focused on, this mission will be set as a real purpose and tried to be achieved. Only the university D gave detailed information on this subject and mentioned that TTO outputs in

compliance with 1513 performance criteria are monitored through 4 interim evaluations annually.

4.4.2 Outputs and Self-Sufficiency of TTO's

When we ask TTOs for information on their patents and licensing, it is seen that apart from the fact that there is one license from each of the universities A and F, the licensing is not made and the number of patent applications varies between 2 and 386. The number of corporations established is also very low. Some start-ups of TTOs appear to be inactive. The TTOs in the university D has established 7 spin-off companies to date, and has made more than 25 commercialization agreements, resulting in a commercialization revenue of more than 250,000 €. The management of TTO of the university A stated that although the number of start-ups, spin-offs or patents are quite high, these activities are not carried out through the TTO. It is observed that this information is reported to the TÜBİTAK every three months, and to their own managements well.

Compared to patents, we understand that licenses are more preferable. This is because the process of obtaining a patent is very long and difficult. We understand that TÜBİTAK is pushing for the license. We have found out that the license is issued through a prototype. It is stated that licensing can be made after the technological readiness level 3 but it is generally preferred to have the level 4-6. There is no obligation to obtain a patent for licensing. The industry-sponsored research rate ranges from 40% to 67%. The industry-sponsored research rate of the TTO in the university B, which is good in terms of efficiency and number, is 40%, whereas the TTO of the university H, which states that it has not yet achieved its self-sufficiency, is 60%.

According to Bercovitz and Feldman (2006), sponsored research, licenses and spin-offs are the core components of the university-industry collaboration. This is because sponsored research develops applied research in a university. Licensing and other

technology transfer mechanisms ensure the supply of funds to the company during the transfer process. TTOs in the city of Ankara are not successful enough in this context.

We are informed that the most preferred technology transfer method is to establish start-ups. Academicians, especially from the Faculty of Medicine, are more inclined to make a profit from their firms and achieve better. Thus, they will earn more revenue and provide additional employment. The TTO in the university T stated that they started by explaining how difficult it is for the academicians to establish a firm. At this university, priority is given to education at the request of senior management, and researchers are not insisted on being entrepreneurs for data. Thus, academicians do not look forward to establishing start-ups. The same TTO has already stated that academics should not establish a company, but only when they are partners, more efficient results are achieved because their management skills are not very good. TTO of the university A mentioned that the students establish more start-ups because they give more importance to research. Academics are very good at these companies and they achieve very good results by directing students. In the university F, there is a similar situation and when they compare this situation with patent and licensing, they state that they have less patents and licenses because of distrust, lack of understanding or high expenses. These negative statements support the articles by Guimon (2013) and Zuniga and Correa (2013). According to their research, legal and operational deficiency, problem in finding the right partner, inefficient management of the intellectual property, or the fact that the researchers do not allocate resources to the commercialization efforts also have a negative effect on the technology transfer. In this way, technology transfer is prevented and expectation and interest inconsistencies are experienced. In most of the OECD countries, incentive awards have been given to researchers to encourage collaboration and strengthen these mechanisms (Guimon, 2013).

We asked whether universities have any incentive system in order to direct the number of disclosures and technology transfer. We have seen that TTOs informing about the numbers have invention notifications with an average of 20 decks. In the TTO of a

newly founded foundation university, there is no disclosure of the invention yet, while the TTO of the university D has 37 in 2018. We have learned that universities attach importance to this issue and they provide incentives. We see that the projects such as patent application or industry-supported project construction in the university E, which has an academic performance system, are included to this system and their salaries are evaluated accordingly. In theory, we have found out that an associate professor can receive a higher salary than a professor. Moreover, we are informed that the university G received bonuses at the beginning of a project or in national or international registrations by applying the reward system. In the university G, we are informed that the award system is applied in the accepted projects and national/international registrations. The same university stated that it has given priority to projects that have a potential in general and have reached a certain technological level. According to Xu et al. (2011), the disclosure of the invention is a quantitative measurement method used in the freedom of financing of the TTO. In this context, it is observed that TTOs do not have a desired level of disclosure.

The university A did not give data about the disclosure of an invention but stated that they do not have any official incentive and reward system. It has been stated that there may be a reward behind closed doors based on the invention and the instructor, but more importance is attached to the research and major publications in the university. According to the new law (6769 Intellectual Property Law), inventions must be primarily on behalf of the university. However, due to the high expenses required in the notification of the invention, we have found out that universities prefer better quality discoveries as they do not want to meet this cost.

The TTO manager of the university E mentioned that there is an executive committee within their organization. They are prioritized and supported by academicians who have previously filed a patent application, who have many projects and who come with a project in hand, but who are not financially inadequate. On the contrary, the TTO in the University F stated that they are working on the number of TÜBİTAK targets and they do not find much support from the management.

We see that TTOs are in profit and ensure their sustainability in terms of their self-efficiency, although they do not have 1513 program except the two of them. It is seen that TTOs, which have high project revenues or funded by the universities, will ensure sustainability even if the 1513 program ends and they will not have any personnel concerns. Moreover, since the industry, TUBITAK or international projects have passed through here (except METU), the absence of the 1513 program does not seem to have much effect. Only the TTO management of the university H stated that the discontinuation of the support would create difficulties for them and that they could go as far as reducing staff. In this context, METU, which does not work as Project Support Office and has a structure that meets the expectations of TÜBİTAK, does not justify its self-sufficiency.

4.4.3 TTO's Ways of Self-Promotion and the Motivation of the Parties to Ensure University-Industry Collaboration

In general, it is seen that all the projects are carried out through TTOs and academics are already visiting TTOs. Thus, it was understood that the researchers are informed about the university-industry collaboration, patent applications or start-ups. However, it is stated that the most effective and most frequently used method is visits. Within this scope, regular visits are made both to the industry and academicians. When looking at the TTOs of the larger universities, it is seen that they have a stronger collaboration with the President's Office and deans, and the requests for announcements from TTOs are carried out through them and presentations are made based on these interviews. As the number of academicians in smaller universities is less, it is seen that TTO employees know almost all of these academicians and they have knowledge about their fields, while it is seen that TTOs of larger universities work more institutionally. In this sense, it is noteworthy that there is a system that includes knowledge about academics, fields and even personal notes about personal characteristics. There are documents indicating which researcher works in which areas, and which projects he/she is carrying out. Social media is also used extensively for publicity. To do this, TTOs also have an outsourcer or communication specialist.

Therefore, it is seen that there is a communication problem between the two parties and they think differently.

At the industry level, TTOs have been declared to carry out activities such as cooperating with industrial committees, industrial zones and conducting one-on-one meetings with firms. For university TTOs with its own Tecnopark, it can be easier to match firms and academicians. However, these universities are more inclined to give priority to their firms and academicians in order to not to expand externally. As the industry is tired of previous visits, we see that the new TTOs have aninability to enter the system in terms of introducing themselves to the industry.

In the early days when TTOs were newly established and little known, TTOs agreed that there were such cases where researchers made direct discussions with firms and made projects, and the academic side had less financial gain.

The priority regarding how the parties are motivated is given to the high number of financial means. Academics are more prone to the projects where they make higher income. At the same time, the qualitative elements such as the advancement of their academic career, their increasing awareness of the industry or networking also play an important role in the motivation of academicians. This result, which came out of the statements of TTO managers, seems to be consistent with the purpose as stated by D'este and Perkman (2010) in their paper. Nevertheless, we see that there are very successful academics who are not motivated by the money. These researchers are those who wish to use the project solely for the purpose of financing their own research. On the other hand, there are academics who think that they cannot get the support they deserve due to the reasons such as the failure of the commercialization of their inventions, the lack of academic satisfaction, the lack of adequate support from the university or the market. We are informed in the university B, a very new research university, that university-industry collaboration is more prominent compared to the academic direction, and that its researchers have considerable financial gains by doing various projects. As they are very new research universities, it is seen that they just

started to give - weight to this direction and to receive instructions from the management in this regard and therefore, they started to give importance to the projects they have never considered before.

When we look at the motivation of the universities, we see that more research is done but there is no Money coming out of their pocket and they have both financial and career-wise gains.

When we look at the factors that motivate the industry, we see that the priority is given to the costs. They aim to get more returns with less costs in less time. Increasing the competitiveness and market share by increasing the use of technological and scientific knowledge is among the targets of the industry. However, with the high competition in a turbulent economy like Turkey, how much time will be allocated to technology transfer and long-term R&D studies is ambiguous. Since the ministries force industry to establish R&D centers, the industry is also pushed to work with academics. In addition, they also want to work with the academician, since the acceptability of a joint project presented with an academician will be high. On the other hand, it is stated that also the industry does not like the attitudes of some of the academicians and there are also some companies where the opinion that "Invention and licensing cannot be made without me" is prevailing. On the other hand, there are cases where the academician and the company come together often. In this case, they take on the role of collaboration and mediation for both parties to TTOs.

We understand from the interviews with the TTOs that if the academician has never provided consultancy before, s/he may explain theoretically or, rather, prefer not speaking, and even if s/he is very competent at his/her job, s/he cannot carry on with the industry. While the industry expects outputs as soon as possible, the academician is looking for more long-term recruitment. This is because the academician wants to have articles from this business process and to ensure sustainability in the sense of carrying out a thesis. In this sense, both sides speak different languages. Therefore, the TTOs must be involved from the very beginning. The possibilities are discussed with

the industry. In this sense, personnel sustainability comes to the fore. This is because long-term staff are well aware of the academics, they are aware of which organization they can/cannot have collaboration. First, the TTO in the university B stated that they are focused on their own researchers. Money had not been mentioned between the parties. They are based on the request of the academician provided that it is reasonable. The researchers preferred working with the people they were accustomed to, and that they had trouble if they could not find them. Friedman and Silberman (2003) stated in their study that personal relations and network are important in technology transfer and this happens over time. In this context, older TTOs seem to be more advantageous. In this sense, we see that personnel sustainability is important, on the contrary, almost all TTO officials complained about lack of experienced staff and the high number of staff circulation. Reasons for high circulation can be listed as follows; it takes a lot of time to train new graduates, experienced staff start their own companies or provide consultancy services in larger companies. Within the scope of the 1513 program of TÜBİTAK, we conclude that there is no defined workflow for the personnel and the constant change in the TTOs is a problem.

4.4.4 A Critical Overview of Implementation Principles of 1513 TÜBİTAK Technology Transfer Offices Support Program

We asked managers of TTOs how they would design the 1513 program or whether they want to change this program. All of them complained about similar issues: parameters change continuously and they cannot adapt to this situation. Due to the changes in performance indicators every year, traceability cannot be achieved. Therefore, no comparison can be made with the previous year. Furthermore, they cannot adapt to new structure because of the constant change. In general, they claim that they have no freedom.

The high frequency of reporting causes TTO employees to devote most of their time to the reporting process. Moreover, the same data is given to the Council of Higher Education (YÖK), the Governorate and the Ministry of Industry in different formats. Considering that they made their planning and preparation according to the previous

year, TTOs are being challenged by the changing implementation principles or performance indicators during the year.

Another issue is that the targets and expectations are set too high without considering the different size and volume of all TTOs. This is because if the performance cannot be achieved according to the new system, the money will be deducted and a punishment system will be implemented. Therefore, they do not find the program encouraging.

The fact that the grants are not paid on time, the application and evaluation process takes a long time and the costs are increasing are among the reasons that make the collaboration difficult.

4.5 Evaluation of the Interviews with TÜBİTAK

A face to face interview was held with the Head of Entrepreneurship Support at TÜBİTAK, and Deputy Group Coordinator of Technology Transfer Mechanisms Support Group and detailed information about 1513 support programme was obtained from them. They were asked deficiencies of the programme, whether the program met expectations and created added value, and how they would design it now. First of all, we have find out that, there was a one-year design process when this program started. At the beginning of the program, there were different views on whether all TTOs should be given equal support, and consequently, it is foreseen that equal amount of support will be given to TTOs which are entitled to receive support according to the EIUI.

However, they also acknowledge the deficiencies of the program and state that the program was revised in 2018. As described in section 3.7 the first 5-year period was mentioned in this program, but the next 5-year process was called as an additional period and no clear information was given. As of 2018, the program has been presented more clearly. This is because it was mentioned that the module concepts included in the support program in 2012 created a framework but they stereotyped the TTOs. The

reason is that as universities have different heterogeneous structure, it is understood that the same money with the same support program will not have the same results in different universities. In this sense, this support process is grouped under 2 sections and the first step called “Developing of Institutional Capacity” aims to provide 80% support by covering the first 5 years. The aim of this support is to provide physical and human infrastructure in universities to institutionalize the HR and to reflect the strategic plan objectives. The second five-year period, referred to as the “Target-oriented growth phase” covers the period in which the targets are set and the TTOs seem to have difficulty in delivering these targets. Thus, TTOs are forced to update themselves and keep them dynamic. In this context, the rate of the support will vary between 40% and 80% depending on whether they can meet their goals. We are informed that weight is given to the challenging areas they have fallen behind and that they are given support to this end. As the outcomes of this practice will be seen this year, it is not yet clear how efficient the new system will be. However, it is understood that they are working hard in this way: According to EIUE and TTOs, targets are determined based on the surveys administered to TTOs. How much expenditure is spent on resources of income and international studies is reviewed in the determination process. The aim in step 2 is to encourage TTOs to be promoted with the awareness that the better acquires better. It should be emphasized that the awareness module should not last so long and the only aim should not be awareness. In spite of all these, TÜBİTAK informs that the targets are determined by TTOs but pushed a bit more by TÜBİTAK.

Given the performance indicators, we see that they are in parallel to international metrics by scanning the entire literature. There are 14 categories in the indicator and parameters such as the number and budget of contracted R&D projects funded publicly or fully by industry, number of declarations of the invention, number of national/international patent applications and the number of -registered ones, number of license agreements and the revenues obtained, number of firms established and the revenue obtained. The amount of support varies based on the rate of performance.

Whichever performance indicator a TTO lags behind, the focus on the indicator will be increased in order to improve the performance.

We are informed that universities should now focus on patents and licenses because in the new strategic plan they are also informed that their goals have changed in this direction. Together with the new industrial property law, priority is given to the universities and they can turn to this an advantage. Universities are not allowed to establish companies under normal circumstances except TTOs; however, YÖK made a regulation for researchers to establish companies through TTOs.

In response to the question of whether it creates added value, we learn that only several universities in the United States that considerable financial gain has been generated through one or two drug molecules. As the university-industry collaboration is more common in the United States, they are more successfull. This collaboration culture is developing recently in our country. They find it enough when a TTO covers their expenses. In our country, TTOs are not at this stage, but they have the relevant potential. According to the management of TÜBİTAK, our university has high level researchers, but when we look at the world average, our research quality is low.

TTOs are criticized with regards to personnel circulation by TÜBİTAK. They are criticized that their business processes are not institutional and they work just to earn money. However, it was stated that staff of TTOs should work as they are in the private sector and they should embrace their job. While they are expected to be nested within industrial zones, it is complained that they are located in plazas still without no license.

According to the management, the university administration should make a clear distinction between where to allocate resources. As the support for 1513 will eventually end, it is stated that it is necessary to think how to obtain income outside the support. In addition, it is proposed that start-up activities can be established by PhD students under the supervision of academicians.

Strong targets should be set by TTOs. Otherwise, they would be in a difficult situation when the 1513 support was over. It is mentioned that outputs are obtained but the consequences and effects are insufficient, and they should be approved more by the industry. Otherwise, at the end of the 1513 support, most of the TTOs would work as project offices and do secretarial work.

4.6 Concluding Remarks

In this study, assessment of technology transfer is tried to be evaluated in the university industry collaboration process in Turkey. In this context, a questionnaire was applied to the academicians, face-to-face interviews were conducted with the TTOs in Ankara and interviews were conducted with the relevant managers in TUBITAK. However, no survey or interview work has been conducted by the industry with any institution, which can be stated as the deficiency in this study. Below is a section where all the interviews are compared.

First of all, participation in the survey is limited. It is seen that the participants of the survey is mostly from engineering faculty and male, but it is understood that this has a more balanced distribution in interviews with TTOs. It is concluded that researchers move away from basic research to more applied research. While there is a direct correlation between the number of SCI papers and age, the age of the academicians and the number of SCI papers indicate that they are oriented towards applied research, and it is seen that applied research is important in this age range.

When we look at the collaboration with other organizations, we see that the researchers primarily collaborate with other departments in their own institutions and the half of them on average work with other universities and public institutions. At this point, we can conclude that TTOs, which have Technoparks in particular, do not cause their academicians to work outside. In this regard, the TTO in University B, which has its own Technopark, also said that they work diligently with the academicians of other universities and they are satisfied with that. They may collaborate with other

universities for reasons such as the deductions in their own universities, or the failure of adopting the policies of their own universities.

Although collaborations, projects and consultancy are important, it is more important for the researchers to have academic credentials and to write scientific papers. At this point, TTOs must work very effectively and know the academician well and make the matching correctly. Otherwise, no effective collaboration will be possible. At this point, the circulation of personnel again comes to the fore. As it is understood from our research and studies in the literature (Campell 2007, Norman & Eisenkot 2017), the presence of expert personnel who are trained in the TTO is important, and the personnel sustainability facilitates the collaboration process.

It is seen that most of the researchers are not involved in any start-up and spin-off activities. For the Entrepreneurial and Innovative University Index, these mechanisms are at the forefront and play an important role in the scoring of universities. In fact, this shows that universities are willing to be encouraged in this direction. However, even in 3rd generation universities, participation in these mechanisms is not sufficient. The importance of scientific publications is a priority and academicians do not want to keep their academic identities in the background. Moreover, some TTOs think that researchers' partnership with industry should not be more important than their academic identity of academics. Therefore, it can be provided to support the industry through the academic consultancy through doctoral students or alumni. In addition, as TUBITAK managers mentioned, the fact that TTO personnel are not sufficiently specialized, work without taking ownership of the job or the offices have a cumbersome structure prevents them from being successful. For this reason, it will be difficult to collaborate for the employee who cannot give positive energy to both sides.

Similarly, even though the TTOs have been pushed by TUBITAK on patent and licensing issues, we see that university academics do not care much about licensing, and very few of them think about commercialization. Rather than the reasons for the difficulty of the long duration of obtaining patents, we see that academicians are

reluctant in the commercialization process of the technology transfer activities. Besides, researchers do not think that the industry has a sufficient capacity.

A large number of academics think that the industry has not paid enough attention to their work. TTOs have considerable amount of work on this issue and they need to develop their ability to understand and reconcile clearly the demands of both sides. This is because the same approach can be directed towards academics from industry. There may be cases where industry is not satisfied with the actions of the academics and thinks that they are in need of the industry.

Regarding the 1513 support program, the constant change in the performance indicators confirms that TTOs are in confusion among themselves. Although all of TTOs' structures are different from each other, it is understood that parallel outputs can be expected from all TTOs, which discourages the TTOs to work.

In this study it is seen that with the 1513 support, awareness has been raised, the parties have been socialized with each other and good interaction and network have been ensured in the university-industry collaboration. However, in this collaboration, the result and impact of the technology transfer is not sufficient, and the mechanisms of commercialization remains inadequate.

If we consider the hypotheses again with these results, we see that:

1- Researchers are willing to participate in university-industry collaboration even though some of them are searching for resources for scientific purposes or work for only teaching purposes.

2- Even though managers of TTOs think that they are well-known in the interviews, when the results of the survey and TUBITAK interviews are evaluated, TTOs are not active enough in collaboration process.

CHAPTER 5

CONCLUSIONS AND POLICY RECOMMENDATIONS

This study starts with the introduction of the processes of change starting from the first establishment process of universities to the present. Universities were first established for educational purposes; however, research mission was also included under the influence of religious, economic developments and wars in the world. Due to lack of financial resources, the necessity of taking an entrepreneurial role arose.

In this context, the production of knowledge in universities has become institutionalized, leading the university to have an entrepreneurial role, and the transfer of this knowledge to the industry has led to the establishment of university-industry collaborations. Technology Transfer Offices have been established in order to bring these two different structures together in a sound way and they are expected to be an interface in technology transfer processes. With the establishment of TÜBİTAK 1513 support program in 2013, Technology Transfer Offices have become widespread and recognized in Turkey. This process obliged both sides and forced them to collaborate. The stakeholders have different roles in this collaboration and they gain different satisfaction and gains from this collaboration. However, this process has led to some difficulties as well as the returns as described in detail by both universities, industry and TTOs.

Table 18 summarizes the challenges and incentives that led the parties to collaborate in this technology transfer process.

Table 18

Drivers and Barriers for the Parties

In Terms of researchers		In Terms of TTOs		In Terms of Industry	
Barriers	**Drivers**	**Barriers**	**Drivers**	**Barriers**	**Drivers**
lack of university policy	university incentives	excess circulation of staff	management support	lack of qualified staff	financial gains
lack of motivation	network	lack of staff quality	Incorporated company	budget shortage	public incentives
insecurity	funding	lack of management support	autonomy	Different expectations	networking
impenetrability	increased recognition	İnsufficient interest of the stakeholders	tangible/adoptive incentives	Imposibility of technical infrastructure	being next to the name of the academician
multiplicity of costs	financial gain	frequency of reporting process	public service	High cocts	
lack of interest from industry	resourcing	continuous change of parameters	financial gain		
Different expectations	reward	legal restrictions			
excessive procedure	Reputation and career	being new in the market			
legal restrictions					
IPR problems					
faith in not finding enough support					

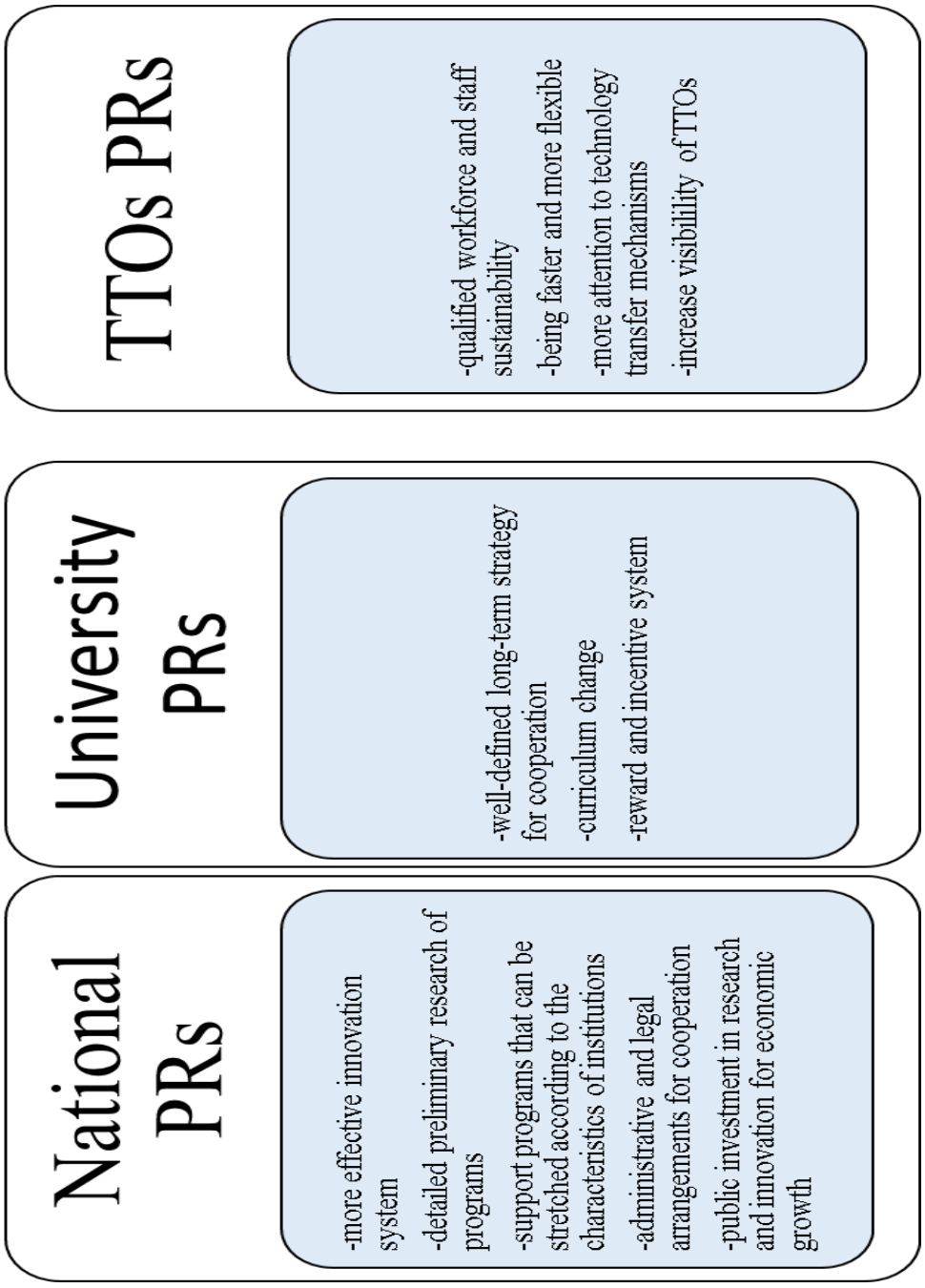
Based on the above table and the whole of this study, the main factors affecting the technology transfer in university-industry collaboration are as follows:

- Even if scientific publications are the first target of academics, there is a tendency to decrease the level of basic research to applied research.
- In case of collaborations, researchers seem to be more likely to work with other units in their own university.
- Researchers are open to collaboration but do not have enough tendency to technology transfer mechanisms such as spin-offs, start-ups and licensing.
- The fact that the personnel circulation rate is high in the Technology Transfer Offices, the lack of sufficient expertise and experience has a negative effect on all parties.
- In addition to the university-industry collaboration, where TTOs are not in an organization that TUBITAK expects to be, it is seen that they work more like project support offices.
- There are some prejudices of academics against industry and industry against academia.
- TUBITAK's constant change in the support system has begun to be an obstacle. Moreover, there is not enough explanation about the changed systems and no detailed information is given about how the elections and scoring system are made.
- There is a communication problem among university, industry, TTOs and TUBITAK.

In the light of the above findings, we conclude that we have not been successful enough in technology transfer efficiency in university-industry collaboration. In this context, figure 5 summary and detailed explanations of the policy recommendations (PRs) are given below.

Figure 5

Policy Recommendations



5.1 National Policy Recommendations

Innovation systems enable the dissemination of knowledge by increasing research and the emergence of new ideas. Thus, the commercialization process of research studies is accelerated and the number of firms increases. Therefore, the infrastructure in the regions where TTOs are close should be well explored and the government should decide which innovation system to focus on and develop policies and incentive systems that can channel universities and TTOs in this direction. However, in developing countries like Turkey, it is difficult to keep pace with this fast moving structure. Therefore, a good balance must be maintained. In order to ensure entrepreneurship, policies and incentives should ensure that academic freedom and efforts are not put into the background. The government should not only provide financial support, but should also be able to play a regulatory role in direct collaboration. It should be actively involved as another stakeholder in university-industry collaboration, and must either invest directly or encourage other stakeholders to establish their infrastructure by providing financial support. Collaboration among these three stakeholders should be continuous, intensive and renewable.

Each institution should be assessed based on its own region and its own characteristics. TUBITAK will give more priority to these institutions as the universities in the regions with high technological firms will be more prone to technology transfer. For this reason, each university should be supported in different ways in accordance with its own conditions. Policies should be developed in a way that stands out for the good of the university. Since the competitiveness and technological competence of each region is different, innovation systems should be determined accordingly. In order to create innovation in the national sense, regional, technological and sectoral innovation systems should be subjected to a detailed examination and the selection and functioning of the innovation system should be ensured based on the characteristics of the region to be developed. In all of the innovation systems, the factors such as networking, collaboration and competition stand out. Therefore, whether regional, sectoral or technological innovation system is applied; attention should be paid to the

creation of competition and having interaction between institutions and stakeholders in these regions. It should be a priority to educate individuals who will contribute to the people and the future of the country and to the development of a more livable country that will aim to increase the social standards and to do research in this sense. Institutions such as TÜBİTAK should prepare a feasibility study in which they will be able to examine their infrastructure and the results it will generate in detail. It should support each institution based on its own characteristics. Thus, a more balanced distribution will be provided among the institutions it supports and it will prevent inter-institutional confusion. Policies should be developed that will not harm the parties unchanged continuously. In addition, adequate disclosure should be made about the policies and changes made.

5.2 Policy Recommendations for Universities

Universities need to support their researchers by becoming the priority of knowledge and technology transfer. Because the scientific research produced at the university can be commercialized through technology transfer. Management should be open to collaboration and should be able to involve academicians and students when necessary. They need to have well-defined long-term strategic plans to ensure and implement this.

To contribute to the economy of the country to increase the interoperability of stakeholders, universities can provide more research and outcomes by going through a curriculum change that will allow more applied research, and will enable students to engage with industry under the supervision of academics. In this way, academicians who are not able to connect directly with industry can indirectly contribute to industry through students.

On the other hand, university should give the academician more privilege and freedom to do more research. For this reason, the university should establish a fine balance between education, research and commercialization missions. It should be able to provide more support to researchers who are prominent in providing technology transfer during the collaboration process. It should use the reward and incentive

system, but in doing so, it should not neglect other researchers to take measures that do not blind the creativity and ambition. While üniversities earn income through entrepreneurship, they should be able to balance to prevent commercial exploitation or conflict of interest. On the other hand, it should not be forgotten that the main mission of universities is to provide research-supported education, and the purpose of serving the society should not be put back. It should be a priority to educate individuals who will contribute to the people and the future of the country and to the development of a more livable country that will aim to increase the social standards and to do research to this end.

5.3 Policy Recommendations for TTOs

Considering the findings of the study, it is seen that both the university and the industry are open to work together but they cannot use the common language. Therefore, the biggest role in the process of university industrial collaboration falls to Technology Transfer Offices. The basic necessity for TTOs is that their personnel should be expert in their business, dynamic, flexible, has a structure that understands both languages and can communicate well with both parties. For this reason, as we have seen in the results, it should be ensured that the personnel is made more valuable by preventing the circulation of personnel and the sustainability of the personnel should be facilitated by contributing to the development of the personnel with both material and spiritual incentives. The fact that TTOs are more institutional, more autonomous and capable of taking initiative will contribute to the establishment of corporate culture and commitment of the personnel. In order to achieve this structure, the university administration and TÜBİTAK should take the necessary initiatives.

TTOs should also give importance to their promotion in order to raise awareness and provide trust. They should make face-to-face visits to both industry and university academics and provide mutual trust.

In the developing countries, the process of commercialization is limited due to reasons such as low quality of education or insufficient financing, and the spin-off, start-up,

licensing and patent mechanisms are not sufficient to accelerate the process. Considering the Entrepreneurial and Innovative University Index, there may be significant differences in the rankings (Appendix A-J) according to the success of universities and TTOs. In this context, TTOs have a big job. Not only because of the necessity of TÜBİTAK and data, but also the feasibility of explaining it to academics, it is necessary to strengthen this channel with academicians who are prone to collaboration. Alternatively, it may be another way for academicians to provide counseling by providing these activities through doctoral students or alumni.

5.4 Suggestion for Further Research

In this thesis, technology transfer evaluation is made in university-industry collaboration. The role of TTOs in bringing universities and industry together was tried to be understood and the views of academicians, TTO and TUBITAK managers were evaluated. Policies have been developed at country, university and TTO level in order to overcome the problems. In order to obtain more clear results; it is recommended that the number of responses to the surveys to be conducted will be higher, the diversity of the city and the region will increase in interviews with TTO employees, and that large and small scale firms should be included in the interviews by the industry.

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APPENDICES

A. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF SABANCI UNIVERSITY

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
Sabancı University	2012	**1**	**84**	19,2	9,2	25,0	12,5	18,3
	2013	**2**	**85,8**	20,0	10,1	25,0	13,4	17,3
	2014	**2**	**81,4**	19,5	6,2	25	12,5	18,3
	2015	**1**	**88,4**	19,9	11,3	25	13,5	18,8
	2016	**1**	**95**	20	13,1	25	12,5	24,4
	2017	**1**	**90,97**	19,6	15	25	12,7	18,8
	2018	**3**	**85,49**	18,08	15,16	27,9	N/A	24,36

B. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF METU

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
METU	2012	**2**	**83**	18,9	10,6	22,2	12,2	18,8
	2013	**1**	**86,0**	19,2	11,2	21,9	15,0	18,8
	2014	**1**	**83,1**	19,6	8,7	22,4	13,8	18,8
	2015	**2**	**86,0**	19,7	11,4	23,1	13,1	18,8
	2016	**2**	**85,8**	20,0	10,5	22,6	13,9	18,8
	2017	**2**	**87,3**	19,8	10,9	25,0	12,8	18,8
	2018	**2**	**83**	18,9	10,6	22,2	12,2	18,8

C. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF ÖZYEĞİN UNIVERSITY

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
Özyeğin University	2012	**4**	**69**	13,3	6,5	19,3	10,9	18,8
	2013	**7**	**67,4**	11,9	3,8	20,8	13,7	17,1
	2014	**6**	**73,06**	15,2	6,5	20,3	12,3	18,8
	2015	**7**	**73,47**	16,5	6,9	21,8	11,7	16,6
	2016	**8**	**75,31**	16,4	7,5	20,8	12,3	18,3
	2017	**9**	**74,36**	16,2	6,9	22	11,9	17,3
	2018	**14**	**65,44**	13,85	11,88	20,71	N/A	18,99

D. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF BOĞAZİÇİ UNIVERSITY

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
Boğaziçi University	2012	**6**	**65,0**	19,0	0,9	24,2	3,4	17,1
	2013	**4**	**76,3**	20,0	7,3	22,8	11,1	15,1
	2014	**3**	**76,3**	18,5	5,5	24,1	10,0	18,2
	2015	**3**	**79,7**	18,0	8,8	24,7	9,4	18,8
	2016	**5**	**80,1**	18,0	10,2	24,1	11,1	16,7
	2017	**5**	**82,2**	18,0	10,7	24,9	10,7	17,9
	2018	**5**	**83,3**	20,6	15,5	28,1	N/A	19,3

E. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF KOÇ UNIVERSITY

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
Koç University	2012	**8**	**57,0**	17,2	5,9	22,2	9,9	2,2
	2013	**8**	**61,7**	17,1	7,5	23,8	9,6	3,6
	2014	**5**	**73,6**	16,0	9,4	24,9	11,3	12,0
	2015	**5**	**76,4**	16,6	10,9	23,8	7,8	17,4
	2016	**6**	**78,6**	18,0	10,0	24,9	9,7	16,0
	2017	**7**	**78,8**	16,8	9,0	24,9	10,2	17,9
	2018	**11**	**68,9**	18,6	13,7	27,1	N/A	9,5

F. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF HACETTEPE UNIVERSITY

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
Hacettepe University	2012	**11**	**49,0**	13,5	5,5	13,6	6,6	9,5
	2013	**10**	**56,7**	14,8	6,3	16,2	9,4	10,0
	2014	**14**	**53,5**	13,0	7,7	14,2	9,2	9,4
	2015	**14**	**54,4**	12,6	8,2	14,8	9,8	9,0
	2016	**17**	**51,6**	12,8	7,6	14,4	9,1	7,7
	2017	**16**	**52,5**	12,7	6,2	16,7	12,0	4,9
	2018	**8**	**75,9**	20,2	12,5	24,4	N/A	18,8

G. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF EGE UNIVERSITY

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
Ege University	2012	**12**	**47,0**	13,6	5,0	15,1	7,6	5,6
	2013	**14**	**53,0**	12,8	4,2	16,6	12,8	6,6
	2014	**15**	**49,7**	11,4	3,4	15,7	13,0	6,2
	2015	**15**	**54,3**	11,5	4,0	17,5	13,7	7,6
	2016	**13**	**55,2**	12,5	4,5	16,4	15,0	6,8
	2017	**14**	**54,0**	10,9	4,7	18,2	15,0	5,2
	2018	**10**	**70,7**	18,4	10,3	25,0	N/A	17,0

H. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF GAZİ UNIVERSITY

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
Gazi University	2012	**15**	**44,0**	11,1	3,3	9,5	7,6	12,4
	2013	**28**	**54,9**	11,1	6,3	13,3	12,1	12,1
	2014	**16**	**48,1**	10,4	4,1	11,3	12,8	9,4
	2015	**18**	**49,5**	11,4	5,6	11,6	13,4	7,5
	2016	**21**	**50,3**	12,1	5,2	11,1	13,1	8,8
	2017	**21**	**46,3**	10,9	5,0	12,0	12,4	6,0
	2018	**13**	**66,8**	18,1	10,7	19,3	N/A	18,7

İ. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF SELÇUK UNIVERSITY

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
Selçuk University	2012	**16**	**43,0**	9,1	6,4	8,1	6,1	13,6
	2013	**11**	**55,2**	11,6	8,2	13,3	9,9	12,2
	2014	**10**	**59,6**	11,7	10,4	12,0	13,3	12,2
	2015	**12**	**59,1**	10,6	10,9	13,9	12,3	11,4
	2016	**12**	**58,7**	11,0	11,6	14,4	13,7	8,0
	2017	**17**	**52,4**	9,6	9,6	14,6	12,9	5,6
	2018	**19**	**57,9**	15,0	13,6	15,6	N/A	13,7

J. ENTREPRENEURIAL AND INNOVATIVE UNIVERSITY INDEX RANKING OF YILDIZ TECHNICAL UNIVERSITY

University	Years	**General Rank**	**Total**	Scientific and Technological Research Competence (23,75%)	IP Pool (18,75%)	Collaboration and Interaction (28,75)	Entrepreneurship and Innovation Culture	Economic Contribution and Commercialization (28,75)
Yıldız Technical University	2012	**41,0**	10,8	5,0	15,3	6,8	3,0	**41,0**
	2013	**49,6**	12,4	3,3	15,4	9,1	9,4	**49,6**
	2014	**57,4**	10,2	4,5	17,0	12,9	12,9	**57,4**
	2015	**63,9**	10,5	10,6	19,0	12,0	11,9	**63,9**
	2016	**67,6**	12,3	11,1	18,5	11,6	14,1	**67,6**
	2017	**68,7**	12,6	11,8	20,2	10,2	14,1	**68,7**
	2018	**81,4**	17,2	17,5	24,1	N/A	22,6	**81,4**

K. ONLINE QUESTIONNAIRE CONTENT (TURKISH)

Üniversite-Sanayi İşbirliği Sürecinde Teknoloji Transferi Verimliliğinin Ölçülmesi Anketi (2018)

• Sağlanan tüm bilgiler gizlilik esasına uygun olarak muhafaza edilecektir.

• Herhangi bir noktada belirsizlik olduğu durumda açıklayıcı notları dikkate alınız.

• ( ) alanına uygun olan figürü işaretleyiniz.

A.Hakkınızda

1. Üniversitedeki pozisyonunuz nedir?

○ Profesör

○ Doçent

○ Yardımcı Doçent

○ Akademik ziyaretçi

○ Post doktora

○ Doktora Öğrencisi

○ Diğer

2. Hangi bölümde çalışıyorsunuz?

…….

3. Bu üniversitede kaç yıldır görev yapmaktasınız?

Birden fazla üniversitede çalışıyorsanız asıl olanı dikkate alınız.

4. Cinsiyetiniz nedir?

○ Erkek

○ Kadın

5. Lütfen, yaşınızı belirtiniz.

○ 20-24

○ 25-29

○ 30-34

○ 35-39

○ 40-44

○ 45-49

○ 50-54

○ 55-59

○ 60 ve üstü

6. Toplam SCI (Science Citation Index) sayınızı belirtiniz.

○ 1-9

○ 10-19

○ 20-39

○ 40-59

○ 60-79

○ 80-99

○ 100-+

7. 2007-2017 yılları arasında alınmış bir patentte mucit olarak yer aldınız mı?

○ Hayır

○ Evet, bireysel

○ Evet, ortaklı

○ Evet, hem bireysel hem ortaklı

8. Eğer patentiniz varsa lütfen sayısını (bireysel ve ortaklı toplam) belirtiniz. (Aynı patentin farklı ülkelerde onaylanmış başvuruları tek bir patent olarak sayılmalıdır.)

○ 1

○ 2-5 arası

○ 6-10 arası

○ 10 dan fazla

9. Eğer patentiniz varsa patente veya patentlere ilişkin herhangi bir firma ile lisans anlaşması yaptınız mı?

○ Evet, yerli bir firma ile

○ Evet, yabancı bir firma ile

○ Hayır, yapmadım

10. 2007-2017 yılları arasında bir patent başvurusunda mucit olarak yer aldınız mı?

Cevabınız evetse,ne kadar sıklıkla ?

○ Hayır

○ Bir kez

○ 2-4 kez

○ 5-10 kez

○ 10 kereden fazla

11. Geçtiğimiz 10 yıl içinde herhangi bir akademik filiz işletme (spin−off) faaliyetinde ortaklığınız oldu mu ?

Not: Spin−off var olan bir kuruluş tarafından kurulan yeni ve bağımsız bir iş demektir. Genellikle, spin-off bilgi, teknoloji, tesisler ve / veya personel gibi varlıkları içerir. Oluşturulduktan sonra, ana iş ile spin-off arasında resmi bir bağlantı olabilir ya da olmayabilir.

○ Hayır, olmadı.

○ Evet, bir akademik filiz işletmeye (spin-off kuruluşunda) ortak oldum.

12. Geçtiğimiz 10 yıl içinde herhangi bir başlangıç firmasında (start−up faaliyetinde) ortaklığınız oldu mu ?

Not: Mevcut kuruluşlar tarafından kurulmayan yeni firmalar burada start-up olarak anılmaktadır.

○ Hayır, olmadı.

○ Evet, bir başlangıç firmasına (start-up oluşumuna) ortak oldum.

B. Kuruluşunuz Hakkında

1. Araştırma grubunuzun aşağıdaki kategorilerde ne kadar zaman harcadığını (toplam sürenin bir yüzdesi olarak) belirtiniz.

"Araştırma grubunuz" ile, aynı proje ve/veya araştırma okulu veya alt bölümü gibi aynı alanda günlük olarak birlikte çalışan bir grup araştırmacıyı kastediyoruz.

○ Temel araştırmalar (acil bir başvuru ile desteklenmeyen araştırmalar)

○ Uygulamalı araştırma (belirli bir uygulamaya yönelik araştırma)

○ Deneysel geliştirme (pratik deneyim kullanarak prototipleme vediğer sistematik çalışmalar)

2. Araştırma grubunuzda üretilen bilginin ana kullanıcısını en iyi tanımlayan sektörü belirtiniz.

Cevap birden fazla ise, içinde olduğunuz asıl sektörü belirtiniz.

○ Kimya sektörü (özellikle ilaç sektörü ürünleri hariç)

○ İlaç veya biyoteknoloji sektörü

○ Makina, temel ve fabrikasyon metal ürünleri ve makina mühendisliği ile ilgili sektörler

○ Elektrik ve telekomünikasyon ekipmanları

○ Bilgi ve İletişim Teknolojileri sektörü (yazılım dahil)

○ Diğer imalat sanayileri, lütfen belirtiniz

○ Diğer hizmet sektörleri, lütfen belirtiniz

○ Diğer, lütfen belirtiniz

3. Halihazırda başka bir işveren için de danışmanlık yapıyorsanız, bu diğer işvereni karakterize ediniz.

○ Büyük şirket (250'den fazla çalışan)

○ Orta ölçekli işletme (100−250 çalışan)

○ Küçük işletme (100'den az çalışan)

○ Üniversite ve eğitim

○ Kamu ya da yarı kamu araştırma kuruluşu

○ Diğer, lütfen belirtiniz

○ Halihazırda başka bir işveren için çalışmıyorum

4. Bu diğer işverende pozisyonunuzu ve ana faaliyetinizi kısaca anlatabilir misiniz?

……

5. Bu diğer işverenin faaliyet sektörü hangisidir?

Cevap birden fazla ise, içinde olduğunuz asıl sektörü belirtiniz.

○ Kimya sektörü (özellikle ilaç sektörü ürünleri hariç)

○ İlaç veya biyoteknoloji sektörü

○ Makina, temel ve fabrikasyon metal ürünleri ve makina mühendisliği ile ilgili sektörler

○ Elektrik ve telekomünikasyon ekipmanları

○ Bilgi ve İletişim Teknolojileri sektörü (yazılım dahil)

○ Diğer imalat sanayileri, lütfen belirtiniz

○ Diğer hizmet sektörleri, lütfen belirtiniz

○ Diğer, lütfen belirtiniz

6. Daha önce başka bir işveren için çalıştıysanız, bu diğer işvereni karakterize ediniz.

○ Büyük şirket (250'den fazla çalışan)

○ Orta ölçekli işletme (100−250 çalışan)

○ Küçük işletme (100'den az çalışan)

○ Üniversite ve eğitim

○ Kamu ya da yarı kamu araştırma kuruluşu

○ Diğer, lütfen belirtiniz

○ Daha önce başka bir işveren için çalışmadım

7. Bu eski işverende pozisyonunuzu ve ana faaliyetinizi kısaca anlatabilir misiniz?

8. Bu eski işverenin faaliyet sektörü hangisidir?

Cevap birden fazla ise, içinde olduğunuz asıl sektörü belirtiniz.

○ Kimya sektörü (özellikle ilaç sektörü ürünleri hariç)

○ İlaç veya biyoteknoloji sektörü

○ Makina, temel ve fabrikasyon metal ürünleri ve makina mühendisliği ile ilgili sektörler

○ Elektrik ve telekomünikasyon ekipmanları

○ Bilgi ve İletişim Teknolojileri sektörü (yazılım dahil)

○ Diğer imalat sanayileri, lütfen belirtiniz

○ Diğer hizmet sektörleri, lütfen belirtiniz

○ Diğer, lütfen belirtiniz

C. Teknolojik Alanınız

1. Araştırma grubunuz için aşağıdaki bilimsel disiplinlerin her birinin önemini değerlendiriniz.

	önemsiz	çok az önemli	az önemli	önemli	çok önemli
Tıp ve Biyolojik Bilimler					
Kimya					
Fizik					
Malzeme Bilimi					
Matematik					
Bilgisayar Bilimi					
Elektrik Mühendisliği					
Makina Mühendisliği					
İktisadi ve İdari Bilimler					
Psikoloji, Bilişsel çalışmalar					
(Diğer) Sosyal bilimler					

2. Aşağıdaki ifadelerin, araştırma grubunuzun dahil olduğu teknolojik alan için ne kadar geçerli olduğunu belirtiniz.

Teknolojik alanımda…	kesinlikle katılmıyorum	katılmıyorum	ne katılıyorum ne katılmıyorum	katılıyorum	kesinlikle katılmıyorum
*… bilgi öncelikle "bilimsel belgeler" olarak ifade edilir (örneğin dergi makaleleri, konferans bildirileri...)					
*… bilgi öncelikle "gri literatürde" ifade edilir (örneğin patentler, endüstriyel raporlar, gizli bildiriler, tartışma listeleri)					
*… bilgi çoğunlukla insanlarda somutlaşır veyazılı belgelere aktarılması zordur					
*… önümüzdeki beş yıl içinde büyük teknolojik gelişmeler bekleniyor					
*… çoğu zaman birbirine bağlı parçalara sahip sistemlerle çalışırız					

D. Diğer Kuruluşlarla İşbirliği

1. Sizin/araştırma grubunuzun son on yılda ARGE anlamında kiminle işbirliği yaptığınızı belirtiniz. Not: Bu işbirliği, her iki tarafın da girişimden hemen ticari fayda sağladığını ima etmemektedir. Bununla birlikte, aktif işbirliği olmaksızın saf iş sözleşmesi, işbirliği olarak kabul edilmemektedir.

	hiç	tesadüfen	sık sık	çok sık
*Kendi kuruluşunuzdaki diğer bölümlerle				
*Devlet veya kar amacı gütmeyen özel araştırma kurumlarıyla				
*Diğer üniversite veya yüksek öğretim kurumlarıyla				
*Ticari laboratuvarlar veya ARGE işletmeleriyle				
*Ticari imalatçı veya servis sağlayıcılarıyla (örn. danışmanlık)				
*Danışmanlarlarla (özel danışmanlık veya danışmanlık firmaları)				

E. Üniversiteler İçin Bilgi Aktarım Kanalları

1.Sektöre bilgi aktarımı açısından araştırma grubunuz/sizin için aşağıdaki kanalların ne kadar önemli olduğunu belirtiniz.
Lütfen nicelik (transfer sıklığı) ve nitelik (bilginin ne kadar iyi aktarıldığı) kombinasyonuna dayanarak önem düzeyini değerlendiriniz.

	önemsiz	çok az önemli	az önemli	önemli	çok önemli
A. Yayınlar					
*(hakemli) dergilerde veya kitaplarda bilimsel yayınlar					
*profesyonel yayınlar ve raporlar dahil olmak üzere diğer yayınlar					
B. Konferanslara ve ağa katılım					
*Katılabileceğiniz konferans ve çalıştaylara sanayi personelinin katılımı					
*Üniversite personeli ile kişisel (resmi olmayan) temaslar					
*Profesyonel kurumlara üyelik ile kişisel iletişim					
*Mezunlar aracılığı ile kişisel iletişim					
C. Araştırmacıların Hareketliliği					
*Sektörde stajyer olarak çalışan öğrenciler					
*Üniversite mezunlarının sanayiye katılımı (BSc veya MSc seviyesi) ile kişisel iletişim					
*Üniversite mezunlarının sanayiye katılımı (Doktora düzeyi)					
*Üniversite personelinin sanayiye katılımı					
*Hem üniversitede hem de işletmelerde görev yapan personel					

*Sanayi ile geçici personel değişimi (örneğin personel hareketlilik programları)					
D. Ortak projeler, sözleşme araştırması ve danışmanlık					
*Ortak ARGE, AB çerçeve programları kapsamında sektörle birlikte projeler					
*Sanayideki diğer ortak ARGE projeleri					
*Sanayi için sözleşme araştırması (doktora projeleri hariç)					
*Doktora projelerinin sanayi tarafından finansmanı					
*Üniversite personelinin sanayi danışmanlığı					
*Sözleşme temelli iş eğitimi ve üniversitede eğitim					
E. Fikri Mülkiyet					
*Patent ofislerinde veya patent veritabanında bulunan patent metinleri					
*Patentlerin lisanslanması ve sanayiye 'know−how' lisanslarının verilmesi					
F. Diğerleri					
*Üniversite spin−off'ları (bir bilgi kaynağı olarak)					
*Üniversitenin Teknoloji Transfer Ofisi (TTO) tarafından düzenlenen özel bilgi aktarım faaliyetleri					
*Sektörde paylaşma olanakları (örneğin laboratuvarlar, ekipman, konut)					
*Lisanslama yapılması					

2. Siz/araştırma grubunuz ve özel sektör arasında bilgi ve teknoloji aktarımı hangi biçimlerde gerçekleşir ve sizin/araştırma grubunuz için bu formlar ne kadar önemlidir? (her başlık için birden fazla cevap mümkün)

	önemsiz	çok az önemli	az önemli	önemli	çok önemli
Gayrıresmi iletişim, kişisel iletişim ağı					
*bilgi alışverişi için özel sektörde çalışanlarla gayri resmi irtibatlar (örn. telefon, e-posta yolu)					
*Özel sektörün konferanslarına, sergilerine, çalıştaylarına vb. katılıyoruz					
*Özel sektörün araştırma laboratuvarlarının akademik yayınlarını okumak veya alıntılamak					
Teknik Tesisler					
*Ortak laboratuvarlar					
İşletme sektörünün ARGE departmanlarında teknik tesislerin veya araştırma merkezlerinin kullanımı					
Hizmet içi eğitim, sürekli eğitim					
*özel sektörde çalışan mezunlarla iletişim					
*özel sektörde çalışan eski personelle iletişim					

*Kurumsal ARGE projelerine öğrenci katılımı					
*özel sektörde işbirliği içinde tez projeleri yapmak					
*özel sektörle işbirliği içinde doktora projeleri yapmak					
*ortak öğretim kursları veya programları					
*Özel sektör personeli için öğretim görevleri					
*sektörün uzmanlık kurslarına veya kurum					
*özel sektörle işbirliği içinde doktora projeleri yapmak					
Araştırma					
*özel sektör ile işbirliği içinde araştırma projeleri (kısmen veya tamamen iş sektörünün finanse ettiği)					
*özel sektör ile uzun vadeli araştırma sözleşmeleri (araştırma sözleşmesi)					
*araştırma konsorsiyumları (en az bir şirket katılımcısı ile)					
Danışmanlık					
*Özel sektör için uzmanlık / raporlar					
*Özel sektöre danışmanlık					

3. Önceki sorularda kaçırdığımız bir bilgi aktarım kanalı varsa aşağıya yazabilirsiniz. Bu kanalı ne kadar dikkate aldığınızı da belirtiniz.

4. Bilgi ve teknoloji transferi sanayilerden üniversitelere de olabilir. Sizin/araştırma grubunuzun sanayi tarafından geliştirilen bilgi ve teknolojiyi ne ölçüde kullandığını belirtiniz.

○ Hiç
○ Çok küçük bir dereceye kadar
○ Küçük bir dereceye kadar
○ Büyük bir dereceye kadar
○ Çok büyük bir dereceye kadar

5. Sektörle sağlanacak bilgi ve teknoloji transferinde aşağıdaki araçların ne kadar önemli olduğunu belirtiniz

	önemsiz	çok az önemli	az önemli	önemli	çok önemli
akademik yayınlar					
patentler					
lisanslar					
spin-off'lar					
start-up'lar					
Teknokentler					
TTO'lar					
kuluçka merkezleri					
üniversite uygulama ve araştırma merkezleri					

6. Son on yılda, bünyesinde yer aldığınız üniversitedeki Teknoloji/Bilgi Transfer Ofisinin hizmetlerinden ne sıklıkta yararlandığınızı belirtiniz.

○Hiç
○Nadiren
○Ara Sıra
○Sık
○Çok sık

7. 1513 kodlu TÜBİTAK Teknoloji Transfer Ofisleri Destekleme Programı Uygulama Esaslarına ilişkin kural ve süreçlerden haberdar mısınız?

○Evet, haberdarım.
○Kısmen haberdarım.
○Hayır, haberdar değilim.

8. 1513 kodlu TÜBİTAK Teknoloji Transfer Ofisleri Destekleme Programı Uygulama Esaslarına ilişkin kural ve süreçlerden haberdar iseniz bu program esaslarını teknoloji transferi ve ticarileştirme faaliyetleri açısından destekleyici buluyor musunuz?

○Evet, destekleyici buluyorum.
○Kısmen destekleyici buluyorum.
○Hayır, destekleyici bulmuyorum.
○Bilgim yok

9. Genel olarak üniversitenizdeki Teknoloji/Bilgi Transfer faaliyetlerini nasıl değerlendirirsiniz?

○Çok zayıf
○Zayıf
○Orta
○İyi
○Çok iyi

10. Sizi motive eden şeyler ve özel şirketler ile bilgi ve teknoloji transferi düzenlemelerine girme hedefleriniz nelerdir? Bunlar sizin/kuruluşunuzun faaliyetleri için ne kadar önemlidir? (her başlık için birden fazla cevap mümkün)

	önemsiz	çok az önemli	az önemli	önemli	çok önemli
Finasal nedenler					
*araştırma projelerinde maliyet tasarrufu					
*araştırma projelerinde zaman tasarrufu					
*temel araştırmaları genişletmek için kaynaklar					
*ticari başarı					
*işten elde edilen kaynaklar kamu finansmanında daha esnek bir şekilde kullanılabilir					

Beşeri sermayeye erişim, insanlarla ilgili örtük bilgi ('tacit knowledge')					
*kurumdaki uzmanlığı tamamlamak için belirli yeteneklere erişim					
*yeni araştırma güdüleri					
*endüstriyel araştırmacılarla fikir alışverişinde bulunma					
*kurum personeli ve/ya öğrencileri için pratik deneyim					
*kurumun kendi araştırma alanında ek araştırma anlayışı kazanma					
Özel sektör araştırma bulgularına erişim (kodlanmış bilgi/codified knowledge)					
* patentler, lisanslar					
*müfredat için pratik problemlerle ilgili bilgi sahibi olmak					
Özel sektör ARGE tesislerine erişim					
*Özelsektör teknolojik ekipmanlarına ya da uzmanlaşmış teknolojilere erişim					
*müfredat için pratikte kendi araştırma bulgularını test etme fırsatı					
Kurumsal veya örgütsel güdüler					
* Özel sektörde öğrenciler ve/ya kurum personeli için iyi iş fırsatları sağlama					
*Üniversitenin akademik danışman organlarında iş temsilcilerinin varlığını güvence altına almak					
*Üniversite misyonunu genişletmek					
*Belirli bir teknolojinin yayılmasını teşvik etmek					
*Kamu arasında ARGE bulgularının yaygınlaştırılması					
*bölgesel gelişmeyi teşvik etmek					
*bilimin imajını geliştirmek					
*diğer güdüler					

11. Akademik araştırmaların ticarileştirilmesine yönelik aşağıdaki sorulara ilişkin görüşlerinizi belirtiniz.

	evet	kısmen	hayır	fikrim yok	kararsızım
*Araştırmalarınızın yayın ile yeterince faydaya/değere dönüştüğünü düşünüyor musunuz?					
* Ticarileştirmeye yönelik faaliyetleri işinizin önemli bir parçası olarak görüyor musunuz?					
*Araştırmalarınızı ticarileştirmek için bir girişimde bulunmayı düşünüyor musunuz?					
*Akademisyenlerin/araştırmacıların ticarileştirme faaliyetlerinin teşvik edilmesi gerektiğini düşünüyor musunuz?					

*Bulunduğunuz üniversitenin, akademisyenlerinin /araştırmacılarının ticarileştirme faaliyetlerine önem verdiğini / desteklediğini düşünüyor musunuz?					
*Bulunduğunuz üniversitenin ticarileştirmeye yönelik politikası / stratejisi var mı?					

12. Sizin/kuruluşunuzun mali durumu bilgi ve teknoloji transferi sonucunda değişti mi?

○ Değişmedi
○ Araştırmalar için ek kaynaklar edindim
○ Öğretim için ek kaynaklar edindim
○Teknik Tesisler için ek kaynaklar edindim

13. Bilgi ve teknoloji transferinin bir sonucu olarak sizin/kuruluşunuzun araştırma yönelimi değişti mi?

○ Değişmedi
○ Uygulamalı araştırmaya daha çok yöneldim
○ Temel araştırmaya daha çok yöneldim

14. Bilgi ve teknoloji transferi, sizin/kurumunuzun öğretim, ileri eğitim veya hizmet içi eğitim faaliyetlerini etkiledi mi?

○ Etkilemedi
○ Uygulamaya yönelik daha fazla eğitim sağlıyorum
○ Öğretim ve öğrenci desteğine daha az zaman ayırabiliyorum

15. Bilgi ve teknoloji transferinin bir sonucu olarak sizin/kuruluşunuzun bilimsel itibarı değişti mi?

○ değişmedi
○ daha iyi itibar
○ daha kötü itibar

F. Sektörle işbirliği yolunda duran engeller

1. Özel sektöre bilgi ve teknoloji transferini ve/ya sizin/kurumunuzun bilgi ve teknoloji transferi sürecini yoğunlaştırmasını neler engeller? (Birden fazla cevap mümkün)

	önemsiz	çok az önemli	az önemli	önemli	çok önemli
Bilgi eksikliği					
*Özel sektördeki araştırma faaliyetleri hakkında bilgi edinmenin zorluğu (gizlilik)					
* Özel sektördeki uygun bir ortak bulmanın zorluğu					
*Sektörün yetersiz donanımlı olması (örn. Teknoloji Transfer Ofisleri kapasite eksikliği)					

Öğretim ve temel araştırma alanlarındaki problemler					
*Öğretimin çok zaman gerektirmesi					
*Bilimsel bağımsızlığın bozulması					
*Akademik yayın faaliyetlerinin engellenmesi					
*Temel araştırmanın ihmal edilmesi					
İş dünyasındaki potansiyel ortaklar arasında bilgi birikimi aktarımı için gerekli koşullar					
*Şirketler tarafında kalifiye eleman eksikliği					
*Şirketlerin teknik imkanlarının eksikliği					
*Şirketlerin bilimsel projelere ilgilerinin eksikliği					
*Kurumunuz açısından özel sektörde yetersiz araştırma sorularının varlığı					
Kurumunuzda eksik bilgi birikimi için gerekli şartlar					
*Bilgi ve teknoloji transferi için akademik uzman eksikliği (kapasite)					
*Kurum personelinin yeterince girişimci olmaması					
*Araştırma odağının sanayi sektörü için yeterince ilgi çekici olmaması					
*Araştırma bulgularının ticarileştirme imkanının olmaması					
Maliyetler, riskler, belirsizlik					
*Ar-Ge sonuçları hakkında belirsizlik					
*Sektörün maliyetler ve/ya verimlilik konusunda farklı fikirlerinin olması					
*Potansiyel iş ortaklarının ARGE bütçelerinin çok düşük olması					
Örgütsel, kurumsal engeller					
*Kaynak yoğun yönetim ve onay prosedürleri, yasal kısıtlamalar					
*Akademik kurum tarafında (örneğin teknoloji transfer ofisleri aracılığıyla) proje yönetimi desteğinin olmaması					
*Akademik kurum tarafında araştırma bulgularının ticarileştirilmesi için destek eksikliği					
*Mülkiyet Hakları sorunları					
*Akademik kurum tarafında proje yönetimi problemleri (örn. Koordinasyon veya iletişim sorunları)					
*Projelerin programlanması konusunda aciliyet durumunda farklı görüşler					
*Güven eksikliği					
*diğer engeller					

2. Aşağıda ticarileştirme faaliyetlerini kısıtlayabilecek veya engelleyebilecek birçok faktör sıralanmıştır. Bu faktörlerin ticarileştirme faaliyetlerinizi yürütmenizi olumsuz yönde etkilediğine/engellediğine ne ölçüde katılıp katılmadığınızı belirtiniz.

	kesinlikle katılmıyorum	katılmıyorum	ne katılıyorum ne katılmıyorum	katılıyorum	kesinlikle katılıyorum
*Yürütülen araştırmaların uygulamaya yönelik olmaması					
*Akademik ve bilimsel faaliyetlerin yoğunluğu nedeniyle ticarileştirme faaliyetlerine yeterli zaman ayrılamaması					
*Üniversitenin yeterli desteği sunmaması					
*Akademik yükselme ve teşviklerde ticarileşme faaliyetlerinin yeterince dikkate alınmaması					
*Özel Sektörün AR&GE faaliyetleri konusunda isteksiz olması/bilgi eksikliği					
*AR&GEfaaliyetleri sonucunda ortaya çıkan ürünlerin kullanımının özel sektör tarafından riskli bulunması					
*Özel sektör ve kurumunuzun farklı kurumsal kültür ve beklentilere sahip olması					
*Ticarileştirme konusunda bilgi ve deneyim eksikliği					
*Ticarileştirmenin taşıdığı ekonomik riskler					
*Fikri mülkiyet hakları paylaşımı konusundaki belirsizlikler/yaşanabilecek sorunlar					
*Fikri mülkiyet hakları mevzuatının yetersiz olması					
*Ticarileştirme faaliyetlerine aracılık edecek/danışmanlık verecek kurumsal yapıların (Teknoloji Transfer Ofisleri, patent ofisleri vb.) yeterli olmaması					
*Ticarileştirmeyi teşvik edecek kamu desteklerinin bütçe açısından yeterli olmaması					
*Ticarileştirmeyi teşvik edecek kamu desteklerinin nitelik (içerik, başvuru şartları, değerlendirme süreçleri, erişilebilirlik, hizmet kalitesi vb.) açısından yeterli olmaması					
*Risk sermayesi, banka kredisi gibi finansman araçlarına erişimde sıkıntı yaşanması					
*Desteklerin daha çok araştırma ve geliştirmeye yönelik olması, ticarileştirme aşamasını yeterince kapsamaması					
*Teknoparklarda sunulan hizmet ve desteklerin etkin olmaması					

3. Aşağıdaki ifadelerle ilgili fikrinizi belirtiniz.

	kesinlikle katılmıyorum	katılmıyorum	ne katılıyorum ne katılmıyorum	katılıyorum	kesinlikle katılıyorum
*Disiplinimde aktif olan özel işletmeler üniversitelerde mevcut olan bilgilerin çok azını kullanıyor					
*Mevcut bilgimi sanayiye aktarırken önemli engeller görüyorum					
*Sanayi, üniversitede geliştirilen bilgi ile ilgilenmiyor					
*Üniversiteler, bilgilerini sanayiye aktarma					

4. Aşağıdaki ifadeleri dikkate alarak bilgi ve teknoloji transferiyle ilgili görüşlerinizi belirtiniz.

	kesinlikle katılmıyorum	katılmıyorum	ne katılıyorum ne katılmıyorum	katılıyorum	kesinlikle katılıyorum
*Sanayi ile işbirliği, akademik ve ticari araştırmacılar arasındaki kültürel farklılıklar nedeniyle engellenmektedir.					
*Sektöre bilgi aktarımı üniversiteler için çok maaliyetlidir. (hem para hemzaman açısından)					
*Şirketler üniversitelerle ARGE işbirliği yapmak istemiyor, sadece bilgimizi istiyorlar					
*Sözleşme araştırması yürütmek sadece araştırma grubumuz için daha fazla gelirle sonuçlanmaktadır. Böyle bir araştırma yürütmekten bir şey öğrenmiyoruz.					
*Ortak bir ARGE projesi için uygun endüstriyel ortak bulmak zor.					
*Ortak ARGE, araştırmasını yayınlamak isteyen akademik araştırmacı ve patent araştırması yapmak isteyen ticari araştırmacılar arasındaki çatışma nedeniyle engellenmektedir.					
*Ödüllerim çoğunlukla bilimsel yayınlarabağlı olduğu için sektörle işbirliği yapmakta zorlanıyorum.					

G. Kamu-Özel Sektör Bilgi Transferi için Politikalar

1. Araştırma grubunuzun son on yıl içinde nasıl finanse edildiğini belirtiniz.

%

○ Doğrudan devlet finansmanı (temel finansman)
○ Dolaylı devlet finansmanı (hibe bazlı fonlama)
○ Ticari finansman (sözleşme finansmanı)
○ Özel kar amacı gütmeyen araştırma kuruluşları
○ Diğer

2. Deneyimlerinize göre, bir devletin araştırma işbirliğini geliştirecek en iyi araçları sizce nelerdir ?
En fazla iki kategori seçebilirsiniz.

○ Vergi araçları (örn. ortak ARGE çalışması için vergi indirimleri)
○ Üniversitelerde Teknoloji Transfer Ofislerine (TTO) mali ve diğer destek
○Yeni teknolojik girişimlerin start-up safhasında destek (örn. konut, özel destek, özel vergi planları)
○ Bilim ve iş ARGE'sine köprü olan kuruluşlar için destek
○ Hedeflenen Inovasyon Programları
○ Üniversitelerde girişimcilik ikliminin iyileştirilmesine yönelik politika
○ Araştırma çıktılarını incelemek ve ödüllendirmek için üniversite programları
○ Fikrim yok

3. Sizce, bir devlet sanayi ile işbirliğini politika ve programlarla teşvik etmeli midir? Eğer öyleyse aşağıdaki kutucuğa açıklama yapınız.

L. ONLINE QUESTIONNAIRE CONTENT (ENGLISH)

Survey of Measurement of Technology Transfer Efficiency in University-Industry Collaboration Process (2018)

• All information provided will be handled in strictestconfidence
• If anything is unclear, please consult the explanatory notes
• Please place a cross in the relevant field ( ) or enter the appropriate figüre

A.About You

1. What is your position at the university?

○ Professors
○ Assoc.Prof
○ Asist.Prof.
○ Academic Visitors
○ Post doct.
○ Phd Student
○ Other

2. At which department do you work?
---

3. For how many years have you been working at this university?
If you work in more than one university, consider the original one.

---

4. What is your gender?
○ Male
○ Women

5. Please indicate your age.

○ 20-24
○ 25-29
○ 30-34
○ 35-39
○ 40-44
○ 45-49
○ 50-54
○ 55-59
○ 60 +

6. Indicate the total number of SCI (Science Citation Index).

○ 1-9
○ 10-19
○ 20-39
○ 40-59
○ 60-79
○ 80-99
○ 100-+

7. Did you participate as an inventor in a patent obtained between 2007 and 2017?

○ No
○ Yes, individual
○ Yes, in partnership
○ Yes, both individually and in partnership

8. If you have a patent, please indicate the number (individual and joint total). (Applications of the same patent approved in different countries should be counted as a single patent.)

○ 1
○ 2-5 times
○ 6-10 times
○ More than 10

9. If you have a patent, have you entered into a license agreement with any company for patents or licences?

○ Yes, with a local company
○ Yes, with a foreign company
○ No, I didn't

10. Did you participate as an inventor in a patent application between 2007-2017?

If so, how often?

○ No
○ Once
○ 2-4 times
○ 5-10 times
○ More than 10

11. Have you had any personal involvement in a spin−off business during the past 10 years?

Note: by a spin−off we mean a new, independent business founded by an existing organisation. Usually, assets such as knowledge, technology, facilities and/or staff are brought into the spin−off. After its creation, there may or may not be a formal link between the parent business and the spin−off. New firms not founded by existing organisations are referred to here as start−ups.

○ No, it didn't.

○ Yes, I became a partner in an academic sprout business.

12. Have you had any personal involvement in a spin-off business during the past 10 years?

○ No, it didn't.
○ Yes, I became a partner in a spin-off company.

13. Have you had any personal involvement in a start-up business during the past 10 years?
Note: New companies not established by existing organizations are referred to here as start-ups.

○ No, it didn't.
○ Yes, I became a partner in a start-up company.

B. About Your Organisation

1. Please indicate how much time (as a percentage of total time) your research group spends on the following categories of research.

By 'your research group' we mean a group of researchers that work together on a daily basis on the same projects and/or same area such as a research school or
○ Basic research (research that is not motivated by an immediate application)
○ Applied research (research geared towards a specific application)
○ Experimental development (prototyping and other systematic work using practical experience)
○ Machinery, basic and fabricated metal products, and mechanical engineering−related sectors
○ Electrical and telecommunications equipment
○ Information and Communication Technologies sector (including software)
○ Other manufacturing industries, please specify
○ Other services sectors, please specify
○ Other, please specify

3. If you are already consulting another employer, characterize this other employer.

○ Large company (more than 250 employees)
○ Medium−sized enterprise (100−250 employees)
○ Small business (less than 100 employees)

○ University and education
○ Public or semi−public research organisation
○ Other, please specify
○ I did not work for another employer before

4. Can you please shortly describe your position and main activity at this other employer?

……

5. What is the activity sector of this other employer?

If there are several, please indicate the one in which you are involved yourself.

○ Chemical sector (excluding products specifically for the pharmaceutical sector)

○ Pharmaceutical or biotech sector

○ Machinery, basic and fabricated metal products, and mechanical engineering−related sectors

○ Electrical and telecommunications equipment

○ Information and Communication Technologies sector (including software)

○ Other manufacturing industries, please specify

○ Other services sectors, please specify

○ Other, please specify

6. If you previously worked for another employer, then please characterise this former employer.

○ Large company (more than 250 employees)
○ Medium−sized enterprise (100−250 employees)
○ Small business (less than 100 employees)
○ University and education
○ Public or semi−public research organisation
○ Other, please specify
○ I did not work for another employer before

7. Can you please shortly describe your position and main activity at this other employer?

8. Which is the sector of activity of this former employer?

If there are several, please indicate the one in which you are involved yourself.

○ Chemical sector (excluding products specifically for the pharmaceutical sector)

○ Pharmaceutical or biotech sector

○ Machinery, basic and fabricated metal products, and mechanical engineering−related sectors

○ Electrical and telecommunications equipment

○ Information and Communication Technologies sector (including software)

○ Other manufacturing industries, please specify

○ Other services sectors, please specify

○ Other, please specify

C. Your technological field

1. Please rate the importance of each of the following scientific disciplines for your research group.

	unimportant	very littyle important	little important	important	very important
○Medicineand Biological Sciences					
○ Chemistry					
○ Physics					
○ Materials Science					
○ Mathematics					
○ Computer Science					
○ Electrical Engineering					
○Mechanical Engineering					
○Economics and Administrative Sciences					
○ Psychology, Cognitive studies					
○ (Other) Social sciences					

2. Please indicate to what extent the following statements are applicable to the technological field that your research group is engaged in.

In my technological field ...	totally disagree	disagree	more or less disagree/agr	agree	totally agree
*… knowledge is primarily expressed in 'scientific documents' (e.g. journal articles, conference papers, and proceedings)					
*… knowledge is primarily expressed in 'grey literature' (e.g. patents, industrial reports, confidential memorandums, discussion lists)					
*… knowledge is predominantly embodied in people and is difficult to lay down in written documents					
*… major technological breakthroughs are expected within the next five years					
*… we often work with systems that have many interdependent parts; changes in one part imply changes in many other parts					
*… knowledge is primarily expressed in 'scientific documents' (e.g. journal articles, conference papers, and proceedings)					

3. Do you see the transfer of knowledge and technology to the private sector as an important part of your business?

○ unimportant
○ very little important
○ less important
○ important
○ very important

D. Cooperation with other organisations

1-Please indicate with whom your research group has had RDcooperation over the past five years.

Note: this does not necessarily imply that both partners have derived immediate commercial benefit from the venture. Pure contracting out of work without active collaboration,

	never	incidentally	often	very often
*Other departments within your own organisation				
*Governmental or private non−profit research institutes				
*Other universities or other higher education institutes				
*Commercial laboratories or Rdenterprises				
*Commercial manufacturer or service provider (exc. consultancy)				

E. Channels of knowledge transfer from universities

1. There are various ways (channels) via which knowledge can flow from universitie to firms.

Please indicate how important you consider the following channels for your research grou in terms of knowledge transfer to the industry.

	unimportant	of very little important	of little important	Important	very important
A. Publications					
*Scientific publications in (refereed) journals or books					
*Other publications, including professional publications and reports					

B. Participation in conferences and networking					
*Participation of industry staff in conferences and workshops that you attend					
*Personal (informal) contacts with university staff					
*Personal contacts via membership of professional organisations					
*Personal contacts via alumni organisations					
C. Mobility of researchers					
*Students working as trainees at the industry					
*Outflow of university graduates to the industry (BSc or MSc level)					
*Outflow of university graduates to the industry (PhD level)					
*Outflow of university staff to the industry					
*Staff holding positions in both a university and a business					
*Temporary staff exchange with the industry(e.g. staff mobility programmes)					
D. Joint projects, contract research and consultancy					
*Joint RD projects with the industry in the context of EU Framework Programmes					
*Other joint RD projects with the industry					
*Contract research for the industry (excl. Ph.D. projects)					
*Financing of Ph.D. projects by the industry					
*Consultancy of university staff members the industry					
*Contract based in−business education and training at the industry					
E. Intellectual property					
*Patent texts, as found in the patent office or in patent databases					
*Licensing of patents and ‘know−how’ licenses to the industry					
F. Others					
*University spin−offs (as a source of knowledge)					
*Specific knowledge transfer activities organised by the university’s Technology Transfer Office (TTO)					

*Sharing facilities (e.g. laboratories, equipment, housing) with the industry					
*Licensing					

2. What forms does knowledge and technology transfer between your institute and the business sector take, and how important are these forms for your institute?

	unimportant	of very little important	of little important	Important	very important
Informal contacts, personal network of contacts					
*informal contacts (e.g. By phone, email) with employees from business sector for information exchange					
*attending business sector conferences, exhibitions, workshops etc.					
*reading or quoting the academic publications of business sector research laboratories					
Technical facilities					
*joint laboratories					
*use of technical facilities or research centres at business sector R&D departments					
Training, further education, staff mobility					
*contacts with graduates employed in the business sector					
*contacts with former staff employed in the business sector					
*student participation in corporate R&D projects					
*allocating thesis projects in collaboration with the business sector					
*allocating doctoral projects in collaboration with the business sector					
*engagement of business sector scientists in your institute's own R&D projects					
*joint teaching courses or programmes					
*teaching assignments for business sector staff					

*attendance of specialised courses or training programmes of the institute by business sector scientists					
Research					
*research projects in collaboration with the business sector (partially or fully funded by the business sector)					
*longer-term research contracts with the business sector (contract research)					
*research consortiums (with at least one company participating)					
Consulting					
*Expertises/reports for the business sector					
*Consulting for the business sector					

3. If we have overlooked a channel of knowledge transfer in the previous queston, you can write it down below. Please indicate also how important you consider this channel.

4. Knowledge may also flow from industries to universities. Please indicate to what degree your research group uses knowledge.

○ Not at all

○ To a very small degree

○ To a small degree

○ To a large degree

○ To a large degree

○ To a very large degree

2. How important are the following media for knowledge and technology transfer with the business sector?

	unimportant	of very little important	of little important	important	very important
academic publications					
patents					
licenses					
spin-offs					

start-ups					
Tech Parks					
TTOs					

6. Indicate how often you have benefited from the services of the Technology / Knowledge Transfer Office at the university in which you are a part of the last decade.

- ○ Never
- ○ Rarely
- ○ Occasionaly
- ○ Often
- ○ very often

7. Are you aware of the rules and processes related to the Implementation Principl 1513 coded TUBITAK Technology Transfer Offices Support Program?

- ○ Yes, I know.
- ○ I'm partially aware.
- ○ No, I'm not aware.

8. If you are aware of the rules and processes of the 1513 coded TUBITAK Techno Transfer Offices Support Program Implementation Principles, do you find t program principles supportive in terms of technology transfer and commercializa activities?

- ○ Yes, I find supportive.
- ○ I find it partially supportive.
- ○ No, I don't find supportive.
- ○ I have no information

9. **How do you evaluate the Technology / Knowledge Transfer activities in y university in general?**

- ○ Very weak
- ○ Poor
- ○ Average
- ○ Good
- ○ Very good

10. What is your motivation and what are your objectives in going into knowledge and technology transfer arrangements with private companies, and how important are they for the activities of your institute?

	unimportant	of very little important	of little important	Important	very important
*cost savings in research projects					
*timesavings in research projects					
*resources for expanding basic research					
*resources for extending research facilities					
*commercial success					
*resources from business can be used more flexibly than public funding					
*collaboration with business as a reference when applying for more public funding					
*certain applied research projects can only be carried out in collaboration with companies					
*Access to human capital, person-related knowledge ('tacit knowledge')					
*access to specific capabilities to supplement expertise within the institute					
*new research impetus					
*exchange of ideas and experiences with industrial researchers					
*practical experience for institute staff and/or students					
*gaining additional research insight in the institute's own area of research					
*Access to business sector research findings ('codified knowledge')					
*patents, licenses					
*gaining knowledge about practical problems for curriculum					
*Access to business sector R&D facilities					
*access to business sector technological equipment or specialised technology					

*opportunity to test own research findings in practice					
*securing good job prospects for students and/or institute staff in the business sector					
*securing the presence of business representatives in the university's academic consultant bodies					
*extending the university's mission					
*promoting the diffusion of a particular technology					
*diffusing key R&D findings amongst the public					
*promoting regional development					
*improving the image of science					
*other motives, i.e.					

11. Give your opinion on the following questions regarding the commercialization of academic research.

	yes	partially	no	N/A	neutral
*Do you think that your research has turned into enough benefit / value with publication?					
* Do you see commercialization as an important part of your business?					
*Are you considering making an attempt to commercialize your research?					
* Do you think that the commercialization activities of academicians / researchers should be encouraged?					
*Do you think that your university gives importance to the commercialization activities of its academicians/ researchers?					
*Does your university have a policy/ strategy for commercialization?					

12. Has the financial position of your institute changed as a result of the knowledge and technology transfer?

○ additional resources for technical facilities
○ additional resources for research
○ Additional research for teaching
○ changes

13. Has the research orientation of your institute changed as a result of the knowledge and technology transfer?

○ no change
○ more geared to applied research
○ more geared to basic research

14. Has the knowledge and technology transfer affected teaching, further education or further training activities at your institute?

○ no impact
○ education provided is more geared towards practice
○ less time available for teaching and student support

15. Has the scientific reputation of your institute changed as a result of the knowledge and technology transfer?

○ no change
○ better reputation
○ worse reputation

F. Obstacles to knowledge and technology transfer with the business sector

1. What obstacles prevent knowledge and technology transfer with business companies and/or what obstacles prevent your institute from intensifying the process of knowledge and technology transfer?

	unimportant	of very little important	of little important	important	very important
Lack of information					
*difficult to get informed about research activities in the business sector (confidentiality)					
*difficult to find an appropriate partner in the business sector					
*interface to the business sector poorly equipped (e.g. technology transfer offices lack capacity)					
Problems in the areas of teaching, basic research					

*teaching requires too much time					
*scientific independence impaired					
*hindrance to academic publication activities					
*neglecting basic research					
Necessary conditions for transfer of know-how lacking amongst potential partners in the business sector					
*lack of qualified staff on the part of companies					
*lack of technical facilities on the part of companies					
*lack of interest in scientific projects on the part of companies					
*insufficient interesting research questions in the business sector for our institute					
*Necessary conditions for transfer of know-how lacking in our institute					
*lack of academic specialists for knowledge and technology transfer (capacity)					
*approach of institute staff not entrepreneurial enough					
*our research focus is not interesting enough for the industry sector					
*no possibility of commercialising our research findings					
*uncertainty about R&D results					
*industry has different ideas on costs and/or productivity					
*R&D budgets of potential business partners are too low					
Organisational, institutional obstacles					
*resource-intensive administrative and approval procedures, legal restrictions					
*lack of project administration support on the part of the academic institution (e.g. Through technology transfer offices)					
*lack of support for the commercialisation of research findings on the part of the academic institution					
*Property Rights problems					

*project management problems on the part of the academic institution (e.g. coordination or communications problems)					
*different views on urgency with regard to the scheduling of projects					
*lack of confidence					

2.Below are several factors that may restrict or hinder commercialization activities. Indicate the extent to which you agree that these factors adversely affect / hinder your conduct of your commercialization activities.

	totally disagree	disagree	more or less disagree	agree	totally agree
*Research conducted is not practical.					
*Due to the intensity of academic and scientific activities, there is not enough time for commercialization activities.					
*Inadequate support from the university					
*Inadequate consideration of commercialization activities in academic promotion and incentives					
Private sector's reluctance to R & D activities / lack of information					
*Having different corporate culture and expectations of your private sector and your institution					
*The use of products resulting from R & D activities is considered risky by the private sector					
* Lack of knowledge and experience in commercialization					
*Economic risks of commercialization					
* Inadequate intellectual property rights legislation					
*Uncertainties regarding the sharing of intellectual property rights / potential problems					
*Inadequate institutional structures (Technology Transfer Offices, patent offices, etc.) that will act as intermediaries /consultants for commercialization activities					

*Inadequate public support to promote commercialization in terms of budget					
* Inadequate public support to promote commercialization in terms of quality (content, application requirements, evaluation processes, accessibility, service quality, etc.)					
*Difficulties in access to financial instruments such as venture capital and bank loans					
* Supports are mainly for research and development, not adequately covering the commercialization stage					
*Inefficient services and supports provided in technoparks					

3. Please indicate your agreement or disagreement with the following statements.

	totally disagree	disagree	more or less disagree	agree	totally agree
*Private businesses active in my discipline are making too little use of the knowledge available in universities					
*I see significant barriers stand in transferring my knowledge to the industry					
*The industry is not interested in the knowledge developed at the university					
*Universities are not willing to spend time and money in transferring their knowledge to industry					

4. Please indicate your agreement or disagreement with the following statements about knowledge transfer.

	totally disagree	disagree	more or less disagree	agree	totally agree
*Cooperation with the industry is hindered by cultural differences between academic and commercial researchers					

*Transferring knowledge to the industry is too costly for universities (either in terms of money of time)					
*Companies do not want to cooperate on Rdwith universities; they just want to absorb our knowledge					
*Conducting contract research only results in more income for our research group. We do not learn anything from conducting such research					
*It is hard to find appropriate industrial partners for joint RDprojects					
*Joint RDis hindered by conflicts between academic researcher who want to publish research and commercial researchers who want to patent research					
*I hardly have any incentive to cooperate with the industry since my rewards mostly depend on scientific publications					

5. Do you see specific opportunities for improving knowledge transfer fron universities to businesses? If so, please describe below.

……..

G. Policy for public−private knowledge transfer

1. Please indicate how your research group was financed over the past five years.

multiple answers possible

○ Direct government funding (base funding)

○ Indirect government funding (grant−based funding)

○ Commercial funding (contract funding)

○ Private non−profit research foundations

○ Other

2. What, in you experience, are the best instruments for governments to improv research cooperation?

You may select up to two categories.

○ Tax instruments (e.g. tax deductions for joint RDwork)

○ Financial and other support to Technology Transfer Offices (TTOs) at universities

○ Support for new technological enterprises in their start−up phase (e.g. housing, tailored support, specific tax schemes

○ Support for organisations that bridge science and business RD

○ Targeted innovation programmes

○ Policy to improve the entrepreneurial climate at universities

○ University programmes for reviewing and rewarding research output

○ I do not know

3. Should, according to your opinion, the government foster research cooperation with the industry with policies and programs? If so, please describe how below.

…….

M. INTERVIEW QUESTIONS WITH TTOS (TURKISH)

1- TTO'nun statüsü (Teknokent,vakıf,kurum kapsamında TTO A.Ş.) büyüklüğü nedir? (Sermaye, personel sayısı)

2- Finansman kaynakları nelerdir?

3- TTO personeli için teşvik sistemi var mı?

4- Risk yönetimi var mı?

5- TTO'nun hedef (misyon) tanımı var mı?

6- TTO çıktıları (patent sayısı ve geliri, lisans sayısı ve geliri, kurulan şirket sayısı, vb.) nelerdir? Bunların raporlamaları yapılıyor mu, yapılıyorsa kime yapılıyor, otonomi var mı?

7- Gelir/gider dengesi nasıl (kar mı, zarar mı), buna dair hedef koyuyorlar mı, TTO'nun öz yeterliliği var mı?

8- Yeni teknolojiler hangi evrede lisanslanıyor ve bu lisansların kapsamı nedir?

9- Sanayi sponsorlu araştırma oranı nedir?

10- TTO'nun kendini üniversite ve sanayiye tanıtım yolları nelerdir? Her iki taraf içinde yeterince tanındığınızı düşünüyor musunuz?

11- Buluş ifşalarında artış sağlandı mı, araştırmacıları buluş ifşasına ve üniversite teknoloji transferine yöneltmek için ne gibi teşvik ve ödül sistemleri geliştirildi?

12- En çok tercih edilen teknoloji transfer mekanizması (lisans verme, start-up kurma) nedir, gerekçeleri nelerdir?

13- Sizinle herhangi bir nedenle iletişime geçen öğretim elemanlarının cinsiyet ve fakülte dağılımı nasıldır?

14- Teknoloji transferinde TTO motivasyonları, araştırmacının/akademisyenin motivasyonları, üniversitenin motivasyonları, sanayinin motivasyonları nelerdir, hangi noktalarda örtüşüyorlar/ayrışıyorlar?

15- Öğretim elemanları ve sanayi ile iletişim kurmada yaşanan güçlükler nelerdir? Bu ikilinin işbirliğinden beklentisi nedir?

16- "1513 TÜBİTAK Teknoloji Transfer Ofisleri Destekleme Programı Uygulama Esasları"nda değiştirmek/eklemek istediğiniz noktalar var mıdır? (Kendiniz tasarlamış olsaydınız nasıl olurdu?)

N. INTERVIEW QUESTIONS WITH TTOS (ENGLISH)

1- What is the size of TTO's status (Technopolis, foundation, TTO Inc. within the scope of the institution)? (Capital, number of personnel)

2- What are the sources of financing?

3- Is there an incentive system for TTO personnel?

4- Is there risk management?

5- Does the TTO have a target (mission) definition?

6- What are the TTO outputs (number of patents and income, number of licenses and income, number of companies established, etc.)? Are their reporting done, if so, to whom, is there autonomy?

7- How is the income / expense balance (profit or loss), do they set targets for this, does TTO have self-sufficiency?

8- At what stage are new technologies licensed and what is the scope of these licenses?

9- What is the industry-sponsored research rate?

10- What are the ways of TTO to introduce itself to university and industry? Do you think you are well-known in both sides?

11- Is there an increase in discovery disclosures, what incentive and reward systems have been developed to direct researchers to discovery disclosure and university technology transfer?

12- What is the most preferred technology transfer mechanism (licensing, start-up setting), what are the reasons?

13- What is the gender and faculty distribution of the faculty members who have contacted you for any reason?

14- What are the motivations of the TTOs/researchers-academician/university/industry and at what points do they overlap/dissociate?

15- What are the difficulties in communicating with faculty and industry? What is the expectation of this duo from cooperation?

16- Are there any points you would like to change / add in the "1513 TÜBİTAK Technology Transfer Offices Support Program Implementation Principles?? (What if you had designed it yourself?)

O. INTERVIEW QUESTIONS WITH TUBITAK (TURKISH)

1- 1513 TÜBİTAK Teknoloji Transfer Ofisleri Destekleme Programı Uygulama Esasları'nın eksiklikleri nelerdir?
2- Programın yarattığı katma değer nelerdir?
3- Program beklentileri karşıladı mı?
4- Program şuan tasarlansaydı nasıl olurdu?

P. INTERVIEW QUESTIONS WITH TUBITAK (ENGLISH)

What are the deficiencies of the 1513 TÜBİTAK Technology Transfer Offices Support Program Implementation Principles?

2- What are the added value created by the program?

3- Did the program meet the expectations?

4- How would the program be designed now?

Q. APPROVAL OF THE METU HUMAN SUBJECTS ETHICAL COMMITEE

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
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Sayı: 28620816/393

25 Haziran 2018

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Prof.Dr. Erkan ERDİL

Danışmanlığını yaptığınız yüksek lisans öğrencisi Belkız MAVİŞ'in **"Üniversite Sanayi İşbirliği Sürecinde Teknoloji Transferi"** başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülerek gerekli onay **2018-SOS-127** protokol numarası ile **26.06.2018 - 30.12.2018** tarihleri arasında geçerli olmak üzere verilmiştir.

Bilgilerinize saygılarımla sunarım.

Prof. Dr. Ş. Halil TURAN
Başkan V

Prof. Dr. Ayhan SOL
Üye

Prof. Dr. Ayhan Gürbüz DEMİR
Üye

Doç. Dr. Yaşar KONDAKÇI
Üye

Doç. Dr. Zana ÇITAK
Üye

Doç. Dr. Emre SELÇUK
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Sayı: 28620816 / 261

10 Mayıs 2019

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

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Saygılarımızla bilgilerinize sunarız.

Prof. Dr. Tülin GENÇÖZ
Başkan

Prof. Dr. Tolga CAN
Üye

Doç.Dr. Pınar KAYGAN
Üye

Dr. Öğr. Üyesi Ali Emre TURGUT
Üye

Dr. Öğr. Üyesi Şerife SEVİNÇ
Üye

Dr. Öğr. Üyesi Müge GÜNDÜZ
Üye

Dr. Öğr. Üyesi Süreyya Özcan KABASAKAL
Üye

R. TURKISH SUMMARY / TÜRKÇE ÖZET

Modern anlamda kurulan ilk üniversiteden günümüze kadar öncelikli misyonu eğitim olan üniversitelerin evrimsel sürecine bakıldığında, bu misyona araştırma misyonu da eklenerek bilginin üretilmesi, yayılması, topluma sunulması ve korunması gibi temel ilkelerle birlikte günümüz üniversite anlayışı oluşmaya başlamıştır (Oosterlinck, 2006). Artan küreselleşmeyle birlikte, üniversitelerin ekonomik ve sosyal kalkınmaya katkı sağlamak da misyonları arasında yer almış ve bu faaliyetler üniversitelerin girişimci bir rol üstlenmesine yol açmıştır (Sakınç and Bursalıoğlu 2012, Norman and Eisenkot 2017). Günümüz bilgi toplumunda üniversiteler bilginin asıl kaynağı, bilim ve teknoloji üreten kurumlar haline gelmişlerdir.

Dünyada yaşanan dini, ekonomik gelişmeler ve savaşların etkisiyle üniversitelerin görevleri ve sorumlulukları artmıştır. Üniversitelerin, artan misyon ve sorumlulukları karşısında artan nüfusla beraber öğrenim talebinin artması fakat bunu karşılayacak kamu kaynaklarının yetersizliği üniversitelerin gelir kaynaklarını çeşitlendirmesine ve girişimci bir rol üstlenerek özellikle en önemli paydaşı sayılabilecek sanayi ile işbirliği yapmasına yol açmıştır (Yüksek Öğretim Kuırumu (YÖK), 2007, Sakınç and Bursalıoğlu 2012). Böylelikle sanayi üniversitelerden kendileri için bilim ve teknoloji üretmelerini beklerken üniversiteler de temelde maddi kaynak sağlamayı beklemektedirler. Bunun yanı sıra, bu işbirliğinde bilginin ticarileştirilmesi, gain reputation gibi etkenler de önemli rol oynamaktadır (D'este and Perkman, 2010).

Üniversite sanayi işbirliği mekanizmasını güçlendirecek en önemli arayüzlerden biri bu tezin de konusunu oluşturan Teknoloji Transfer Ofisleri'dir. Çünkü Teknoloji Transfer Ofisleri (TTO'lar), araştırmaların lisanslanması ve ticarileştirilmesi, potansiyel araştırmacıların belirlenmesi, yeni bağlantılar oluşturmak, üniversiteden sanayiye teknoloji transferini aktarmak gibi hususlarda temel rol oynamaktadır (Graff et al. 2002, Khademi et al. 2014). Böylelikle üniversitelerde yaratılan bilginin hangi firma tarafından kullanılabileceği ya da sanayinin talep ettiği bilginin hangi araştırmacıya denk düşeceği hususları için TTO'lar en iyi aracı konumundadırlar.

Dünya geneline baktığımızda ise ABD üniversitelerin patent faaliyetlerinin teşvik edilmesi ve ürünlerin ticarileştirilmesinin sağlanması adına 1980'de Bayh-Dole Yasasını çıkararak tüm dünyaya öncülük etmiş ve diğer ülkelerin de benzer yasalar çıkarmasını sağlamıştır. Böylelikle yapılan buluşların ticarileştirilme sürecinde buluşçunun hak sahibi olması sağlanarak bilginin üretimi ve ticarileştirilmesinin artırılması bu yolla teknoloji transferine katkı sağlanması hedeflenmiştir (Levenson 2005, Merhacı 2015). Bu yasa ile TTO'ların kurulma ihtiyacı doğmuştur. TTO'ların kurulmasıyla birlikte de akademisyenlerin girişimciliğe adım atması hızlanmış, üniversiteler girişimcilik yeteneklerini geliştirmiş ve TTO'ların hızla yaygınlaştığı görülmüştür (Etzkowitz 2001, Friedman and Silberman 2003, Bucsai 2013, Rogers et al. 2000).

Ülkemizde TTO'ların kurulma sürecine baktığımızda ise Sabancı Üniversitesi, ODTÜ ve Hacettepe Üniversitesi'nde ilk yapılanmaların olduğu görülmektedir. 2013 yılında TÜBİTAK 1513 'Teknoloji Transfer Ofisleri Destekleme Programı" ile üniversite sanayi işbirliğini geliştirmek amacıyla bir destek programı oluşturulmuş ve bu programdan sonra TTO'ların kurulma faaliyetleri hızlanmıştır. Bu destek programıyla birlikte, akademik girişimciliğin teşvik edilmesi amacıyla üniversite sanayi işbirliğinin gelişmesi, teknoloji transferinin sağlanması ve ticarileştirilmesinin desteklenmesi hedeflenmiştir. Bu kapsamda ilk olarak 2012 yılında Girişimci ve Yenilikçi Üniversite endeksinde sıralamada yer alan on üniversite TTO'su 10 yıl boyunca geri ödemesiz olarak destek almaya hak kazanmıştır.

Rekabet gücünün giderek beşeri sermaye ile ölçülebildiği, yeni bilgi üreten ve bu bilginin transfer edilmesini sağlamakta öncü kurum olan üniversitelerle bu bilgiyi kullanarak teknoloji transferinde bir diğer taraf olan sanayi kısmı esas alındığında bu iki farklı kültürü bir araya getiren TTO'ların verimliliği tartışma konusu olmaktadır. Bu bağlamda literatürde de TTO'ların başarısı, üniversite-sanayi işbirliğinde teknoloji transferinin ne kadar iyi sağlanıp sağlanamadığı ile ilgili bazı çalışmalar yapılmıştır. Bu çalışmanın konusunu ise, üniversite sanayi işbirliğinde teknoloji transferini

değerlendirmek ve bu işbirliğinde TTO'ların rolünü araştırmak olmuştur. Bu amaç doğrultusunda sorulan araştırma soruları ise şunlardır:

- Üniversite-Sanayi işbirliğine akademisyenlerin bakış açısı nedir?

- Akademisyenler üniversite-sanayi işbirliğinde teknoloji transferinin neresinde yer almaktadır?

- Üniversite-sanayi işbirliğindeki arayüz mekanizması olan TTO'ların bu işbirliği sürecinde teknoloji transferini sağlamadaki rolü nedir?

Ülkemiz gibi gelişmekte olan bir ülkede TTO'ların çok uzun bir geçmişinin olmaması ve girişimcilik faaliyetlerinin de çok eskiye dayanmamasından dolayı yukarıdaki araştırma soruları altında aşağıdaki hipotezler oluşturulmuştur:

1- Akademisyenler üniversite sanayi işbirliğinde aktif olarak yer almayı düşünmemektedirler.

2- Paralel şekilde, TTO'lar işbirliği sağlama sürecinde kendilerini yeterince ispatlayamamışlardır.

Bu çalışmada 2013 yılında TÜBİTAK 1513 'Teknoloji Transfer Ofisleri Destekleme Programı" ile destek alan üniversitelere bağlı TTO'larla proje yapan akademisyenlere bazıları açık uçlu olan toplamda 182 adet soru sorulmuştur. Bunun yanı sıra Ankara ilinde bulunan 9 adet TTO yöneticisi ile mülakatlar yapılmıştır. Ayrıca TÜBİTAK'dan konu ile ilgili 2 adet yönetici ile de yüzyüze görüşmeler gerçekleştirilmiştir. Akademisyenlere anket yapılması, TTO ve TÜBİTAK yöneticileriyle görüşmeler yapılması bakımından konu üç farklı bakış açısıyla ele alınmış ve sonuçlar daha önceki literatürde yapılan çalışmalarla da desteklenerek literatüre yeni bir bakış açısı kazandırmıştır. Literatürde genellikle sadece TTO'larla mülakatlar yapılarak performanslarını etkileyen faktörler belirlenmeye çalışılmıştır (Graff et al. 2002; Muscio 2010; Xu et al. 2011; Üstündağ et al. 2011; Curi et al. 2012; Khademi et al. 2014; Değerli 2017; Güler 2018). Bu bağlamda, bu üç farklı tarafın birbirlerine ve

özellikle TTO'lara bakış açısını belirleyen bu şekilde bir çalışma bulunmamaktadır. Bu anlamda, TTO'ların üniversite ve sanayiyi bir araya getirmedeki rolü anlaşılmaya çalışılmış, tüm tarafların görüşleri değerlendirilmiş, birbirlerinin örtüşen ya da farklı oldukları yönler ortaya konmuştur. Ortaya çıkan sorunların giderilebilmesi için ülke, üniversite ve TTO düzeyinde politikalar geliştirilmiştir.

Bu bilgiler doğrultusunda yapılan çalışmayı değerlendirdiğimizde; öncelikle ankete katılım sınırlı sayıda olduğu için; mühendislik fakültesi ve erkek ağırlıklı olduğu görülmekte fakat, TTO'larla yapılan görüşmelerde bunun daha dengeli bir dağılıma sahip olduğu anlaşılmaktadır. Araştırmacıların temel bilimlerdenden uzaklaşarak daha çok uygulamalı bilime yöneldikleri sonucuna varılmıştır. SCI makale sayısı ve yaş arasında doğru orantı görülmekteyken, uygulamalı araitırmaya yöneldiğini belirten akademisyenlerin yaşları ve SCI makale sayıları çeşitlilik göstermekte ve her kesimin uygulamalı araştırmayı önemseyerek buna yöneldiği görülmektedir.

Diğer kuruluşlarla işbirliklerine bakıldığında araştırmacıların öncelikli olarak kendi kurumlarındaki diğer birimlerle işbirliği içinde oldukları ve ortalama yarısının da diğer üniversite ve kamu kurumlarıyla çalıştıklarını görüyoruz. Bu noktada, kendi üniversite bünyesinde özellikle TEKNOKENT'i var olan TTO'ların araştırmacıları daha çok kendi bünyelerinde çalışmaya eğilimli oldukları sonucuna varabiliriz.

Her ne kadar işbirliklerinin önemli bulunması ve projeler yürütülerek danışmanlık yapılması gibi seçenekler ön planda olsa da araştırmacıların akademisyen kimlikleri ağır basmakta ve bilimsel makalelerin yapılması çok önemli bulunmaktadır. Bu noktada TTO'ların çok etkin çalışması akademisyenini iyi tanıması ve eşleştirmeyi doğru bir biçimde yapması gerekmektedir. Aksi halde işbirliği yürüyemeyecek ve bu işbirliğinden herhangi bir verim alınamayacaktır. Bu bağlamda TTO'ların bahsettiği personel sirkülasyonuna engel olarak personelin daha değerli kılınması sağlanmalı gerek maddi, gerekse manevi teşviklerle personelin gelişimine katkı sağlanarak sürdürülebilirliği kolaylaştırılmalıdır. Bu teşvikler sadece TÜBİTAK'ın zorunlu tuttuğu eğitimlerle kalmamalıdır. Araştırmamızdan ve literatürde yer alan

makalelerden de anlaşıldığı üzere (Campell 2007, Norman and Eisenkot 2017) TTO'da yetişen uzman personelin varlığı önemli olmakta personel sürdürülebilirliği de işbirliği sürecini kolaylaştırmaktadır.

Araştırmacıların çoğunun start-up ve spin-off faaliyetinde bulunmadıkları görülmektedir. Girişimci ve Yenilikçi Üniversite Endeksi için de bu mekanizmalar ön planda olup puanlamada önemli yer tutmaktadır. Aslında bu durum üniversitelerin bu alanda teşvik edilmek istendiğini göstermektedir. Fakat, 3. jenerasyon üniversitelerin bile bu mekanizmalara katılımı yeterli seviyede değildir. Haliyle bu mekanizmaların önemli bulunduğu konusunda da yeterli çoğunluk sağlanamamaktadır. Bu kapsamda yine TTO'lara büyük iş düşmekte sadece TÜBİTAK zorunluluğu nedeniyle veri olsun diye değil, akademisyenlere bunun yapılabilirliği ve zorlukları detaylı bir şekilde anlatılarak ve yapabileceğine inanılan akademisyenlerle işbirliğine girerek bu kanal güçlendirilmelidir. Doktora öğrencilerinin ya da mezunları aracılığıyla bu faaliyetlerin gerçekleştirilmesi sağlanarak akademisyenlerin danışmanlık desteği vermesi de bir alternatif olmaktadır. Ayrıca TÜBİTAK yöneticilerinin bahsettiği gibi personelin yeterince uzmanlaşmamış olması, işini sahiplenmeden çalışması ya da bu ofislerin hantal bir yapıya bürünmesi kendi içlerinde iş yapabilme inancını azaltabilir. Bu nedenle iki tarafı da iyi yönetemeyen çalışan için işbirliğini sağlamak zor olacaktır. Personelin daha dinamik, esnek, her iki dili de anlayan ve her iki tarafla da iyi iletişim kurabilen bir yapıda olması gerekmektedir.

Benzer şekilde patent ve lisans konusunda da TÜBİTAK tarafından TTO'lara bir baskı yaratılsa da üniversite akademisyenlerinin özellikle lisanslama konusunu çok önemsemedikleri ve çok azının ticarileştirme girişiminde bulunmayı düşündüğünü görmekteyiz. TTO'ların patent almanın zorluğu ve uzun sürmesi gerekçelerinden ziyade aslında akademisyenlerin teknoloji transfer faaliyetlerini önemli bulup ticarileştirme sürecinde isteksiz davranmakta ve sanayinin kapasitesinin yeterli olduğunu düşünmediklerini görüyoruz.

Akademisyenlerin büyük bir kısmının çalışmaların sanayi tarafından yeterince ilgi gösterilmediğini düşünmektedirler. Zira bu konuda yine TTO'lara fazlaca iş düşmekte konusunda kendilerini geliştirmeleri gerekmektedir.

1513 program desteğine ilişkin olarak performans göstergelerinin sürekli değişmesi TTO'ların kendi içlerinde karmaşa yarattığını doğrulamaktadır. Yapılarının farklı olmasına karşın tüm TTO'lardan paralel çıktılar beklenmesi yapılabilirliği ve çalışma isteğini körelttiği anlaşılmaktadır. Bu nedenle TÜBİTAK yöneticilerinin de bahsettiği gibi geçen yıl yapılan düzenlemelerle her TTO'nun kendi yapılanmasına göre fonlanması sağlanarak hedefleri belirlenmiştir. Fakat bu sistemin detaylı bir fizibilite çalışmasının yapılarak sürekli bir değişim söz konusu olmayacak şekilde bir sistemin kurulması gerekmektedir.

Bu çalışmada görülmektedir ki 1513 desteğiyle birlikte farkındalık yaratılmış, tarafların kaynaşması sağlanmış ve üniversite sanayi işbirliğinde iyi bir etkileşim ve bağlantılar elde edilmiştir. Fakat bu işbirliğinde teknoloji transferinin sonuç ve etki kısmı yeterli olmamış, ticarileştirme mekanizmaları yetersiz kalmıştır.

Bu değerlendirmeler ışığında hipotezlere dönersek :

1- Her ne kadar bazı araştırmacılar kaynak arayışını bilimsel amaç için yapıyor olsa da veya sadece öğretimi amaç edinmiş akademisyenler olsa da üniversite-sanayi işbirliğinde yer almaya isteklidirler.
2- Yapılan mülakatlarda TTO'lar kendilerinin yeterince iyi tanındığını düşünse dahi, anket sonuçları ve TÜBİTAK mülakatları değerlendirildiğinde TTO'ların işbirliği sağlama sürecinde yeterince aktif olamadıkları görülmüştür.

Özetle, tez çalışmasının tümü değerlendirildiğinde aşağıdaki sonuçlara ulaşılmaktadır:

- Bilimsel yayınlar akademisyenlerin ilk hedefi olsa dahi basic research'te azalma applied research'e yönelme eğilimi bulunmaktadır.

- İşbirlikleri söz konusu olduğunda araştırmacıların daha ziyade kendi üniversitesindeki diğer birimlerle çalışmaya daha yatkın oldukları görülmektedir.
- Araştırmacıların, işbirliğine açık fakat özellikle spin-off, start-up ve lisanslama gibi teknoloji transfer mekanizmalarına yeterli eğilimi bulunmadığı görülmektedir.
- Teknoloji Transfer Ofislerinde personel sirkülasyonunun fazla olması, yeterli uzman ve deneyime sahip olunmaması tüm taraflar için olumsuz etki yaratmaktadır.
- TTO'ların TÜBİTAK'ın olmasını beklediği bir yapılanmada olmadıkları üniversite sanayi işbirliğinin yanısıra aslında daha çok proje destek ofisleri gibi çalıştıkları görülmektedir.
- Akademisyenlerin sanayiye karşı, sanayinin de akademiye karşı bazı ön yargıları mevcuttur.
- TÜBİTAK'ın destek sistemini sürekli değiştirmesi destekten çok köstek olmaya başlamıştır. Üstelik değişen sistemle ilgili olarak yeteri kadar açıklama yapılmamakta ve puanlama ya da seçimlerin nasıl yapıldığı hakkında bilgi verilmemektedir.
- Üniversite, sanayi, TTO'lar ve TÜBİTAK arasında iletişim problemi bulunmaktadır.

Bu bulgulara ulusal, üniversite ve TTO'lar bazında yapılan politika önerileri aşağıda yer almaktadır:

Ulusal Düzeyde Politika Önerileri:

İnovasyon sistemleri araştırmaların artmasını, yeni fikirlerin açığa çıkmasını sağlayarak bilgi yayılımının sağlar. Böylelikle araştırmaların ticarileştirilme süreci hızlanır ve firma sayılarında artış görülür. Bu nedenle TTO'ların yakın olduğu bölgelerdeki alt yapı iyi araştırılmalı ve hükümet hangi inovasyon sistemi üzerinde yoğunlaşması gerektiğine karar vererek üniversiteleri ve TTO'ları bu yöne kanalize

edebilecek politika ve teşvik sistemleri geliştirmelidir. Fakat Türkiye gibi gelişmekte olan ülkelerde hızlı ilerleyen bu yapıya ayak uydurmak zor olduğundan dengenin iyi sağlanması gerekmektedir. Yapılacak politika ve teşviklerle girişimciliğin sağlanması adına akademik özgürlük ve çalışmaların geri plana atılmaması sağlanmalıdır. Sadece finansal destek vermemeli yeri geldiğinde kendisi de doğrudan işbirliği içine girerek düzenleyici bir rolde bulunabilmelidir. Üniversite-sanayi işbirliğinde yer alan diğer bir paydaş olarak aktif şekilde yer alabilmeli, gerek kendisi doğrudan yatırım yapabilmeli ya da diğer paydaşlara finansal destek sağlayarak onların altyapılarını kurmaya teşvik etmelidir. Bu üç paydaş arasında işbirliğinin sürekli, yoğun ve yenilenebilen bir yapıda olması gerekmektedir.

Her kurum kendi bulunduğu bölgeye göre ve kendi özelliklerine göre değerlendirilmelidir. Yüksek teknolojik firmaların olduğu bölgelerde bulunan üniversiteler teknoloji transferine daha yatkın olacakları için TÜBİTAK'ın bu kurumlara öncelik tanıması daha faydalı olacaktır. Bu nedenle her üniversiteye kendi şartlarına uygun olarak farklı oranda destek verilmelidir. Üniversitenin kendi içinde iyi olan özelliği ön plana çıkacak şekilde politikalar geliştirilmelidir. Her bölgenin rekabet edilebilirliği ve teknolojik yeterliliği farklı olduğundan bölgesel inovasyon sistemleri buna göre belirlenmelidir. Ulusal anlamda inovasyon yaratılabilmesi için bölgesel, teknolojik ve sektörel inovasyon sistemleri de kendi içlerinde detaylı bir incelemeden geçerek kalkındırılmak istenen bölgenin özelliklerine göre inovasyon sisteminin seçilmesi ve işlerliğinin kazandırılması esas olmaktadır. İnovasyon sistemlerinin tamamında network, işbirliği ve rekabet gibi unsurar ön plana çıkmaktadır. Bu nedenle ister bölgesel, ister sektörel isterse teknoloik inovasyon sistemi uygulansın; rekabetin yaratılması bu bölgelerde tüm kurum ve paydaşlar arasında özellikle sağlam bir etkileşim oluşturulmasına dikkat edilmelidir. Ülke halkına ve geleceğine katkı sağlayacak, toplumsal standartların artmasını hedef alacak daha yaşanabilir bir ülke olmasına katkıda bulunacak bireyler yetiştirmek ve bu yönde araştırmalar yapmak önceliği olmalıdır.

TÜBİTAK gibi kurumlar herhangi bir destek programı tasarladığında altyapısını ve doğuracağı sonuçların detayla incelendiği bir fizibilite çalışması yapmalıdır. Her kurum kendi özelliklerine göre desteklenmelidir. Böylelikle desteklediği kurumlar arasında daha dengeli bir dağılım sağlanacak ve kurumlararası karmaşayı engellemiş olacaktır. Sistemin sürekli değişmeden taraflara zarar vermeyecek politikalar geliştirilmelidir. İlaveten, değişen sistem veya politikalarla ilgili yeteri kadar açıklama yapılabilmelidir.

. **Üniversiteler İçin Politika Önerileri:**

Üniversitelerin bilgi ve teknoloji transferi önceliği haline gelerek araştırmacılarını desteklemesi gerekmektedir. Çünkü üniversitede üretilen bilimsel araştırmalar teknoloji transferi sayesinde ticarileştirilebilir. Yönetim işbirliğini sağlamaya açık olmalı gerektiğinde bu sürece akademisyen ve öğrencileri de dahil edebilmeli ve bunu sağlamak ve uygulamak adına iyi tanımlanmış uzun dönemli bir stratejik planlarının olması gerekmektedir.

Ülke ekonomisine katkı sağlamak paydaşlar arası işbirliğinin işlerliğini artırmak adına üniversitenin daha fazla araştırma yapması için akademisyene daha fazla ayrıcalık ve özgürlük tanıması gibi unsurlarla olabilmektedir. Bu nedenle; eğitim, araştırma ve ticarileştirme misyonları arasındaki ince dengeyi iyi kurgulamalıdır. İşbirliği sürecinde teknoloji transferini sağlamada öne çıkan araştırmacılarına daha fazla destek sağlayabilmelidir. Ödül ve teşvik sistemini kullanmalı fakat bunu yaparken diğer araştırmacıların yaratıcılığını ve azmini köreltmeyecek önlemleri de almayı ihmal etmemelidir. Bir yandan akademisyenin çıkar çatışmasına girmesini engelleyecek diğer yandan da girişimcilik aracılığıyla üniversiteler paza kazanırken araştırmacılarının ticari olarak sömürülmesine engel olacak dengeyi kurabilmelidir.

Üniversiteler, daha çok uygulamalı araştırmaya olanak tanıyacakları, akademisyenlerin danışmanlığında öğrencilerinin sanayi ile içiçe olmalarını sağlayacakları bir müfredat değişikliğine giderek araştırmaların ve çıktıların daha fazla

olmasını sağlayabilirler. Bu yolla doğrudan sanayiyle bağ kuramayan akademisyenlerim, öğrenciler aracılığıyla dolaylı olarak sanayiye katkısı sağlanmış olunur. Diğer yandan üniversitelerin temel misyonunun araştırma destekli eğitim vermek olduğu unutulmamalı, topluma hizmet amacı geri plana atılmamalıdır. Ülke halkına ve geleceğine katkı sağlayacak, toplumsal standartların artmasını hedef alacak daha yaşanabilir bir ülke olmasına katkıda bulunacak bireyler yetiştirmek ve bu yönde araştırmalar yapmak önceliği olmalıdır.

TTO'lar için Politika Önerileri:

Çalışmanın bulgularına bakıldığında hem üniversitenin hem sanayinin birlikte çalışmaya açık olduğu görülmekte fakat ortak dili kullanamadıkları tespit edilmektedir. Bu nedenle, üniversite sanayi işbirliği sürecinde en büyük rol Teknoloji Transfer Ofislerine düşmektedir. Personelinin işinde uzman dinamik, esnek, her iki dili de anlayan ve her iki tarafla da iyi iletişim kurabilen bir yapıda olması gerekmektedir. Bu nedenle sonuçlarda görmüş olduğumuz personel sirkülasyonuna engel olunarak personelin daha değerli kılınması sağlanmalı gerek maddi, gerekse manevi teşviklerle personelin gelişimine katkı sağlanarak sürdürülebilirliği kolaylaştırılmalıdır. TTO'ların daha kurumsal, daha özerk ve insiyatif alabilen bir yapıda olmaları personelinin de kurum kültürü ve bağının oluşmasına katkı sağlayacaktır. Bu yapılanmanın sağlanabilmesi için üniversite yönetimi ve TÜBİTAK'ın gerekli girişimlerde bulunması gerekmektedir.

TTO'lar farkındalık yaratmak ve güven sağlamak adına kendi tanıtımlarına da önem vermelidirler. Hem sanayi ayağını hem üniversite akademisyenlerini sıklıkla yüzyüze ziyaretlerde bulunmalı ve karşılıklı güveni sağlayabilmelidirler.

Gelişmekte olan ülkelerde ticarileşme süreci eğitim kalitesinin düşük ya da finansmanın yetersiz olması gibi nedenlerle teknoloji transfer sürecinde sanayiye katılım sınır olmakta ve süreci hızlandıracak spin-off, start-up, lisanslama ve patent mekanizmaları yeterli olmamaktadır. Bu kapsamda TTO'lara büyük iş düşmekte

sadece TÜBİTAK zorunluluğu nedeniyle sırf veri olsun diye değil, akademisyenlere bunun yapılabilirliği detaylı bir şekilde anlatılarak, yapabileceğine inanılan akademisyenlerle işbirliğine girip bu kanalın güçlendirilmesi gerekmektedir. Alternatif olarak doktora öğrencileri ya da mezunlar aracılığıyla bu faaliyetlerin gerçekleştirilmesi sağlanarak akademisyenlerin danışmanlık desteği vermesi diğer bir yol olabilir.

Gelecekte yapılan araştırmalar için; yapılacak anketlere verilecek cevap sayısının daha fazla olması, TTO çalışanlarıyla yapılan mülakatlarda şehir ve bölge çeşitliliğin artması ve görüşmelere sanayi tarafından büyük ve küçük ölçekli firmaların da dahil edilmesi önerilmektedir.

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