THE ROLE OF FACULTY OWNED BUSINESSES

IN

ENTREPRENEURIAL UNIVERSITIES

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ABSTRACT

THE ROLE OF FACULTY OWNED BUSINESSES IN ENTREPRENEURIAL UNIVERSITIES

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This thesis explains how universities have evolved towards entrepreneurial universities, the role of these universities in country's development and how these universities have achieved knowledge commercialization, the major objective of third generation universities. Among many alternatives, faculty-owned businesses, called academic spin-offs, are the most direct but controversial way, in terms of their academic duties, used to achieve this objective. In addition to academic spin-offs, technology transfer offices, and science and technology parks used for the knowledge commercialization process, are discussed. The studies in the literature suggest that as the universities have moved from science-based to entrepreneurial universities, they have changed their goals and policies. As an example from the Turkish universities, the development and the current state of academic spin-offs at the Middle East Technical University (METU) are presented. Since METU is ranked the highest among Turkish universities in terms of Entrepreneurial University Index prepared by the Turkish Ministry of Science, Industry and Technology, the place of academic spin-offs at METU will help us to understand the state of academic spin offs operating in Turkish universities.

Keywords: Entrepreneurial Education, Entrepreneurial University, Academic Spin-Offs, Knowledge Commercialization, Technology Transfer.

ÖZ

ÖĞRETİM ÜYESİ ŞİRKETLERİNİN GİRİŞİMCİ ÜNİVERSİTELERDEKİ ROLÜ

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Bu tez, üniversitelerin Girişimci Üniversite modeline doğru zaman içindeki gelişimini, bu üniversitelerin rollerini ve üçüncü nesil üniversitelerin temel amacı olan bilginin ticarileştirilmesi işlevini nasıl gerçekleştirdiklerini açıklamaktadır. Pek çok alternatif arasından, akademisyen firmaları, görevleri açısından tartışmalı olmakla birlikte, bu amacı gerçekleştirmek için en doğrudan doğruya olan yoldur. Akademisyen şirketlerinin yanı sıra, bilginin ticarileşmesi sürecinde teknoloji transfer ofisleri ve teknoparkların kullanımı tartışıldı. Literatür çalışmaları gösteriyor ki bilim temelli üniversiteler girişimci üniversiteye doğru hareket ediyorlar, amaç ve politikalarını değiştiriyorlar. Türk üniversitelerinden bir örnek olarak Orta Doğu Teknik Üniversitesi'nde bulunan akademisyen şirketlerinin mevcut durumları ve gelişimleri gösterildi. ODTÜ, Türk üniversiteleri arasında Bilim, Sanayi ve Teknoloji Bakanlığı'nca yapılan ölçümlemede en üst sırada yer aldığı için, ODTÜ'de bulunan akademisyen şirketlerinin durumu, onların Türk üniversitelerinde yerini bize göstermede faydalı olacaktır.

Anahtar Kelimler: Girişimci Eğitim, Girişimci Üniversite, Akademisyen Şirketleri, Bilginin Ticarileşmesi, Teknoloji Transferi.

To my beloved family

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LIST OF ABBREVIATIONS

ACU	Atlantic Canadian University
ASOs	Academic Spin-Offs
ATOM	Animation Technologies and Game Development Center
EACEA	Education, Audiovisual and Culture Executive Agency
EBSO	Aegean Region Chamber of Industry
EU	European Union
ESA	European Space Agency
GIP	Entrepreneurship and Innovation Platform
HEC	Council of Higher Education (YÖK)
HEI	Higher Education Institution
HES	Higher Education System
IASP	International Association of Science Parks and Areas of Innovation
IHTI	İzmir High Technology Institute
IP	Intellectual Property
IPR	Intellectual Property Rights
IT	Information Technologies
ITU	Istanbul Technical University
SMEDO/KOSGEB	Small and Medium Enterprises Development Organization
METU	Middle East Technical University
METUTECH	METU Technopolis
MSIT	Ministry of Science, Industry and Technology
NCEE	National Centre for Entrepreneurship in Education
PCT	The International Patent System
QAA	Quality Assurance Agency
PROs	Public Research Organizations
R&D	Research and Development
RTP	Research Triangle Park
SMEs	Small and Medium-sized Enterprises

STP	Science and Technology Park
SV	Silicon Valley
TDRs	Technology Development Regions
TEKMER	Technology Center
TEYDEP	Directorship for Technology and Innovation Assessment
UIIN	University Industry Innovation Network
USA/US	United States of America
USIGEM	University- Industry Cooperation Development Center
WWII	World War II

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CHAPTER 1

INTRODUCTION

Higher Education Institutions (HEIs) have evolved significantly over time and at an accelerating rate in the last decades. They moved from science-based university to "Entrepreneurial Universities" as called by Etzkowitz (1983). From the perspective of Fayolle&Redford, the expectations of internal (alumni, professors and university staff) and external (industry, government and region/local community) stakeholders of new generation of universities and the changing environmental conditions have led to significant transformations in higher education over time, probably at a pace that has been quickening over the last decades. "Entrepreneurial" or "Third Generation" university model began to be used to identify institutions trying to adapt to the new environmental conditions and expectations of society by trying to develop new tools that the dominant traditional institutions did not have. To meet these expectations, the world of academics and industrial research need to move towards each other and become more intertwined. Significant academic research has been conducted into this important transformation in the HEIs' and their (universities and colleges of HEIs) potential role in shaping economic enterprise and development, as stated by Johnston, Hamilton, and Zhang (2008).

The first generation universities were "Teaching Universities". These were first encountered in the 12th century in Bologna and Paris. Their main objective was the collection, preservation and dissemination of existing knowledge. The second generation universities emerged in the 19th century. They can be called "Research Universities", in addition to the dissemination of knowledge through teaching; the creation of new knowledge through research was their main objective. Recently, the world has been experiencing the emergence of a new type of university, the third generation universities, called "Entrepreneurial Universities". The creation of economic value from knowledge production has become the objective of these

universities. It is believed that the creation of economic value can be much more effective when the universities collaborate with the private and public institutions at all stages of the research process. After the Bologna Declaration in Europe in 1999, as stated by Wong (2007), the policy makers were forced to move towards a knowledge-based strategy for the country's growth in all dimensions which were high-tech spin-offs, industry based research, technology commercialization, capturing foreign talent, and endorsing entrepreneurial mindsets. The standards and quality of European higher education was revised to adapt according to changing needs, society's demands and advances in scientific knowledge to better respond to the expectations of the business world.

As a result of this transformation, universities started to play an increasingly important role in the country's innovation system. The collaboration with technology-driven enterprises and changing strategies, structures and practices in universities, they maintained to create their entrepreneurial mindset for students and faculty members (Fayolle & Redford, 2014). A new type of relationship began to operate progressively within a Triple-Helix nexus which involves universities, private companies from the industry and government institutions (H. Etzkowitz, 2000, 2003; Leydesdorff & Meyer, 2006). This was the response of the universities to the globalization of the knowledge economy in the countries which are growing innovation-driven. In innovation-driven economies, entrepreneurial framework conditions become more important. The transformation started in all dimensions to produce innovative products and services with the most advanced methods in order to provide competitive advantage for the country with entrepreneurial activities. All actors in Triple Helix (university- industry-government) developed new policies and tried to get benefit from this transformation. Universities, with the new entrepreneurial role assigned them, tried to find financial support for their research by creating new knowledge-based companies and selling technology to the existing firms (H. Etzkowitz, 1983, 2001). Firms desired to get more benefits from research carried out by universities through licensing of patents, commercialization of knowledge or valorization. In addition to these, governments which wanted to grow according to the rules of innovation-driven economy started to develop new policies

to support the industry-university collaboration. In this context, academicians started to found their own companies by transferring their research results to the market place. This is the creation of academic spin-offs (ASOs).

Although it seems there are several benefits resulting from this formation for industry and university, there have also been opposing ideas. Academicians had some difficulties as founders of ASOs or working in different types of knowledge commercialization activities. They searched funds for Research& Development (R&D) projects while accomplishing their academic responsibilities at the same time. They are accused being overly engaged in practical matters of society (Krimsky, 2003), losing focus on scientific studies and being reluctant to contribute their academic involvement (H. Etzkowitz, 1983, 2013). In the academic world, the discussions about knowledge commercialization, the developments and the roles assigned to entrepreneurial universities, pros and cons of ASOs have begun.

The main purpose of this thesis is to present the roles of Entrepreneurial University in education system and the situations of ASOs in this new structure. The evolution of universities from education to knowledge commercialization is discussed. The process of knowledge commercialization with technology transfer offices and ASOs with their pros and cons are presented. As an example of Entrepreneurial University in Turkey, the implementation in the Middle East Technical University (METU) is summarized. According to the Entrepreneurial University Index, METU has the highest rank among universities in Turkey. The number of ASOs is one of the measured criteria in this index calculated by the Turkish Ministry of Science, Industry and Technology (MSIT). Describing the current situation of ASOs at METU Technopolis (METUTECH) may be used by the scholars, practitioners, and policy makers and hopefully create a comparison point for further studies on the subject.

In Chapter I, the purpose of the study is clarified as an introduction to the thesis. In Chapter II, a review of the relevant literature about the evaluation of Entrepreneurial University concept and the roles assigned to it and the situations of ASOs at an entrepreneurial university with the implementations, based especially on

METUTECH, are provided. In Chapter III, the data are collected from the ASOs in METUTECH. The assessment of ASOs in METUTECH is described with collected data provided by METUTECH Management. The data analyzed according to specifications of academic-spin offs which are number of companies, dates of establishment, departments, revenue streams, title of academicians, and the university they are working in. In Chapter IV, the conclusions drawn from this study are presented. Some suggestions for future studies are offered to policy makers.

CHAPTER 2

THIRD GENERATION UNIVERSITIES - ENTREPRENEURIAL UNIVERSITY

There is a remarkable development occurred within many universities over the past decades. There is an increase in policies and practices aimed at promoting 'third mission' or 'third stream' activities, i.e. activities directed towards 'knowledge transfer', providing links with industry and commercializing university research and teaching (Shore & McLauchlan, 2012). This is the transition term from research-based universities into Third Generation-Entrepreneurial Universities which have many dimensions and interactions affected by industry and government in Triple Helix nexus. There are four processes related to major changes in the production, exchange and use of knowledge which the Triple Helix model has identified as follows: 1) Internal transformation in each of the helices, 2) The influence of one institutional sphere upon another in bringing about transformation, 3) The creation of a new linkages, network and organization among the three helices and 4) The recursive effect of these inter-institutional networks representing academia, industry and government both on their originating spheres and the larger society (H. Etzkowitz, Webster, Gebhardt, & Terra, 2000). These are the constituents that we want to emphasize in our study among the internal and external factors which are important for the development and implementation of new type of universities. Before examining these interactions between university, industry and government, it would be useful to comprehend the changes in universities over time.

2.1 Emergence of the Third Generation Universities

About 2000 years ago, Aristotle was discussing what exactly the purpose of education of his age was: to create educated people, to educate in virtue, or to satisfy material needs of society which can be summarized as learning, virtue and utility.

The changing priorities between these three purposes of society or majority of them according to the dominance of economic, social and cultural groups shaped the university education system since then (Rüegg, 2003).

The evolution of universities over time can be classified into a generational structure as Wissema (2009) conducted as shown in Table 1. 1st Generation Universities (Medieval Universities) were almost pure teaching institutions, what was expected from them was to collect the existing knowledge and disseminate it to their students. After developing primarily outside of the university system, the scientific method began to be adapted by some universities and they became the initial implementers of the 2nd Generation Universities also known as Research Universities. In addition to their mission of teaching, these institutions added a second mission of conducting research. As a result, they became not only collectors and disseminators of knowledge but also creators of new knowledge. Over time conditions changed again and expectations from universities contributing more directly to economic developments arose. These are the 3rd Generation Universities (Entrepreneurial Universities) which is still in process, started to be more interested in creating economic value from their knowledge production. Three generations of universities are as shown in **Table 1**;

1- The first generation can be identified with the objective of education only. They are defined as Medieval Universities-Bologna University being the oldest and still present (1088).
2- The second generation can be identified with two objectives: Education + Research-Humboldt Type University.
3- The third generation can be identified as know-how exploitation in addition to education and research objectives which are still in process.

Table 1: Characteristics of the three generations of universities, Wissema (2009)

	1st Generation	2nd Generation	3rd Generation
Objective	Education	Education + research	Education + research + know-how exploitations
Role	Defending the truth	Discovering nature	Creating value
Method	Scholastic	Modern Science, monodisciplinary	Modern science, interdisciplinary
Creating	Professionals	Professionals +scientists	Professionals + scientists + entrepreneurs
Orientation	Universal	National	Global
Language	Latin	National languages	English
Organization	Nations, faculties, colleges	Faculties	University institutes
Management	Chancellor	Part-time academicians	Professional management

2.1.1 First Generation – Education

The Medieval Universities were the first generation of universities which can be determined as the pioneer of todays' universities that are evolved from Catholic and Protestant church schools as stated by Wissema (2009). University of Bologna (founded in 1088 but received its charter in 1158) in Italy and University of Oxford (1096) in United Kingdom are founded during this term, at the end of the 11th century as well as University of Paris (~ 1200) in France. Their aim was collecting, preserving and passing the knowledge to their students. It could be said that the universities were strong organizations that were both supported by government and Church in medieval age. They had a lot of privileges and were very similar with the monasteries due to applying their own law and jurisdiction. Teachers were academically free and could use their mind independently although there were occasional conflicts with the Church. Nevertheless, the main purpose of medieval universities was not generation of new knowledge. Wissema (2009) indicates that, it was "protection of the wisdom of past and teaching of obedience to the doctrines of the church". Although they had a significant power on State and Church by

educating the princes as candidates in a disciplinary manner, they could not invent something new for science. The progress in academic revolution took almost eight centuries after the first appearance of Medieval Universities in Europe. The establishment of specialized academic structures for properly educating greater numbers of students as professionals was one of the accelerating factors for the transition to new generation

2.1.1.1 First Transition Period

There was a new intellectual movement during 14th century which was started by Petrarch (1304- 1374) that was called Humanism within the understanding of common learning and amateur and professional people started to research together. It was called human studies. In 1500s, there were still no big changes in universities in Europe. The main difference was the source of the professor's salaries which were increasingly paid by Seculars rather than Church authorities. This rendered universities to be more dependent to civil authorities in state or city. And there was a new term started to be used early in fifteenth century: Academia.

These developments built the conditions for shaping the way of thinking in the Middle Ages and lead to realization of the scientific revolution in the West in 17th century. In 17th century, the observations about nature and reasoning created a strong base that is achieved by Bacon, Boyle and Newton. In those years, many scientists did not teach at universities because of the new way of thinking. As a result, the major enlightenment about science occurred outside of universities. Wissema (2009) indicates that, this was the term; the impact of Church was highly and irrevocably eliminated.

During Renaissance (the period from the 14th to the 17th century), the discovery of the New World (1492), the Protestant Reformation (1517), the age of Enlightenment (1650s to the 1780) and political revolution in France (between 1830 and 1848) which was the term for the evolution of the universities in terms of expansion, differentiation and professionalization, many aspects were added to the university curricula such as human rights and international law.

Ponnusamy and Pandurangan (2014) state that, the transformation from "preservation and transmission of accepted knowledge" to the "discovery and advancement of new knowledge" started during the Age of Enlightenment. This understanding caused the separation of religion and science as an activity and The Scientific Revolution started with the emergence of Modern Science.

2.1.2 Second Generation - Education + Research

Until the end of eighteenth century, the modern scientific method was not the main purpose of universities although it takes its origins from Renaissance. "Modern Scientific Method" was a result of conclusions from objective, systematic and reproducible experimentation made by researchers who started using them and their transparent argumentation. Wissema (2009) stated that, these conclusions are transferred into "laws" which specified the behavior of the systems and modern science and technology. Rüegg (2004) determined that, a new type of university that emerged from this convergence in Germany (Prussia) was named as the general use of the term "Humboldt University" and focused on research which was mono-disciplinary, according to the modern methodology. Their goal was University Education as the student-centered activity of research. By Industrial Revolution, the *specialization* became the significant character of Humboldt University (1810). H. Etzkowitz, Webster, and Healey (1998) stressed that, with the development of research universities, first in Germany and then elsewhere in the world in the 19th century, the redesigning of the university started worldwide radically.

The expenses of universities were paid by governments from the national budget and this made them become dependent on the political authorities. The contact between universities and industry were still isolated although the science and technology faculties understood the increasing importance of the relation between them.

2.1.2.1 Second Transition Period

H. Etzkowitz (2001) indicates that, the late nineteenth and early twentieth centuries, the academic revolution introduced a research mission to the University, and gave

start to the conservation and transmission of knowledge. Building upon the first academic revolution, the second one is the translation of research results into intellectual property, a commercilizable commodity, and economic development (H. Etzkowitz et al., 1998).

In the second transition period, new developments in social and academic worlds occurred. Wissema (2009) determines them as follows; the significant increase number in the population of students and academic entrepreneurship, cost of cutting-edge research and university expenses, and increase in usage of English language in Modern Science, Process of Bologna, strong intertwining with government departments and increase in demands from universities, interdisciplinary research ,challenges establishment of specialized research institutes outside of the university, Mobilization, and Globalization.

Many industrial research and development organizations had to cancel research programs in their basic sciences because of their costs. H. Etzkowitz (1983) states that, there was a need for financial resource for the survival of research groups that was maintained by specialized scientists and for the costs of specialized and complicated equipment. The private sector needed to find a solution for this problem. They decided to connect with academic institutions and universities. The professional scientists from Industry and entrepreneurial scientists from University are getting together in an institutionalized collaboration of the university and an industrial firm and they both had benefits from this collaboration. H. Etzkowitz (2012) indicates that, a new type of Information Technologies (IT) appeared in American Universities like Massachusetts Institute of Technology (MIT-1865) and University of Stanford (1891) and showed that universities can be the origin for technology based entrepreneurial clusters. Especially during World War II, H. Etzkowitz (2001) states that group research have been necessitated by the urgent need for production of military weapons before the enemy. In 1960s', different science areas came together with research and development departments of the companies and their number increased by making basic and applied research additionally with the *interdisciplinary research*.

As a result of these increase in expenses of big research, universities tried to find out some external funds, besides those provided by government, as in Cambridge University example. The need for *sponsorship* is increased for the foundation of private research and development institutes. But universities were not considering being a part of Applied Science and Technology. Wissema (2009) explains that, these applied science projects were conducted by entrepreneurs and government-sponsored institutes like NASA, CERN and European Space Agency (ESA) in those days.

The big technology companies started to be shown as reference for contracted research and provided good job opportunities for graduates by making collaborations with universities. It started in Europe and Asia. The policy makers started to put IT in government program. Most of the governments looked for agencies to establish innovation infrastructure.

Although, know-how exploitation is still seen as a sideline to the main functions of research and education, trends are converging into a new model for universities, just as it was during the *first transition period.* As H. Etzkowitz (1983) determined that, from now on, a new generation occurred in education system which is called *knowledge commercialization* and some of the universities chose the title of *Entrepreneurial University***.** This is the *Second Transition Period.* They are experiencing the models of the commercialization or exploitation of know-how which is the Third Mission of universities, with new organizational structures, marketing activities in order to attract more and better students and staff, and new way of financing (Wissema, 2009).

2.1.3 Third Generation-Education + Research + Knowledge Commercialization

Commercial ventures started in early nineteenth century in Germany, where the research developments were sustained in a proper way in the universities. H. Etzkowitz (1983) stressed that, some professors of chemistry established a factory with the permission taken from the government to produce their research results.

The government of German states understood the importance of contribution of distinguished universities for their prestige and economic development. All these initiatives between academicians and enterprises continued this kind of pursuits in spite of some failures. In the late nineteenth century, scientific research was eminently established in US universities and academicians started to give consultancy services to Industry. The importance of technology and changing organization of research started between the two world wars (H. Etzkowitz, 2001). In research studies, complexity of instruments and equipment and their financial needs increased and some conflicts occurred in establishment of research groups in 1920s in England. Some scientists defended the importance of external financial supports while others rejected to negotiate about them. From the perspective of H. Etzkowitz (1983), it was a contradiction that individual scientist was looking for external funds while the research was conducted in university.

MIT established a special program which is called "industrial liaison program" (H. Etzkowitz, 2001). These programs provided the academician to see the difference of basic and applied research applications and distinctive areas of them were conceived (H. Etzkowitz, 1983). Stanford, Harvard and MIT have come to be more similar as being related closely to the industry (H. Etzkowitz, 2001) and in 1963, Clark Kerr, University of California, Berkeley, determined the vision of the future universities with the term "multiversity".

Laredo (2007) stated that, there has been a transformation from "republic of scholars" to the post-world war model of "fundamental research". The change in the organizational movement of the "republic of science" started from this point on. The Third Mission is a complementary mission to teaching and research for the universities. The relationship of University and Industry has been a center focus for policy-makers. In order to get back the definition of Greek and Roman texts, new knowledge was created and a better understanding was captured through the innovative methodological techniques (H. Etzkowitz, 2001). The "Third Mission" (H. Etzkowitz et al., 1998) emerged after the World War II to combine research (Laredo, 2007) and teaching with technology transfer as the entrepreneurial ones defined.

Shore and McLauchlan (2012) indicates that, the knowledge transfer or exchange is a connector of the research and commercial outcomes (i.e. spin-out and 'spin-in' companies, entrepreneurial incubators, start-up businesses, commercial patenting and licensing, the marketization of research innovations). They are the main factors which constitutes the third stream activities.

Burton Clark as indicated in the article of Smith (1998) introduces five necessary conditions for creation of "Entrepreneurial University" from a "Research University". They are; 'expanded developmental periphery', 'stimulated academic heartland', 'integrated entrepreneurial culture', 'strengthened steering core' and 'discretionary funding base'. Nature of scientific research and knowledge differs in countries. But, for knowledge, to be communicated, using the same language is very important. Wissema (2009) stressed that, English is determined as the common language of entrepreneurial universities which is an important factor to communicate between communities and universities for utilization and sharing knowledge and experiences.

H. Etzkowitz (1983), the first user of the term "Entrepreneurial University", stated that the emergence of "Entrepreneurial Science" was not started as a result of demand from existing industries. It started because of the interaction between venture capitalists and university scientists who decided to take commercial advantage of the industrial applications of their research. Tijssen (2006) explains that, the phenomenon of entrepreneurial universities has an extensive role in the industrialized and developing countries with bringing significant changes to university culture and policy.

Jencks and Riesman (1968) state that, the knowledge commercialization represents a transformation of the role of the university in community similar to the first academic revolution of the late 19th and early 20th century when research became an accepted academic duty. Each new mission of the continuity of universities has evolved out of an attempt to satisfy the previous goal. Research occurred by strengthening the traditional learning in the eighteenth century. But moving from first and second generation universities to third generation university has not

completed their missions. In other words, there are both types of universities currently maintaining their missions which mean that the majority of universities are defined as applying 1st and/or 2nd type of missions. Entrepreneurial type of university is accomplishing the third mission in addition to the first and second missions. The transition period is still in process. Altbach, Reisberg, and Rumbley (2009) indicate that, because of their global nature and the number of institutions and people they affect, the academic revolution was more expanded in the late 20th and early 21st centuries.

Third Mission Universities are network universities. The exploitation of knowledge, integrated with research and education with the activities in places such as science parks, is the core business of Third Mission Universities. The government contribution is decreased and universities became less dependent on state regulations. With the education in Third Mission Universities, scientists, scientifically educated professionals and entrepreneurs can be created. Their governance, incentives and attitudes differs but common language is English in Third Mission Universities. They operate in international and competitive market to be attractive for the best and brightest students and academicians. Wissema (2009) stressed that, the research is conducted in transdisciplinary manner in university institutes which have entrepreneurial attributes and these universities are multicultural organizations. MIT, Stanford and Harvard in USA, Cambridge, Leuven and Munich Universities in Europe are accepted as the best practices of third mission universities.

To see the evolution and implementations in Third Mission University and its effect to regional development, Cambridge Phenomenon can be examined in detail as one of the best practices.

2.1.3.1. Cambridge Phenomenon

Even though MIT and Stanford started to work with the industry before the University of Cambridge (1209), there is a phenomenon about Cambridge where emerging high technology institutes made collaborations with the university. It was

a part of social and political developments in United Kingdom. Wissema (2009) stated that, the emergence of high-tech industry stems from spinout activities of University of Cambridge, and entrepreneurs who were drawn to the scientific and increasingly dynamic environment.

The spinout activities are based on an early time in 1881 by the establishment of Cambridge Instruments. The success of Cambridge cluster was based on laissez-faire approach, making it different from the other universities, during technology transfer and lack of formal policy and infrastructure for the academicians. Druilhe and Garnsey (2003) indicated that university allowed them to undertake entrepreneurial activities such as private consultancy or business creation as long as their commitment was the improvement of university's teaching and research. In 1983, this area was one of the three clusters of industrial firms in UK. At the beginning there were some examples of clusters like the developments in Cambridge shire, UK. The emergence of high-tech industry in that area was so huge that this part of the country became the second richest area in UK. The interactive process with University of Cambridge brought it among the world's top. The area became the magnet of the region in terms of modernization process and spin out activities.

Both scientific and financial reasons brought the academicians to make cooperation with industry if they want to continue their research, they need more financial support than the government provided to them. Also companies started outsourcing for the R&D activities and they named this "embedded research". In this kind of research, researchers worked together from the company and university.

Since the government stated the importance of knowledge-driven economy by White Paper report, they started to transfer the technology to community which was the third formal objective of HEIs, with research and education. With this report the government started to provide funds to finance the links between higher educations with business by the Treasury. With these funds eight Entrepreneurship centers were maintained including one at the University of Cambridge which became later as Cambridge Enterprise.

There is a cluster in Cambridge with more than 3000 active companies that 360 of them were established during 1960s,' to solve the industrial problems of Britain in Cambridge Technopol. As Wissema (2009) stressed that, even though 98% of those companies are there because of the university but only 10% of them are established by the university. And Jamieson (2014) explains that, there are more than 1500 technology-based firms that 14 X $1bn and 2 X $ 10bn companies have come from Cambridge Cluster and £13bn in total revenue from this area where almost 57.000 people are employed by Cambridge Cluster. Some people call this "innovation and entrepreneurship ecosystem". In an innovation ecosystem there are actors or entities whose functional goal is to enable technology development and innovation. Jackson (2011) states that, the actors would include the material resources such as funds, equipment and facilities and human resources such as students, faculty, staff, industry researchers, industry representatives while institutional entities such as universities, colleges of engineering, business schools, business firms, venture capitalists, industry university research institutes, federal or industrial supported Centers of Excellence, and state and/or local economic development and business assistance organizations, funding agencies, policy makers, make up the participating in the ecosystem.

University of Cambridge has the most scientists with Nobel Prices. To date, 90 affiliates of the University have won the Nobel Prize as stated in university web page. And many scientists like Newton, Darwin, and Rutherford (split the first atom there); Crick and Watson (Inventors of DNA double helix structure) pioneered their theories in Cambridge.

The community that established high-tech enterprises, the university modernization process and techno-starter facilities were important in the success of Cambridge Phenomenon. As Wissema (2009) stated that, the university moved from age-old tradition of value-free, pure science to the university that creates value for society and starts cooperating with industry.

2.2 Entrepreneurial University Concept in Triple Helix Nexus and Their Interactions

2.2.1 Entrepreneurial University Concept

The concept of entrepreneurship which is as old as human history has continued its process by having variances of features in different time periods. Ever since the founding of economic history (Adam Smith, Ricardo), entrepreneurship has been identified as an important element reaching and maintaining successful development in economic meaning and it has gained great importance in the development of economies through especially transformation of industrialized societies into knowledge societies. As stated by The National Centre for Entrepreneurship in Education (NCEE), entrepreneurial concept perceived by academicians to be involved in business and commercialization of university intellectual property and is consequently connected in with innovation as part of the work of incubators, technology transfer offices and science and technology parks. This idea is strengthened by government perspective that perceives universities as "engines of growth" with technical innovation that produced in there (NCEE, 2013).

Wissema (2009) indicates that, with the emergence of third mission as transfer of the value of their generated knowledge to society, there is a new type of university was emerged in the mid of 20th century that encourages university-government and industry cooperation in Triple Helix nexus named as Entrepreneurial University as we mentioned in previous chapter.

There are different but similar definitions of entrepreneurial universities. H. Etzkowitz (2003) stated that just as the entrepreneurial university teaches individual students and prepares and sends them out into the world. With respect to him, "Entrepreneurial University" is a natural incubator, providing support formations for teachers and students to start new ventures: intellectual, commercial and conjoint.

In NCEE (2013) report it is explained via innovation:

> *Innovation in an entrepreneurial university development context may therefore be viewed in terms of: new organization and leadership development initiatives; experiments in pedagogy, knowledge organization and program development; internal and external stakeholder engagement; trans-disciplinary activity; and new research explorations, methods and applications to practice.*

Subotzky (1999) explains the entrepreneurial process in an order that globalization caused changes in economic relations and knowledge-based society has raised, and made an impact directly in Higher Education System (HES); rapid innovations in IT sector needed flexible and quick responses; knowledge production approach has changed and information-based skills are emerged. In response to these developments, the implications in training and research activities undertaken by HEIs have changed into "entrepreneurial" or "market" universities which are exhibiting more and more market-liked behavior and contributing to institutional and national needs.

R. Geiger (1992) states that while the distance between university and industry was large in 1980s and faculties, mainly whom stand outside of any connections with private industry, has been conspicuously distrustful of this trend. But response came from industry positively. H. Etzkowitz (1983) indicates that the change in their patent policies have seen in Stanford, Columbia and Harvard Universities by especially in molecular biology in the wake of formation of firms originated in universities during this period. In the middle of 1990's, the role of HEIs are increased and researchers started to interest in Triple Helix approach in the knowledge-based societies (H. Etzkowitz & Leydesdorff, 1997; H. Etzkowitz et al., 2000). The Entrepreneurial and Enterprise University models (Smith, 1998), the concept of academic capitalism (Slaughter & Leslie, 1997) represent the best known conceptualizations to illuminate the rapprochement of the universities and society from the different viewpoints.

Entrepreneurship education is seen as playing a vital role in the development of more and/or better entrepreneurs with greater levels of knowledge, skills and other competencies as explained in Fayolle and Redford (2014)'s book by many authors (Gorman et al., 1997; Pittaway and Cope, 2007; Martin et al., 2013) . The new type

of university is still in process with the new applications and the interval of generations is shortened comparatively.

2.2.2 Triple Helix Concept

Entrepreneurial University is a central concept to the Triple Helix as we mentioned above. As determined in University of (Stanford), it takes a pro-active stance in putting knowledge to use and in creating new knowledge. The concept of Triple Helix the university-industry and government relationships started in 1990s by Etzkowitz & Leydesdorff. They interpret a shift from a dual structure which was maintained by industry-government to a growing triadic relationship between industry-government and university. H. Etzkowitz (2000) indicates that Triple Helix centers on interactions between universities-industry-government as the key to development the conditions necessary for the innovations at the core of knowledge based societies.

It is emphasizing the importance of innovation and entrepreneurship. H. Etzkowitz and Ranga (2013) describes Triple Helix as follows:

> *"The Triple Helix thesis is that the potential for innovation and economic development in a Knowledge Society lies in a more prominent role for the university and in the hybridization of elements from university, industry and government to generate new institutional and social formats for the production, transfer and application of knowledge."*

As explained by H. Etzkowitz (2003) and also by Leydesdorff and Meyer (2006), there are some supporting evidence from the research that under the content of the Triple Helix approach in the knowledge-based societies, universities achievement may be high. Especially changing knowledge production system in universities from Mode I to Mode II, multidisciplinary teams came together, and worked on specific problems in the real world. Kiper (2010) states that while academic concern was important and the produced knowledge was publishing in scientific articles and sharing with public in type of Mode I, transdisciplinary studies started by networking in university-industry collaboration with the application of Mode II.

As it shown in **Figure 1**, the new conceptual Model is Triple Helix Triangulation. Building on the work of Etzkowitz and the need for inter-organizational networks, Farinha and Ferreira (2013) stress the need for the interactive engagement of public and private interests based. H. Etzkowitz and Ranga (2013) indicates that Triple Helix is a very complex system based on relationship with its components and functions as the source of new innovative organizational design and social interactions. There are benefits from this partnership for all the sides of Triple Helix and some motivators as it shown in **Figure 1** as follows.

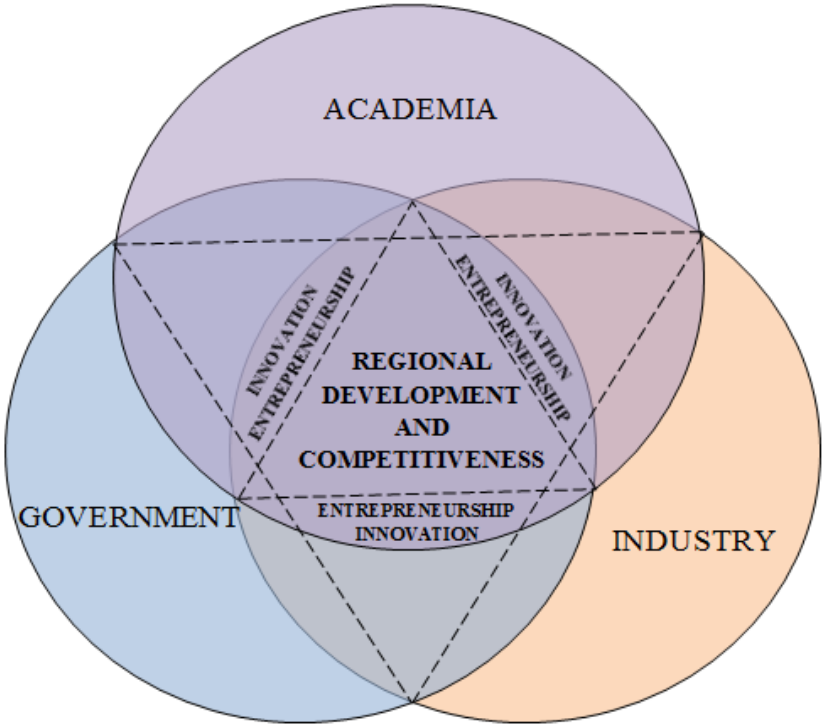

Figure 1: New Conceptual Model: Triple Helix Triangulation

In the "Handbook on the Entrepreneurial University", the authors, Fayolle and Redford (2014), have shared the article of Guerrero and Urbano (2012), and they state that:

Not only Academic Spin-Offs but also students and graduates are seeking support at the university environment to establish a business as startups. New opportunities can be constituted by interrelation between university- industry and government which are the three types of stakeholders to encourage academicians to play greater role in society.

In the comprehensive study, prepared by MSIT (2015a), it explained in detail. For the collaboration of university-industry; from the University's point of view; obtaining financial supports for education and research, fulfill its mission of service in the public interest, opening experience areas for students and academics, to identify significant problems, contribute to regional economic development, to create business areas for alumni. On behalf of the Industry; to access the University's research infrastructure, to reach the laboratory services that it does not provide, facilitate its technologies progress and renewal, selecting potential employees, to provide research opportunities in pre-competition, to improve its own R&D capacity.

H. Etzkowitz (2008) defends and offers recommendations for public policy with the Triple Helix interaction for countries' economic development and its benefits in three components as follows: (i) the existence of multiple actors with different competences and roles across the three institutional spheres; (ii) the emergence of hybrid organizations such as technology transfer offices, university research centers, science parks, incubators and venture capital firms that links the three institutional spheres of university, industry and government; and (iii) the creation of joint Triple Helix projects that cut across the three spheres.

2.2.2.1 Triple Helix Concept in Turkey

The importance of innovation, knowledge based developments, R&D studies and supports and implications are stated in many resources and policy documents in our country based on the relationship between industry-university and government. In Turkey's 10th Development Plan which covers the term of 2014-2018, there is a section including situation analysis of the science, technology and innovation area, with goals, objectives and policies, published in Official Gazette (2013). It is stated that there is an increase in the number of Technology Development Zones and

"R&D and Innovation" supports. On the other hand, the lack of commercialization of knowledge process and innovative entrepreneurship are also stressed. In the 10th Development Plan, there are suggestions about the lacking of above subjects. The interface of research infrastructures and the portion of high-tech production need to be improved and special attention should be given to technology transfers, technology clusters, incubation centers, research centers with the Triple Helix nexus in university-industry and government. "Turkey Industrial Strategy and Action Plan Document" also points out the same subjects, besides it supports Industry Thesis (San-Tez), the realization of technological products, investments, and promotion& marketing support programs. The purpose of the San-Tez Program is to support Masters or PhD Thesis which provide institutionalization of the industry-university collaboration, the research studies which are produced in the universities, commercialization of value-added products and innovations that provide competitive advantages to the country in international competition as stated by MSIT (2014c).

In order to provide coordination between public institutions and organizations about science, technology, R&D and innovation, there is an association is established in 1983 "Supreme Council for Science and Technology". The Council has conducted a meeting at the beginning of this year (6 Jan, 2015) and decided to hold studies done on the Improvement of Universities' R&D Strategy, development of international incubation centers and implications. These studies will conduct intelligent specializations in universities to provide competitive advantages for the country's development as stated by Science and Technology High Committee (MSIT, 2015b).

2.2.3 Performance Indicators of Entrepreneurial Universities

New applications started to be applied as a result of the interactions between university-industry and government. Industry and government effected by Entrepreneurial University concept and they affect HES at the same time. Enterprise education is defined in the Quality Assurance Agency (QAA) report as the process of equipping students (or graduates) with an enhanced capacity to generate ideas and

the skills to make them happen (QAA, 2012). It lets students have the additional information, attributes and capabilities needed to apply these abilities in the context of starting to a new business. Entrepreneurship education has many differences from traditional education and includes many characteristics.

There are many opinions about performance measurements of Entrepreneurial Universities. Many scientists argue that entrepreneurial universities may be *characterized* by a number of *features* and the success of the university can be measured with these features. But the problem is that, there is no standardized entrepreneurial program which is implemented in all universities. As it stated in Enhancing Entrepreneurship Education Programs in Germany and the Netherlands by Ploum (2013); many types of entrepreneurship education programs are offered by HEIs (universities or colleges) with different characteristics and structure. In order to measure the performance of their entrepreneurial strength, it is important to decide which program will be implemented in HEIs to foster entrepreneurship.

There are two targets that determine the entrepreneurial universities. They should both answer the social community's needs (1) in "short term": to provide competitiveness in the world and to increase productivity, quality and efficiency in the country and (2) in "long term": to provide welfare as a result of innovation-based growth in economy via human resources have more entrepreneurial skills.

The authors, Blok, Lubberink, Lans and Omta, stressed that in the book of Fayolle and Redford (2014)), the way of defining the entrepreneurship education differs the implementation. If an entrepreneur is defined as a business owner, the education methodology should focus on self-employed entrepreneurs. However, if entrepreneurship is considered as an inborn characteristic which is difficult to enhance, then the system should center upon intermediacy activities which makes it easier for these kinds of students to start their own businesses. Furthermore, types of entrepreneurship or follow-up business occasions have different dimensions and features. Therefore, entrepreneurship education programs focus on the development of entrepreneurial capabilities, knowledge, skills and attitudes that lead to successful task performance and problem solving with respect to real world entrepreneurial

problems, challenges and occasions stated by Fayolle and Redford (2014). As a result of implementation of entrepreneurial education in US and Europe, different and diversified education curricula have arisen.

There is a survey made by NIRAS Consultancy in 2008 to measure, benchmark and determine the "Dimensions of Entrepreneurship in Higher Education in Europe". This study can be a good benchmark to the HEIs which want to give entrepreneurial education. In the study, the performance is measured by three performance indicators: (1) entrepreneurial students through education (graduating with actual practical entrepreneurship experience from activities offered by the HEI), (2) information transfer to society, and (3) entrepreneurial students through practice (community involvement). The *dimensions of entrepreneurship education* was first identified by FORA (2004) as educational set-up, educational scope, institutional characteristics, outreach and evaluation but later they studied on this subject and develop and improved the model based on the (NIRAS, 2008) reports as follow: (Fayolle & Redford, 2014)

1- *Strategy:* The discussion whether the university should embed the entrepreneurship education program with its "goals" and "policies". If so, the way to apply will need to be in considered.

2- *Resources:* Amount and variety of the "allocated resources" for entrepreneurial education, available in the "self-generated income" of the university.

3- *Institutional infrastructure:* Whether the following possibilities are available in the University. (1) "Facilities" such as incubator studies for (graduate) students or centers of entrepreneurship, (2) "Research" in entrepreneurship, stimulating knowledge commercialization and TTOs, (3) "Multi-disciplinarity" of the entrepreneurial education, (4) "Studies" about entrepreneurial exchange and knowledge transfer between university and society, (5) "Assignment" of mentors, to improve knowledge of entrepreneurship of teachers and students.

4- *Education:* (1) Didactics and pedagogical methods, (2) the "scope of the educational program", (3) the "educational set-up of the program", (4) attitudes, intentions towards and inspiration for entrepreneurship. Not only the quantity of available entrepreneurship courses but also their logic, coherency and efficacy, entrepreneurial mind-set is important.

5- *Outreach:* (1) Linkages between university and business environment, (2) involvement of "external stakeholders" and "alumni", "community" engagement, (3) knowledge transfer to society to enhance the commercialization of research, (4) practical experiences, guest lectures, business visits, value adding activities to provide technical and business supports and development for both students and company owners.

6- *Development:* (1) Satisfying the needs of students and stakeholders, (2) frequent "evaluation of program" with internal and external stakeholders, (3) the implementation of "user-driven improvements" of program, (4) investment in the "human resources" with specific skills and talents involved in entrepreneurship education. Training in project management skills or basic business knowledge is important.

There are some additional studies regarding the same subject. There are some *applications* such as; experiential learning, action-learning approaches which means that students work independently and teachers are both teaching and coaching at the same time. This can be attached to dimension 3 above; "*institutional infrastructure"* which can be linked to assignment of mentors. Entrepreneurial university has new *tasks* as, spin-offs support, patents registration, and technology transfer offices creation and for this purpose needs lecturers who have specific skills and talents for entrepreneurship education. As stated in the survey of Atlantic Canadian University (ACU) these are necessary for ; (1) initiating activities designed to create an environment within universities that exposes learners to the opportunities and challenges of starting a business, (2) encouraging faculties outside of the Faculty of Business to offer courses in entrepreneurship, (3) prompting non-business students to consider venture creation as a career option (ACU, 2004).

The entrepreneurial university concept is most useful if the format creates a strategic aspect for the institution first focusing academic goals than converting knowledge produced at the university into economic and social utility. They should define how start-ups are supported at the university while encouraging entrepreneurship education for ASOs, students and graduates. It is becoming better recognized that, HEIs may play a very important role in economic development through their graduates by boosting their entrepreneurial abilities, pushing them towards more entrepreneurial careers and giving support for their start-ups.

2.2.4 The roles assigned to Entrepreneurial University

Individual motivations, the business potential of scientist-entrepreneurs, the accessibility of external resources, and the university environment are found to play important roles either in fostering or preventing entrepreneurial activity in universities, stated by Druilhe and Garnsey (2003). There are many characteristics of Third Mission Universities as we mentioned in previous part. Wissema (2009) explains that, the response of these characteristics in Entrepreneurial Universities is as follows:

1- The objective of *know-how exploitation*: Creating Entrepreneurial mindset, behavior and practices in Universities to solve economic and social problems.

2- *Competing in international market:* Adapting the culture, practices and pedagogy in University in order to compete in international market.

3- Sustaining *a network with other universities, industries, private R&D firms, financiers, service providers in knowledge carousel:* Establishing techno starters, financial infrastructure, professional support organizations, Technoparks, scientific research and education, communicating with R&D departments of companies and with private R&D institutions.

4- *Transdisciplinary or interdisciplinary research:* Supporting the combination of creativity and design in science and technology, although consilience is difficult between different departments in Universities.

5- *The two-track universities:* Trying to be attractive for the best and brightest students and academicians, they create best environment existing incremental research next to cutting-edge scientific study, as well as supply mass education. So, they can be counted to be *multicultural organizations.*

6- Their *common language is English* as being cosmopolitan.

7- Their *dependency on state regulation is decreasing* but the research grants are given under politically established circumstances so they cannot be counted as academically free. Leading and supporting innovation, creative processes and communities are the responses of universities in Entrepreneurial University system.

2.2.4.1 Measuring Entrepreneurial University Performance in Turkey

The higher education system in Turkey is managed by Council of Higher Education (HEC-YÖK). The HEC is an autonomous institution which is responsible for the planning, coordination and governance of higher education system in Turkey in agreement with HEC Laws. The Scientific and Technological Research Council of Turkey (TÜBİTAK) coordinates basic and applied research and development, acting on proposed policies by the Turkish Academy of Sciences. There is study which is carried out by TÜBİTAK that ranks the first 50 universities in Turkey to put them in an order with respect to their innovative and entrepreneurship capabilities. In 2012, MSIT started the application of this ranking in order help the universities to develop their policy instruments and to create the necessary culture to trigger entrepreneurship and innovation shown in **Table 2**.

They make a computation as being an Entrepreneurial University in Turkey with some **criteria** determined by TUBITAK (2014), and each dimension has a weight in the ranking which can be seen in the **Table 2**.

Table 2: Criteria of Being an Entrepreneurial University (TUBITAK, 2014)

Criteria	**Weight %**
1-Scientific and Technological Research Competence	20%
2-Intellectual Property Pool	15%
3-Cooperation and Interaction	25%
4-Entrepreneurship and Innovation Culture	15%
5-Economic Contribution and Commercialization	25%
TOTAL	**100%**

As it shown in the **Table 3**; METU, Sabancı University, Boğaziçi University and İhsan Doğramacı Bilkent University are at the top of the list.

Table 3: The First 10 Universities in Entrepreneurial and Innovative University Index (2014) in Turkey, (TUBITAK, 2014)

Entrepreneurial and Innovative University Index (2014)							
	University	**TOTAL**	**Scientific and Technological Research Competence**	**Intellectual Property Pool**	**Cooperation and Interaction**	**Entrepreneurship and Innovation Culture**	**Economic Contribution and Commercialization**
1	METU	**83,09**	19,6	8,7	22,4	13,8	18,8
2	Sabancı University	**81,44**	19,5	6,2	25,0	12,5	18,3
3	Boğaziçi University	**76,34**	18,5	5,5	24,1	10,0	18,2
4	Bilkent University	**74,96**	19,1	5,2	22,4	12,7	15,6
5	Koç University	**73,59**	16,0	9,4	24,9	11,3	12,0
6	Özyeğin University	**73,06**	15,2	6,5	20,3	12,3	18,8
7	Istanbul Technic University	**72,42**	15,7	6,8	21,1	10,1	18,8
8	TOBB University	**69,26**	16,2	7,1	18,7	9,0	18,3
9	İzmir High Technology Institute	**67,83**	19,5	5,8	22,1	7,9	12,5
10	Selçuk University	**59,58**	11,7	10,4	12,0	13,3	12,2

This index has prepared according to the data of 2013 and, the universities, which have less than 50 professors in 2013, were not included in the study. The MSIT

declared this ranking before the university entrance examinations in 2014 in terms of guiding students.

When we examine the table in detail:

- ✓ Scientific and Technological Research Competence: METU at the top with 19,6%

- ✓ Intellectual Property Pool: Selçuk University has the highest percentage with 10,4%.

- ✓ Cooperation and Interaction: Sabancı University has 25,0% as the highest grade.

- ✓ Entrepreneurship and Innovation Culture: Anatolian University has the highest grade with 14,4% but it was not enough to be counted in top ten of the ranking.

- ✓ Economic Contribution and Commercialization: METU, Özyeğin, and Istanbul Technic University have the same grade as 18,8%.

After announcing the rankings in 2012 for the first time, the universities that were not interested in gathering information about entrepreneurship and innovation activities, created an interest on these concepts. Over the years, the ranking has changed and it is observed that some new universities which were not available in this ranking before are now involved in the list of first 50 universities.

Data on 23 indicators which are listed below is provided by the information gathered from TÜBİTAK, HEC, MSIT, TPI, Ministry of Development, Small and Medium Enterprises Development Organization (SMEDO/KOSGEB), Technology Development Foundation of Turkey (TTGV) and Academy of Sciences of Turkey.

1- Scientific and Technological Research Competence: 20%

1.1 The number of scientific publications

1.2. Number of Citations

1.3. The number of projects taken from R & D and innovation support programs

1.4 The amount of funds received from R & D and innovation support programs

1.5. The number of national and international science awards

1.6. The number of PhD graduates

2- Intellectual Property Pool: 15%

2.1. The number of patent applications

2.2. The number of patent documents

2.3. The number of utility model/industrial design document

2.4. The number of international patent applications

3- Cooperation and Interaction: 25%

3.1. The number of R&D and innovation projects conducted in university-industry collaboration

3.2. The amount of funds received from the R&D and innovation projects with University-industry collaboration

3.3. Number of R&D and innovation projects with international collaboration

3.4. The amount of the funds obtained from international cooperation in R&D and innovation

3.5. Number of Lecturer/students in circulation

4- Entrepreneurship and Innovation Culture: 15%

4.1. The number of courses about entrepreneurship, technology and innovation management in undergraduate and graduate level

4.2. The number of people working full-time in Technology Transfer Offices, techno-parks, incubation centers and the TEKMER's management

4.3. The presence of the structure of Technology Transfer Office

4.4. The number of trainings/certification programs for entrepreneurship, technology management and innovation management held outside of the university

5- Economic Contribution and Commercialization: 25%

5.1. The number of active ASOs in Technoparks, incubation centers, TEKMER that they have a partnership or ownership

5.2. The number of active firms that university students or students who graduated in the last five years, have a partnership or ownership in the Technoparks, the incubation centers or TEKMER

5.3. The number of employees in the company as joint owner as academicians, incubation centers, Technoparks and TEKMER

5.4. The number of licensed patents/utility models/industrial designs

2.2.5 Effects of Entrepreneurial Approach in Universities in the Triple Helix Balances

In literature, the effective indicators for entrepreneurial universities are analyzed from a number of different perspectives. As stated by H. Etzkowitz (1983), there is a three dimensional struggle that has been going on between academicians and university administrators during to establishment of the relationship between university and industry. While some academicians put strict limits for commercial activities in universities, some of them want to take place in such activities. University administrators want to organize the negotiations with the industry and protect university's and academician's rights. H. Etzkowitz (2012) also states that the entrepreneurial approach in universities affect the Triple Helix balances. The expectation from universities is to be more active in terms of creating an

entrepreneurial ecosystem in the Triple Helix. In knowledge-based economies, the industry provides production, government is the guarantor of contractual relations and university is the source of technology and know-how in Triple Helix nexus. In the last few decades, the intellectual capital of a country started to be as important as its financial capital necessary for its economic growth. In another study of H. Etzkowitz (2003), he indicates that, the indicators of this new perspective are; (1) firms changed their approaches in defining the tangible (financial) and intangible (intellectual) capitals and (2) there is a new way of behavior of academicians' in combining the fundamental discoveries with applications.

There are 4 stages to observe the transformation in Triple Helix which we stated in previous chapter (H. Etzkowitz et al., 2000):

1- Internal transformation in each of helices: Searching funding of research through TTOs and government grant programs, constructing strategic alliances for R&D studies between companies and government are the internal transformation in universities.

2- *Influence one helix upon another:* The Bayh-Dole Act of 1980 is a law that establishes a stable framework for academic technology transfers. This law is supported by both the government and university policy makers.

3- *A new trilateral network to sustain interaction between them:* To fill the gaps in an innovation system by brainstorming for new ideas with the representatives of university- industry and government.

4- *Recursive effects:* By the formation of several new other structures such as firms, which lead to create regional organizations and assist in academic research.

Here, as a consequence of above subject, the importance of "Open Innovation" is of concern as stated by Chesbrough (2003). "Open Innovation" allows organizations to improve their innovative capabilities and reach the wisdom, ideas and skills of people outside of their organization through a structured partnership. At that point,

companies need to make collaboration with the organization outside of their environment to build a better business model, to get the external R&D which can create significant value for their product.

Leisyte and Horta (2011) refer to their study on "science policy and academic research productivity analysis by focusing on knowledge production, diffusion and commercialization policies and implications" and discuss about two main subjects that; (1) changes the country's national science policy and its impact on knowledge management in universities; (2) affects the policies and structural characteristics on academic knowledge production, spread and commercialization. This study concludes that, academic production, diffusion and commercialization are important for both governments and universities and they have applied policies to encourage them. One of the core functions of this helix is to provide benefit to the improvement of national public budget. For realizing this aim, science policies, economic policies and research governance should operate together in triple helix nexus. The indicators of priority-setting, research evaluation and performance-based funding are to be adapted for policy makers. As a result, universities are more situated in public policies to promote innovation. There is a big potential for generating innovation in different fields in university-industry-government relations. There is a good example in Brazil, indicated by Terra, Batista, Campos, and Almeida (2013) that they are trying to foster "innovations in sports" and converting them into commercial successful products by generating spin-offs in universities. They are encouraging professors and students to create academic organizational structures for improving teaching research and economic development focused on "innovation is sports".

2.2.6 Studies on Industry-University Collaborations in Turkey

There is significant room for development in Turkish University-Business Cooperation (UBC) especially in relation to collaboration with Small to Medium Size Enterprises (SME's). As stated in European UBC Country Reports, prepared by University Industry Innovation Network UIIN (2013), the most important types of UBC in Turkey are (1) Entrepreneurship, (2) Mobility of Students, (3) Collaboration

in R&D and (4) Commercialization of R&D results (the least developed type). Turkish academicians perceive the core beneficiaries from UBC to be: (1) Students, (2) Businesses, (3) HEIs and (4) Personal Benefits.

Companies have been getting benefit from Industry-University collaboration in Turkey for a while. But progress is very slow although there are many important support programs in the form of government grants provided by MSIT. The number of spin-off innovations has not increased with this high level of support and has not achieved the desired results. The barriers on Open Innovation studies and enforceability of intellectual property laws are the main subjects that need to be studied. With respect to a study prepared by Temel and Glassman (2013) which is held among 202 Turkish companies, it was understood that not establishing trust and awareness is the major barrier preventing deep research collaborations with universities. Normally, in the context of Industry-University collaboration, companies are making research together, run experiments and using university facilities such as laboratories, equipment to test their product informally. Because of the difficulties stated above, firms still have resistance about this collaboration in Turkey. Turkey was a closed economy prior to the early 1980s. Especially, implementation of liberalization policies, which were introduced in 24th November 1980, was a milestone for Turkey's innovation movement. It is stressed by Temel and Glassman (2013) that, in 1994, the Turkish government launched a number of programs which targets supporting companies, mostly SMEs, to be more innovative. KOSGEB, the Directorship for Technology and Innovation Assessment (TEYDEB) and the Technology Development Foundation (TTGV) were the most essential components and their main purpose was to support firms in generating their own innovations by financial support. These programs also basically encourage companies to collaborate with universities and research centers.

There are many new practices on industry-university collaborations in Turkey. Due to the changes in both Turkey and the world, Turkish government provides some facilities such as establishing new committees to strengthen this collaboration. One of these studies is carried out by MSIT (2014b). Public-University-Industry

Collaboration Draft Report opened discussions for all stakeholders of Triple Helix and came up with some suggestions:

- ✓ Advisory committees involving people from industrial world and universities can be founded.

- ✓ There can be workspaces created for students in companies. It may be one of the ideal methodologies selecting the best students to run his/her owns enterprise in the future.

- ✓ University's officials may take part in some of the technical, economic or administrative problems in the solution process of companies. A payment may be assigned to university officials in return for their assistance.

- ✓ Technology-based companies may carry out joint projects with universities.

- ✓ Sponsors can be part of university-industry collaboration.

- ✓ In our country, many wealthy families prefer setting up their own universities. However, the industrial donation still can be a new funding model for universities.

2.2.7 Entrepreneurial University Implementations

In 21st century, it would be possible to say that entrepreneurial universities started to play an important role in terms of innovation, creativity and economic growth. Both H. Etzkowitz (2001) and Fayolle and Redford (2014) determined that, the main role of them is connecting *"ivory tower"* and *"real world"*. The importance of innovation and entrepreneurship-based policy instruments is increasing in higher education delivered at universities, academies, colleges and institutes of technology. They are important to provide competitiveness, productivity and economic development to countries. For this purpose, many countries started to include entrepreneurship classes in their syllabuses to encourage university students, faculty members and graduates to be part of an enterprise. There are some entrepreneurship

events in universities to encourage these people to meet with the business world. Especially, the "applied facilities" in HES can be followed contemporarily with entrepreneurial approaches with the support of private firms or institutions. In this manner, academicians and university staff can act as *"entrepreneurship ambassadors"* and mentors as stated by OECD (2009).

As stated by EACEA (2012), which is Education, Audiovisual and Culture Executive Agency, the way of thinking entrepreneurially and implementing entrepreneurship education in universities creates an undeniable effect and positive impact for private and public sectors and also for social society. Since education is the primary subject in shaping young people's attitudes and skills, the entrepreneurial education should be started from an early age. It is vital not only to develop the mindset of young people but also to ensure the skills and knowledge that are central to advancing an entrepreneurial culture.

The concept of the entrepreneurial university is a strategy that has been followed by many leading universities around the world. For example, Atlantic Canadian University (ACU) has conducted a study to measure entrepreneurial success in 2004. The study carried out by Gallup Consultancy in 1994 concludes that, almost 70% of high school students mention their interest in venture generation and over 96% of entrepreneurs/managers and students state that the study of entrepreneurship at the university level would be beneficial (ACU, 2004). In this study, the pros and cons about entrepreneurial university and skills, characteristics, personalities of an entrepreneur are stated. Determining the required set of skills for entrepreneurship can be useful to draw the framework of an entrepreneurial program.

Top universities like Stanford, UC Berkeley, MIT, Cambridge and Oxford have served as magnets to attract top students from all around the world, many of whom subsequently stayed on to contribute to the growth of key knowledge-economic sectors in the regions of high-tech industries, creative businesses, and knowledge-intense services for decades.

2.2.7.1 Europe

In *Bologna Declaration (1999)* which was a joint declaration of the European Ministers of Education, is made. It is mentioned that *governments are interested in entrepreneurial improvements at universities.*

Entrepreneurship education is stated as vital and addressed to start from an early age in Europe in early 2000s and focused on the launch of national strategies, determined by EACEA (2012). It is explained in the report of European Commission about Entrepreneurship Education, ec.europa.eu (2014), the implementations started in 2003 in Lithuania, The United Kingdom (Wales) and Norway followed closely behind in 2004. Netherlands and Finland are measuring the impact of entrepreneurial education. Many countries in Europe launched entrepreneurial education recently such as Flemish Community of Belgium, Hungary, Portugal and Romania and they are still proceeding on this subject. In Poland, they are teaching entrepreneurship by "learning by doing" method with innovative programs in their curriculum at younger ages.

As it is stated in the same report, ec.europa.eu (2014), in many countries it is not easy to evaluate and monitor entrepreneurial education due to the insufficient educators. The entrepreneurial education methods are traditional in many countries which is not relevant with the real world entrepreneurship.

2.2.7.2 USA

One of the competitive advantages of USA is their universities. They used this advantage to attract talented foreign students from all around the world and revised their education system to be more entrepreneurial. Thorp and Goldstein (2010) state in their book, Engines of Innovation: The Entrepreneurial University in the Twenty-First Century that, Harvard's world-famous strategist Michael Porter proclaimed after 2008 economic crisis that America promptly requires a coherent economic strategy based on innovation, entrepreneurship, and higher education. As Professor Porter defined, the United States has been uniquely good at conversion of research

into innovation and turning that innovation into commercial business. Peter Drucker also implies the necessity of Entrepreneurial University concept several times in his book "Innovation and Entrepreneurship" (1985). The way of innovative and entrepreneurial thinking as he states in his studies might be the solution for economic development. He expresses the importance of knowledge-based innovation and entrepreneurship. He says *"As the creation of modern research university was itself an entrepreneurial act."*

Americans know that their universities are among one of their nation's most competitive strengths. However, university education in US is very expensive and numerous studies examine how to deal with this. One of the proposals is an innovative and entrepreneurial education system. The worldwide financial crisis in 2008 was an opportunity for American society to understand the importance of innovative approaches, since there were substantial cuts in governmental supports. These cuts especially were for state-supported universities that ranged from sharp decreases in incentives to faculty numbers and compensations that threaten the long-term viability of these universities. One of the milestones of the financial crisis is the uncertainties about research funding and federal financial aids for research universities. It was a chance for them to turn this crisis into an opportunity by applying entrepreneurial approaches in research universities in US. The leading universities started to apply innovative approaches in their syllabuses to figure out new ways for solving economic problems. As indicated by Thorp and Goldstein (2010), these universities used technology and social media more effectively, the American HES provided online models for delivering knowledge to a wide range of students.

Top-ranking universities are well-known for their enormous economic impact with their outstanding scientific endeavors in USA. The best example of the magnitude of such impact is Massachusetts Institute of Technology (MIT). To see the Entrepreneurial University implementations and its effect to regional development, MIT could be evaluated as one of the best practices.

2.2.7.3 MIT

The Massachusetts Institute of Technology (MIT - 1862) is a well-known and the one of most successful universities as an entrepreneurial university in US and in the world. It is a private research university which has $12.4 billion (2014) endowment. MIT has founded as transferring the polytechnic model from Europe. Research studies started in the late 19th century by hiring consulting engineers and independent professionals who established research for companies as faculty members. H. Etzkowitz (2012) stressed that, the university oriented in industrial innovation and transformed from a polytechnic into an entrepreneurial university. MIT has been awarded 81 times, as stated in the list that was generated in December 15th 2014 Nobel Prizes (nobelprize.org) .

There is a research which was done by Roberts and Eesley (2009), the MIT Entrepreneurship Center, the Kauffman Foundation, and Gideon Gartner in 2009 and an updated report in 2011. The aim of this report is to exhibit the economic impact of the entrepreneurial ventures of university graduates. From the perspective of the authors if universities compose a culture and programs that execute entrepreneurship widely reachable to students they would help to support economic growth for the country. This research was one of the largest surveys ever conducted among entrepreneur alumni and checked the important influence of MIT's entrepreneurial ecosystem that supports firm start-ups.

Their survey database permits us to identify when a new firm's technology was;

(1) Licensed directly from a university (MIT or elsewhere); or

(2) Came from a founder's thesis work or from his or her university lab or coursework, or the original product or service idea came from university research.

(3) A faculty member might have been a company co-founder, or involved as a formal or informal advisor in the start-up.

(4) Or the founding team may have met while working as students or staff in a university lab.

If one or more of these four conditions are valid in the company founding, they identify the firm's founding technology as "University-based." If the company was started with some key technological knowledge or capability, but not derived from any of the listed university sources, they identify the firm as based on "Non-University based". The remaining companies are labeled as "No Technology base", which lacks any formal intellectual property or research and development efforts.

2.2.7.3.1 Economic Impact of MIT

Here are some conclusions and important remarks of this study:

- ✓ The survey data includes 25,800 active companies (as of the end of 2006) established by living MIT alumni that employ 3.3 million people and generate yearly world revenues of almost $2 trillion, producing the equivalent of the 11th-largest economy in the world. Those firms that were founded based upon technology drawn from MIT and other universities generate 1.7 million of those jobs and $1.0 trillion of global revenues. Together with the companies based upon non-university technology, the technology-based new firms founded account for 85% of the estimated employment and 92% of the overall global sales impact. Nontechnology-based companies founded by MIT alumni create slightly under a half million jobs, important but only 15% of the overall economic consequences arising from MIT alumni entrepreneurs.

- ✓ The types of companies MIT graduates form are mainly knowledge-based companies in software, biotech, manufacturing (electronics, instruments, machinery. They export a higher percentage of their products, hold one or more patents, and expand more of their revenues on R&D), or consulting (architects, business consultants, engineers). The global revenues per employee of MIT alumni-founded firms are far greater than those produced by the average

American firm. In addition, they employ higher skilled as well as higher paid workers.

2.2.8 Entrepreneurial University Implementations in Turkey

Since the 1980s, with the substantial effects of technological development and globalization, there happened a revolution in university educational system in Turkey. This revolution brought the term of “Entrepreneurial University” concept to the agenda in Turkey and moved up the universities to the national innovation system as an active player to act with industry. As a result of these developments restructuring of HES in Turkey became an important subject for policy makers. The discussions about the developments in HES, in the world, forwarded the policy makers in Turkey to study about a new law draft on the HEC. These restructuring studies in HES started in 2011 in Turkey.

The "Permanent University - Industry Cooperation Commission" was established at the beginning of this year. The Commission (2015) held their first meeting with the representatives from universities and MSIT, TÜBİTAK, Turkish Patent Institute (TPI), KOSGEB, HEC. There are some remarkable decisions related with our study such as;

- ✓ Suggestions will improve the industry-university collaboration by examining the interfaces such as University centers, institutes and TTOs

- ✓ Faculty members' contribution to university-industry collaborative process will be evaluated and recommendations will be presented.

Turkey is 25th in the world and 16th in the region ranking, with respcet to The Global Entrepreneurship and Development Institute GEDI (2015) index about entrepreneurship. Its "Overall GEDI Score" is 54,6%, "Individual Indicators" are 71,4% and "Institutional Indicators" are 67%. As a benchmark, USA is the top of the GEDI list in the world and regional ranks. Its "Overall GEDI Score" is 85%, "Individual Indicators" are 77,9% and "Institutional Indicators" are 92,2%. As it was

stated before, there is a tremendous potential to improve university-business cooperation with entrepreneurship approach especially for the establishment of innovation-based SMEs in Turkey.

Turkey accepted the terms of the Bologna Declaration by attending the Prague meeting in 2001. In this declaration, the importance of reforms to be applied in higher education is stated. Studies to be conducted in research systems in higher education for adapting to changing needs, society's demands and advances in scientific knowledge are determined. The Universities' central role and its adaptation in all dimensions are clarified.

There are many universities that apply entrepreneurial education in their curricula in Turkey. Entrepreneurship courses are offered to students in many universities for a while. Many of them are offering KOSGEB Entrepreneurship Certificate Programs, Young Entrepreneurs Clubs while most of them have an Entrepreneurship Center. They are encouraging start-ups in technoparks in their campus. There are student contests, accelerators and incubators in many of them. There is "Entrepreneurship Minor Honor" in different universities. As mentioned above, there is a ranking carried out by MSIT and TUBITAK (2014) that ranks the universities with respect to their innovative and entrepreneurship efforts in Turkey. Also, Ministry has started to support Industry-University collaboration with the program of TUBITAK 1505. The aim of TUBITAK 1505 is to provide benefit to economy by commercialization of accumulated knowledge and technology supplied by Universities and "Public Research Centers" via transferring them to industry in the form of product or process.

To see the Entrepreneurial University implementations in Turkey and its effect to regional development, METU could be evaluated as one of the best practices.

2.2.8.1 METU

Middle East Technical University (METU), a state university founded in 1956, currently has about 26,500 students. Since its foundation, METU, as an international

research university, has been one of the leading universities in Turkey in terms of depth and breadth of international ties and the amount of funds generated from international research projects. The language of instruction at METU is English. Basic principles of METU stated as; “Scientific” and “Interdisciplinary Approaches”, “Academic Freedom”,” Lifelong Education”, “The Training of Qualified People”, “Student Support”, “Communication with Society” and “Involved Administration". The main METU Campus is located in Ankara. There is another one which is METU Northern Cyprus Campus. Marine Sciences conducts the academic program studies at İçel-Erdemli. There are a total of 40 undergraduate programs in five faculties of METU.

METU has an entrepreneurial vision as being the leading university in Turkey on this field. For students studying in other departments at METU, the Business Department runs three minor programs in general management, corporate finance, and entrepreneurship. According to the developments of university-industry cooperation, with the demand of HEC (2011) from all universities, METU also has prepared a report about view and suggestions on restructuring HES. The entrepreneurial approach at METU can be seen in the university strategic plans (2011-2016).

METU was also selected among the first ten institutions with respect to the T*imes Higher Education* BRICS & Emerging Economies Rankings 2014, announced by Reuters (2014). METU was also selected as 85th among the first 400 institutions in the world according to the “Times Higher Education World University Rankings 2014-2015” which was for the first time, a Turkish university selected for this list. METU is in the first ten in Europe-North America region in the “Red Dot 2014” list with the studies of Department of Industrial Design.

METU is offering KOSGEB Entrepreneurship Certificate Program and providing entrepreneurship as elective courses. METU Young Entrepreneurs Society (YES) is instilling the importance of entrepreneurship and trying to encourage young entrepreneurs to provide connections to the business world with new ideas. The university has an incubation center in METUTECH which is supporting financially

75% of the innovative projects for one to three years as explained in its web page (METUTECH). New Ideas New Business is the oldest entrepreneurship contest in Turkey and is organized by METU. ATOM (Animation Technologies and Game Development Center) is the first and the only established incubation center in Turkey in the digital game sector. "Techno-Thesis Program" supports university-industry collaboration and leads the students to write their thesis to satisfy the needs of the R&D studies of the companies in METUTECH.

TEKNOJUMPP is the first acceleration program in Turkey for techno starters during their studies in abroad. GIP (Entrepreneurship and Innovation Platform) is coordinating the effective usage of sources of all entrepreneurship services and supports provided in METU and METUTECH. METU KOSGEB TEKMER is the technology focused incubation center which was founded in 1992 with the protocol signed between METU and KOSGEB. Techno Starter Incubation Center is giving phase in support for one year to individual entrepreneurship by providing them free office and infrastructure. METU GIMER is the Entrepreneurship and Innovation Research Center which has close ties with Business Administration Department. Its main purpose is to encourage the students in order to carry out their creative, innovative ideas and projects to real world and to provide graduation with the entrepreneurial skills from METU.

2.3 Technology Transfers and Knowledge Commercialization Activities in Entrepreneurial University

As mentioned above, they stated hat, H. Etzkowitz et al. (2000), there is a new way education system which has been developing for decades which is named as “entrepreneurial university” by using the notions like “knowledge valorization”, “transfer of know-how”, “third stream” or “third mission”. These are relevant notions with the research activities of these universities which distinguish them from the traditional ones. *Knowledge Commercialization* is a new application all around the world especially in US and Europe. Polanyi (1958) determines that, it is also relevant to the usage of Personal Knowledge in a commercial way in the ASOs. Without taking *scientist commercialization of research* into consideration, investing

in science and research will not result in economic development or business opportunities and social improvement. The commercialization of the Intellectual Property (IP), as stated by Norcia (2005), owned by universities can help to increase the countries' economies by adding value via establishing partnership between university and industry.

Especially, since the Second World War, H. Etzkowitz (2001) indicates that, scientists have spent much effort in seeking to raise funds from external sources, governmental and private sector, to support their research. Both academic and industrial research are developed independently, each considering their own purposes.

2.3.1 Basic, Applied and Fundamental Research

Frascati Manual, proposed by OECD in 2012, gives definitions for all the relevant terms of research. The definitions of basic research, applied research, research and development, research personnel, researchers, technicians are in this manual. Frascati explained basic research as;

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

Many activities are increasingly captured under the term of "Applied Research". *Applied Research,* which is a new term, is described in this report as one of the three forms of research, along with Basic Research & Experimental Development. *Applied research* is an original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective, as explained by OECD (2012). Also, "Fundamental Research Policy" was developed by OECD, determined in the study of Laredo (2007).

As opposed to Applied Research, the "Fundamental Research" cases are individual, they cannot be generalized. While Applied Research tries to solve specific problems, it is not easy get a result from its practical implementation. But in Fundamental

Research, even it does not have commercial objectives, the result may be an innovation, design, production or product utilization which can be a remedy for industrial development and to solve general problems and may provide a monetary benefit. Druilhe and Garnsey (2003) stated that "Building on Penrose, we also find it useful to distinguish between the *efficient* and *commercial dimensions* of the resource base of a firm. The productive-base includes all the physical facilities of a company whereas the commercial-base ensures legal and marketing adequacy and supports partnerships and collaborations".

As a result of these determinations, it is easy to understand that in entrepreneurial universities the fundamental research is supported which would result in a scientific knowledge that generates financial benefits. After the development of political mindset about how innovation should be, for almost all the countries and financial advantage of the universities, "transfer activities" and rules for who should take patents and how the benefits should be shared are determined. Tijssen (2006) indicates that, although not directly linked to any field of specific science and technology, the existence of university technology transfer institutes (TTIs) supply a measurement tool for university entrepreneurial activities and started transfer activities before 2001/2002.

It is very important to define the differences between, being employed as researcher, technician or research personnel, as stated in OECD (2002) report. This report is providing a good measurement for the financial and human resources devoted to R&D in the industry sectors performing it: higher education (universities), government, business world, and private or non-profit organizations.

2.3.2 Knowledge and Technology Transfers

There are many different channels for the commercialization of public research results as transferring technology such as adaptation of tacit knowledge and publications. Another way is foundation of new firms that is based on research, knowledge or skills which are created in public research institutions. Müller (2008) states that, these are the ASOs, one of the main operations of university technology

transfer, besides sponsored research, licensing out of R&D studies and hiring research personal or students.

There are two types of transfers, stated by Mansfield (1975). *Vertical transfer* is moving from applied research centers to research and development and from there to production departments. Vertical technology transfer includes some methods such as; license purchases, "know-how" agreements, joint ventures, direct purchase, "franchise", turnkey procurement, consultancy services procurements, establishing manufacturing partnerships and foreign expert employment. Kiper (2010) determined in his book that, the technology is embedded in the product, so it is not possible to reach and change it. *Horizontal transfer* is moving from an organization, place and context to another area or department. The horizontal technology transfer methods are many, such as; the R&D activities and projects handled by company itself, joint research with universities and research centers, project collaborations, clusters and take-parts in similar co-operation networks, types of activities involving the intense interaction, collaboration forms which are institutional structures and systems that many parties take place in. From the perspective of Kiper (2010), it is advantageous when compared to Vertical Transfer because, it is possible to reach the technology inside and develop it. Technology is in both physical and non-physical forms. Physical technologies are hardware, machinery and equipment. Non-physical technologies include know-how and know-why. Transfer of technology in the form of knowledge is a very complex process and requires the transfer of process experience and other kinds of experiences that are obtained from practices.

The success of technology transfer is mostly measured by patent applications or licensing and spin-offs. There are some internal stimulus and external venture capital supports for licensing or spin-offs. But scientists or academicians need a structure to figure out this process starting from invention to finding a market value for this innovation. At that stage, TTOs are providing what they want.

2.3.2.1 Technology Transfer Offices (TTOs)

The university–industry technology transfer activities are one of the roles that is assigned to the entrepreneurial universities. Technology Transfer Offices (TTOs) are the organizations that conduct the activities related with fast and effective commercialization of the results of academic research. TTOs are activating as establishing the necessary connections between all parties who are entrepreneurs and researchers, investors and industrialists which are from universities, research centers and private sector. Transfer of technology or technology valorization is a process that transfers scientific knowledge and skills or technological developments from the source of it (university, institutions or government) to a wider range of users who can develop and exploit it into new commercial products or services. Thorp and Goldstein (2010) stated that, In US, after Bayh-Dole Act in 1980, research universities has opened TTOs to monetize knowledge or inventions that are produced at the university and generate licensing and some capital gains for the university.

2.3.2.1.1 The Purposes of TTOs

The purposes of TTOs are (MSIT, 2014a):

- ✓ Creating strategies reducing the risks that scientific researchers face,
- ✓ To provide opportunities for industrialists and investors to meet with researchers and know-how transfer to industry,
- ✓ Training programs about entrepreneurship, innovation, R&D and intellectual property rights,
- ✓ Help entrepreneurs to obtain valid patent documents which they need both for domestic purposes and abroad,
- ✓ Provide the establishment of relationships between qualified personnel and companies,

- ✓ Working on the topics of patent procurement, intellectual property rights, licensing, encouraging establishment of ASOs, market research and venture capital procurement, project funding and bringing together the industries and universities, guiding them with respect to the needs.

2.3.2.1.2 TTO and BTO in METU

METUTECH TTO has been founded in 2007 in the Technopark. The main objective of TTO is sustaining the continuation of research by providing a financial contribution to the researchers and the host university. With these objectives, the main services provided by METUTECH TTO are, giving consultancy services about finance and legal advice during the process of patenting of an invention which has a commercialization potential for the companies and METU. It conducts its activities in coordination with the BTO.

BTO has been founded in 2013 and is supported by TUBITAK 1513 Support Program, declared in 1. Technology Development Zone Summit (bto.metu.edu.tr, 2013). The purposes of the project (METUTECH University-Industry Collaboration and Technology Transfer Development Project) to be supported are;

- ✓ To activate the university-industry cooperation,
- ✓ To support technology-based entrepreneurship,
- ✓ To strengthen the synergy between firms (platforms, cluster and network structures) the effective usage of domestic and international funds during the financing processes of innovation and R&D,
- ✓ To provide the conversion of academic knowledge, experience and research results incorporated in METU into economic, cultural and social values by developing effective partnerships.

All the technology transfer process in METUTECH is as shown in the **Figure 2**. It is complicated and very detail process as explained by METUTECH (2011). Their steps are:

- ✓ The evaluation of the innovation's commercialization potential,
- ✓ Monitoring the patenting process,
- ✓ Identification of the companies which would be interested in the commercialization process,
- ✓ Managing the commercialization process, brokerage and consultancy services given to the marketing stage,
- ✓ Providing legal assistance during patenting /commercialization process,
- ✓ Giving support to set up spin-off companies to the academicians.
- ✓ Preserving Intellectual Property Rights (IPR), Regional in Turkey and in The International Patent System (PCT), assisting applicants in seeking patent protection internationally for their inventions.

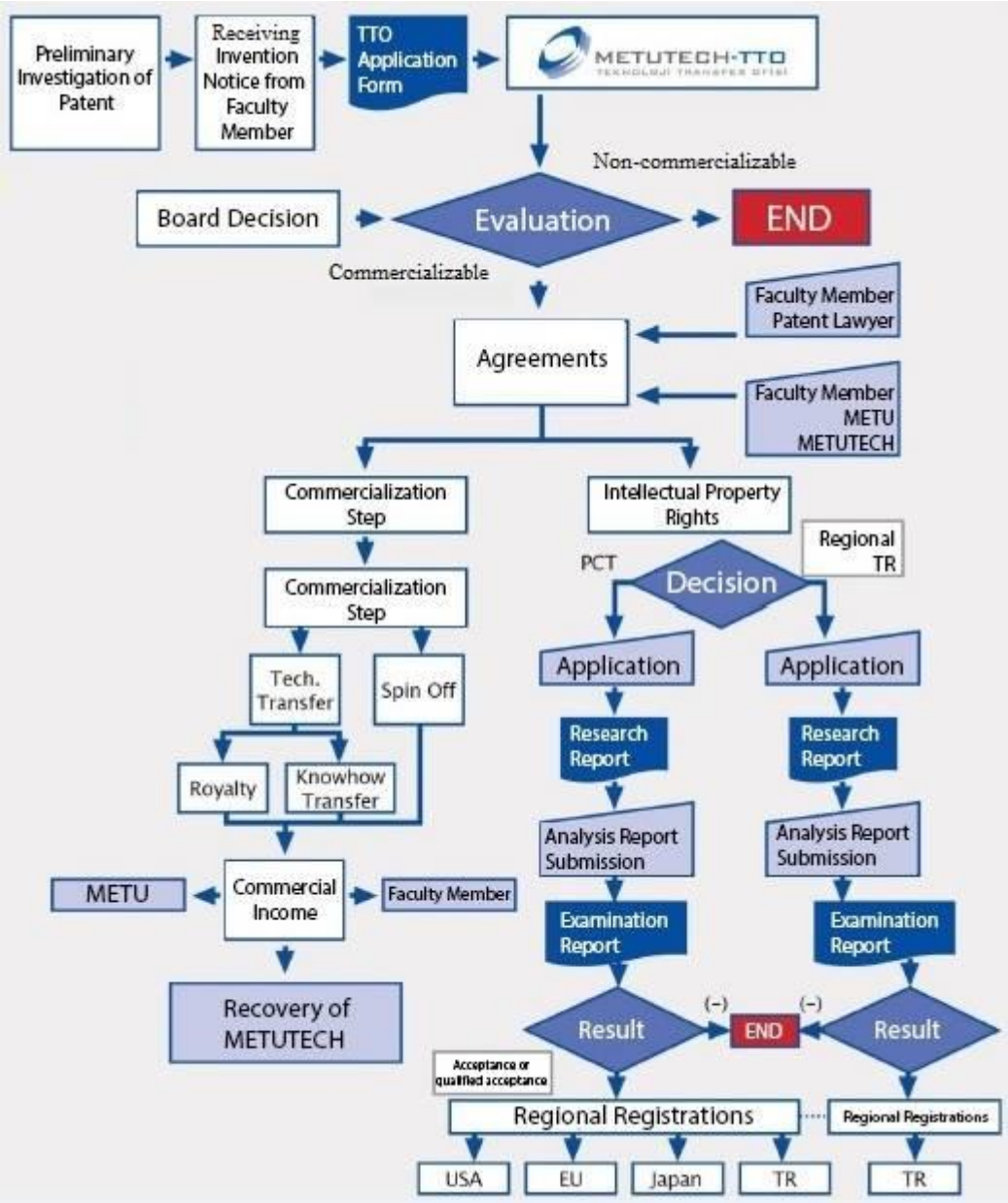

Figure 2: METUTECH TTO Process

2.3.2.2 Science and Technology Parks

Science and Technology Parks (STPs) have many definitions and names because of having different purposes with respect to their establishment. There are many internal and external factors such as; the development strategies and policies that

Techno-Park managers serve, the region they are in, the types of institutions and organizations they take support from and their design and working conditions that determines their differentiation.

Luger and Goldstein (1991) define STP as follows:

> *Research parks (alternatively called science and technology parks) are defined here as organizational entities that sell or lease spatially contiguous land and/or buildings to business or other organizations whose principal activities are basic or applied research or development of new products or process.*

As Luger and Goldstein (1991) mentioned in their book, in this definition they exclude entire high-tech centers such as Route 128 in Massachusetts or Silicon Valley in California which are the highest innovative and productive high-tech regions in the world. High-Tech firms are concentrated outside of formal organizations in there.

International Association of Science Parks (IASP) as being an international agency which is one of the most strongly established networks connects existent STPs (with their firms, entrepreneurs, managerial structure and other services) to other actors of this network such as universities, professional science managers, government agents, policy-makers and more. IASP defines STP as follows:

> *A Science Park is an organization managed by specialized professionals, whose main aim is to increase the wealth of its community by promoting the culture of innovation and the competitiveness of its associated businesses and knowledge-based institutions. To enable these goals to be met, a Science Park stimulates and manages the flow of knowledge and technology amongst universities, R&D institutions, companies and markets; facilitates the creation and growth of innovation-based companies through incubation and spin-off processes; provides other value-added services together with high quality space and facilities.*

Luger and Goldstein (1991) determined that, they are business enterprises with the purpose of serving as a seedbed, or an accelerator for the development of a clustering of innovation and technology oriented in a region or a state, generally close to the universities. The companies that are present in technoparks have many

purposes: (1) getting monetary benefit from this research by taking patent, (2) making collaborations with other firms in industry which are processing this research in its R&D departments. They focus on product advancement and innovation. There are technology-based productions using the scientific knowledge by transferring the results of scientific studies produced in universities. The STPs concept occurs as a result of carrying out those technology-based productions, providing the foundation of new initiatives and collaboration between university, industry and government. Ferreira, Garcia, and Lezana (2011) indicate in their study that, the creation of STPs is a new form of relation and innovation environment in Triple Helix and refers to the installation of networks, similar to industrial districts, but to specialize in high technology.

It is very essential to consider all the constraints like high expenses for development of a new product, shortening of production life cycle time, social context of the innovation organization and entrepreneurs that have to find stored technical data and financial resources for innovation. It is not possible to innovate modern products (innovation) without accumulated knowledge in the universities. All of them meet in university environment if there is a good management and understanding about entrepreneurial university concept. Some radical innovations need new ideas that mainly come from young minds especially the ones that study in universities and science parks.

The difference between science centers and Science and Technology Parks is that STPs are the places where research and knowledge are commercialized. As mentioned in preview parts of our study, the interdisciplinary studies are very important, especially for R&D activities and consequently in innovation process. All disciplines are affecting each other's improvements and are based on each other's developments. And the best place for R&D activities and innovations is STPs where each of all disciplines can find a place.

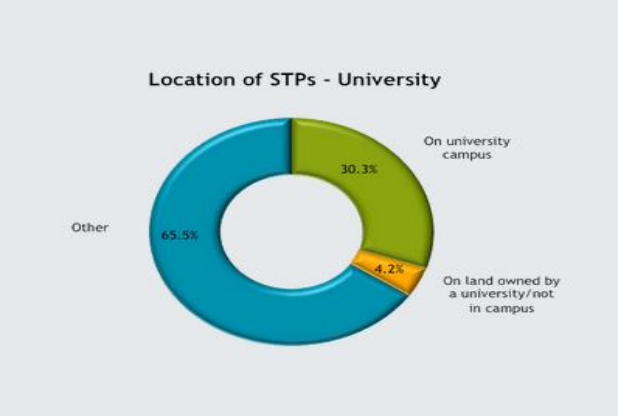

Figure 3: Location of STPs-University (IASP, 2015)

As indicated in Figure 2, 65.5% of them are located outside the universities although the expectation was just the opposite.

2.3.2.2.1 Purposes of STPs

The collaboration between universities and industry, the atmosphere of producing innovative products, conducting qualified R&D studies or working with policy makers for economic growth of the country provides a benefit to university and industry while protecting the IP rights. STPs are special places in terms of having dynamic innovative mixture of policies, activities, programs and high value-added services. They play a key role in the country's economic development. Their managerial purposes are stated by MSIT (2014a);

- ✓ To encourage and manage the production of scientific knowledge between university and industry.
- ✓ To provide an environment and facilities gathering entrepreneurs, technicians, researchers and academicians and establishment of high-tech firms in a particular region.
- ✓ To provide an environment to increase innovation, creativity and quality standards and conducting R&D studies for the invention and translation of an economic value of the R&D studies performed in universities by applying them in the industry.

- ✓ To connect institutions and companies as well as entrepreneurs and knowledge workers.
- ✓ To encourage creation of new businesses via incubation and spin-off mechanism and giving consultancy for their growth.
- ✓ To connect the innovative companies and research institutions with global network throughout the world.

The management of STPs supports the firms in terms of consultancy, finding venture capital, project selection, office and secretariat support and moral support. They can lead to solve the business problems (finance, marketing and management) during the term of commercialization of product or technology. STPs provide resource transformation from different aspects to the university which largely supports the organization during contribution. The University earns income from the management of STPs in return for providing location for the entrepreneurs and firms and versatile source supports such as social facilities and access to library documentation.

2.3.2.2.2 Historical Background of STPs in the World

After the industrial revolution, technological improvements and inventions were the subject of economic competitiveness while increasing the welfare. The STP practices emerged after World War II in developed countries and tried to meet the industrial and technological needs. They emerged as a request of the university faculty members to transfer their knowledge and R&D accumulations to production, means the economic value in entrepreneurial universities. World's first university research park identified as science and Technology Park was established in the early 1950s in United States at the Stanford Research Park of Northern California known as Silicon Valley (SV) today. University of California, San Diego (UCSD) and its biotechnology spinoffs with an entrepreneurial university formation strategy is succeeded to be the best examples of regional innovation clusters.

Britain is the second country after the United States that established STPs. Two research parks were founded in UK; Heriot-Watt University Research Park in

Edinburgh and Cambridge Science Park in Cambridge in 1972. Beginning of 1980s, there were 21 STPs in the world: 12 in US, 7 in France and Belgium, and 2 in UK. Just the opposite of the other countries, they founded STPs in poor regions in Italy. They founded two of them in Bari and Trieste during this term. The first studies on the establishment of STPs in Germany were initiated by the Berlin Technical University in 1978. The Entrepreneur Support Center was founded in 1983 in Berlin. This was followed by a second technology center established in Aachen. H. Etzkowitz (2012) states that, the first venture of STP in France is Sophia Antipolis which is the most advanced one in the country that was founded in 1972. The idea of Technopolis was implemented in the 1980s put in the practice in the 1990s in Japan. STPs have become a distinguished factor in Western Europe as well as in the United States and in many developed countries.

To examine the Science and Technology Parks implementations and their effect to regional development, Research Triangle Park could be evaluated as one of the best practices.

2.3.2.2.3 Research Triangle Park (RTP)

Research Triangle Park (RTP) in North Carolina was founded in 1959 and has been a remarkable success both in US and in the world. It is one of the largest research parks in the world. There are experts in science fields such as IT, biotechnology, telecommunications, micro-electronics, pharmaceuticals, chemicals and environmental science, stated in web page of RTP (2015). There are 200+ research companies, 39,000+ high-tech workers, and 22.5 million sq. ft. of built space in 7,000 acres (2,833 hectares). There are two companies which have more than 5.000 workers (Cisco Systems, Inc. IBM Corporation) and 53% of them have less than 10 workers, 46% of the firms are in Biotech & Life Sciences, written in Headquarters (2015) Report. Research Triangle Park is half the size of Manhattan and the RTP Foundation has purchased a new land (100 acres). When complete, the development could generate $2 billion in new private investment and 100,000 jobs, as written by Sorg (2014) in web page.

Cirillo (2013) express its development shortly as follows. There are “New-Line” industries and the type of industries differs in time. Most of the growth in economy in that area and in US produced by these New-Line industries is dealing with e-learning, electronics, telecommunications, engineering, chemicals, management and business services. Cirillo states that, the strategic agglomeration model of RTP is based on the logic of “geographically clustered economic activity” or research/technology/industrial clusters – as put forward by the economist Alfred Marshall in the 1800s and later expanded on by others like Kenneth Arrow and Paul Romer - and more recently by Michael Porter. They explain benefits that are accumulated for works, companies, and local economies into three “externalities” including:

1. *Input externalities:* In a geographic concentration for a given industry, sharing infrastructure and transportation costs reduced the total cost and specialized services help for it.

2. *Labor market externalities:* Specialized skilled workers can concentrate the jobs easily and this is attractive to local companies.

3. *Knowledge externalities:* Highly concentrated and interrelated activities in a limited geographic area facilitate the spread of information and knowledge.

In its current state, RTP meets all of the conditions associated with satisfying “geographically clustered economic activity”.

2.3.2.3 STPs in Turkey

The idea of establishing a research park has started to emerge in the early 1970s in Turkey. TUBITAK Marmara Research Center (MRC) was founded in 1972, keeps on working in Kocaeli, in “TÜBİTAK Gebze Campus". The first University-Industry development center in Turkey is EGE University-Development Center of Industry Cooperation (USİGEM) which was established in 1983. The first cooperation of University and industry is between Ege University and the Aegean

Region Chamber of Industry (EBSO). İzmir Technopark Inc was founded in 1988 as determined in the book written by Bilgehan (2012) .

Istanbul Technical University (ITU), Istanbul Chamber of Industry and Commerce put a research park into operation in 1985. This research park has been operating under the name of Technology Development Center according to the agreement signed between ITU and KOSGEB.

METU TEKMER was founded in 1991. TEKMER is a center that was founded by protocol among KOSGEB, METU and Institutions (Chamber of Industry and Commerce/ Chamber of Commerce/Chamber of Industry/Technopolis /Technopark / Research Institutions, etc) and work within the coordination of KOSGEB. TEKMERs are the common platforms where SMEs and university come together for R&D activities under the coordination of KOSGEB.

METUTECH was established in 2001. Detailed information about METUTECH will be presented in the following parts of our study. İzmir Technology Development Zone and Bilkent Cyberpark was founded in 2002. Hacettepe Technokent was founded in 2003 and İzmir Science Park was founded in 2010. Çanakkale, Muallimköy (Gebze), Kahramanmaraş and Tekirdağ Technology Development Zone and some others are still in process.

2.3.2.3.1 Technology Development Regions Apply Laws in Turkey

Turkey has legislated the law for Technology Development Areas (TDRs) (Law 4691) in 2001 and the revised law (Law 6170) in 2011. According to these laws, establishment of TDRs are regulated and taken under control of MSIT. There is a Founders' Committee of TDR that needs to have at least one member representing a university, high technology institute or a public R&D center inhabiting in the same city, which submits an application for the establishment of TDR to the MSIT. There

are delegates that represent MSIT, Ministry of Finance, Ministry of Public Works and Settlement, State Planning Organization (DPT), HEC, TÜBİTAK and the Union of Chambers and Commodity Exchanges of Turkey (TOBB) for the approval of establishment of TDRs.

2.3.2.3.2 Exemptions and Tax Reductions in General

We can list the exceptions and supports as follows, stated by MSIT (2014a):

- ✓ Income Tax Exemption for companies, entrepreneurs and corporates,
- ✓ Income Tax Exemption for R&D Personnel. There is a full tax exemption for the research, software engineers and R&D personnel related to the works in TDRs. The is possible only if the entrepreneurs and institutions provide the Ministry of Finance with the necessary documentation approved by the Managing Company in TDRs, regarding the personnel (researchers, software engineers and R&D department) they employ and duration of their employment at the R&D projects, on a monthly basis.
- ✓ There are also some exemptions for support personnel and corporate income taxes, VAT and Insurance Premium Support,
- ✓ Encouragement of Foreign Investors and providing easiness for Foreign workers,
- ✓ Supports for Faculty,
- ✓ R&D Investment Support,
- ✓ Exemption for Investment Support for STPs (Customs duty exemption, VAT Exemption, interest support, Insurance premium employer share support, Tax reductions, Investment allocation)

2.3.2.3.3 Special Exemptions and Supports for STPs

There are almost 90% supports for R&D personnel which are working in a TUBITAK Projects in STPs. In that Zone, running wastewater plants, exemptions about wastewater price shall be administered by associated Municipalities. KOSGEB supported entrepreneurs operating at Technology Development Centers with some exemptions provided by the law. They are R&D, Innovation and Industrial Application Supports and Entrepreneur Supports.

They are supporting innovative ideas financially that is produced by the young entrepreneurs who will be graduated in one year from a university as undergraduate, master or PhD student. The total amount is 100.000 TL at most for machinery, software, personnel, services and management expenses.

2.3.2.4 METUTECH

The first studies have begun at the end of the 1980s especially with the examination of US and England examples as well as the other world examples and concrete steps have been taken for the establishment of METUTECH. METUTECH is accepted as the first science and research park in Turkey. With the support of these studies, METU TEKMER is opened, under the main objective of set-up of incubation centers for technology development with the cooperation of KOSGEB in 1992. With the help of the successful results obtained, it was encouraged to establish METUTECH. In 2001, the legal framework related to the Technopolis Technology Development Zones with the Act of 4691 was enacted by MSIT (2014a). METUTECH growth was accelerated with effectuation of this Law.

The main purpose of METUTECH is to provide facilities to the companies which are producing high-tech products and services, their developments with the R&D activities through benefiting from METU's intellectual capacity and information pool. Management of METUTECH also encourages maintaining the collaboration between industry-university. They assist in transforming the university's research infrastructure and information accumulation into economic value through spin-offs, promoting university based start-ups. Shareholders of Teknopark Inc. are The Middle East Technical University Development Foundation, Ankara Chamber of

Industry, Bleda Co, EBI Co, Ortadoğu Yazılım Co., and Middle East Technical University.

METUTECH is at the top of the “Technology Development Zones Performance Index" in 2015 between 36 Technology Development Zones in Turkey. With METU academician’s contributions, 97 new projects, in 2013, 70 new projects in the first 8 months of 2014 started in METUTECH. 18 national, 25 international, 3 Triadic patent certificates and 3 Utility Model certificates has been taken by METU Academician’s innovations whose IP rights are still available.

The company profiles mainly arise from research and development on information technologies (IT), electronics, leading edge materials, energy, defense industry, chemistry, environment technologies, telecommunications, and biotechnology. The incubation center at the METUTECH serves to start-ups and micro sized companies. Most of those companies have started operation as spin-offs from METU research projects. The purpose of these activities is promoting entrepreneurship and innovation. METUTECH hosts partners to several European Union Sixth Framework Program (FP6) projects, such as NICE, SINCERE, ReSIST, SmeInnov8gate and IP4INNO.

There are many types of buildings with different designs in METUTECH. METU Technology Development Center has two main parts as “software houses” and “R&D” facilities with the connection of recreation places and management buildings besides pedestrian ways, shopping centers and many social facilities. The Development Plan was designed by METU Department of City and Regional Planning Design Studio in 1997. Until the end of 2012, the covered area reached up to 105.000 square meters. Due to growth faster than expected, it would reach up to 250.000 square meters till the end of 2020.

Apart from the main campus, there are two external sub-zones: Technology development campus in OSTİM (Middle East Industry and Trade Center) Organized Industrial Region and METU-MEMS (Micro-Electro-Mechanical Systems) Research and Application Center. The main campus has the largest number of firms

among those three. And the headquarters of METUTECH is in the main campus. Our study covers all the academic spin-off companies in those three zones. But the results of the main campus firms made up the core material of the Thesis.

2.3.3 Knowledge Commercialization Process in Entrepreneurial Universities

Wissema (2009) explains the know-how commercialization process in third-mission universities which are transferring the research results to other parties. In this kind of universities, they have marketing department and three types of customers which are 1- Techno-based big companies in need of pure and applied science, 2- Production companies in need of development for the products, 3- Young knowledge-based companies, techno starters, or young entrepreneurs in need of all kind of supports. Universities can promulgate the know-how in two ways:

1- *Existing company:* They can make an agreement in two basic forms: a) Project which concerns a "result responsibility", they can make research order-based or sales or licensing of patents; b) Projects which concern only an "effort responsibility", *before the competition,* basic technologies are being produced by *sponsors* or *embedded research* where researchers and business world work together at the same location (Cambridge Phenomenon).

2- *New company foundation:* There are two types of companies: a) Emerged by scientific research- *academic spin-offs,* b) Techno starters- if university does not have IPR, it cannot get financial benefit from the value that techno starters has created.

2.3.3.1 Types of Knowledge Commercialization

The rationale of knowledge commercialization, encouraged by governments and university management by research commercialization policies, has become institutionalized owing to founding TTOs, hiring IP officers, applying inner procedures concerning IP rights and licensing, and establishing ecosystems for enterprise investors, stated by R. L. Geiger and Sá (2008). In order to discriminate between these new organizational forms located within academia but tied to

industry, a set of criteria is a need to classify the specific form of collaborations (H. Etzkowitz et al., 1998). Etzkowitz is cited in his book that OECD (1990) offers a typology of collaboration based on three measures:

1) The institutional level of cooperation,

2) The sphere of cooperation, and

3) Durability of the arrangements.

There are many ways to *commercialize knowledge* which Gieger (1992) explains as follows:

- ✓ *Consultants:* Links between firms and individual faculty members,
- ✓ *Science Advisory Boards:* "Intellectual Units". An academician can be a member on a science advisory board. It usually guarantees university scientists substantial benefits for themselves and their research.
- ✓ *Personnel Exchange:* Brings the industrial researchers into a university research environment.
- ✓ *Contract Research:* More than half of the research agreements are contract-based. Support is provided to faculty who also serve as consultants.
- ✓ *Research Consortia:* An agreement among several companies to support a particular vein of research at a single university.
- ✓ *Cooperative Research Centers* with the existence of Industrial Affiliate Programs: Sponsoring companies pay an annual fee to support the center and in return, have privileged access to research results.
- ✓ *Research Centers:* Focuses on specific technologies and designed to attract industry support.

There is another type of contract based on joint research. There are differences between joint and contract research. Joint research is a long-term, broad, trans-institutional interaction between many scientists. Contract research is more individual-based and short-term and there is less integration between industrial and academic partners (H. Etzkowitz et al., 1998).

Another way to utilize academic research in a commercial manner is to constitute university spin-off firms which will be investigated in detail in next chapter as one of our core purposes of this study.

2.4 Academic Spin-Offs and Their Roles in Entrepreneurial University

Academic entrepreneurs (H. Etzkowitz et al., 2000; Meyer, 2003) or academic spin-offs (Müller, 2008) is the other type of knowledge commercialization that academicians establish companies in order to transfer knowledge and technology from university to industry. As Müller stated, there is no clear definition of academic spin-offs. Because of this difficulty about the determination of the type of technology transfer, we meet different nomenclature of this foundation; such as academic spin-offs, academic entrepreneurs, entrepreneurial scientist, faculty owned businesses, techno-starters, entrepreneurial academics last but not least university spin-off companies. It can be understood that some authors, i.e. Slaughter and Leslie (1997), who are against this establishment, calls this concept as "academic capitalism".

Spin-off is a type of corporate restructuring that emerges when a corporation splits into parts or divisions to create a new corporation. The new company that is spun-off takes some of the parent company's assets and equipment. During the establishment of academic spin-off, the academician can be evaluated as human asset of the university. Druilhe and Garnsey (2003) states that, studies of technology transfer supplying descriptive statistics on academic entrepreneurship describe spin-offs as a homogenous class. Shore and McLauchlan (2012) contend that ASOs are knowledge brokers and mediators with track records for income-generation; individuals who are able to successfully operate in the space between the academy and industry, able to leverage external funding for their research and to employ teams of researchers and support staff. Iacobucci and Micozzi (2015) determined them as one of the most promising ways of transferring research results to the market place: the creation of ASOs. They are seen as innovators who have succeeded in creating or running viable spinout businesses.

There are three contextual factors that accelerated the rise of ASOs:

1- The ownership of intellectual property rights by technology transfer offices (TTOs) relative to that of faculty has increased.

2- There is increasing institutional pressure on universities and public research organizations to commercialize research through licensing and/or ASOs.

3- It is the availability of public funds aimed at addressing the so-called financing and knowledge gap (Clarysse, Wright, Lockett, Mustar, & M, 2007).

It was proposed that there were five broad categories of university spin-outs, which was indicated by Druilhe and Garnsey (2003) based on Spin-off activities at Cambridge University in general as follows:

1- Technical consultancy, sales (distribution), research services
2- Development company i.e. Licensing IP
3- Software-based company
4- Product-based company
5- Create infrastructure

Although the initial typology was available (consultancy, development company, software, product-based company, infrastructure creation), it conflated important sub-sectors as disclosed in the empirical analysis such as; contract R&D, production for niche market, in-house manufacturing and manufacturing outsourced.

2.4.1 The Role of Academic Spin-Offs in Entrepreneurial University

The importance of funds coming from patenting of the discoveries, determined by H. Etzkowitz (1983) that, made by scientist who still is an academic personnel in university has been increased. This provided competitiveness and productivity to the country's economic development in recent decades. Combining new resources based

on leading edge technology is easier for academicians as they are closer to these technologies when compared to other entrepreneurs. Spin-offs from universities are seen as the entrepreneurial option to licensing by many scientists and TTOs. But they need financial resources which are not easy to reach due to their status. At that point using university facilities is a beneficial way for them especially for an innovative production Druilhe and Garnsey (2003) stress that, if the success of Cambridge Phenomenon is discussed today, it is because of the economic contribution of ASOs. There were early spin-outs from Cambridge University at the end of 19th century. Cambridge Scientific Instruments Company is founded in 1881 by Haroca Darwin, Charles Darwin's son.

The miscellaneous R&D activities are maintaining together with professors, research institutes and faculties. Technological knowledge is therefore increasingly becoming a commercially tradable resource. Spath and Renz (2005) indicates that, the universities of the 21st century are playing a key role as incubators and network hubs for knowledge management and innovations and academicians are taking a vital role in this partnership, written in the article of Pinkwart and El-Ella (2012).

Following mid-1990s, Fini (2010) determined that, legislative revolutions that pushed public research institutions in the direction of considerable proactivity in commercializing their research results. Universities in many parts of the world have begun to invest in the establishment of internal mechanisms (organizational procedures, incentives, regulations, etc.) that aimed at assisting academic entrepreneurship in its varying formats. Empirical studies have defined a range of elements facilitating or inhibiting the foundation and development of spin-offs. Even though, Penrose (1995) determines that, there were some encouragements for scientists to become entrepreneurs, because of university environment and policies, there were some preventions. Their characteristics and adequacy was important to be an entrepreneur besides being an academician.

There are different types of academicians in entrepreneurial universities, as explained by Thorp and Goldstein (2010), they are public, translational, artistic, entrepreneurial and engaged scholar. Public scholars writing a text book, giving

lectures which are available on DVD, being an expert on mainstream media. The translational ones are playing a role between basic research and commercialization. The artistic ones are musicians, dancers, writers and filmmakers that need to change their attitudes according to industry needs, such as innovation and ideal settings for exploring new models by interacting with interdisciplinary approaches. Entrepreneurial scholars are builders that connect people who had no previous connections to academia by assembling the necessary resources. Engaged scholars can develop service-learning courses and programs which combine academic consistency with experiential learning on a particular project.

Although, it seems attractive to all parties, it is not so easy for the academicians to balance their time and mindset to be both in university and in private company to satisfy both. They are the main human assets both for the university and for those companies. H. Etzkowitz (1983) stresses that, from the university side, they can establish a firm unless it does not infringe the "one-fifth rule". When there is an increase of infraction on "one-fifth rule" and academicians started to give precedence to their firm, their time usage balance is changing. At that point, university management forces the academicians to resign due to disruption in their departmental responsibilities and participation in committees. There are different implementations in countries. H. Etzkowitz (2012) indicates that, some British universities require academicians who want to have faculty owned business to resign their post in contrast to many universities in US. While in University of Cambridge, Druilhe and Garnsey (2003) states that, there is a liberal implementation for academicians. There is a conspicuous example of this situation in Harvard in 1982, indicated by H. Etzkowitz (1983). Walter Gilbert, Nobel prize-winning biochemist and chief executive officer to Biogen, SA, had to leave the university. In 1982, Gilbert, under pressure from colleagues and university administrators, resigned his chair at Harvard; he was not permitted to retain it while also serving as chief executive officer at Biogen.

There are too many resistances from the academic point of view, which grounds the arguments on facts that the presence of an academic person is a researcher for science not a tradesman for business world. There occurs a conflict of interest. But if

the professor makes the research within the university and obtain research fund from external sources, the university management protects him and show as a model to others. The only conflict occurs, from the perspective of H. Etzkowitz (1983), when university interests conflicts external interests. Both internal and external resources are very important for ASOs. Not only for academicians but also for all type of entrepreneurs, there is a huge distinction between recognizing an opportunity for a technology-based product from the first step and create a market value for it as it is launched. Research applied in the university may result in potential for technologies that are highly general and need upward study to develop applications, with consequent ambiguity. The original patents often constitute an inadequate basis for exploitation. Müller (2008), Druilhe and Garnsey (2003) stresses that, further developments, improvements and intellectual property protection are necessary if these technologies are to be exploited commercially. At that stage, giving consultancy may give better results for both academician and industry.

2.4.2 Types of Business Activities Maintained by Academic Spin-Offs

The publishing, structures of universities, courses in entrepreneurship and incubators have a positive effect on the academicians for the knowledge commercialization through technology transfer offices. In Druilhe and Garnsey (2003) study:

- ✓ Mustar (1997) makes a distinction between firms which were founded by academicians and the link they maintained with the science.

- ✓ Autio (1997) differentiates these firms according to their transformation of knowledge as science-based firms to create niche markets. ASOs were comparatively more active in transforming scientific knowledge into basic technologies. Engineering-based firms are relatively more effective in transforming fundamental technologies into application-specific technologies.

- ✓ Stankiewicz (1994) classifies academic spin-off firms according to the way they operate and identifies different modes of operations: consultancy and R&D contracting mode, product-orientated mode, and technological-asset orientated

mode. These modes require a different set of technical skills, different approach to governance and financing, different connections to the academic knowledge base, and a different form of infrastructural support.

2.4.3 Pros and Cons of Academic Spin-Offs:

ASOs creation has some substantial **advantages.** Fayolle and Redford (2014) published Burg' study that, the reasons to foster the creation of university spin-offs as follows:

(1) *Knowledge utilization:* Citizens are paying taxes and waiting for the return as social or economic benefit. This is valid also for the new knowledge and produced inventions at least in the public universities. It is desirable if these inventions provide benefits to the public. In universities, academicians provide tacit knowledge for the innovations especially during the early stage developments to make them a commercial product.

(2) *Economic growth:* University spin-offs, especially high-tech firms have an essential role for national scale economic growth and provide expertise to solve the specific problems.

(3) *Learning from the other 'culture':* Business life is completely different from academic world. In other words, academic world is known to be ivory towers. Engaging in the university spin-off establishment with industry can obtain new research ideas.

(4) *Revenue generation:* Commercialized knowledge provided by the university can result in income for universities. This occurs from patents or license sold to business world or the equity they take in spin-off companies or all the related activities for this invention.

Entrepreneurial academic is a new social class and spin- offs creation have some **disadvantages**. How do they perceive their role within the university, negotiate the

apparent contradictions of that position, and conceptualize the relationship between the university and society? Shore and McLauchlan (2012) explains the drawbacks as follows:

- ✓ Universities have been 'penetrated' and 'colonized' by industry and (financial) transactions,
- ✓ From a legal perspective, they are 'public institutions' and are defined as 'not for profit',
- ✓ They are organizations whose main mission is determined as teaching and research,
- ✓ For some, the phrase 'academic entrepreneur' is an oxymoron or contradiction in terms of academia,
- ✓ But some academicians are interested in privatization and the ethos of entrepreneurialism enthusiastically. The mission of liberal education is lost.

The question is; what type of risks is borne by the academic entrepreneur? In his article, Burg and some other academicians have put on the table the arguments against university spin-off creation as follows:

Reduce academic commitment: Causes conflicts of interest, need investment in time and effort, academic tasks versus the commitment to private entrepreneurship stated by many authors (Bird et al., 1993; Renault, 2006) in the book of Fayolle and Redford (2014). But results show the opposite. Quality of articles arises and number of citations increases by the university spin-offs.

Research direction change: Focusing more commercial opportunities, engaging in entrepreneurial activities may change research direction, determined by Colyvas and Powell (2006). Fundamental research can result in path-breaking innovations and growing commercial and monetary interests may result in losing of researcher's direction. But over-embeddedness can reduce future academic and commercial

success, stressed by Owe-Smith and Powell, (2003), stated in Fayolle and Redford (2014) study.

Anti-commons effect: The research can only be shared by the company that bought the rights of it; they have sold the rights on the intellectual property. The academician cannot share the research results with the outside world as well as with other scientists, stated by Krimsky (2003). This is against one of the key values of university namely "to create and sustain an intellectual commons: a knowledge archive openly accessible to all members of society, from the perspective of Argyres and Liebeskind (1998). Cooperation among faculties is decreasing if the research results are commercialized. If IP is protected by a patent, it receives slightly fewer citations than their unpatented pairs.

Threats to objectivity: If the spin-off has an inappropriate or unscientific behavior, it damages the reputation of the university, determined by Blumenthal, (1992), Shane, (2004).

Inequity among faculty: Income inequity but there is not an empirical research about it.

Departure of faculty: Leaving academic career but not perceived as problematic and no empirical study.

Unfair competition by spin-offs: There are State-sponsored enterprises, which leads to unfair competition for the new ventures. However, there are also many financial supports for new enterprises.

2.4.4 Success Factors and Economic Impacts of Spin-Offs

Innovation is the most important factor affecting the success of university spin-off companies. Moreover, other variables that increase the success of university spin-off companies are personnel support of university, R&D activity and open innovation. There are some different incubation strategies for spinning-out firms all around the world. Segal Quince Wicksteed Research Company explains that, in Cambridge,

with the number of year 2000, about 20% of the firms have a University founder, indicated by Druilhe and Garnsey (2003). In K.U. Leuven, which is one of the first tech transfer offices in Belgium, has been founded in 1972 in Leuven University for R&D studies, has long spin-off tradition. Over the past 35 years, Leuven has led to creation of over 100 spin-off companies, explained in their web page (Leuven). These companies have a total combined income of well over 400 million EUR and employ over 3500 individuals, stated by Ruiz (2013).

In the Portuguese case, ASOs impact has been modest. Based on a sample of 101 ASOs associated to the members of the University Technology Enterprise Network, it is found that ASOs are quite small (employing on average 9 full time equivalent individuals and a turnover of 300.000 EUR). Besides being highly R&D intensive, Portuguese ASOs are internationally-led with almost half of the respondent firms involved in Export, indicated by Teixeira and Grande (2013).

It is stated by Iacobucci and Micozzi (2015) that, as found in other European studies, the empirical evidence about Italy indicates that most ASOs have experienced a very low growth and they start small and remain small. As referred in their article, in Northern Ireland ASOs are technology lifestyle businesses, not dynamic high-growth potential start-ups. In Europe, the high-tech clusters are in consideration of policy makers but the more developed high-tech entrepreneurial environments such as the Boston area or the Silicon Valley are big competitors ASOs from all around the world. They have the capability to select to best projects and enough resources to allocate.

There are many reasons which depends on regional characteristics for increasing economic impacts of ASOs which are stated by Fini (2010) as follows;

- ✓ Multi-disciplinarity causes creation of new type of disciplines such as nanotechnologies.
- ✓ R&D activities in smaller and more dynamic firms with sophisticated scientific bases are the centers to pursuit new technologies.

- ✓ Provides free framework for academic institutions to maintain technology transfer operations with following different legal changes in different countries.

The other factors;

- ✓ The importance that a university gives to its third mission, the culture of the university, its attitude towards spin-offs and the competence of the TTO, indicated by Lockett, Wright, and Franklin (2003),

- ✓ The reputation and research eminence of individual universities and their response to political power wielded at international, national, and subnational levels, stated by Di Gregorio and Shane (2003),

- ✓ The sectors in which spin-offs are concentrated, their relation with the local environment strong, stressed by Iacobucci and Micozzi (2015). The study in Italy shows that there is a strong concentration of spin-offs at regional level. The most important factors are the collaborations with industrial partners and with the parent university according to the owner of ASOs in Italy.

As it is shown in **Table 4**, set of indicators to measure the impact of ASOs differs, determined by (Iacobucci & Micozzi, 2015).

Table 4**: Set of Indicators to Measure the Impact of Academic Spin-Offs**

Impact	**Indicators**
High-tech employer	Sector of activity Number of employees
Source of technological entrepreneurship	Sector of activity Promoters, owners, managers
Links with parent institutions	Grants and contracts with the parent university
Creation of international networks	Presence of foreign companies in the ownership International cooperation in R&D projects Extension of geographical market
Source of technological spillover	Collaboration with other firms at local level Labor mobility Formation of technology clusters
Stimulate business support services	Incubators Start-up competitions Entrepreneurship courses

2.4.5 Legal Basis of Ownership in Academic Spin-Off in Turkey

In Turkey, there are some strict rules applied and permissions taken from the university management. To commercialize their research, academicians can establish firms, become partner to an already existing firm or take place in the board of a firm in the TDRs, provided that they inform university headquarters and supply necessary permissions. The academicians should inform the university management and "directorate of working capital" that they will spend some of their time in a private company or the one they own and earn some money in return for their efforts. Technology Development Zones Implementation Regulation which is prepared as Article 9 of the Law on Technology Development Zones No. 4691 is explaining the academic staffs' situations.

Employment of Personnel in the Zone Article 16 states that:

Employment of personnel in Zone and in the Managing Company shall be carried out according to the labor and working legislation in force. Foreign managers and qualified R&D personnel may be employed within the framework of Law on Foreign Capital Incentives no. 6224 and provisions of relevant legislation. The personnel of public institutions and agencies and those of universities that are needed to provide services as research personnel for the activities in the Zone may be employed **part-time** or full-time upon the permission of their institutions. The earnings of lecturers, academic staff and research assistants working as part-time personnel shall be kept outside the scope of the university's revolving fund. The personnel that will be employed on **a full-time** basis shall be given an un-paid leave by their institutions and their link to their position shall continue. The academic staffs who are working on a **temporary assignment** basis both domestically and abroad as foreseen in Article 39 of Law No. 2547 may carry out their studies in the institutions of the Zone upon the permission of the Executive Board of the University. The **earnings of the lecturers** who are appointed in the Zone on paid leave shall be kept outside the scope of revolving fund of the University. Furthermore, **the academic staff**, with the permission of the Executive Board of the University, may **establish a company** for the purpose of commercializing the outcome of their studies may take up partnerships in an established company and/or may assume positions in the management of such companies stated in web page of (teknopark.comu.edu.tr).

CHAPTER 3

ACADEMIC SPIN-OFFS IN METUTECH

3.1 A Demographic Examination

This thesis is different from other/similar studies conducted in other Technoparks. The thesis draws on a database of university spin-offs and on real-time data from METUTECH Management to investigate them. METUTECH is the most adequate pilot area to check the scientific, social and revenue generating ability positions of ASOs in an entrepreneurial university. The sample is used to identify their current conditions of revenue generating ability, titles, departments, foundation year and numbers of ASOs at METU.

3.1.1 Methodology and Data Collection

To draw an overall picture of ASOs in today's METUTECH, we requested statistical data from the METUTECH management. Before receiving the data, we made a classification as follows:

- ✓ The number of ASOs as an academician in METU or from other universities that have company in METUTECH.
- ✓ Their foundation and kick-off years in METUTECH.
- ✓ The title and departments of the academicians in ASOs.
- ✓ Their annual revenues in terms of private, public or foreign sectors distributions, from R&D projects or others.

3.1.2 Data Selection and Sampling Methodology

After informing the METUTECH management and completing the necessary paperwork between METU Business Administration Department and the METUTECH management, we received the data that constitutes the basis of our

study. We made face-to-face interviews with the METUTECH management several times. It is clear that this data collected about ASOs was one of the most comprehensive and detailed compilation they edited until now. This study covers all the academic people that have ASOs in METUTECH from METU and from other universities.

3.1.3 Type of the study

This is a cross-sectional, descriptive and interpretative type of study to make an assessment about the spin-offs in METUTECH. Before presenting the descriptive statistics that we gathered from the data, it is important to tell the reader that the names of the companies are kept confidential for the privacy. Each company has been coded with a number like Spin-off 1, Spin-off 2 and so on.

3.1.4 Place and Interval

In our study at METUTECH, the interval differs as follows:

The foundation and kick-off dates start from 1989 until March, 2015. The data about their revenues differs. The revenues of 2011 and 2012 are not included. We compared the data with 2010 and 2014 for the purpose of examining the differences between these 4 years.

3.1.5 Purpose and Importance of the Study

In this study, the main purpose was to make an assessment about ASOs at METU which is the leading entrepreneurial university in Turkey. ASOs are one of knowledge commercialization methodologies of entrepreneurial universities. For the purpose of making an assessment about their current situation, METUTECH is a proper STP for the study. The data that was given from METUTECH Management was sufficient to interpret for this purpose. The purpose of the study, which was investigating ASOs with respect to the years of establishment, their titles, revenues and departmental distribution, is conducted.

3.1.6 Population and Sample

There are 75 academicians in ASOs in METUTECH and 60 of them are academicians from METU. There are 63 ASOs and in 53 of these companies, there at least one academician from METU. The remaining 10 of the companies have academician from other universities. The 60 academicians are from different departments of METU. Some of them have more than one company ownership. In our study, our main purpose is to examine academic-spin offs in METUTECH which has at least one academician from METU. But, for comparison, we used also the total number of ASOs in METUTECH

3.1.7 Analysis

3.1.7.1 Analysis for the Company Profile

Table 5: Company Distribution in Terms of Having an Academician from METU

	Amount (n)	**%**
Firms with METU Academicians	53	84%
Others	10	16%
TOTAL	**63**	**100%**

There are 63 ASOs in METUTECH and 53 of them, means 84%, have at least one academician from METU as the owner of the company. Although METUTECH campus located in Ankara, there are some ASOs from other cities (Karabük, Konya, Gaziantep, Muğla). And, there is no medical faculty in METU but there is a firm established by medical doctors (GATA) in METUTECH.

There are **303** companies in METUTECH and almost 200 of them have been established there. When we compare these numbers with ASOs in METUTECH:

63/303= **21%** of the companies in METUTECH are ASOs.

53/303= **17%** of the ASOs have at least one academician from METU.

200/303= **67%** of the total companies has been founded at METUTECH.

In total 63 ASOs:

19 ASOs of 63 firms, did not declare revenue for the term of 2013-2014. Some of the firms have transferred their offices to other STPs. Most of the companies are working as project-based. As a result of this, when the project ends, some of them are closed. But some of the ASOs are keeping their places by paying their rents and liabilities. There are 2 companies which are listed as passive. There are 40 companies active (revenue in most recent year) now, whis equal to 63% of established companies. An additional 13 companies are operating but with no revenue in the most recent quarter. In order to be conservative, we are not treating them directly as active in the calculations.

There are some companies that have been founded in another place and settled in METUTECH after a while. For example, there is one company founded in 1989, at a time when METUTECH had not started its activities. This company was transferred to METUTECH in 2002. There is another company founded in 1992 but was transferred in 2006. Both of these companies have academic people both from METU and other universities.

Our benchmark year is 2010. When we compare the years 2010 and 2014, we see that there is an increase in the foundation ASOs in METUTECH which has at least one academician from METU. 27 of Spin-offs, which means 51% of all ASOs in METUTECH, that are the firms with METU academicians, are founded after 2010. And the date between foundation and kick-off is shortening after 2010.

In 63 companies, generally there is only one academician as the owner of the company. 55 of them have only 1 academician which constitutes 87% of the data. It is also valid for academicians from METU.

Table 6: Company Distribution According to Foundation Dates

Date Established	# of Firms METU Academicians	%	# of Firms All Academicians	%
1989	1	2%	1	2%
1992	0	0	1	2%
1997	0	0	1	2%
2001	2	4%	2	3%
2003	1	2%	1	2%
2004	2	4%	3	5%
2005	2	4%	2	3%
2006	3	6%	4	6%
2007	2	4%	3	5%
2008	3	6%	4	6%
2009	3	6%	3	5%
2010	7	13%	7	11%
2011	2	4%	2	3%
2012	7	**13%**	9	**14%**
2013	12	**23%**	14	**22%**
2014	5	**9%**	5	**8%**
2015	1	**2%**	1	**2%**
TOTAL	**53**	**100%**	**63**	**100%**

In the spin-offs that have at least one academician from METU, 90% of them have only 1 academician as the owner of the company. The number of companies with more than one scholar is 8 in general and 5 from METU.

Table 7: Number of Academicians in firms and Their Percentage Distributions in Academic Spin-Offs in METUTECH

	TOTAL		**METU**	
Number of Academician	**# of firms**	**%**	**# of firms**	**%**
1	55	87%	48	90%
2	5	8%	3	6%
3	2	3%	1	2%
4	1	2%	1	2%
TOTAL	**63**	**100%**	**53**	**100%**

Only 2 other universities have made a partnership with the academicians from METU. The number of Spin-offs which has academicians from other universities is 10 spin-offs with 14 academicians.

3.1.7.2 Distribution of Academicians With Respect to Departments and Titles

Total of Academicians in ASOs in METUTECH are **75.**

The Number of Academicians in Spin-Offs in METUTECH According to the Years

As mentioned at the **Table: 8,** the ownership of academic spin-off has started to increase after 2010. And establishment of academic spin-off are increased after 2012 with the legal regulation for the researchers.

According to the Years

The number of firms that has at least one academician from METU is 61 with 76% of total academicians. One of the academicians has left in 2014 from METUTECH. In Total, 42 ASOs established their firms after 2010, means 56% of 75 academicians.

After 2010, 34 ASOs which have at least one academician form METU established their firms, means 56% of 61 academicians from METU.

Table 8: Academic Ownership in Yearly Basis in METUTECH (Total/METU)

TOTAL		**METU**	
	AMOUNT	**YEAR**	**AMOUNT**
2001	1	2001	1
2002	1	2002	1
2003	1		
2005	4	2005	3
2006	3	2006	1
2007	5	2007	4
2008	4	2008	3
2009	6	2009	6
2010	8	2010	8
2011	1	2011	1
2012	16	2012	12
2013	16	2013	13
2014	8	2014	7
2015	1	2015	1
TOTAL	**75**	**TOTAL**	**61**

Distribution of Academicians With Respect to Departments

There are academicians from different departments. Most of them are mainly from three departments which are Electric Electronic Engineering, Mechanical Engineering and Biology.

Table 9: Number and Percentages of Academicians According to Their Departments in METUTECH

# of Academicians According to Departments in METUTECH				
Departments	**Total**	**%**	**METU**	**%**
EEE	17	23%	15	24%
ME	11	14%	9	15%
BIO	7	9%	6	10%
AE	5	7%	4	7%
CE	5	7%	5	8%
CENG	5	7%	5	8%
II	5	7%	5	8%
MEDICAL	4	5%	0	0%
METE	3	4%	2	3%
CEIT	2	3%	2	3%
CHEM	2	3%	2	3%
GEO	2	3%	1	2%
ID	2	3%	2	3%
CHE	1	1%	1	2%
GENETICS	1	1%	0	0%
MINE	1	1%	1	2%
PHYS	1	1%	0	0%
STAT	1	1%	1	2%
TOTAL	**75**	100%	**61**	100%

The other departments are Aerospace Engineering, Chemistry Engineering, Civil Engineering, Informatics Institution, Medical Faculty, Metallurgical and Materials Engineering, Computer Education and Instructional Technology, Chemistry, Geology, Industrial Design, Chemical Engineering, Genetics, Mining Engineering, Physics and Statistics.

When the data examined in order to departmental distribution, as mentioned above the most ownership comes from 3 departments which are EEE, ME and BIO which are in Total 49% of all the ASOs in METUTECH.

Electrical and Electronic Engineering (EEE) Department

Total number of ASOs from EEE is 17 which have 23% in Total. This department is also at the top of the ownership list of METU academicians in METUTECH. There are 15 academicians, and they have 24%. There is an increase after 2010. 67% of Spin-offs have established after 2010 from EEE department.

Mechanical Engineering (ME) Department

The second highest department is having an academic spin-off in METUTECH is ME with 11 spin-offs in Total with the 14% in the list. There are 9 academicians in ASOs in METUTECH from ME department with the percentage of 15.

Biology (BIO) Department

The third highest one in the list is department of BIO with the percentage of 9 with 7 spin-offs in total. There are 6 academicians from BIO department. 67% of them have founded after 2010.

Distribution of Academicians According to Their Titles

There are 61 METU academicians in ASOs in METUTECH. As we see from the **Table 10**, there is an increase after 2010 of establishment of spin-offs. In 2015, there is only 1 ASOs due to the data was until the end of March, 2015.

Table 10: Distribution of Academicians According to Their Titles

Year	TOTAL	Prof	Associate Prof	PhD	Research Assistants	METU
2001	1		1			1
2002	1	1				1
2003	1			1		
2005	4	3		1		3
2006	3	2		1		1
2007	5	2	3			4
2008	4	2	1	1		3
2009	6	5		1		6
2010	8	5	1	2		8
2011	1	1				1
2012	16	5	7		4	12
2013	16	4	6	1	5	13
2014	8	6	2			7
2015	1	1				1
TOTAL	**75**	**37**	**21**	**8**	**9**	**61**

Table 11: Total Distribution and Percentages of METU Academic Spin-Offs According to Their Titles

Title	# of People	%
Research Assistants	9	15%
PhD Holders	5	8%
Assoc. Professors	12	20%
Professors	35	57%
Total	**61**	**100%**

The highest number of title in METU academicians are Professors. There are 35 Professors with 57% in Total as seen in **Table 11.**

Research Assistants

There are 9 Research Assistants in Total as being an owner of a spin-off in METUTECH. All of them founded their companies after the legal permission in 2012. There are 804 Research Assistants in METUTECH in total at the end of March 2015 (YÖK, 2015). Their percentage is very low when we compare them with the total number of Research Assistants in METU.

9/804= 1.1%

There is an increase in number of Research Assistants's ASOs foundation after 2012 over time. Because of the new legal implementation for the Research Assistants, company ownership in STPs is available for them since then. However, 67% of Research Assistants, means 6 of them has left from the company in 1 or 2 years.

PhD

There are 8 PhD holders that have academic spin-off in METUTECH in Total. There are 5 PhD holders from METU in METUTECH. At the end of March 2015, there are 295 PhD holders in METU in total. Their percentage is very low when we compare them with the total number of PhD holders in METU.

5/295= 2% of them have academic spin-off in METUTECH.

According to the Years

There is no important change according to the years for the distribution of the ownership for PhD holders.

Associate Professors

There are 21 associate professors have academic spin-off in METUTECH. There are no assistant professors that have a spin-off in METUTECH.

According to the Years

We can easily see that after 2010 there is an increase being ownership as academic spin-off at METUTECH with the title of associate professors. 57% of them has founded after this year.

There are 12 Associate Professors from METU in ASOs in METUTECH. There are 176 Associate Professors in METU at the end of March 2015.

12/176= 7% of them have academic spin-off in METUTECH.

58% of them has founded after 2010.

Professors

The most academic spin-off ownership is the title of professor in METUTECH with the amount of 37. 61% in Total but one of them has left in 2014.

According to the Years

There are no radical changes in order to distribution of them according to the years. But after 2010 it is increasing. 15 of Professors have established their companies after 2010. It means 41 % of them have founded after 2010 in Total.

The most company ownership is in ASOs in METUTECH in METU academicians belongs to Professors. They are 35 professors in ASOs in METUTECH. In METU, there are 384 Professors at the end of March, 2015. (YÖK, 2015)

35/384= 9 % of them have ASOs in METUTECH.

43% of them which has at least one academician from METU has established their firms after 2010.

3.1.7.3 Analysis for the Revenues

The revenue that generated by the company which has established in 2015 is not included in revenue calculations. The total revenue generated by ASOs by active 40 firms which has at least one academician from METU is **40,298,833.09 TL** in 2014. There are revenues from foreign countries, from public and private sectors as R&D or out of R&D activities.

Total Revenues in Years

In the **Table 12**, the total revenues have shown that the academic spin-off in METUTECH has generated between 2004 and 2014. These are the firms that have at least one academician from METU. When we divide the total revenues to the number of companies with declared revenues in that year, we see the Average Revenues they generated in terms of private and public sectors, and also from abroad. While average revenue was 825,324.29TL in 2013, it has increased to 1,007,470.83TL in 2014.

When we made a comparison between the years 2010 and 2014, the number of firms with declared revenues has increased from 23 to 40. This means that there is a 74% increase. Total revenue they generated has increased from 15,842,188.01 TL to 40,298,833.09 TL which means:

(40,298,833.09 TL /15,842,188.01 TL)-1= 154% increases in total revenue from year 2010 to year 2014.

Table 12: Total and Average Revenues of Academic Spin-Offs in METUTECH with the Percentages in Years

Year	Total Revenue (TL)	Average Revenue (TL)	# of Firms	% Change
2004	1,513,571.98	756,785.99	2	
2005	2,486,258.06	414,376.34	6	-45%
2006	5,894,774.88	535,888.63	11	29%
2007	5,960,951.32	496,745.94	12	-7%
2008	7,140,166.45	476,011.10	15	-4%
2009	9,715,819.20	539,767.73	18	13%
2010	15,842,188.01	688,790.78	**23**	28%
2013	28,061,022.48	825,324.19	34	19%
2014	40,298,833.09	1,007,470.83	**40**	22%

When we divide the total revenues to previous years' amounts we see the percentage increases and decreases. For example the revenue differences between 2013 and 2014 are 22%. There is no data for years 2011 and 2012.

There were **23** companies in METUTECH with declared revenues in 2010 and 20 of them are still present with declared revenue for 2014. When we compare the year 2010 with year 2014, according to the Average Revenues that the spin-offs generated, we see that there is an increase in average revenues of almost 46%.

(1,007,470.83 TL/688,790.78 TL)-1=46%

Of the 23 ASOs from 2010. there is 1 spin-off which is not available (passive) and 2 with no revenue in 2014, in METUTECH.

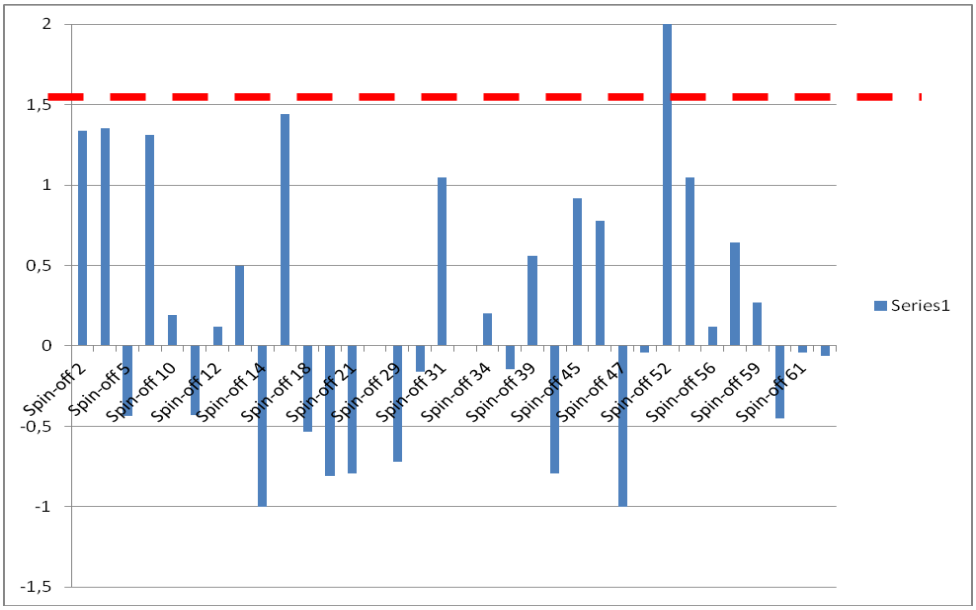

Figure 4: The Spin-Offs Revenues Increase and Decrease Particularly in 2013-2014.

Number of firms and total revenue is increasing every year in METUTECH. But the average revenue has increased and decreased in years depends on firm amounts and the revenue they generated as shown in **Figure 4.** These are revenue changes of 34 firms, years 2013-2014.

When we compare 21 spin-offs' which are founded after 2010 revenues from 2010 to 2014:

(29,728,928.38 TL/15,842,188.01 TL)-1= 88%

There is 88% revenue increase from 2010 to 2014 for the same spin-offs that they were in METUTECH both in 2010 and 2014. There are 20 new firms in METUTECH that they were not there before 2010.

The comparison between the revenue of year 2010 and 2014 is in **Table 13.**

Table 13: Total and Average Revenues of 2010 and 2014

Revenues of old firms	REVENUE of 2010	REVENUE of 2014	~ %	Revenue of New Firms (2014)
TOTAL	**15,842,188**	**29,728,928**	**88% increased**	**10,569,905**
# of firms	23	20	13% decreased	20
Average	688,791	1,486,446	115% increased	528,495

The total revenue for 2014 is **10,569,904.71 TL + 29,728,928.38 TL = 40,298,833.09 TL**

There are 10 ASOs which have more than 1 Million TL Total Revenues in 40 spin-offs in METUTECH in 2014.

Table 14: Average Revenues Generated in Sectors

Year	Total Foreign Rev.	Total Public Sec. Rev.	Total Private Sec. Rev.	Total Revenues	# of firms
2004	7,457.50	777,649.20	728,465.28	1,513,571.98	4
2005	175,569.80	885,393.10	1,425,295.16	2,486,258.06	6
2006	26,274.12	2,754,638.13	3,113,862.63	5,894,774.88	11
2007	5,893.56	2,047,114.82	3,907,942.94	5,960,951.32	12
2008	415,629.48	850,992.55	5,873,544.42	7,140,166.45	15
2009	984,050.16	1,798,078.16	6,933,690.88	9,715,819.20	18
2010	425,937.94	2,170,719.68	13,245,530.39	15,842,188.01	23
2013	7,152,315.76	19,278,403.27	1,630,303.45	28,061,022.48	34
2014	4,652,026.35	31,476,870.02	4,169,936.72	40,298,833.09	40
Year	**Average Foreign Rev.**	**Average Public Sec. Rev.**	**Average. Private Sec. Rev.**	**Average Revenues**	**# of firms**
2004	1,864.38	194,412.30	182,116.32	378,393.00	4
2005	29,261.63	147,565.52	237,549.19	414,376.34	6
2006	2,388.56	250,421.65	283,078.42	535,888.63	11
2007	491.13	170,592.90	325,661.91	496,745.94	12
2008	27,708.63	56,732.84	391,569.63	476,011.10	15
2009	54,669.45	99,893.23	385,205.05	539,767.73	18
2010	18,519.04	94,379.12	575,892.63	688,790.78	23
2013	210,362.23	567,011.86	47,950.10	825,324.19	34
2014	116,300.66	786,921.75	104,248.42	1,007,470.83	40

It is observed that there is an increase in foreign and public revenues but decrease in the private sector revenues over time as shown in **Table 14.**

Number of firms is increased 74%, total revenues are increased 154%, and average revenues are increased 46%. Between the years, 2010 and 2014, while average foreign revenue has increased 527% and public revenues are increased 734% on average but there is 82% decrease in private sector revenues.

As a result;

The number of ASOs and academicians who has an ownership in METUTECH has increased cumulatively while it was one or two initially in METUTECH for the first years of its establishment. It was not surprising to see that, 84/% of them have at least one academician from METU. There are academicians from other universities even from other cities that have a spin-off in METUTECH.

The most ownership in METUTECH is in academicians that who are at the position of professor. And it was not surprising to see the increase for the researcher being an owner of an academic spin-off after the legal regulation in 2012.

There are 63 ASOs in METUTECH and 53 of them have at least one academician from METU with the date of March 2015. 9 of them have left from METUTECH. Two of them had an ownership from outside of METU and 7 of them were companies which had academicians from METU. One of them has transferred its company to another Technopark. 2 of them are classified as passive condition. When we compare the number in total as:

53 of them were active at the beginning of 2014. 11 of them have no activity now. One of the ASOs did not declare revenue for 2014 but is still there. As a result 40 of them are in METUTECH in current situation. And they generated revenue in total 40,298,833.09 TL for the year 2014.

We tried to investigate the academic spin-offs' performance in detail. Between the term of 2010 and 2014, their revenues and number of firms are increased as it stated

in our study. As we mentioned above, there are some companies that did not declare revenue for 2013-2014 term. Our assessment is from this output that they have a project which was satisfactory both in monetary and work load which covers more than one year. So they did not declare revenue for this term, they are trying to complete their projects. And there is another reason for not declaring revenue but still being in METUTECH. To have a place in STPs is very difficult. When companies had a place in a STP they wanted to keep this area with paying its rent and liabilities to the management and trying to get a new project. As a result of our study about ASOs in METUTECH, we examined them in terms of their years of establishment, the academician's titles, revenue they generated and departmental distribution as current situation.

Some studies conducted on this subject to benchmark to our study in METUTECH

1- İzmir High Technology Institute (IHTI): There are 23 ASOs in January 2013 in İzmir Technology Development Area which is 23% of all their companies. 23/98= 23%. There are 34 companies in METUTECH in January, 2013.

2- Leuven Research Park in Belgium. Leuven has led to creation of over 100 spin-off companies. METUTECH there are 40 spin-offs in 2014. Leuven has reached this number in 35 years while METUTECH has reached 40 companies in 13 years (2001-2014)

3- 100 spin-offs have generated 400 million Euro incomes in Leuven and employing more than 3,500 people while ASOs in METUTECH have generated 40 million Turkish Lira (~13, 6 million Euros) and 473 people are working in ASOs.

CHAPTER 4

CONCLUSION

4.1 Summary

In this study, comprehensive literature review about the practices and applications of entrepreneurial universities, knowledge commercialization, technology transfers and academic spin-offs with pros and cons, legal regulations, and best practices are conducted. The various roles assigned to the Entrepreneurial University are outlined and specific attention is given to the role played by ASOs. A demographic examination is carried out on ASOs at METUTECH.

In Chapter I, the purpose of the study is clarified as an introduction to the thesis. There has been a significant change in Higher Education Institutions over time. Currently they seem to be moving from science-based university to "Entrepreneurial Universities" or "Third Generation Universities" models. In order to satisfy the expectations of internal and external stakeholders new generation universities are emerging. The activities in universities are directed towards 'knowledge transfer', providing links with industry and commercializing university research and teaching. Universities are having increasingly important role in the country's innovation system. Within a Triple-Helix nexus which involves universities, private companies and government institutions, a new type of interaction began which refers entrepreneurial activities. All actors in Triple Helix (university- industry-government) developed new policies and tried to get benefit from this interaction. Among many alternatives, ASOs are the most direct one of the knowledge commercialization activities. The main purpose of this thesis explained as to present the roles of Entrepreneurial University in education system and the situations of ASOs in this new structure with their pros and cons.

In Chapter II, the emergence of Third Generation Universities-Entrepreneurial University is investigated. As it is stated in Table 1, characteristics of the three generations of universities are evolving over time. The first generation of universities is defined as Medieval Universities, can be identified with the objective of education only. I explained the reasons of First Transition Period from first generation universities to second type of universities with a new intellectual movement scientific revolution, Renaissance, the age of Enlightenment. The triggering developments of the transition from "preservation and transmission of accepted knowledge" to the "discovery and advancement of new knowledge" are stated. The second generation of the universities is defined as Humboldt Type University, can be identified with two objectives: Education + research. I emphasized the "Modern Scientific Method", and the specialization in this term. In Second Transition Period, we saw the new developments in social and academic worlds for many reasons. The Conclusion was, the significant increase number in the population of students and academic entrepreneurship, interdisciplinary research, Globalization were the most important ones. The third generation of universities is defined as Entrepreneurial Universities, can be identified as know-how exploitations in addition to education and research objectives. The first user of the term of Entrepreneurial University was H. Etzkowitz, 1983. Stanford, Harvard and MIT, Cambridge Universities and the implementations of entrepreneurial education is explained in this chapter with best practice. Triple Helix Concept is the best identification of this new type of term in Higher Education System as I explained in detail, based on the Figure 1.

The success factors of entrepreneurial education and roles of them are stated and there is still no standard measurement of this new entrepreneurial system. I must say that the measurement of Turkish Ministry of Science, Industry and Technology is very detailed and effective way of measuring universities in terms of their entrepreneurial and innovative success. METU is at the top of this ranking for the year 2014. In Chapter II, I also examined effects of entrepreneurial approach in Universities in the Triple Helix balances, studies on Industry-University

Collaborations in Turkey, Entrepreneurial University implementations in Europe, USA and Turkey with best practices. Technology transfers, knowledge commercialization activities, Science and Technology Parks, ASOs in Entrepreneurial University are stated in this chapter also. Their structures and implementation studies are examined. The general profile of METUTECH is given in detail.

In Chapter III, I explained the details of my study about ASOs in METUTECH. I got the data form METUTECH Management with the details of number of ASOs, their foundation and kick-off years, distribution of academicians with respect to departments and titles and annual revenues in terms of private, public or foreign sectoral distributions, from R&D projects or others. My findings were: There are 40 active (declaring revenues) ASOs in METUTECH (March, 2015). Their numbers and revenues are increased over time. Between the years, 2010 and 2014, the number of firms is increased 74%, total revenues are increased 154%, and average revenues are increased 46%. Between these years, while average foreign revenue has increased 528% and public revenues are increased 734% on average but there is 82% decrease in private sector revenues.

4.2 Discussions

4.2.1 Discussions on Entrepreneurial University and Implementations

Advanced third mission activities are rich, involving the commercialization of knowledge and deeply affecting the academic ethos. Due to their effect, there is a resistance that occurred in the academic world. The shift to an entrepreneurial university still raises resistance in segments of the scientific community, stressed by Fuller (2005). It has consequences not only for ethical standards, but also for the concept of knowledge as a public good. While the number of HEIs increased in last decades, expansion did not mean that the first and second missions were fully achieved. A University does not become an Entrepreneurial University simply by offering Entrepreneurship courses. Also, not all Universities could or should become Entrepreneurial Universities. There is probably sufficient room for many institutions

at different levels. But remaining at the research level for a long time may be ended by falling out of the race.

There is a big resistance to change in academic community. It is stemmed from avoidance to have a conflict between commercial world and education environment. In commercial world, the knowledge which is produced in university will be commercialized. And in education environment, researchers make their researches independently. H. Etzkowitz (1983) indicated in his study that, some of the academicians think that, those universities which are involved in entrepreneurial activities are concerned about possibly harmful effects on their institutions. Bill Graham, the president of the University of Toronto Faculty Association, stated in 1999, "*Developing entrepreneurs is not the goal of university education and venture creation is not their priority. Turning scholars into entrepreneurs undercuts the very idea of postsecondary education " (ACU, 2004).*

Have research and education lost their way in being associated with knowledge commercialization? This is a key question both for the individual (researcher) and organizational levels (universities). The principal success factors in this kind of strategy and in developing the entrepreneurial dimension within the universities relates to the capacity of universities to develop 'ambidexterity' at the institutional and individual levels, stressed by Chang (2009).

H. Etzkowitz et al. (2000) state the technology commercialization role is one of the identifications of entrepreneurial university model. We believe that, ''Entrepreneurial'' university model, particularly in the context of late-industrializing economies, also implies a significant emphasis on injecting a greater dimension of entrepreneurship to the contents of university education itself. Stated differently by Wong (2007) that, not only does the university need to take on new functions, but also the nature of its core function of education needs to be re-oriented as well. The contribution of universities to society is complex and non-linear, and universities differ in the focus and balance of their engagement activities. This is desirable in a system which supports 'a variety of excellence' and in which

discipline areas differ in their range of knowledge transfer activities, indicated by Howard (2006).

Guerrero and Urbano (2012) explained that, the ability and capacity of universities to change and adopt new course of action seems low while there is a big impact about entrepreneurship in economic growth generated from universities, as stated in the book of Fayolle and Redford (2014). Although, there is a trend about entrepreneurial universities, due to bureaucracies it seems not easy to convert the traditional ones into entrepreneurial. There is a disconnection between academic world and industry in terms of converting knowledge into economic and social utility. It is obvious that, there is a necessity for universities to become more and more entrepreneurial, converting its strategy, its structure and policies into economic value. But uncertainty and complexity in their environment is very high, and the entrepreneurial pressures from within need to be rearranged according to countries' and universities' conditions. A university which is fully engaged with economic, social and cultural needs of society, stated by NCEE (2013), can be said to be ideal. But there must be a limit about the degree of collaboration with a supervisor in university. On one hand, it would be useful if they are more involved in the world of business, on the other hand too much entrepreneurship in universities curriculum may reduce the number of research and scientists.

4.2.2 Discussions on Academic Spin-Offs

Especially Krimsky (2003) states his disagreements very strongly about the degree of engagement of university members in practical matters of society. He argues the university community's walls to be too liberally breached in engagement with the commercial world. Still, a fundamental incompatibility of purpose remains evident between academic and commercial institutions, determined by H. Etzkowitz (1983). The incompatibility of purpose becomes visible in the everyday operations of the university. Faculty, who become entrepreneurs, although they tend to be overachievers, can hardly find time to fulfill all the unremunerated chores of academic citizenship. Moreover, the two roles that need to be fulfilled require decisions the interests of which inherently conflict. As H. Etzkowitz (1983) states,

many faculty entrepreneurs eventually leave the university when their firms become commercially successful. This situation represents a triumph for the university's mission of economic development but a loss for academic purposes. The more demanding the role of the academic investor achievements in the new spin-off firm, the bigger the potential for conflicts of interest between academic and commercial activities, stressed by Lockett et al. (2003).

The productivity of the university is largely based on the finite quantity of faculty time and effort. The more time faculty devotes to technology transfer in special centers, or to promoting proximity effects, the less he will be available for teaching and fundamental investigation.R. Geiger (1992) indicates that, the linkages to industry might be construed as inimical to university teaching. In most of the countries, the academician's restriction of time usage in their firms is the main problem. It is both related with the legal permissions and the mentality of university management. The initial resource endowment, intensity and availability interact with the productive opportunities if they find and use the funds with the best-fit business model on the basis of resource endowments. This is very difficult, unless they make a good partnership. The pursuit of patents is likely to entail a different course of research from the endeavor to publish journal articles. And continual involvement with patenting will surely preclude other lines of research, stressed by Feller (1990) in Geiger study. In this sense, the pitfalls just discussed, stem more from the pressure to commercialize scientific research relationships, than from the fact of doing research under industrial support.

Compared with the big and famous universities or research centers (Stanford Research Park, WARF, or the high-tech firms that have prospered in Silicon Valley or around Route 128 in Boston) many others do not have competitive advantage and cannot reach funds. Just like in Turkey, business start-up is still not recognized as a career pathway in many European countries as it is stated in EC report (ec.europa.eu, 2014). The survival rates of SMEs are very low in US, as stated by University of Tennessee Research Center (2015), as in Europe and Turkey. Due to changing environmental conditions in business world, big companies will not be the focal point of employment. The expectation from SMEs in terms of employment

potential is more than that from big companies. It was understood that SMEs will play an important role for the young generations in the future for employment. Hence, spin-offs from universities as SMEs, as a starting point, will be more attractive than it was before.

4.3 Conclusion

In this thesis, the knowledge commercialization activities at METU are assessed. It is observed that revenues and the number of academicians employed at the METUTECH increased over time. The growth rate of revenues is higher after 2010. The number of academicians increased with the change in regulation that allows researchers to become owner of a company in STPs in 2012. Three departments of METU, EEE, ME and BIO, have the highest number of ASOs at METUTECH both in total number of ASOs and the one which has at least one academician from METU. Between the years, 2010 and 2014, number of firms is increase 75%, total revenues are increase 254%, and average revenues are increased 46%. While average foreign revenue has increased 630% and public revenues are increased 835% on average but there is 82% decrease in private sector revenues. It would be better to understand, the reason behind decrease in private sector.

In our literature review, we meet that Third Mission activities and Entrepreneurial University system and the transition process is encouraged by most of the policy makers, scientists, and academicians. Especially both in Europe and in Turkey, remarkable reports have been conducted by policy makers, (i.e. OECD, EU Commission, MSIT) to encourage Entrepreneurial Education. In different countries, the success of entrepreneurial education has been tried to be measured in terms of answering the social community's needs: (1) in "short term": to provide competitiveness in the world and to increase productivity, quality and efficiency in the country and (2) in "long term": to provide welfare as a result of innovation-based growth in economy via human resources have more entrepreneurial skills. The economic conditions and studies show that future employment in the companies will be in SMEs not in big companies. Especially the SMEs which have established as a result of university- industry and government interactions will invigorate the

economy. Despite their economic importance, a number of alternative implications for Entrepreneurial Universities are referred in the literature. University's strategy, using resources, institutional infra-structure, type and the way of education, outreach and satisfying the stakeholders are some of the dimensions of Entrepreneurial Education with other practices. In many studies we saw there are conflicts to identify the indicators to measure the entrepreneurial success in the HES. In many countries it is not easy to evaluate and monitor entrepreneurial education due to lack of sufficiently trained educators. There is still no consensus about Entrepreneurial Education applications, structure and contents both in literature and in practice.

Entrepreneurial education has been in the agenda of Turkish policy makers, because of the EU adaptation policy process. To increase the interaction between university-industry and government Ministry of Science, Industry and Technology has started a measurement in universities. The Ministry created a comprehensive Entrepreneurial and Innovative University Index based on several measures, such as "Entrepreneurship and Innovation Culture" or "Economic Contribution and Commercialization". The universities are required to satisfy these criteria. The indicators of this measurement are very detail and we hope this effort will increase entrepreneurial attitudes, studies in universities and foster them to be an Entrepreneurial University. However, when they try to satisfy these expectations, they may lose their core mission and move to a different direction. The practices are very important without become distant from the core mission of the university.

Most of the studies examining about academic-spin offs are very recent. Due to the variety of their naming (i.e. academic entrepreneurs, techno-starters) it was very difficult to benchmark the studies in literature. As an example the information I gathered from Leuven Techno Park web page, they called only "spin-offs" and this is the valid naming for most of the studies about ASOs.

There are few studies about ASOs situation in Turkey. Comprehensive studies are not held yet in this field as I come across. The only Turkish study I encountered, referred to them as "academic entrepreneurs", in Turkey for İzmir Technology Development Zone which was presented in METU Congress Center in 2012 by

Tomur (2012). This was a useful benchmark study providing some comparison points to those for METUTECH. The number of spin-off innovations has not increased with high level of support and has not achieved the desired results in Turkey. The importance of innovation-based technology is recognized in our country as well as in the world. The collaboration studies among university, industry and government has been encouraged by the recent government policies in Turkey. Although Ministry of Science, Industry and Technology has provided several incentives for the development of the collaboration, the outcomes have not been achieved yet about spinoff innovations. As it stated in Turkey's 10^{Th} Development Plan, the lack of commercialization of knowledge process, innovative entrepreneurship is a problem in university-industry collaboration. There seems a necessity to be improved in that coordination.

Based on the literature, the following suggestions can be applied in order to increase the number of entrepreneurial universities in Turkey:

- ✓ The transformation process from the traditional system to third mission can be carried out project by project and every one of them should be planned with all sides of the process.

- ✓ The gap between industrial sector and universities and research system should be reduced.

- ✓ The attraction of foreign talent could be improved in a knowledge based economy. We need specialized knowledge workers just as the dynamic economic regions like Silicon Valley, London, New York City, and Boston. They have benefited from the influx of foreign talent.

- ✓ It should be pointed out that not all universities have adequate quantity and quality of research activities to generate patents that could be licensed to industry. There may be some easiness for Patent offices to be established in the university environments.

- ✓ Planning is the key factor for a good Business Plan. The planning step can be evaluated as the most and the critical process to start an idea for entrepreneurial activities, especially if the process has a strong change potential on education system.

- ✓ The joint development of research projects can be promoted the structuring of R&D activities within private companies, helping to spread the culture of research and innovation in universities.

- ✓ The funds can be allocated to research projects where the university and the companies are required to cooperate in order to encourage ASOs.

- ✓ Identifying the firm's founding technology as "University-based" and measuring their economic impact is a very successful and beneficial study which was conducted by MIT in USA. A study like this can be beneficial for the universities in Turkey as well.

- ✓ A set of interaction activities can be establish by the universities, including the supply of technological services (tests, measurements, consultancies, information services), educational services, joint research projects with companies, projects carried out by incubated small companies and projects originating with 'junior' companies. To manage all these activities, technology transfer offices (TTOs) can be created first by the universities with strong leadership in R&D activities and technology based incubators, as stated by H. Etzkowitz, Mello, C., Almeida, M. (2005).

- ✓ Encourage companies to invest in R&D activities jointly with universities.

- ✓ To take advantage of Third Mission, complex internal arrangements are needed and significant changes must be introduced in the culture and values of the academy, as indicated by Maculan and Mello (2009).

- ✓ Participation of the universities in local economic and social development can be increased.

- ✓ Entrepreneurial mindset and Entrepreneurial effectiveness: Educators who are responsible for creating or delivering an enterprise and entrepreneurship curriculum can help students develop enterprising behaviors, attributes and skills as well as entrepreneurial mindset and capabilities, as indicated in QAA (2012) report.

Universities, consequently, should change their policies, strategies, structures and organizational rules to allow researchers to engage more easily with university activities in relation to the Third Mission. Innovation and entrepreneurship are equally important factors for countries in terms of increasing their competitiveness, productivity and quality to provide welfare to the community.

REFERENCES

ACU. (2004). Entrepreneurship in Atlantic Canadian University Environments, PART I Understanding Entrepreneurs: An Examination of the Literature: The Atlantic Canadian Universities Entrepreneurship Consortium.

Altbach, P. G., Reisberg, L., & Rumbley, L. E. (2009). Trends in Global Higher Education: Tracking an Academic Revolution. A Report Prepared for the UNESCO 2009 World Conference on Higher Education.

Argyres, N. S., & Liebeskind, J. P. (1998). Privatizing the intellectual commons: Universities and the commercialization of biotechnology. *Journal of Economic Behavior & Organization, 35*(4), 427-454.

Bilgehan, H. (2012). *Ege Üniversitesi İlkler Kitabı*.

bto.metu.edu.tr. (2013). ODTÜ ve ODTÜ Teknokent Teknoloji Transfer Ofisi'yle Destek Aldı.

Center, S. B. D. (2015). Startup Business Failure Rate By Industry. from Bradley Univ, University of Tennessee Research http://www.statisticbrain.com/startup-failure-by-industry/

Chang, Y., Yang, P. Y.,Chenc, M. (2009). The determinants of academic research commercial performance: Towards an organizational ambidexterity perspective. *Research Policy, 38*, 936-946.

Chesbrough, H., W. (2003). *Open Innovation: The New Imperative for Creating and Profiting from Technology*. Boston, Mass. : Harvard Business School Press.

Cirillo, C. M. (2013). Birth of an Idea: The Creation of Research Triangle Park and Its Sustained Economic Impact on the Research Triangle Area. Retrieved from http://sites.duke.edu/urbaneconomics/?p=899

Clarysse, B., Wright, M., Lockett, A., Mustar, P., & M, K. (2007). Academic spin-offs, formal technology transfer and capital raising. *Industrial and Corporate Change, 6*(4), 609–640.

Colyvas, J. A., & Powell, W. W. (2006). Roads to Institutionalization: The Remaking of Boundaries between Public and Private Science. *Research in Organizational Behavior, Vol 27, 27*, 305-353.

Commission. (2015). "Daimi Üniversite - Sanayi İşbirliği Komisyonu" Toplantılarının İlki Gerçekleştirildi. 2015, from http://www.yok.gov.tr/web/guest/daimi-universite-sanayi-isbirligi-toplantilarinin-ilki-gerceklestirildi

Declaration, T. B. (1999). The Bologna Declaration, Joint declaration of the European Ministers of Education.

Di Gregorio, D., & Shane, S. (2003). Why do some universities generate more start-ups than others? *Research Policy*, 209-227.

Druilhe, C., & Garnsey, E. (2003). Do Academic Spin-Outs Differ and Does it Matter? *The Journal of Technology Transfer, 29*(3-4), 269-285.

EACEA. (2012). Entrepreneurship Education at School in Europe, National Strategies, Curricula and Learning Outcomes. *Education, Audiovisual and Culture Executive Agency (EACEA P9 Eurydice and Policy Support).*

ec.europa.eu. (2014). Final Report of Thematic Working Group on Entrepreneurship Education: ET2020.

Etzkowitz, H. (1983). Entrepreneurial Scientists and Entrepreneurial Universities in American Academic Science. *Minerva, 21*(2-3), 198-233.

Etzkowitz, H. (2000). Tech transfer, incubators probed at Triple Helix III. *Research-Technology Management, 43*(6), 4-5.

Etzkowitz, H. (2001). The second academic revolution and the rise of entrepreneurial science. *Ieee Technology and Society Magazine, 20*(2), 18-29. doi: Doi 10.1109/44.948843

Etzkowitz, H. (2003). Innovation in innovation: the Triple Helix of university-industry-government relations. *Social Science Information Sur Les Sciences Sociales, 42*(3), 293-337.

Etzkowitz, H. (2008). *The triple helix : university-industry-government innovation in action*. New York: Routledge.

Etzkowitz, H. (2012). Triple helix clusters: boundary permeability at university-industry-government interfaces as a regional innovation strategy. *Environment and Planning C-Government and Policy, 30*(5), 766-779.

Etzkowitz, H. (2013). Anatomy of the entrepreneurial university. *Social Science Information Sur Les Sciences Sociales, 52*(3), 486-511.

Etzkowitz, H., & Leydesdorff, L. A. (1997). *Universities and the global knowledge economy : a triple helix of university-industry-government relations*. London ; New York: Pinter.

Etzkowitz, H., Mello, C., Almeida, M. (2005). Towards "meta-innovation" in Brazil: The evolution of the incubator and the emergence of a triple helix. *Research Policy, 34*, 411–424.

Etzkowitz, H., & Ranga, M. (2013). Triple Helix Systems An Analytical Framework for Innovation Policy and Practice in the Knowledge Society. *Industry and Higher Education, 27*(4), 237-262.

Etzkowitz, H., Webster, A., Gebhardt, C., & Terra, B. R. C. (2000). The future of the university and the university of the future: evolution of ivory tower to entrepreneurial paradigm. *Research Policy*, *29*(2), 313-330.

Etzkowitz, H., Webster, A., & Healey, P. (1998). *Capitalizing knowledge : new intersections of industry and academia*. Albany, NY: State University of New York Press.

Farinha, L., & Ferreira, J. J. (2013). Triangulation of the Triple Helix: a Conceptual Framework.

Fayolle, A., & Redford, D. T. (2014). *Handbook on the Entrepreneurial University*: Edward Elgar Pub.

Ferreira, N., A., Garcia, R., J., & Lezana, A. G. (2011). *The role of UFSC and the creation of Technological Innovation Park in Joinville and Region*. Retrieved from: http://www.leydesdorff.net/th9/

Fini, R., Grimaldi, R., Santoni, S., Sobrerob, M. (2010). [Complements or substitutes? The role of universities and local context in supporting the creation of academic spin-offs].

Fuller, S. (2005). What Makes Universities Unique? Updating the Ideal for an Entrepreneurial Age. *Higher Education Management and Policy, OECD, 17*(3), 27-49.

Onuncu Kalkınma Planı (2014-2018) (2013).

GEDI. (2015). from http://thegedi.org/countries/turkey

Geiger, R. (1992). The Ambiguous Link: Private Industry and University Research. In W. Becker & D. Lewis (Eds.), *The Economics of American Higher Education* (pp. 265-297): Springer Netherlands.

Geiger, R. L., & Sá, C. M. (2008). *Tapping the riches of science : universities and the promise of economic growth*. Cambridge, Mass.: Harvard University Press.

Headquarters, R. (2015). The Research Triangle Park 2015 Company Directory. from http://aws-master.s3.amazonaws.com/wp-content/uploads/2015/03/RTP_Directory_2015_Final.pdf

Yükseköğretimin Yeniden Yapılandırılması (2011).

Howard, J., Sharma, A. (2006). Universities' Third Mission: Communities Engagement: Business/Higher Education Round Table (B-HERT).

Iacobucci, D., & Micozzi, A. (2015). How to evaluate the impact of academic spin-offs on the regional context: an empirical analysis of the Italian case. *The Journal of Technology Transfer, 40*(3), 434.

IASP. (2015). Location of STPs University.

Jackson, D. (2011). Innovation Ecosystem. *Policy Studies*.

Jamieson, S. (2014). UNICAMP. University of Camridge Enterprise.

Jencks, C., & Riesman, D. (1968). *The Academic Revolution*. New York, NY: Doubleday.

Johnston, L., Hamilton, E., & Zhang, J. (2008). Learning through Engaging with Higher Education Institutions A Small Business Perspective. *International Small Business Journal, 26*(6), 651-660.

Kiper, M. (2010). *Dünyada ve Türkiye'de Üniversite-Sanayi İşbirliği ve Bu Kapsamda Üniversite-Sanayi Ortak Araştırma Merkezleri Programı (ÜSAMP)* (1 ed.): TTGV.

Krimsky, S. (2003). *Science in the private interest : has the lure of profits corrupted biomedical research?* Lanham: Rowman & Littlefield Publishers.

Laredo, P. (2007). Revisiting the Third Mission of Universities: Toward a Renewed Categorization of University Activities? . *Higher Education Policy*. doi: 10.1057/palgrave.hep.8300169

Leisyte, L., & Horta, H. (2011). Introduction to a special issue: Academic knowledge production, diffusion and commercialization: policies, practices and perspectives. *Science and Public Policy, 38(6)*, 422-424.

Leuven, K. from http://flandersbio.be/life-sciences-database/kuleuven/

Leydesdorff, L., & Meyer, M. (2006). Triple Helix indicators of knowledge-based innovation systems - Introduction to the special issue. *Research Policy, 35*(10), 1441-1449.

Lockett, A., Wright, M., & Franklin, S. (2003). Technology Transfer and

Universities' Spin-Out Strategies. *Small Business Economics,, 20*(2), 185-200.

Luger, M. I., & Goldstein, H. A. (1991). *Technology in the garden : research parks and regional economic development*. Chapel Hill: University of North Carolina Press.

Maculan, A. M., & Mello, J. M. C. (2009). University start-ups for breaking lock-ins of the Brazilian economy *Science and Public Policy, 36*(2), 109-114. doi: 10.3152/030234209X406791

Mansfield, E. (1975). *International Technology Transfer: Forms, Resource Requirements, and Policies* (Vol. 65): American Economic Association.
METU. General Information History. from http://www.metu.edu.tr/

METUTECH. About METUTECH. from https://h2020.metu.edu.tr/about-odtu-teknokent

METUTECH. (2011). ODTÜ TEKNOKENT. from http://www.teknolojitransferi.gov.tr/TeknolojiTransferPlatformu/resources/temp/CA838233-2CAB-4707-BE33-4563B9FC8CF6.pdf;jsessionid=8EB84AFEAA8E78275FD6B97C11ED5362

Meyer, M. (2003). Academic entrepreneurs or entrepreneurial academics? Research-based ventures and public support mechanisms. *R&D Management, 33*(2), 107-115.

Bilim, Sanayi ve Teknoloji Bakanlığından: Teknoloji Geliştirme Bölgeleri Uygulama Yönetmeliği (2014a).

MSIT. (2014b). Kamu Üniversite Sanayi İşbirliği (KÜSİ) Değerlendirme Raporu ve Strateji Belgesi Taslağı: The Ministry of Science, Technology and Industry - General Directorate of Science and Technolgy.

SAN-TEZ Programı Sanayi Tezleri Projelerinin Desteklenmesi Hakkinda Yönetmelik (2014c).

MSIT. (2015a). from http://www.sanayi.gov.tr/userfiles/file/tgb%20yeni/TGB%20GENEL%2006_04_2015.pdf

Science and Technology High Committee (2015b).

Müller, K. (2008). *University Spin-Off's Transfer Speed –Analyzing the Time from Leaving University to Venture*. ftp://ftp.zew.de/pub/zew-docs/dp/dp08034.pdf

NCEE. (2013). The Entrepreneurial University: From Concept to Action: The National Centre for Entrepreneurship in Education.
NIRAS. (2008). Survey of Entrepreneurship in Higher Education in Europe.
nobelprize.org. List of Nobel laureates by university affiliation.

Norcia, V. (2005). Intellectual property and the commercialization of research and development. *Science and Engineering Ethics, 11*(2), 203-219.

OECD. (2002). Frascati Manual: Proposed Standard Practice for Surveys on Research and Experimental Development.

OECD. (2009). Universities, innovation and entrepreneurship criteria and examples of good practice: OECD, .

OECD. (2012). Working Party of National Experts on Science and Technology Indicators: MEASURING R&D IN DEVELOPING COUNTRIES.

Penrose, E. (1995). *The Theory of the Growth of the Firm*: Oxford University Press.

Pinkwart, A., & El-Ella, N. A. (2012). *Business Economics as a Driver of Innovation*. Leipzing Graduate School of Management.

Ploum, L. J. L., Blok,V., Lans, V. T., Omta, S.W.F. (2013). Enhancing Entrepreneurship Education Programs in Germany and the Netherlands. www.deutschland-nederland.eu.

Polanyi, M. (1958). *Personal knowledge; towards a post-critical philosophy*. Chicago,: University of Chicago Press.

Ponnusamy, J., & Pandurangan, A. (2014). *A Hand Book on University System*.

QAA. (2012). Enterprise and entrepreneurship education: Guidance for UK higher education providers: The Quality Assurance Agency (QAA) for Higher Education

Reuters, T. (2014). Times Higher Education World University Rankings.

Roberts, E. B., & Eesley, C. (2009). Entrepreneurial Impact: The Role of MIT. MIT Sloan School of Management.

RTP. (2015). The Research Triangle Park. from http://www.rtp.org/about-us/

Rüegg, W. (2003). *A History of the University in Europe: Volume 2, Universities in Early Modern Europe* University of Cambridge.

Rüegg, W. (2004). *A History of the University in Europe: Universities in the Nineteenth and Early Twentieth Centuries (1800–1945)* (Vol. 3).

Ruiz, M., Carballido, J., Vega, J., A. (2013). University Spin-off Creation by Spanish Researchers in Agricultural Engineering. *J. Technol. Manag. Innov.*, *8*(3).

Shore, C., & McLauchlan, L. (2012). 'Third mission' activities, commercialisation and academic entrepreneurs. *Social Anthropology, 20*(3), 267-286. doi: 10.1111/j.1469-8676.2012.00207.x

Slaughter, S., & Leslie, L. L. (1997). *Academic capitalism : politics, policies, and the entrepreneurial university*. Baltimore: Johns Hopkins University Press.

Smith, D. (1998). Clark, B. R. Creating Entrepreneurial Universities: Organizational Pathways of Transformation. [Creating Entrepreneurial Universities: Organizational Pathways of Transformation]. 373-377.

Sorg, L. (2014). Research Triangle Park plans for the biggest changes in 50 years.

Stanford. The Triple Helix concept. In T. H. R. Group (Ed.). stanford.edu.

Subotzky, G. (1999). Beyond the Entrepreneurial University: The Potential Role of South Africa's Historically Disadvantaged Institutions in Reconstruction and Development. *International Review of Education*.

Teixeira, A., & Grande, M. (2013). Determinants of the Economic Performance of Portuguese Academic Spin-offs: Do Science & Technology Infrastructures and Support Matter?

teknopark.comu.edu.tr.

Temel, S., & Glassman, B. (2013). Examining University-Industry Collaboration as a Source of Innovation in the Emerging Economy of Turkey. *International Journal of Innovation Science, 5*(1), 81-85.

Terra, B. R. C., Batista, L. A., Campos, S., & Almeida, M. (2013). Interaction Among Universities, Government and Spin-off Companies in a Brazilian Context to Generate Sports Innovation. *Journal of Technology Management & Innovation, 8*(2).

Thorp, H., & Goldstein, B. (2010). *Engines of Innovation: The Entrepreneurial University in the Twenty-First Century*.

Tijssen, R. J. W. (2006). Universities and industrially relevant science: Towards measurement models and indicators of entrepreneurial orientation. *Research Policy, 35*(10), 1569-1585.

Tomur, E. (2012). *Üniversite Sanayi İşbirliği Başarılı Uygulamalar Çalıştayı.* Retrieved from file:///C:/Users/SONY/Downloads/usimp-usi-calistay_e-tomu-16012013131423.pdf

TUBITAK. (2014). Girişimci ve Yenilikçi Üniversite Endeksi 2014 Sıralaması. from http://www.tubitak.gov.tr/sites/default/files/2014_gyue_siralama.pdf

UIIN, S.-t.-B. M. R. C. a. (2013). UBC Country Reports: logic and characteristics.

Wissema, J. G. (2009). *Towards the Third Generation University*. Massachusetts 01060: Edward Elgar Publishin, Inc.

Wong, P. H., Y., and Singh, A. (2007). Towards an ‘‘Entrepreneurial University’’ Model to Support Knowledge-Based. *World Development, 35*(6), 941-958.

YÖK. (2015). Akademisyen Sayıları Raporu. from https://istatistik.yok.gov.tr/

APPENDICES

A. TURKISH SUMMARY

Günümüzde, birçok ülkede üniversitelerin eğitim politikaları, yeni nesil olarak adlandırılan girişimci üniversite modeline yönelmiştir. Bu gelişmeyle paralel olarak da üniversite, sanayi ve devlet işbirliğinin ülkelerin ekonomik gelişimine daha fazla katkı sağlaması hedeflenmiştir. Yeni üniversite modelinde, üniversitenin hem içindeki paydaşların (akademik personel, öğrenciler ve çalışanlar) hem de dışındaki paydaşların (sanayi, devlet ve kamu) beklentileri ve rolleri de zaman içinde değişime uğramıştır. Bu beklentileri karşılama sürecinde, üniversite ve sanayi daha yakınlaşmış, hükümetler de bu yakınlaşmayı destekleyici adımlar atmıştır. Üniversitelerde üretilen bilginin ticarileşmesi süreci de, bu gelişim ve değişimden etkilenmiştir. Yükseköğrenimdeki bu değişimin nasıl geliştiği ve akademisyenlerin bu değişim içindeki rollerinin irdelenmesi, gelecek nesil üniversitelerin oluşumunda önemli olacaktır. Bu gelişim süreci, üniversite-sanayi-devlet arasındaki etkileşimin artması, yenilikçi uygulamalar, yeni yapıların ortaya çıkması, bu nedenle artı ve eksi yönleriyle incelenmeye değerdir.

Üniversitelerin zaman içindeki gelişimi üç aşamada incelenebilir. İlk nesil üniversiteler sadece eğitim odaklıydı. Paris ve Bologna üniversiteleri bu dönemde kurulan ve hala faaliyette olan üniversite örnekleridir. Ortaçağ üniversiteleri olarak adlandırabileceğimiz bu üniversitelerde, ilk eğitimler dini amaçlı öğretileri hedeflediği için dini otoritelerin bu kurumlarda söz sahibi olduğu görülmektedir. Bu üniversiteler hem kilise hem de devlet tarafından destekleniyordu. Bu üniversite tipi zaman içinde birçok değişime uğramış, din etkisi yerini daha laik bir eğitime ve çeşitliliğe bırakmıştır. Bu değişim süreci olan yaklaşık olarak yedi yüzyıl sürmüştür. “kabul edilmiş bilginin korunması ve aktarılması” döneminden “yeni bilginin keşfi ve geliştirilmesi” dönemine geçiş ile üniversitelerde ikinci nesil dönem başlamıştır. On sekizinci yüzyılda Modern Bilim Metodu uygulaması başlamıştır. Bu dönemde

üniversitelere, eğitim misyonunun yanı sıra araştırma görevi de verilmiştir. Üniversitelerin büyük bir kısmında dini otorite ile bağlantı kesilmiş, devlet katkısının yanı sıra yavaş yavaş özel fonların katkısı ile araştırma merkezlerinin de kurulma süreci başlamıştır. Modern Bilim Metodunu ayrı ayrı disiplinlerle uygulayan, öğrenci odaklı eğitim ve araştırma yapan ve uzmanlaşma sürecini başlatan üniversitelere en iyi örnek Prusya'da (Almanya) kurulan Humboldt Üniversitesidir.

Daha önce kilisenin etkisi altında olan üniversiteler, devlet desteği arttıkça onların uyguladığı politikalara göre şekillenmeye başladılar. Ancak araştırma masrafları arttıkça devlet tarafından sağlanan finansman yetersiz olmaya başladı ve devlet politikalarından bağımsız, farklı alanlarda uzmanlaşan, araştırma çalışmalarını üniversite dışında yapmaya başlayan özel araştırma merkezleri çoğaldı. Fakat hala sanayi ve üniversite işbirliğinin önemi ortaya çıkmamıştı. Bu dönemde yaşanan bazı değişiklikler olarak yükseköğrenimin uygulama biçimini tekrar değiştirdi. Bunlar, öğrenci sayısındaki artış, akademik dünyada girişimciliğin başlaması, artan araştırma masraflarına karşın yetersiz kalan devlet desteği, disiplinler arası çalışmaların bir ihtiyaç olarak ortaya çıkması ve artması, sayılabilir. Üniversitelerin en iyi öğrenci ve eğitmenleri çekme gayreti dolaşımı hızlandırmış ve ortak kullanım dili olarak İngilizce ortaya çıkmıştır. Özellikle iki dünya savaşı arasındaki dönemde düşmandan önce ileri savaş teknolojisini üretmek hayati önem taşıyınca, birçok daldan araştırmacının ortak çalıştığı kurumlar oluşturuldu. Ancak bu dönemde hala uygulamalı bilim ve teknoloji üniversitelerde yapılmamaktaydı. NASA, CERN gibi projeler üniversite dışında yapılmaya başlandı.

Massachusetts Teknoloji Enstitüsü (MIT), Stanford ve Cambridge gibi üniversitelerde, bilginin ticarileşmesi amacıyla iş dünyası ile ortak çalışmaların yapıldığı kümelenmeler ortaya çıkmaya başladı. Üniversitelerin hemen yanında teknoloji ağırlıklı bu teknoparkların oluşumu üniversitelerin, bölge ve ülkenin refah seviyesinde, istihdamda ve sosyal olarak da bireylerde olumlu etkilerini artırdı. Bu gelişmeler üniversitelerde yeni bir dönemin başladığını gösteriyordu. Üniversitelerde üretilen bilginin ticarileşmesi konusuna daha fazla odaklanan, bunun için akademisyenlerin şirket kurmasını destekleyen, üniversite-sanayi işbirliğini

devlet desteğini de alarak sağlayan yeni bir model ortaya çıktı: Girişimci Üniversite Modeli. Yeni nesil üniversite modelinde her üç kesimin de hem beklentisi hem de oynadıkları rol arttı. Üniversiteler, bölgelerinde bulunan en iyi öğrenci ve akademisyenleri çekmeyi hedefleyerek eğitim sistemlerinde girişimciliği özendiren, mezunlarının kendi şirketlerini kurmasını hedefleyen bir uygulama başlattılar. Bu nedenle de iş dünyası ile ortak bazı etkinlikleri üniversite içinde yaparak, bu ikili arasındaki işbirliğinin artmasını sağladı. İş dünyası üniversitelerin araştırmacı gücünü daha verimli kullanmanın önemini anladı. Devlet ise ekonomik büyümenin teknoloji tabanlı olursa çok daha hızlı, iyi ve sürdürülebilir olduğunu fark etti.

İnsanoğlunun var olduğu dönemlerden beri mevcut olan girişimciliğin günümüzdeki önemi, farklı alanlarda, iyi eğitim almış, donanımlı kişilerce uygulanmaya başlaması, küresel gelişmelerin de bir sonucu olarak ortaya çıktı. Özellikle ekonomik kriz dönemlerinde ülkeler, kendilerine rekabetçi üstünlük sağlayacak yönlerini ortaya çıkartmaya başladılar. Amerika Birleşik Devletleri, bu nedenle girişimciliğin teşvik edildiği türlerini de kapsayacak biçimde, üniversitelerini öne çıkararak bu akımı başlattı. Daha sonrasında, diğer ülkelerde de hem girişimciliği teşvik edici yenilikçi eğitim sistemleri uygulanmaya başladı hem de üniversite-sanayi-devlet işbirliği teşvik edildi.

Girişimci üniversitelerin özelliklerini belirleyen unsurlar, uygulamadaki farklılıklardan dolayı tek bir şablon altında toparlanamamakla birlikte genel olarak şu şekilde sıralanabilir:

Strateji: Üniversitenin eğitim programında amaçlar, misyon, vizyon gibi alt başlıklarda girişimciliği hedefleyen eğitim verileceğini belirtmesi,

Kaynaklar: Üniversitenin girişimcilik eğitimine ayırdığı ve kendisi tarafından üretilen kaynaklar ve bunların çeşitliliği,

Kurumsal Altyapısı: 1) Kuluçka merkezlerinin mevcudiyeti, 2) Bilginin ticarete dönüştürülmesi için teknoloji transfer ofislerinin varlığı, girişimci araştırma anlayışı, 3) Disiplinler arası çalışmaların yapılabilmesi, 4) Toplumla girişimcilik ve bilginin

aktarılması konusunda etkileşim sağlamak, 5) Öğrencilere girişimciliği öğretebilecek mentorların atanması,

Eğitim: 1) Öğretici ve eğitim bilimine dayalı olması 2) Eğitim programının kapsamı 3) Eğitimsel kurulumu 4) Davranış, amaç ve eğilimlerin girişimci yönde olması. Sadece yeterli sayıda girişimcilik derslerin programda olması değil onların mantıksal tutarlılığı ve girişimci zihniyette olması,

Dışa açılım: 1) Üniversitenin iş dünyası ile bağları 2) Dış paydaşlar, mezunlar ve toplumla entegrasyonu 3) Topluma bilgi transferi yapabilmesi ve bilginin ticarileşmesini teşvik etmesi 4) Uygulamadaki deneyimler, konuk eğitmenler, iş dünyasına ziyaretler, hem öğrencileri hem de iş sahiplerinin teknik ve iş yapma anlamında destekleyen, değer yaratan aktivitelerin varlığı,

Gelişim: 1) Öğrencilerin ve diğer paydaşların ihtiyaçlarına cevap verme 2) Dahili ve harici paydaşlarla eğitimde iyileştirme çalışmalarının sıklığı 3) Kullanıcı odaklı iyileştirmelerin uygulanması programı 4) Girişimci eğitim konusunda yetenekli, donanımlı insan kaynaklarına yatırım yapılması.

Bir üniversitede girişimcilik faaliyetlerini hızlandıran veya engelleyen unsurlar arasında, bireysel motivasyonlar, girişimci bilim adamlarının iş yapma potansiyeli, dış kaynaklara ulaşabilme ve üniversitenin çevresi sayılabilir. Yukarı saydığımız girişimci üniversiteyi belirleyen unsurların girişimci üniversitedeki yansıması şu şekilde olmaktadır.

1) **Bilginin ticarileşmesi:** Ekonomik ve sosyal problemlerin çözümünde girişimci düşünce yapısının, davranış ve uygulamalarının oluşması,
2) **Uluslararası pazarda rekabet:** Üniversitenin, kültürünün, uygulamalarının ve eğitim sisteminin uluslararası rekabete göre uyarlanması,
3) Bilgi dönme dolabında bulunan, başka üniversiteler, enstitüler, özel şirketteki Ar-Ge firmaları, finansçılar, servis sağlayıcılarla **network** sağlamak: Tekno girişimci şirketlerin kurulması, finansal altyapı, profesyonel destek sağlayıcılar,

şirketlerin Ar-Ge bölümleri, teknoparklar, bilimsel araştırma ve eğitim, özel AR-Ge firmaları ile iletişim.

4) **Disiplinler arası** transfer ve disiplinler üstü araştırmalar: Üniversitelerde disiplinler arası mutabakat sağlanması zor olsa da bilim ve sanayide yaratıcılık ve tasarımın bileşiminin desteklenmesi,

5) **İki yapılı** üniversiteler: Bir yandan, en son teknolojiler konusunda çoğalan araştırmalarıyla, en akıllı, yaratıcı öğrenci ve akademisyenler için cazip olmaya çalışan bir yapı, diğer yandan çok geniş kitlelere yaygın eğitim veren diğer yapının mevcudiyeti. Bu durumda girişimci üniversiteler çok kültürlü organizasyonlar sayılabilir.

6) **Çok uluslu** olduklarından ortak dilleri **İngilizce**dir.

7) **Devlet uygulamalarına bağlılıkları** azalmakla beraber, araştırma fonlarının politik oluşumda verilmesi, akademik özgürlük sayılmaz. Yeniliği desteklemede, yaratıcı süreçler oluşturmada ve topluluklara öncülük etmek, üniversitelerin girişimci üniversite sistemindeki yansımalarıdır.

Bu özelliklerin bir üniversitede olması, gerçek anlamda uygulanması ve miktarının fazlalığı, o üniversitenin Girişimci Üniversite olarak tanımlanmasını gerektirir. Bu uygulamalar üniversitedeki öğrencilerden iş dünyasına yabancı olanları oraya yakınlaştırmak, bunun için gereken ortamı sağlamak, uygulayarak öğrenmelerini desteklemek için yapılmaktadır. Öğretim üyelerinin de şirket kurarak buluşlarını ticari alana taşımalarını teşvik etmekte, aynı zamanda farklı üniversitelerde ders vermelerini de desteklemektedir. Özellikle Avrupa'da yapılan Yükseköğrenimde Girişimci Eğitim konulu çalışmalar, konuyla ilgili OECD raporları ve girişimcilik eğitimin başarısını ölçme gayretleri, konunun karar vericilerin masasında olduğunu göstermektedir.

Stanford, UC Berkeley, MIT, Cambridge ve Oxford gibi girişimci üniversitelerde, üniversitenin rolleri yukarıdaki gelişmeler ışığında şekillenmeye başlamıştır. Ancak girişimci eğitimin tanımındaki farklılıklar da tartışmalıdır. Eğer girişimci ile kendi işini kuran kişi anlaşılıyorsa, öğrencilerin mezuniyet sonrası kendi firmalarını kurmaya yöneltilmesi farklı bir girişimcilik eğitimidir. Ayrıca doğuştan gelen bir

özellik olan bu tür girişimcilik tipi eğitimle öğretilemez. Böyle öğrencilere ancak aracılık yapılır. Ama girişimcilikle iş fırsatlarını yakalamak hedefleniyorsa o da başka bir girişimcilik eğitimini gerektirir. Bu durumda öğrenciye, girişimcilik yeteneklerine, özelliklerine, davranışlarına, gerçek hayattaki girişimcilikle ilgili sorunların çözümüne, zorluklara ve fırsatlara yönelik başka bir eğitim verilir. Gallup Araştırma Şirketi tarafından 1994'te Amerika'da yapılan bir çalışmada lise öğrencilerinin %70'i kendi şirketlerini kurmayı hedeflediklerini, girişimci/yöneticilerin ve öğrencilerin %96'sının üniversitelerde verilen girişimcilik eğitiminin avantajlı olduğunu söyledikleri belirtilmiştir.

Girişimcilik başarısının nasıl ölçüleceği konusu tartışmalıdır. Avrupa komisyonunun 2014 yılında, girişimcilik eğitimi temalı grubun hazırladığı raporda bazı önemli hususlar bulunmaktadır. Raporda da belirtildiği üzere, girişimci eğitimlerin değerlendirilmesi, ölçümlenmesi için gerekli donanıma sahip eğitmen yoktur. Ayrıca, birçok ülkedeki eğitimler gerçek hayattan kopuk ve gelenekseldir. Girişimcilik eğitimin genç yaşta verilmesi daha faydalıdır (üniversiteden önce).Avrupa'da yüksek eğitimdeki değişiklikler 1999'da imzalanan Bolonya Deklerasyonu sonrasında başlamış ve toplumun ihtiyaçlarına yönelik eğitim yapılmasına özel önem verildiği belirtilmiştir. Türkiye de bu deklarasyonu 2001 yılında imzalamıştır. Amerika'da ise özellikle 2008 yılındaki ekonomik kriz sonrası girişimciliğin önemi daha iyi anlaşılmış ve eğitim sistemi özellikle bu yönde ilerlemiştir.

Üniversiteler artık iş dünyasına, ülke ekonomilerine ve kendi yapılarındaki olumlu değişikliklere ait durum tespiti yapma konusunda birçok çalışma başlatmıştır. Bunlardan en etkileyici olanı MIT tarafından 2009 yılında hazırlanan ve 2011'de revize edilen rapordur. Bu çalışmada, MIT öğrencilerinin, mezunlarının, akademisyenlerinin yani kısaca MIT Üniversitesi tabanlı olarak nitelenen kişilerin kurdukları şirketlerin ekonomik büyüklüğü hesaplandığında, dünyanın en büyük 11. ekonomisine denk olması çok çarpıcıdır.

Üçlü sarmal olarak nitelendirilen üniversite-sanayi ve devlet unsurları arasındaki ilişkiler, etkileşimler hem kendi içlerinde hem de birbirlerinin yapısında

değişikliklere ve yeni bakış açılarına sebep olmaktadır. Firmaların entelektüel sermayeyi de artık bir değer olarak kabul etmeleri, akademisyenlerin temel araştırma sonuçlarını kendilerinin uygulamaya aktarması, yeni bakış açısının bu etkileşimindeki belirleyicileri olarak ortaya konmaktadır. Üçlü sarmaldaki unsurlardaki değişim 4 aşamada ortaya çıkmaktadır: 1) Her unsurun **kendi içindeki değişimi**: Teknoloji transferi için kaynak arayışında olan üniversitelerin devletle AR-Ge çalışmaları yapmaya başlaması, kendi içinde olan değişime örnektir. 2) Bir unsurun **diğer unsur üzerindeki** etkisi: Devletin fikri mülkiyet haklarının korunması yönünde üniversite ile birlikte çalışarak yeni kanun çıkartması bu değişime örnektir. 3) Yeni bir **üçlü network** kurulması: İnovasyon sistemi içindeki boşlukların doldurulması için üniversite- sanayi- hükümet temsilcileri ile beyin fırtınası yapılması 4) Kendini **yenileme etkisi**: Yeni yapıların, bölgesel oluşumların ortaya çıkması, akademisyenlerin desteklenmesi. Üçlü sarmaldaki bu değişimler sonucu ortaya çıkan unsurlardan birisi de "Açık İnovasyon" modelidir. Hiçbir firma dünyanın en yetenekli, donanımlı çalışanlarını bir araya getiremez. Bu nedenle, firmalar ürettikleri ürünün özelliklerini artırmak, toplumun ihtiyaçlarını daha uyumlu hale çok çabuk bir şekilde getirmek zorundadır. Aksi halde rakibi bunu ondan önce yapabilir. Bu durumda açık inovasyon uygulaması ile farklı kesimlerden araştırmacılarla proje çalışmaları ve işbirliği yaparak, ürününü geliştirir.

Teknoparklar ve benzeri yapılar, bu üçlü unsurun işbirliği neticesinde ortaya çıkmıştır. Teknoloji uygulamalarının, AR-Ge çalışmalarının bir arada yapıldığı, firmalara hem danışmanlık hizmeti, hem de buluşlarını geliştirmek ve ticarileştirmek konusunda destek sağlayan, ülke ve bölge ekonomileri için önemli yapılardır. Amerika'da Kuzey Karolina'da bulunan Araştırma Üçgeni Parkı (Research Triangle Park), 200'den fazla firmada, 40.000'e yakın ileri teknoloji elemanının çalıştığı bu bölgede üçlü sarmalda yer alan tüm kesimlere girdilerde, işgücünde ve bilgi konusunda büyük oranda katkı sağlamaktadır. Aynı şekilde, Silikon vadisi olarak adlandırılan bölge, Avrupa'da Cambridge bölgesindeki yapılanma, Belçika'daki Leuven Teknoparkı önemli Teknoloji merkezleri olarak sayılabilir. Ülkemizde ise ODTÜ, Bilkent, Hacettepe, İstanbul Teknoparkları, TÜBİTAK Marmara Araştırma

Merkezi ve birçok teknoloji geliştirme merkezleri hem ülke ekonomisine büyük oranda katkı sağlamakta hem de üniversite-sanayi işbirliğini artırmaktadırlar.

Bilginin üretilmesi, dağıtılması ve ticari olarak değerlendirilmesi sürecinde bilim politikaları ve akademik verimlilikte ilgili politikalarda da değişiklikler olmaktadır. Bunlar **1)** Ülkelerin ulusal bilim politikaları değişmekte, **2)** Bu politikaların bilginin üretilmesi, dağıtılması ve ticari olarak değerlendirilmesi sürecinde etkileri olmaktadır. Üçlü yapı içindeki unsurlar bu değişimden etkilenmekte ve bunun sonucu olarak da ülke bütçesine katkı sağlamayı hedeflemektedirler.

Araştırma şekillerinin temel, uygulamalı ve esas araştırma şeklinde tanımlarının ve uygulamadaki farklılıkların ortaya çıkması, araştırmacı, AR-GE, araştırma görevlisi tanımının da yapılmasına ve masrafların ayrı ayrı belirlenmesini gerektirmiştir. Temel (basic) araştırmalarda bir soruna çözüm aranırken, uygulamada sonuç almak oldukça zorken esas (fundamental) araştırma denilen modelde ticari bir beklenti yokken bile sonuç bir buluş, yeni bir tasarım veya faydalı model olabilmekte, endüstriyel gelişime katkı sağlayabilmekte ve parasal bir değere de dönüşebilmektedir. Bu durum bir firmanın araştırmasının etkili ve ticari yönlerinin olduğunu belirtmenin önemini ortaya çıkartmıştır. Ürün tabanlı firmalar ürünün tüm faydalı yönlerini ortaya çıkartırken ticari tabanlı olanlar yasal ve pazarlama yeterliliğine sahip ortaklık ve işbirliğini teşvik etmektedir.

Araştırmaların sonucu olarak ortaya çıkan bilginin ürün üzerinde uygulanması, değişikliğe yol açması ile oluşan teknolojilerin transferi işlemleri de girişimci üniversitelerin özellikleri arasındadır. Teknoloji transferleri yatay ve dikey olmak üzere iki çeşittir. Yatay transferde uygulamalı araştırma merkezinden AR-GE merkezine, oradan da üretim bölümüne geçmektedir. Lisans alımları, know-how anlaşmaları, ortak girişimler, direk alımlar, bayilik verilmesi, anahtar teslimi üretim, danışmanlık servisi, üretim ortaklığı kurulması ve yurtdışı uzmanı alımı yatay transferin içerdiği yöntemler arasındadır. Yatay transferde teknoloji ürüne gömülür, ona ulaşmak ve değiştirmek bu nedenle zordur. Dikey transferde ise bir organizasyon, yer veya ortamdan başka bir alana veya bölüme geçiş vardır. Birçok dikey transfer yöntemi vardır. Şirketin kendi yürüttüğü AR-GE faaliyetleri, projeleri

üniversiteler ve araştırma merkezleri ile ortak araştırmalar, proje işbirlikleri, kümelenmeler, benzer şirketlerde yer alma, yoğun katılımın olduğu araştırmalarda yer alma, endüstriyel yapılarda ve sistemlerde işbirlikleri. Yatay transferle karşılaştırınca daha avantajlı olduğu görülür. Çünkü teknolojiye ulaşmak ve değişiklik yapmak mümkündür. Teknoloji transferlerinin başarısı patent müracaatları, lisanslama ve akademisyenlerin şirket kurmaları ile de ölçülmektedir.

Girişimci veya üçüncü nesil üniversitelerdeki faaliyetlerden en önemlileri teknolojinin transferi ve bilginin ticarileşmesidir. Girişimci üniversitelerde bilginin ticarileşmesi, onun üçüncü kişilere transferi olarak tanımlanmaktadır. Bu üniversitelerin girişimcilik ve pazarlama ortak faaliyetleri ve 3 türlü müşterileri vardır. 1) Uygulamalı ve saf bilim isteyen teknoloji tabanlı büyük şirketler, 2) Ürünlerin gelişilmesini isteyen üretim firmaları 3) Her türlü desteğe ihtiyacı olan bilgi tabanlı genç şirketler. Üniversiteler ürünlerini resmi olarak 2 şekilde duyurabilirler:

1) *Mevcut şirketle:* İki şekilde anlaşma yapabilirler. a) Sonuç sorumluluğu taşıyan sipariş araştırma veya satış, lisanslama üzerine ya da patentlenme araştırma anlaşması. b) B) Sadece çabalama sorumluluğu gerektiren projeler. Rekabetten önce temel teknolojilerin sponsorlar tarafından üretilmesi ya da gömülü araştırma da denilen araştırmacıların ve iş dünyasının bir araya geldiği araştırmalar (Cambridge örneği).

2) *Yeni şirket kurulması:* İki çeşit şirket vardır. a) Bilimsel araştırma sonucu ortaya çıkan-akademisyen şirketleri b) Teknoloji öncüleri- eğer üniversitenin Fikri Mülkiyet Hakları koruması yoksa tekno öncülerin yarattıklarından finansal fayda sağlayamaz.

Bilginin ticarileşmesinin de birçok yöntemi vardır.

1- *Danışmanlık:* Firma ve akademisyen arasında anlaşma yapılmasıdır

2- *Bilim Danışma Kurulu:* Bir firmanın bilim danışma kurulunda yer almak hem bilim adamının kendine hem de araştırmasına finansal destek sağlar.
3- *Personel değişimi*: Endüstriyel araştırmacıyı üniversite araştırmacısı ile yer değiştirmek
4- *Araştırma kontratı:* Yarıdan fazla araştırmalar sözleşme tabanlıdır. Verilen destek akademisyenin danışmanlık yapmasıdır aynı zamanda.
5- *Araştırma Konsorsiyumu:* Birden fazla şirketin bir üniversitedeki araştırmanın bir bölümünü desteklemesi
6- Endüstriyel üyelik programları ile ortaya çıkan *Ortak Araştırma Merkezi*: Yıllık üyelik aidatı yapılması ile araştırma sonuçlarına ulaşma ayrıcalığı
7- *Araştırma Merkezleri:* Özel teknoloji ve tasarımlara odaklı ve sanayiden destek alan merkezler

Ortak araştırmaya dayalı bir başka yöntem daha vardır. Uzun dönemli ve kapsamlı olan Ortak araştırma ile kısa dönemli daha az entegrasyon gerektiren sözleşmeli araştırma arasında fark vardır.

Üniversite araştırma sonuçlarından faydalanmanın, bilgiyi ticarileştirmenin bir başka yolu da akademisyenin şirket kurmasıdır. Akademisyen şirketlerin tek bir tanımlamasının olmaması, onlar hakkında araştırma yapmayı zorlaştırmaktadır. Akademisyen girişimciler, teknoloji öncüleri, girişimci bilim adamları, iş sahibi fakülte üyeleri gibi birçok tanımlamalar vardır. Bu oluşuma karşı çıkanların kapitalist akademisyen gibi tanımlamalarda bulunduğu görülmektedir.

Üniversite-sanayi işbirliğinin ilk başladığı dönemlerden günümüze kadar gelen süreçte, akademik dünyada bu işbirliğine sıcak bakmayan üniversite yönetimleri ve akademisyenler olmuştur. Hatta Nobel ödüllü bir Amerikalı bilim adamının üniversiteden gelen baskı neticesinde kürsüsünü bırakmak zorunda kalması ve kurucusu olduğu firmaya gitmeye zorlanması ilginç örnekler arasındadır. Girişimci üniversite modelinde, akademisyenlerin mesai saatlerinin beşte bir oranı olan sınırı geçmemek kaydıyla ve yasal mevzuata dayalı olarak, kendi şirketlerini kurmalarına, yaptıkları araştırmaların sonuçlarını kendilerinin piyasaya sürüp finansal kazanç sağlamalarına izin verilmektedir. Bu girişimin avantajları arasında akademisyenin, ürettiği ürünün veya bilimsel bilginin uygulamadaki karşılığını birebir görmesi,

aksayan taraflarına müdahale edebilmesini sağlamaktadır. Öğrencilerine de gerçek hayat uygulamaları konusunda daha gerçekçi bilgiler verebilmektedir. Bu girişime karşı çıkanlar ise, akademisyenin bilimden uzaklaşacağını, araştırmaların devlet veya şirketlerin istediği şekilde yön değiştireceğini, bunu da bilimsel araştırmada özgürlüğe ters düşeceğini belirtmektedirler. Ayrıca, akademisyenlerin üniversitelerde komisyonlara katılma, öğrencilerin gelişimine atkı sağlayacak başka sosyal projelerle uğraşma gibi sorumlulukları da bulunmaktadır. Üç faktör akademik şirketlerin artmasına neden olmuştur:

1) Teknoloji transfer ofislerinde yoluyla fikri mülkiyet hakları sahipliği
2) Lisanslama veya akademik şirketler yoluyla bilginin ticarileşmesi üzerine üniversitelerin ve kamu araştırma merkezleri üzerinde artan baskı
3) Bilgi açığını kapatmak üzere ortaya çıkan fonlara ulaşmada kolaylık

Üniversitelerde akademisyenlerin oynadığı rol her geçen gün artmakla beraber özellikle girişimci üniversite modelinde onlara daha fazla rol atfedilebilir. Öğrencilerle, toplumla, iş dünyası ve üniversite politikalarının oluşturulmasında daha fazla entegrasyonları gerekebilir. Sanat dallarında uzman akademisyenlerin endüstrinin ihtiyaçlarına göre daha yenilikçi uygulamalara yönelmesi gibi bazı akademisyenler ise sosyal medyayı kullanarak toplumla iletişimi artırmada girişimci rolünü üstlenebilmektedirler. Akademisyenlerin şirket kurmasının faydaları şöyle sıralanabilir: 1) Bilgiden yararlanma, 2) Ekonomik büyümeye katkı, 3) Diğer kültürden öğrenme (iş dünyası) , 4) Gelir yaratma. Ancak daha önce d belirttiğimiz üzere akademisyenlerin şirket kurmasına karşı koyan düşünceler de mevcuttur. Akademisyenin üniversiteden ayrılabileceği, akademisyenler arasında gelir farklılıklarının artacağı, bunun da huzursuzluk yaratacağı, şirkteler arasında akademisyenlerin kurduklarına devlet desteğinin fazla olmasından dolayı haksızlık olabileceği, objektiflikten ayrılabilecekleri, bilginin topluma açık olarak değil bir şirketin bünyesinde muhafaza edilmesinin genel eğilime ters olması gibi birçok karşıt görüş vardır. Ancak bu küçük ama teknoloji yoğun şirketlerde yeni teknolojilerin ortaya çıkması, disiplinler arası çalışmanın faydaları, akademisyenlerin teknoloji transfer ofisleri ile çalışmaları neticesinde farklı

ülkelerde uygulanan farklı yasal uygulamaları görmeleri girişimci üniversite ruhuna uygun görülmektedir. Üniversitenin tanıtımı bu özel çalışmalarla duyurulmaktadır. Akademik şirketlerin yoğun olduğu teknoloji kümelenmeleri artı sinerji yaratmakta ve hem üniversiteye hem de sanayiye büyük katkı sağlamaktadır.

Türkiye girişimcilik konusunda, Global Girişimcilik ve Kalkınma Enstitüsü tarafından yapılan çalışmada şu anda dünyada 25., bölgesinde ise 16. sıradadır. Türkiye'de üniversite- sanayi işbirliğini artırmak için çok geniş bir alan vardır. Özellikle, Küçük ve Orta Bütçeli İşletmelerin (KOBİ) Türk ekonomisine katkısı oldukça fazladır ve girişimcilik alanında büyük bir potansiyele sahiptir. Dünyadaki gelişimler de istihdam ve iş yaratma konusunda özellikle teknoloji tabanlı KOBİ'lerin geleceğin şirketleri olduğunu göstermektedir. Avrupa Birliği (AB) üniversite- sanayi işbirliği ülke raporunda Türkiye'de bu alanda en önemli gelişmeler 1) Girişimcilik 2) Öğrenci Dolaşımı 3) Ar-Ge çalışmalarında işbirliği 4) Bilginin ticarileşmesi alanında yapılan çalışmalardır (en az gelişmiş olan alan). Türkler, üniversite-sanayi işbirliğinden en çok fayda sağlayanları şöyle sıralıyorlar. 1) Öğrenciler, 2) İş dünyası, 3) Yükseköğrenim Kurumu 4) Kişisel faydalananlar.

Türkiye'de, özellikle kapalı ekonomiden daha liberal uygulamalara geçilen 1980 sonrasında, Bilim, Sanayi ve Teknoloji Bakanlığı, üniversite-sanayi işbirliğini artırıcı yönde birçok çalışma başlatmıştır. KOBİ'lerin desteklenmesi ve daha inovasyon tabanlı büyümeleri için birçok kurumsal çalışma başlatılmıştır. Türkiye Bilimsel ve Teknolojik Araştırma Kurumu, Teknoloji ve Yenilik Destek Programları Başkanlığı (TEYDEB), Küçük ve Orta Ölçekli İşletmeleri Geliştirme ve Destekleme İdaresi Başkanlığı (KOSGEB), Türkiye Teknoloji Geliştirme Vakfı gibi kurumlar bu konuda çalışmalar yapmaktadır. Teknoloji Geliştirme Bölgeleri, Teknoparklar, girişimciler, girişimcilik eğitimleri ve girişimcilik devlet tarafından desteklenmektedir. Birçok harcama ve vergi muafiyetleri, arazi tahsisleri, kira indirimleri sağlanmaktadır. Konuyla ilgili üniversitelerden de görüş alınarak yeni komisyonlar kurulmaktadır. **Ancak, bu kadar fazla desteğin karşılığı olarak istenilen inovasyon tabanlı, teknolojiye dayalı ekonomik büyüme gerçekleştirilememektedir**. Bu konuda iyileştirme çalışmaları sürekli yapılmaktadır. Bilim, Sanayi ve Teknoloji Bakanlığı tarafından oldukça kapsamlı

olarak hazırlanan Kamu- Üniversite- Sanayi İşbirliği (KÜSİ-2014) taslak raporu paydaşların tartışmasına açılmıştır.

Bakanlığın 2012 yılından beri uygulamaya koyduğu Girişimci ve Yenilikçi Üniversite Endeksi, üniversitelerin bu alanlara yönelmesinde etkili olmuş, bir rekabet başlatmış ve bunun sonucu da yükseköğrenimde uygulamada ortaya çıkmıştır. Son yıllarda girişimcilik konusunun üniversite müfredatına girmesi, bazılarında yan dal olarak sunulması, girişimcilik merkezlerinin artması, iş dünyası ile ortak projeler üretilmesi ve bunların devlet desteğini alması bu uygulamalardan bazılarıdır. Bakanlık 5 ana dalda ve 23 alt dalda çalışmalara atfettiği ağırlıklarla ölçümleme yapmaktadır. Bunlar, Bilimsel ve Teknolojik Araştırma Yetkinliği (%20), Fikri Mülkiyet Havuzu (%15), İşbirliği ve Etkileşim (%25), Girişimcilik ve Yenilikçilik Kültürü (%15) ve Ekonomik Katkı ve Ticarileşme (%25) olarak belirlenmiştir.

Bilim, Sanayi ve Teknoloji Bakanlığı tarafından düzenlenen, Girişimci ve Yenilikçi Üniversite Endeksi sıralamasında, Orta Doğu Teknik Üniversitesi (ODTÜ) 2014 ilk sıraya yerleşmiştir.

ODTÜ 1956 yılında kurulan bir devlet üniversitesidir. Yaptığı teknoloji tabanlı uluslararası araştırmalar, akademik kadrosu, ülke ekonomisine hem maddi olarak hem de insan gücü bakımdan katkısı sebebiyle Türkiye'nin bölgesinde ve dünyada önde gelen üniversitelerindendir. Girişimcilik alanındaki vizyonu, yaptığı etkinliklerle, müfredata koyduğu derslerle, öğrenci ve akademisyenlerinin şirket kurarak Ar-Ge projelerinde çalışmalarını teşvik etmesiyle uygulamada kendini göstermektedir. Üniversitenin kaynaklarının bu alanda en verimli şekilde kullanılmasını sağlamaktadır. Girişimcilikle ve bilginin ekonomik değere kavuşması ilgili olarak bünyesinde Teknokent, Teknoloji Transfer Ofisi, Bilgi Transfer Ofisi, kuluçka merkezi çeşitli yapıların olması, müfredatında girişimcilik derslerinin bulunması, girişimcilikte yan dal yapılabilmesi, yurtiçi ve yurtdışı iş dünyası ile entegrasyonunu sürdürmesi, girişimcilikle ilgili aktivitelerde bulunması, ODTÜ'nün girişimci üniversite olarak nitelendirilmesini sağlamaktadır.

Akademisyenlerin şirket kurması Türkiye'de bazı yasal düzenlemelerle uygulamaya konulmuştur. Üniversite yönetimini bilgilendirmek ve yasal olarak izinlerini almak kaydı ile akademisyenler yaptıkları araştırmaların sonuçlarını ticarileştirmek amacıyla teknoloji geliştirme bölgelerinde şirket kurabilir, kurulu bir şirkete ortak olabilir, yönetiminde görev alabilir.

Yukarıda anlatılan girişimci üniversitelerin özellikleri ve akademisyenlerin bilginin ticarileştirilmesi amacıyla şirket kurmalarına iyi bir örnek ODTÜ Teknokent'te kurulmuş olan akademisyen şirketleridir. Buradaki akademisyen şirketlerinin durumlarının incelenmesi bize Türkiye'deki akademisyen şirketleri hakkında bir fikir verebilir.

ODTÜ Teknokent Yönetimi'nden aldığımız izinle, çalışmamızla ilgili olan, bu bölgede kurulmuş akademisyen şirketlerine ait bilgiler bize verildi. Bilgiler Mart 2015 tarihi itibariyledir. Bu bilgilerin detayı şöyledir:

Şirketlerin kuruluş yılları, ODTÜ Teknokent'te faaliyete geçiş yılları, şirket sahiplerinin hangi üniversitelere mensup oldukları, akademik ünvanları, elde ettikleri gelirlerin özel sektör, kamu ve yabancı ülkelere satışa göre ve AR-GE faaliyeti kapsamında dağılımları. Elde ettiğimiz bu bilgilerden ulaştığımız sonuçlar şu şekildedir:

ODTÜ Teknokent'te kurulmuş toplam akademisyen şirketindin % 84'ünde ODTÜ'lü akademisyenlerin ortaklığı vardır. ODTÜ Teknokent yerleşkesi Ankara'da olmasına rağmen, Ankara dışındaki üniversitelerin akademisyenleri tarafından ODTÜ Teknokent'te kurulan şirketler mevcuttur. ODTÜ'de mevcut olmayan Tıp Fakültesi akademisyenlerinin teknoloji geliştirmek amacıyla ODTÜ Teknokent'te şirket kurdukları görülmektedir. Akademisyenlerin 76%sı ODTÜ mensubudur. Kurulan şirketlerin %63'ü şu anda faaliyettedir. En çok akademik şirket üç bölümden kurulmuş bulunmaktadır. Bunlar, Elektrik Elektronik Mühendisliği, Makine Mühendisliği ve Biyolojik Bilimler Bölümleridir. Akademik unvan olarak en çok profesörlerin şirket ortaklığı vardır. Araştırma görevlileri ise, kendilerine tanınan yasal düzenleme sebebi ile 2012'den sonra şirket ortağı olarak ODTÜ

Teknokent'te faaliyete geçmişlerdir. Ancak, araştırma görevlilerinin %67'si şirket ortaklığından ayrılmışlardır.

ODTÜ Teknokent'te kurulmuş ve ODTÜ'lü akademisyenlerin ortaklığı bulunun şirketlerde, şirket sayılarında ve toplam ve ortalama gelirlerinde zaman içinde artış vardır. Yurtdışı ve kamu gelirlerinde artış olmasına rağmen özel sektör gelirlerinde azalma gözlemlenmiştir. 2010 yılı bilgilerini 2014 bilgileri ile karşılaştırdığımızda:

Şirket sayılarında %75, toplam gelirlerinde % 254, ortalama gelirlerinde ise %46 artış olmuştur. Ortalama yurtdışı gelirler % 630, kamu gelirleri %835 artarken, özel sektör gelirleri %82 azalmıştır.

Yaptığımız çalışma ODTÜ Teknokent'teki akademisyen firmaları hakkında bizlere bir fikir vermektedir. Genel olarak hem şirket sayılarında, hem gelirlerinde artış olması gelecek yıllarda burada şirket kurmak isteyen akademisyenler için bir temel oluşturabilir. ODTÜ hem nitelikli insan kaynağı hem de sunduğu imkanlarla teknoloji geliştirme konusunda kendini ispatlamış bir üniversitedir. Ancak yurtdışındaki teknoparklara baktığımızda, hem akademisyenlerin şirket kurma açısından daha istekli oldukları hem de daha fazla gelir yarattıkları söylenebilir. Bu da bize teknoloji odaklı ülke büyümesinde bir hedef oluşturabilir.

Ülkemizde genelde teknokentlerde tüm şirketler temel alınarak, onların yarattıkları ekonomik değere bakılmaktadır. Oysa bizim yaptığımız bu çalışma akademisyenler için özeldir. Akademisyenlerin şirket kurma konusundaki önyargıları, bu ve benzeri çalışmalarla değişebilir. Başarılı örnekleri gözlemlemek, yeni akademisyen şirketlerinin de oluşumunu hızlandırma yönünde olumlu bir adım olacaktır.

Çalışmamızın sonunda şu hususlar söylenebilir: Dünyada ve de ülkemizde girişimci üniversiteler için henüz standart bir girişimci eğitim modeli oluşturulamamıştır. Girişimci olarak tanımlanan üniversitelerin başarılarının ölçümlenmesi oldukça zordur. Yaptığımız literatür taramasında, en başarılı bulduğumuz çalışma, MIT tarafından gerçekleştirilen, öğrencileri ve mezunları da kapsayan ve zaman içinde yarattıkları ekonomik değeri ortaya koyan çalışmadır. Bu tarz çalışmalar,

üniversitenin hem bölgesi hem de ülkesi açısından girişimcilik potansiyelini ve başarısını ölçmede çok faydalıdır. Girişimci üniversitelere verilen rollerde de henüz bir standart oluşmamıştır. Ülkemizde, üniversite-sanayi işbirliğini destekleyen devlet yardımları oldukça fazla olmasına rağmen, teknoloji yaratma konusunda yavaş ilerleğimiz söylenebilir. Devletin, özellikle Bilim, Teknoloji ve Sanayi Bakanlığı'nın hem girişimci üniversite sayısını hem de üniversite-sanayi işbirliğini artırmaya yönelik oldukça ciddi çalışmalar yaptığını belirtmek gerekir. Dünyada, en büyük ekonomiler arasına girmek için, ülkemizde hem girişimciliğe, hem de girişimci eğitime daha fazla önem verilmesi gerekmektedir.

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü ☐

Sosyal Bilimler Enstitüsü ☑

Uygulamalı Matematik Enstitüsü ☐

Enformatik Enstitüsü ☐

Deniz Bilimleri Enstitüsü ☐

YAZARIN

Soyadı : YÜKSEL

Adı : Peyman

Bölümü : İşletme

TEZİN ADI (İngilizce) : The Role Of Faculty Owned Businesses In Entrepreneurial Universities

TEZİN TÜRÜ : Yüksek Lisans ☑ Doktora ☐

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. ☐
3. Tezimden bir (3) yıl süreyle fotokopi alınamaz. ☑

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