ACADEMIC ENTREPRENEURS: MOTIVATIONAL ASPECTS, CHALLENGES AND SUCCESS CRITERIA IN TECHNOLOGY DEVELOPMENT ZONES IN ANKARA

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

ENVER HAKAN KONAÇ

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF SCIENCE AND TECHNOLOGY POLICY STUDIES

AUGUST 2018

Approval of the Graduate School of Social Sciences

_____

Prof. Dr. Tülin Gençöz
Director

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

_____

Prof. Dr. M. Teoman Pamukçu
Head of Department

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

_____

Prof. Dr. M. Teoman Pamukçu
Head of Department

Examining Committee Members

Assoc. Prof. Dr. İ. Semih Akçomak (METU, STPS) _____

Prof. Dr. M. Teoman Pamukçu (METU, STPS) _____

Asst. Prof. Dr. Elif Kalaycı (Atılım Uni., ECON) _____

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name **:** Enver Hakan Konaç
Signature **:**

ABSTRACT

ACADEMIC ENTREPRENEURS:
MOTIVATIONAL ASPECTS, CHALLENGES AND SUCCESS CRITERIA IN TECHNOLOGY DEVELOPMENT ZONES IN ANKARA

KONAÇ, ENVER HAKAN

M.S., Department of Science and Technology Policy Studies

Supervisor: Prof. Dr. M. Teoman Pamukçu

August 2018, 176 pages

Based on 23 replies received to an online questionnaire and 18 face-to-face interviews with academic entrepreneurs (AEs) active on a number of university-based technology development zones in Ankara, (i) motivational aspects of academics in starting their own businesses, (ii) the challenges they subsequently face in their business environment, and (iii) their success criteria as perceived by them were assessed. In light of the information generated by the questionnaire and interviews, the validity of six propositions was explored: (i) whether AEs would tend to have a hybrid persona mixing pecuniary and nonpecuniary values but placing more weight on non-pecuniary values (P1); (ii) whether the ultimate purpose of AEs differs from their non-academic counterparts in the sense that creating societal benefit is more important for them than profit-oriented business (P2); (iii) whether AEs are successful in building up sound business/industry networks after engaging in entrepreneurial activities (P3); (iv) whether developing products for a niche market enabled the AEs to reach their commercialization goals (P4); (v) whether the entrepreneurial activities of AEs cause a decline in their academic performances (P5), and finally (vi) whether the innovative

ideas of AEs originate primarily from their academic activities and knowledge (P6). P1, P3 and P4 were supported by the findings, whereas P2, P5 and P6 were not supported. Finally, policies for the government, industry actors and universities were recommended.

Keywords: Academic entrepreneurs, motivations, challenges, success criteria, Turkey.

ÖZ

AKADEMİK GİRİŞİMCİLER:
ANKARA'DAKİ TEKNOLOJİ GELİŞTİRME BÖLGELERİNDE MOTİVASYON FAKTÖRLERİ, KARŞILAŞILAN ZORLUKLAR VE BAŞARI KRİTERLERİ

KONAÇ, ENVER HAKAN

Yüksek Lisans, Bilim ve Teknoloji Politikaları Çalışmaları Bölümü

Tez Yöneticisi: Prof. Dr. M. Teoman Pamukçu

Ağustos 2018, 176 sayfa

Ankara'daki bazı üniversitelerin teknoloji geliştirme bölgelerinde faaliyet göstermekte olan akademik girişimciler (AG'ler) arasından 23 kişi tarafından internet anketine verilen cevaplar ve 18 yüz yüze görüşme sonucunda, (i) akademisyenlerin kendi firmalarını kurma kararlarındaki motivasyon faktörleri, (ii) girişimcilik faaliyetleri sırasında karşılaştıkları sorunlar, (iii) kendilerine dönük olarak algıladıkları başarı kriterleri araştırılmıştır. Anket ve yüz-yüze görüşme sonucunda elde edilen bilgiler ışığında, altı önermenin geçerliliği incelenmiştir: (i) AG'ler parasal ve parasal olmayan değerlerin karışımından oluşan hibrit bir kişilik yapısına sahip olmakla beraber, parasal olmayan özellikleri daha ağır basmaktadır (Ö1), (ii) toplumsal fayda yaratılmasının, girişimlerinin kâr elde etmesinden daha önemli olduğunu düşünmeleri nedeniyle AG'lerin amaçları, akademik olmayan girişimcilerden farklılık arz etmektedir (Ö2), (iii) AG'ler girişimcilik faaliyetlerine başladıktan sonra sağlam iş/endüstri ağları oluşturmada başarılıdırlar (Ö3), (iv) AG'lerin niş pazarlara sunulacak ürünler geliştirmeleri, ticarileştirme hedeflerine ulaşmalarını sağlamaktadır (Ö4), (v) AE'lerin girişimcilik faaliyetleri akademik performanslarında bir düşüşe sebep olmaktadır (Ö5),

ve (vi) AG'lerin ürünlere dönük yenilikçi fikirler oluşturmaları, birincil olarak akademik bilgi birikimlerine dayanmaktadır (Ö6). Ö1, Ö3 ve Ö4 elde edilen bulgularca desteklenirken, Ö2, Ö5 ve Ö6 desteklenmemiştir. Son olarak, hükümet, endüstri aktörleri ve üniversitelere dönük politika tavsiyelerinde bulunulmuştur.

Anahtar Kelimeler: Akademik girişimciler, motivasyon, sorunlar, başarı kriterleri, Türkiye.

To my beloved wife Ece and my son Bartu.

ACKNOWLEDGEMENTS

I was reluctant to go back to school after so many years. I thought I was too old for such endeavors. My colleagues at my work place and my family convinced me otherwise and supported me all the way through. Therefore this thesis was made possible not only by my own effort but also by many people who believed in me and motivated me throughout my time at the STPS.

I would like to take this opportunity to extend my gratitude to my boss at Hemosoft, Dr. Şükrü Çetinkaya who has kindly granted me permission to enroll in the program.

I would like to thank my family members who have supported a full-time husband and father in his efforts to go back to school again.

I also thank my friends at Hemosoft who have helped me out with studying to ALES and provided me with their insights during my time at the STPS.

I would like to thank my supervisor; Prof. Dr. M. Teoman Pamukçu for his invaluable guidance and help in selecting my thesis topic and convincing many academic entrepreneurs to take part in my research. He has also kindly provided me with constructive feedback while I was writing this thesis.

I would like to extend my thanks to the METU Teknokent Administration for providing me with the contact information of academic entrepreneurs active on the premises. Without their help, I would not have been able to start the data collection phase of this thesis.

Lastly, I would like to thank my classmates at the STPS. Their positive and friendly approach to me was fun and rejuvenating.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

AE(s)	Academic entrepreneur(s)
BAP	Scientific Research Project
CFCU	Central Finance and Contracts Unit
EU	European Union
IPR	Intellectual property rights
IT	Information technologies
ITEP	Advanced Technology Projects Support Program
KOSGEB	Small and Medium-sized Enterprise Development and Support Administration
METU	Middle East Technical University
MIT	Massachusetts Institute of Technology
Ph.D.	Doctor of Philosophy
R&D	Research and development
SANTEZ	Industry Theses Technoentrepreneurship Program
SCI	Science Citation Index
SSM	Undersecretariat of Defense Industries
STPS	Science and Technology Policy Studies
TDZ(s)	Technology development zone(s)
TSE	Turkish Standards Institute
TTGV	Technology Development Foundation of Turkey
TTO(s)	Technology transfer office(s)
TÜBİTAK	Scientific and Technological Research Council of Turkey
US / USA	United States

CHAPTER 1

INTRODUCTION

Academic entrepreneurship in context of university-industry collaboration is a major component of science and technology policies. The improvement of the scientific knowledge base through conversion of academic ideas/know-how into marketable products/services promotes market competition. Promoting academic entrepreneurship as a component of university-industry collaboration has become a prominent factor in the developed countries for the past decades. University-industry collaboration is believed to lead to a higher innovation level and overall economic competitiveness. Academic entrepreneurship, throughout its progress within the last 60 years, has taken its roots from the US universities. Academicians in the US have since been carrying out entrepreneurship activities in addition to their traditional roles of teaching and research. Laboratory management, hiring researchers, developing projects for additional resources are examples for these entrepreneurship activities. Academicians in the US interact with the politicians and industry partners. Furthermore, they have the liberty to be members of the management boards of private companies so that they can promote their scientific disciplines and areas of research for commercial purposes (Cansız, 2016). As the birthplace of academic entrepreneurship, the USA is famous as its well-running university science parks, such as Stanford Research Park established in 1951, Research Triangle Park established in 1959 and subsequent many others which continuously make big contributions to the establishment of American national innovation system (Kenney and Von Burg, 1999; Zou and Zhao, 2014). In the USA, university science parks have become an essential component of national/regional innovation systems through the cutting-edge knowledge spillover, the transfer of academic research results to industrial practice, joint research contract and other

university-industry linkages (Su et al., 2015). Enactment of the Bayh–Dole Act[1] in 1980 has led to a rapid increase in commercial knowledge transfers from U.S. universities to firms through mechanisms such as licensing agreements, research joint ventures and university-based startups (Allen et al., 2007).

In an attempt to take advantage of this potential, many universities in developed countries have transformed themselves from a traditional university to a university with strong ties to industry and one that supports the entrepreneurial activities of its scientists (Krabel & Mueller, 2009). Given the fact that universities remain one of the most important components of entrepreneurship ecosystem, research commercialization emerges as a means to define a new term, namely "entrepreneurial university". This term is in fact a result of transition to a knowledge society and knowledge economy. Bercovitz and Feldman (2008) stated that faculty members' decisions to engage in technology transfer activities point to their acceptance of the university's initiative for academic entrepreneurship. Etzkowitz (2003) states that in addition to the two traditional roles of teaching and research, an entrepreneurial university has a 'third mission' of direct contribution to industry and society, and that is the ability to translate "knowledge produced within the university into economic and social utility". In this respect, the corporate work of academic entrepreneurs (AEs) surely reduce the time required for the academic research results to reach the end-users and the national technology market for the benefit of the society. On the other hand, Beyhan and Rickne (2015) report that there are cases where scholars or universities oppose the idea of being entrepreneurial, claiming that such direction is in opposition to the key functions of a university. For example, the loss of time originally allocated for the traditional academic roles of research and teaching led many academics argue that the role of the university was not to do business, but to support business (Henrekson and Rosenberg, 2001).

[1] The Bayh–Dole Act or Patent and Trademark Law Amendments Act (Pub. L. 96-517, December 12, 1980) is United States legislation dealing with intellectual property arising from federal government-funded research.

The innovative entrepreneurship in Turkey has started in 1980s and followed by the entry of e-commerce and telecommunications entrepreneurs to the market in 1990s alongside the rapid spread of internet and global mobile technologies. The period from 2000s onwards signifies a boost of cooperation with developed countries during which the state has increased its support to the industry. Taking developed countries as examples, Turkey also took the opportunity created by a shift to knowledge economy to promote academic entrepreneurship by establishing business incubators, technology development zones (TDZs) and technology transfer offices (TTOs) within the premises of reputable universities. The National Act #4691 on Technology Development Zones which went into effect in 2001 provided a legal framework for such set-up. The impact of this regulation has become visible starting from 2003. Table 1 below shows the cumulative number of TDZs and number of enterprises founded by AEs from 2003 to 2015 in Turkey. The number of active TDZs has increased from 3 in 2003 to 42 in 2015 whereas the number of enterprises founded or (co)-owned by AEs has increased from 15 in 2003 to 656 in 2015.

Table 1. Indicators on academic entrepreneurship in Turkey (cumulative)

	Active TDZs	**Number of enterprises founded or (co)-owned by AEs**
2003	3	15
2004	6	22
2005	11	44
2006	14	100
2007	18	130
2008	18	151
2009	23	217
2010	28	279
2011	32	373
2012	34	497
2013	39	382
2014	42	542
2015	42	656

Source: Cansız, M. (2016), "Türkiye'de Akademik Girişimcilik", T.C. Kalkınma Bakanlığı, Sosyal Sektörler ve Koordinasyon Genel Müdürlüğü, Yayın No. 2692, Ankara, p. 110.

Ankara is a city with renowned universities as well as highly-developed technology-based enterprises such as defense industry firms, software development firms and machinery production firms all of which employ qualified human resources. For this reason, Ankara remains the city that benefits the most from state research and development (R&D) support and spends the most for R&D. Ankara is home to the best-performing TDZs accommodating the highest number of AEs across the country. Table 2 displays some important indicators pertaining to the five university-based TDZs in Ankara by 2015. There are 888 private companies operating within these university-based TDZs in Ankara, 140 of which are founded or (co)-owned by AEs. 5 out of 42 active university-based TDZs in Turkey, approximately 27 percent of the companies, about 21 percent of enterprises founded or (co)-owned by AEs and 34 percent of total employees remain within the premises of university-based TDZs in Ankara (Cansız, 2016).

Table 2. Some indicators about university-based TDZs in Ankara

	Number of Enterprises	**Number of Employees**	**Number of Patents**	**Number of enterprises founded or (co)-owned by AEs**
Bilkent	197	3281	58	25
Ankara	89	492	0	19
Gazi	111	844	9	27
Hacettepe	204	1698	17	18
METU	287	5120	89	51
Ankara Total	888	11435	173	140
Turkey Total	3325	33380	496	656
Share of Ankara (%)	26,7	34,3	34,9	21,3

Source: Cansız, M. (2016), "Türkiye'de Akademik Girişimcilik", T.C. Kalkınma Bakanlığı, Sosyal Sektörler ve Koordinasyon Genel Müdürlüğü, Yayın No. 2692, Ankara, p. 29.

The national act (Act #4691) which regulates TDZs mandates that faculty members may engage in private businesses as long as they do so within the boundaries of TDZs. Today many faculty members in Turkey enjoy the business ecosystem at their businesses within the TDZs. A report by the Ministry of Development of Turkey states that the emergence of entrepreneurial universities ensured a faster transfer of know-how accumulated at the universities to industry and society (Cansız, 2016). The report

goes on to state that this has caused significant improvements in quantitative indicators associated with universities (e.g. active TDZs, number of academic enterprises, number of AEs) and that a similar improvement in qualitative indicators (e.g. innovation capacity, technology development capability) is crucial for the country's development. According to the report, as of July 2015 there are a total of 3325 businesses operating on the premises of TDZs nationwide. As shown in Table 1, approximately 20% of these which correspond to a total of 656 have been founded by AEs. The number of AEs would rise to around 1500 when the AE company partners who may have joined their colleagues in their AE-founded businesses are included. One should note that Turkey ranks 37th[2] with a score of 44.5 among 137 countries included in the 2018 Global Entrepreneurship Index which has been constructed according to entrepreneurial performances as well as capacities, attitudes and aspirations (Acs et al., 2018). Parallel to this standing, the number of TDZs as well as faculty members who engage in private entrepreneurship still remain short when compared with those in developed countries (Cansız, 2016). Determinants of what leads an academician to found his/her own business as well as the challenges experienced in this context are subjects of today's literature even in developed countries. Therefore, these issues should be tackled in more detail in Turkey which is a developing country with only 2,2 billion US Dollars-worth high-tech exports per annum which is equivalent to less than 1,4 percent of the total exports of Turkey[3].

Understanding the motivational aspects of the AEs is important because only then one can relate to the incentive system of the academic world and to the potentially changing nature of knowledge production. These aspects affect how scientists perceive their role in society, the legitimization of scientists to engage in commercial activities as well as policies and strategies used by governments and university administrations (Beyhan and Rickne, 2015). Identifying challenges faced by the AEs are also important in order to understand the common problems faced by AEs with a view to solving them so that university-industry linkages can be maintained seamlessly and benefits on the national

[2] The top country is the US with a score of 83.6.

[3] Calculated according to the Turkish Statistical Organization (TÜİK) 2017 figures.

economy and innovation system are realized in a shorter time and in a more efficient manner. Lastly, the success criteria perceived by AEs themselves are important to develop the appropriate strategies to render AEs more successful in their commercialization efforts. Overall, the appropriate strategies and policy recommendations, whether they deal with only one of the aspects explored in this thesis or their combinations or all of them, would rely on a thorough analysis of motivations to become an AE, challenges faced by AEs and their success criteria.

Krabel and Mueller (2009) pointed out that possible commercialization channels included patenting, licensing, consulting and firm founding. Firm-founding is one of the ways for the university researchers to transform know-how into an innovation. In fact, the term ‘university researcher’ may include Ph.D. students in addition to the university instructors who constitute the actual academic staff in universities. Therefore, a Ph.D. student who (co)-owns a private enterprise may qualify to be referred to as an AE. However, due to difficulties in acquiring information on Ph.D. students who are also company owners/partners, the target population of this thesis had to be narrowed down to university instructors (actual academic staff) who also run their own businesses. In other words, the target population of this thesis is the Academic Entrepreneurs (AEs), a term that is used henceforth to define university instructors who also run their own businesses (university spin-off or independent firms) as a sole owner or a company partner (i.e. firm founding by Krabel and Mueller’s definition). There has to be a primary question reflecting the aim of this study and that would be "what are the elements affecting the establishment and management of businesses run by university scientists?" In this respect, this thesis focuses on the motivational aspects of academicians in starting their own businesses, the challenges that they face in their business environment as well as their success criteria. The behavioral patterns and other factors driving these three elements (motivational factors, challenges faced and success criteria) would very much affect the university and state policies aiming to promote university-industry collaboration. Therefore, this thesis aims to make an assessment of the three elements (motivation factors, challenges faced and success criteria), explore the validity of a number of propositions based on this assessment and

finally come up with policy recommendations for the government, industry and the universities. It is important to hear from the AEs themselves about what motivated them into running their own businesses, the challenges they face as double-hatted individuals and what drew their path to become successful business persons as well as how all these relate to the university-industry collaboration. In so doing, the validity of six propositions were explored in this thesis to understand whether or not the findings support the following:

- AEs would tend to have a hybrid persona mixing the pecuniary rewards and non-pecuniary values but with more weight on non-pecuniary values,
- the ultimate purpose of AEs differs from their non-academic counterparts in the sense that creating societal benefit (i.e. to achieve something with the motive to benefit people/society/humanity) is more important than making profit in the former,
- AEs were successful in building up sound business/industry networks after engaging in entrepreneurial activities,
- having developed products for a niche market enabled the AEs to reach their commercialization goals,
- the entrepreneurial activities of AEs cause a decline in their academic performances,
- the innovative product ideas of AEs originate primarily from their academic activities and knowledge.

The study was initially planned to include AEs operating within the premises of the Middle East Technical University (METU) – Technology Development Zone (Teknokent) but subsequently supported by a small number of AEs from other universities due to the low level of feedback to the online questionnaire created to collect data. METU-Teknokent Inc., the administrative organization responsible for managing the Teknokent was officially requested by METU-Science and Technology Policy Studies Department (STPS) to inform the AEs of the present study and forward to them the online questionnaire link. Unfortunately, a sufficient level of feedback was

never acquired, leaving the number of AEs who have completed the questionnaire at 23 even after little support from AEs operating on the premises of other university technology development zones (namely Hacettepe University and Gazi University). A total of 18 AEs were also interviewed face to face to acquire in-depth information regarding their motivations and the challenges they face. The comprehensive online questionnaire consisted of 60 questions pertaining to general information, motivation factors, success criteria and challenges faced.

The next chapter (Chapter 2) will introduce the literature about the motivational aspects of and challenges faced by AEs. This chapter will also provide a review of academic entrepreneurship in general as well as of universities as key components of the innovation system. The output of this chapter is expected not only to shed light on the description, summary and critical evaluation of the literature covered therein in relation to the findings displayed and propositions explored, but also to provide an overview of sources researched in order to demonstrate how my findings fit within a larger field of study. Following the description of the methodology adopted in this study in Chapter 3, Chapter 4 will put forward and examine the main findings of this study in terms of motivational aspects, success criteria and challenges faced and consequently reveal which factors are more important for AEs. Chapter 5, the conclusion chapter will review my findings and consequently cover a discussion of policy recommendations, talk about the study's limitations and set the basis for future work.

To my knowledge, there are no other studies that have been previously conducted in Turkey on this topic. Beyhan and Rickne (2015) explored the motivations of academic nanotechnology scientists to interact with industry and identified main motivations. Cansız (2016) explored the academic entrepreneurship in Turkey from the sociological point of view by taking Bourdieu's "practice theory" as the basis for its analysis and further making a holistic analysis involving concepts such as habitus, field and capital. I was unable to find a study which dealt with one or more of the three issues of interest covered in this thesis, i.e. the motivational aspects of AEs in Turkey, the challenges they face and their success criteria in general. While a few questions in the

questionnaire of Cansız (2016) coincide with my questions, the questions asked in my questionnaire and the answers designed to be scored and/or selected by AEs are unique and differ a great deal. Finally, to the best of my knowledge, the six propositions selected to be explored in connection to the AEs in this thesis have not been tackled earlier in Turkey. These features in my opinion may satisfy the novelty aspect of this thesis. This thesis is expected to contribute to the literature in terms of the three above-mentioned issues and help policy makers come up with relevant and consistent policy solutions.

CHAPTER 2

LITERATURE REVIEW

My thesis topic is a widely explored one worldwide. Many researchers dealt with a wide range of sub-topics of academic entrepreneurship in their works. In this chapter, I will try to discuss those which I think would be closely related to my thesis topic under four sub-sections.

Firstly, I will try to provide a review of what academic entrepreneurship is. Secondly, I will provide a review of how universities play the role of facilitator in spawning private businesses. Thirdly, I will focus on the literature covering the motivations of AEs in engaging commercialization activities. Lastly, I will put forward the literature explaining the challenges that AEs have to face throughout the innovation system. Before I go any further, I would like to point out that the definition of technology transfer in this study is not the classic definition that envisages the transfer of technology from a mother firm to its subsidiaries in another country, but rather is the phases of knowledge transfer from the university to the industry by AEs.

2.1. What is academic entrepreneurship?

Academic entrepreneurship refers to activities carried out by universities to promote commercialization activities on campus and in surrounding areas of the university (Siegel and Wright, 2015). These surroundings may point to the technology development zones which accommodate business incubators, TTOs, university spin-off firms and other R&D firms which become functional on university campuses with the approval of the university administrations. There are a number of suggestions for the definition of AEs such as, “academicians who engage in entrepreneurship activities in

addition to their academic work", "entrepreneurs who start a business and occupy themselves full-time with it in dedication to their scientific fields of interest" and "individuals who manage their scientific business enterprise owing to their scientific and business know-how" (Meyer, 2003, Dickson et al., 1998). A business venture (co)-founded by a university student, technician or faculty member is the focus of academic entrepreneurship as that venture could be considered a component of a well-organized university-industry linkage (Doutriaux, 1987). Although academic entrepreneurship is a multi-phased mechanism, the starting point is always a university researcher at faculty or laboratory level. However, contributors to collaboration needed to perform activities that fall under the definition of academic entrepreneurship may include many other stakeholders including TTOs, faculty administrations, funding agencies and industry firms (Wood, 2011). TTOs assist the AEs in their bureaucratic entanglements relating to their commercialization and patenting activities. Funding agencies fund the projects, albeit within certain limits, developed by the AEs and provide them with the short-term capital they need. Industry firms are the members of the business/industry networks that the AEs seek to establish throughout their entrepreneurial lives and are crucial for possible business collaborations. Although "patenting, licensing, consulting and firm founding" can be counted among the academic entrepreneurship activities (Krabel and Mueller, 2009, Gulbrandsen, 2005), this thesis concentrates only on the firm-founding dimension in context of the commercialization activities undertaken by AEs.

A study by Nyeko and Sing (2015) examined academic entrepreneurs under three classifications, namely the academic entrepreneur; the entrepreneurial academic and the academic-entrepreneur. **Academic entrepreneurs** are academic faculty members who engage in the commercialization of academic intellectual property (Etzkowitz, 2004). Their activities include external teaching, initiating the development of new degree programs and conducting seminars and training events for academia and industry. **Entrepreneurial academics** are managerial change agents in universities who make use of external funding sources to establish research and teaching organizations outside the walls of the university. They put together research teams which include graduates, apply for research grants and conclude contracts with industry (Henrekson and

Rosenberg, 2001). Their common undertakings include teaching, research-based industry work, research-based consulting for industry through the academia as well as administrative tasks (Perlman et al., 1998). They develop products or services with commercialization potential, acquire research funding (grants) from governmental, non-governmental or international organizations, jointly implement research projects with industry and provide research-based assistance to small business owners. **Academic-entrepreneurs** are faculty members who undertake commercial activities outside the academic circle with or without the involvement of the university (Dickson et al., 1998; D'Este and Patel, 2007). They have the option of quitting academia and continuing with their business (Evans and Klosten, 2000). They contribute to entrepreneurial activities by taking part in the formation of joint university-industry ventures, collaboration schemes with industry to establish joint venture(s) privately, formation of new spin-off companies, establishment of university incubators and/or science parks, formation of university centers to realize commercialization activities and founding of own company(s) (Nyeko and Sing, 2015).

In this thesis, my definition of AE corresponds to the latter, i.e. **academic-entrepreneur** in words of Nyeko and Sing. This distinction is especially important in terms of who holds the intellectual property rights pertaining to an output created by the AE. Without taking into account academic-entrepreneurship in the sense of 'firm-founding', we observe that the faculty member, as in the cases of academic entrepreneur and entrepreneurial academic, continues to work for the university and the ownership of intellectual property often lies, at least in part, with the university (Siegel and Wright, 2015). However, after 'firm-founding', as in the case of the academic-entrepreneur, any intellectual property rights that may accrue as a result of corporate commercialization activities of the AE lie with the AE.

Meyers and Pruthi (2011) argue that academic entrepreneurship is valuable to universities, students and various other stakeholders for the following reasons. It helps universities enforce their innovation mission. It is a way for universities to demonstrate that an economic value added and an impact is created beyond their walls. It leads to an

increase in commercialization revenues and fills the technology transfer pipeline beyond traditional technology-based ideas and inventions. It creates a competitive advantage in attracting highly talented faculty and students as faculty members and students may often tend to work at R&D companies where they can improve themselves. It provides students with the knowledge, skills and abilities they need to succeed by providing them on-the-job training, regardless of their career choice. It satisfies a market need as there may be great demand for the product/service to be offered by the AE's company. It fosters creative thinking that would help explain how universities should satisfy their multiple missions.

Faculty members and their academic attributes prove to be crucial in the progress of academic entrepreneurship. The eminence of universities has a positive impact on the commercialization tendencies, research capacity and academic entrepreneurship activities of the universities. There is an argument asserting that higher quality researchers are more likely to found firms to exploit their inventions than lower quality researchers; and that on average, higher quality researchers are found in more prominent universities. Tacit intellectual capital belongs to a small set of leading researchers (Di Gregorio and Shane, 2003). As stated by Tijssen (2006), academic entrepreneurship has three phases. The first phase is the **application-driven – science-oriented phase** in which the entrepreneurship awareness in the university or the industry perception of the researchers are augmented. Research competencies are created, new ideas are increasingly focused on problem-oriented research and commercialization potentials and industrial linkages are defined in this phase. This phase is followed by the **product-oriented – utility-driven phase**. Prototype implementation associated with the R&D work is undertaken in line with the customer demands; business ideas and concepts are developed; maintenance and support mechanisms are sought; administrative, financial and organizational capabilities and strategies are strengthened. Third phase is the **business-oriented – market-driven phase** during which market studies are conducted, business plans are drawn up, intellectual property right issues are clarified and resolved and the first sales efforts

yielding income generation are carried out. AEs can now focus on the sales of the product henceforth.

In terms of involvement in the commercialization process, Etzkowitz (1998) describes three types of entrepreneurial scientists: (i) the “hands-off” AEs who leave the commercialization matters to the hands of the TTO, (ii) AEs as the “knowledgeable participants” who are willing to play a significant role in participation to the commercialization process, and (iii) the “seamless web”, i.e. the integration of campus research groups with company research programs. All in all, AEs are actually a liminal (in-between) group, i.e. on a boundary between the industry and academics rather than inside both of them. This liminality with one leg in the academics and one leg in the industry allows them to develop a flexible networking and commercialization process. While a “seamless web” between university and industry is still far from realization, liminal scientists achieve a very strong integration of entrepreneurship with teaching activities. And even the most commercially oriented and financially motivated entrepreneurial scientists are claimed to place their academic objectives over their business objectives (Gulbrandsen, 2005).

The uncertain business environment requires AEs to develop certain competencies if they want to successfully grow their nascent businesses. Penrose (1959) argued that entrepreneurial ability should be considered separately and distinctly from other resources like capital or human capital. Godfrey and Gregerson (1999) defined this competency development process as “an entrepreneurial ability to identify, develop and complete new combinations of existing asset bundles or new unmet opportunities.” Firm-founding and successful management is closely associated with specific resources and capabilities, such as intellectual human capital (Zucker et al., 1998), technological resources (Heirman and Clarysse, 2004), academic characteristics (Di Gregorio and Shane, 2003) and routines like teaching, research and publications (Lockett and Wright, 2005). Regarding the attributes that the AEs should possess, Rahim et al. (2015) stated that competencies such as risk taking, bravery, sufficient knowledge, values, strategic thinking and self-confidence were vital for successful entrepreneurship. They explained

that high technical skills, scientific research excellence and superior academic performance that were present in the faculty members manifested themselves in successful entrepreneurship. In terms of success criteria, industrial working experience in form of either previous employment in the industry or consultancy services for the industry, research collaboration with industry (D'Este et al., 2010) and engagement with real life applications (Arrow, 1962) would positively influence the ability of academic researchers to accumulate tacit knowledge, exploit the commercial opportunity of their research outcomes and face challenges in bringing the commercial outcomes from lab to market.

Rasmussen et al. (2011) identified three competencies for venture creation that had to be achieved through entrepreneurial experience and business network development. Opportunity refinement, leveraging and championing. "**Opportunity refinement** means discovering and distinguishing between opportunities in order to transform scientific research into viable business concepts". To enhance opportunity refinement competency, AEs need to attract new employees with industrial experience who can identify and interact with industrial partners. "**Leveraging competency** means that AEs evolve their credibility and entrepreneurial experience to integrate the internal and external resources by also receiving help from the university, TTO and public support schemes". Lastly, "**championing competency** means developing an ability to include external champions as resource providers by convincing them to contribute to the venture's development". Championing is related to the commitment or the leadership role needed to sustain the venture start-up process. A sustainable championing competency calls for internal champions in the entrepreneurial team and external individuals or people who are higher in the organization. Champions positively influence with their efforts the projects implemented by the venture. University managers and experienced entrepreneurs who become chairman of a company are good examples of such influential champions. Rasmussen et al. (2011) exemplify this as "The Gamma chairman became an effective champion within the external environment, albeit only after the inventor convinced him to join the venture."

The authors reached the following results: a) to develop an opportunity refinement competency, venture teams with a high portion of AEs likely need additional industry experience. AEs often do not recruit new team members to develop market related competencies, b) ventures with a high proportion of AEs need additional support and entrepreneurial experience to be able to develop a leveraging competency, and c) ventures with a high proportion of AEs likely need additional champions[4] within the university to be able to gain outside champions. The more complex the venture is, the greater the need for the championing competency (Rasmussen et al., 2011).

2.2. Universities as key elements of the innovation system

There are two ways scientific knowledge can be transferred to industry. First is through the channel of conference proceedings or journal articles presented or written by scientists in a publicly available manner. The second is through commercialization activities including patenting, licensing, joint research and consultancy with private firms and firm founding. While factors like personality, motivation factors and willingness to engage in commercial activities, overall economic situation and legal conditions of the country can be listed as determinants of an AE's decision to start up a business, it is the characteristics of the university itself that paves the way for the emergence of startups in technology development zones (Hesse, 2014). The foundation for a university-based commercial activity is laid over a university's knowledge and technology arsenal. This arsenal depends to a great extent upon many other factors such as the quality of teaching and research, internal regulations, cooperation schemes with the industry and ability to attract financial resources. Teaching and research have been the two typical missions of a traditional 'ivory tower' university. However, after the 1990s this started to change with new expectations regarding the role of the universities within the system of knowledge economy. A third mission which involves academic entrepreneurship has enabled many universities to get a broader source of funding from

[4] Academic researchers themselves might be important champions initially, especially with respect to championing the technology, while persons with another background may be needed to champion the commercial aspects in later stages. New champions had to be recruited to tackle the very different challenges encountered later in the start-up process.

non-governmental or public organizations, and subsequently become ‘entrepreneurial universities’. Hence, universities are now in a prominent position to contribute to competitiveness and economic development either by interacting with the industry or by implementing other types of commercialization activities such as the establishment of new firms (Gómez-Gras et al., 2007). This transformation of the role to include a third mission for a university is referred to in the literature as “from ivory towers to engines of economic growth” (D’Este & Perkmann, 2011). “In accepting this new task, universities become part of a coherent system involving the interaction among industry, government, innovation and economic progress” (Etzkowitz and Leydesdorff, 2000). Academic entrepreneurship is not only an extension of teaching and research activities, but at the same time possesses some other features such as the internalization of technology transfer capabilities and taking a role traditionally played by industry. The transition to the entrepreneurial university enhances traditional academic missions. Teaching, the first academic mission, leads to a second academic mission of research which paves the way for economic and social development as a third mission. The contemporary entrepreneurial university ensures that academia takes a leading role of production based on continuous organizational and technological innovation (Etzkowitz, 2008).

Etzkowitz (2008) listed five norms of the entrepreneurial university and stated that the optimal result would be reached when there was a balance between them.

- **Capitalization:** The creation and dissemination of knowledge serve the purpose of using that knowledge and disciplinary advance; when the economic and social development require capitalization of knowledge, there exists an enhanced role for the university in society.
- **Interdependence:** There is an interaction between the entrepreneurial university, industry and government; therefore an entrepreneurial university is not an ivory tower isolated from society.

- **Independence:** The entrepreneurial university is a relatively independent organization; and it is not an entity that depends upon another institutional structure.
- **Hybridization:** When the tensions between the principles of interdependence and independence are resolved, an opportunity to realize both objectives simultaneously is born which points to the formation of hybrid organizational formats.
- **Reflexivity:** The changing conditions in the relationship between the university, industry and government necessitate a renovation of the internal structure of the university and that of industry and government.

Critics to this entrepreneurial university phenomenon voiced their fears that academic science is being instrumentalized and even manipulated by industry and that 'entrepreneurial science' might have a detrimental effect on the long-term production of scientific knowledge. They said that universities may become 'knowledge businesses' that serve the interests of specific stakeholders rather than generating public goods for national audiences. Other risks, they said, may also emerge such as a shift from basic research towards more applied topics and less academic freedom, lower levels of research productivity among academics and a slowing-down of open knowledge diffusion (D'Este & Perkmann, 2011).

Encouraging faculty members to become economic entrepreneurs may not be the best way to bolster university-industry collaboration. Instead, a collaboration scheme that contributes to both industry applications and academic research should be enabled. Such collaboration should allow channeling of academic input into commercial solutions and promotion of new ideas and new research questions for university research. "Announcements of the 'entrepreneurial university' may therefore be premature and based on an overstated generalization of insights from the life sciences." (D'Este & Perkmann, 2011). In fact, the growth of polyvalent[5] research fields with simultaneous theoretical, technological, and commercial potential is the reason why

[5] Having a number of different forms, purposes, aspects or principles.

entrepreneurial universities that retain the classic features of the "ivory tower" research universities have been emerging (Etzkowitz, 2008).

It is worth mentioning that the priorities and scope of university-industry collaboration differ significantly between developed and developing countries, as shown in Table 3.

Table 3. Priorities for university-industry partnerships at different stages of economic development along the three missions of universities

	Most developed countries	Least developed countries
Teaching University	• Private participation in graduate programs • Joint supervision of PhD students	• Curricula development to improve undergraduate and graduate studies • Student internships
Research University	Research consortia and long term research partnerships to conduct frontier research.	• Building absorptive capacity to adopt and diffuse already existing technologies • Focus on appropriate technologies to respond to local needs
Entrepreneurial University	• Spin-off companies, patent licensing • Entrepreneurship education	• Business incubation services • Entrepreneurship education

Source: Guimon, J. (2013), "Promoting University-Industry Collaboration in Developing Countries", The Innovation Policy Platform, Policy Brief, World Bank, p. 3.

Guimon (2013) explains that the capacity of the universities in developing countries to jointly undertake innovation projects with industry is undermined by the poor quality of education and the lack of financing available to universities. This incapacity is exacerbated in developing countries due to the very little experience of the universities in industry collaboration schemes, managerial capacity issues, cultural and institutional barriers. Existing collaboration in developing countries is limited to the recruitment of university graduates by firms as employees, consultants or interns. When compared with the developed countries, there is a much less likelihood of commerciliziation channels such as emerging spin-offs or patents. Therefore, capacity-building measures

aiming to overcome these obstacles and build effective university-industry linkages require significant amount of time and sustained effort. University policies in developing countries should seek to foster innovation and learning primarily in the informal sector as it constitutes the main source of income for a larger proportion of the population, but with the final purpose of ensuring a shift toward more formal, innovative and inclusive business environment, which would ultimately spur economic growth and employment (Guimon, 2013).

Not all university policies are highly supportive of the university spin-offs. The level of support varies significantly according to university policies, variations in structures of technology transfer offices and a wide diversity of formalizing the contractual relations around this technology (Clarysse et al., 2005). "An entrepreneurial university is one that welcomes a culture of entrepreneurship and installs an entrepreneurial mindset in every graduate, no matter what their interests, dreams and values happen to be." (Thorp and Goldstein, 2010). Zhou (2007) states the three primary characteristics of an entrepreneurial university as: (i) systematic acceptance of and support for entrepreneurship activities; (ii) intermediary structures, such as a technology transfer offices; (iii) a significant number of faculty members willing to form firms. Key elements of the university ecosystem facilitating entrepreneurship include: (1) the rise of institutions such as business incubators and science/technology/research parks in support of technology transfer and entrepreneurship, (2) significant increase in the on-campus entrepreneurship courses and programs (in multiple faculties/schools), (3) establishment and growth of entrepreneurship centers, (4) a rise in the number of "surrogate entrepreneurs"[6] on campus to stimulate commercialization and start-up creation, and (5) an increase in the support of entrepreneurial ecosystem by alumni commercialization funds and student business plan competitions (Siegel and Wright, 2015). Similar motives were observed in a study conducted in South Africa, listing the motives as the culture of entrepreneurship, university support for entrepreneurial activities and passion for research and innovation (Tengeh and Rorwana, 2017).

[6] Universities have two options when they formulate policies to develop new technology-based start-ups. One approach is to encourage faculty members to engage in this activity. Another avenue is to encourage **surrogate** (external) entrepreneurs to assume a leadership role (Franklin et al., 2001).

Another set of criteria for a sound entrepreneur university is as follows: (i) Top-down vision, strategy and leadership of the university administration, (ii) a curriculum that is stimulated by well-defined entrepreneurship learning objectives, (iii) robust internal and external networks, (iv) innovation culture, and (v) experiential learning and knowledge-transfer opportunities (Meyers & Pruthi, 2011).

AEs draw their stock of knowledge from the universities, thus universities offer direct benefits to knowledge-based startup ventures and amplify the impact of available resources. Depending on the robustness of this relationship, universities could play an important role in promoting innovation and economic empowerment in both industrial and developing economies. Especially in developed countries, universities play an active role in the innovation process by actively enabling the technology transfer process (O'Neal et al., 2012). Economic growth in developed economies is driven, among others, by the commercialization of knowledge stock created by the universities since firms often rely on academic research to carry out their innovative activities while some industries need significant amount of academic research support in order to generate innovative products/services (Mansfield, 1995, Jaffe, 1989, Cohen and Levinthal, 1990). In line with this statement, Waakee & Van der Sijde (2002) explained that potential global start-ups drew a significant amount of resources from universities and that this statement was consistent with the fact that the emergence of global start-ups is more common in high tech industries which massively accommodate knowledge created by research activities of universities (e.g. biotechnology, nanotechnology, etc.).

There are two opposite beliefs regarding the type of environment an entrepreneurial effort is initiated from. While some authors propose that the likelihood of starting up a business necessitates a resource-rich environment, some state that entrepreneurial skills like spotting opportunities and matching them with the right resources may still prevail in extremely unpromising and resource-constrained environments. De Silva et al. (2012) conclude that resource constraints did not totally inhibit entrepreneurial efforts of the AEs in a resource-constrained environment because AEs were able to overcamo various resource barriers. In extremely unpromising and resource-constrained

environments, entrepreneurial skills may play an important role in identifying opportunities and matching these with available resources. Thus, there may be a negative relationship between resource constraints and stimulation of entrepreneurial behavior in such relatively resource-constrained environments. Those who had engaged in a higher number of diverse activities were able to overcome resource barriers to a greater extent by capitalizing on a relatively high level of synergistic effects generated by knowledge and skills, input-output flows as well as social networks than those who had engaged in a limited number of similar activities. De Silva et al. (2012) also concluded that diversification by several AEs, i.e. taking up a greater number of different activities, generated synergies between multiple academic entrepreneurial activities and highlighted the importance for a university to have a team of different academic entrepreneurs who complement each other. The means of technology transfer from universities to society in Germany was examined and it was found that professors conducting both basic research and research on how to apply their research findings had a better success in raising industry funds. It was also found that specialized research units obtained significantly more public grants (Hottenrott, 2012).

Participation of academcians in entrepreneurship is greatly influenced by the environment at the university (Kenney and Goe, 2004). A number of studies have stated that national and university policies need to provide consistent support to ensure adequate university spin off emergence (Brint, 2005), given that governments and universities adopt the right intellectual property policies (Wright et al., 2007) or necessary steps are taken by university administrations in favor of resource allocation for commercialization of research (Brint, 2005). Different departments within the same university may display significantly different levels of entrepreneurial activity (Bercovitz and Feldman, 2008). Rasmussen et al. (2014) compared the development of entrepreneurial competencies within spin-offs based in different departments at the same universities and observed significant differences in early venture performance. Even small differences in the support received from department administration and senior faculty members in favor of commercialization activities were found to have a major impact on the development of the spin-off. The higher the level of support was,

the better the entrepreneurial competencies were developed from external actors outside the department and greater the ventures gained momentum. In contrast, insufficient support from the department for commercialization activities severely inhibited the evolution of spin-offs regardless of university level policies and practices. The departmental support could be as follows: allowing the AEs to work on their commercialization activities for 30-60 days per academic year, not displaying hostility towards AEs, adopting friendly departmental regulations in favor of AEs so that they can work closely with industry actors, strong ties between AEs and other faculty members and providing further assistance when needed, forging new contracts with the industry, providing lab space, technicians and sabbaticals to AEs, etc.

In a comprehensive study concerning the rise of university technology transfer and academic entrepreneurship, Siegel (2011) provided a detailed review of key theoretical and empirical literature as follows. The faculty quality and the ability of the university and inventor(s) to assume equity in a startup rather than licensing royalty fees were assessed to be the two key determinants of university-based startups (DiGregorio and Shane, 2003). It was found that quality of the academicians, commercial capacity of the university and the amount of federal science and engineering funding provided were also significant determinants of university startup formation (O'Shea et al., 2005). In a study conducted in the UK, Franklin et al. (2001) suggested that old universities with well-established research reputations where the most suitable policies have been adopted in favor of entrepreneurs generate the most startups. Lockett et al. (2003) confirmed this result by concluding that universities with clear well-defined strategies regarding the formation and management of spinouts generate the most startups. Similarly, a study by Lockett and Wright (2005) suggested that universities wishing to accommodate startups should make use of the broad commercial skills of well-managed technology transfer offices. After qualitatively analyzing five European universities that had outstanding performance in technology transfer, Clarke (1998) concluded that the success of the universities was very much affected by the existence of an entrepreneurial culture at those institutions. In a similar manner, Roberts (1991) revealed that social norms and tacit approval of entrepreneurs at MIT proved critical in

successful academic entrepreneurship at MIT. Audretsch (2000) examined the extent of differences between AEs and other entrepreneurs and found that AEs tend to be older and more scientifically experienced. To sum up, I can say that the right environment in favor of entrepreneurial activities and existence of a sound enterprise infrastructure[7] greatly contribute to the empowerment of university researchers to produce technologically feasible and commercially viable innovations (Rahim et al., 2015).

2.3. Motivating forces behind academic entrepreneurship

A commercialization activity like licensing or patenting may be a profitable effort for universities, research institutions or TTOs, hence these organizations might have a monetary concern like additional income in mind while dealing with commercialization activities. However, such a motive may not be prevalent for individual AEs. Whether financial incentives, i.e. a raise in the income or receiving premium, really boost work effort among researchers at universities or other research institutions is a long-debated issue with mixed conclusions. Results of a study by Frey (1997) propose that financial incentives have the potential to "crowd in" intrinsic[8] motivation and increase the work effort if researchers perceive those financial incentives as supportive. However, an opposite effect occurs if financial incentives are perceived as controlling, and this time the intrinsic motivation is ''crowded out'' eventually causing a decrease in the work effort despite the increasing financial incentives. Here, supportive means an acknowledgement of the employees' work effort and their high intrinsic work motivation whereas controlling means management decisions designed to control the behaviors of employees. Andersen and Pallesen (2008) put Frey's offer to test at 162 Danish research institutions (17 government research institutions and subunits of 10 universities) in order to observe how an increase in financial incentives affected the number of publications. The perception of the employees as to how they see the

[7] Enterprise infrastructure encompasses a good intellectual property management system and an efficient TTO.

[8] The term "intrinsic" is used to define the desirable return or reward that is gained as a result of the work undertaken (academic entrepreneurship in particular) and it is linked to self-improvement, problem solving and tacit academic/scientific knowledge rather than pecuniary rewards or acquirement of prestige.

financial incentives, i.e. supportive vs. controlling, was measured by a survey which asked the employees whether they see the pay system and wage bonuses as an appreciation of outstanding employee effort or a pat on the shoulder or a management control device. Andersen and Pallesen found a positive correlation between the financial incentives perceived as supportive and the number of publications. However, not the perceived supportiveness per se but its combination with the strength of the financial incentives led to the increase in publications. Like in Frey's study, when the incentives were perceived as controlling, stronger financial incentives to publish more scientific work reduced the number of publications.

Agency theory assumes that pay policies should motivate scientists and their departments to invent new technology and disclose such discoveries to their respective TTOs (Markman et al., 2004). In contrast, it was reported by Colyvas et al. (2002) that financial incentives were not effective in motivating academicians to commence invention-producing research projects. Markman et al. (2004) found a negative relation between monetary incentives given to scientists who had successfully-licensed inventions and the number of new licenses granted by young ventures as well as the number of startups. Similarly, sharing revenues with (paying royalties to) scientists' departments is significantly yet negatively related to the number of incubators. Finally, another hypothesis, which predicted a positive relationship between salary of TTO personnel and entrepreneurial activity, was supported; TTO salary was significantly and positively related to the number of equity licenses and to the number of new ventures, but not to the number of university business incubators. The results surprisingly show that incentives to scientists and to their departments are negatively related to entrepreneurial activity.

Lam (2011) proposed that individuals could be extrinsically or intrinsically motivated to different degrees in their pursuit of a commercial activity. He broke the motivational aspects into three concepts; 'gold' (for financial rewards), 'ribbon' (for reputational/career rewards) and 'puzzle' (for intrinsic satisfaction). According to this study, 'gold', while undermining the reputational-based reward system can be the

choice of some AEs whereas ribbon is the most common choice among scientists as it enables the scientists to gain vast recognition and prestige from peers and usually allows them to enjoy additional rewards such as higher salary and more research funds. Puzzle is considered a reflection of the Mertonian world of scientific research, where the reward system in science is mainly based on recognition and esteem awarded by the scientific community to those who make genuine contributions to the knowledge stock of science. On the other hand, some AEs who fall within the 'puzzle' category are intrinsically motivated to advance knowledge, and they also derive immense satisfaction from engaging in challenging and creative activities. Lam (2011) found that the great majority of the scientists were motivated by the rewards of the 'ribbon', using commercial activities as a means to generate resources for their research while the 'gold' which puts the emphasis on pecuniary rewards, although not completely irrelevant, is seen as important by a much smaller proportion of the scientists.

The findings of Lam's (2011) study suggest that policies designed to promote research commercialization often favor financial incentives tied to successful exploitation of ideas. If this is the case, academics motivated by a complex mix of extrinsic and intrinsic rewards can benefit little from policy initiatives focusing narrowly on providing financial rewards. Moreover, the diverse values and motives underlying scientists' commercial pursuits would mandate a differentiated approach if the policy is desired to be effective (Lam, 2011).

Clarysse et al. (2011) constructed four hypotheses to test whether the entrepreneurial capacities of AEs, past entrepreneurial experiences, living in an environment where academic entrepreneurship is stimulated and starting a career after the creation of a central TTO at the university influence positively entrepreneurial pursuits. After defining "opportunity recognition capacity" as "the capability to identify a chance to combine resources in a way that might generate a profit", they concluded that such entrepreneurial capacity was the single most important variable explaining entrepreneurs' engagement in commercial activities. Authors also stated that the role of

the TTOs in increasing the entrepreneurial activities of academics appears to be rather limited, or even non-existent.

Bercovitz and Feldman (2008) examined the backgrounds and work environments of academicians and followed their engagement with academic entrepreneurship. After constructing eight hypotheses, they reached a number of results regarding the relationship between organizational change and the tendency to follow the change. They found that individuals were more likely to pursue commercialization activities if they have been trained at institutions that had been active in technology transfer. They also concluded that the longer the time that had elapsed since graduate training, the less likely the individual was to accept commercialization norms. They found that when the chair of the department was active in the technology transfer, other members of the department were also likely to participate, but only for symbolic reasons. Lastly, they came to the conclusion that that technology transfer behavior was directed by the experience of those who have already undertaken technology transfer activities.

Beyhan and Rickne (2015) explored the motivations of academic nanotechnology scientists to interact with industry and identified three main motivations for them: 1) to increase resources for academic research; 2) to learn from firms; 3) to commercialize research results. They found that the importance of motivations differed according to the forms of commercial activity. While consulting was motivated by commercialization, research-based interactions were driven by aims to either commercialize or to learn from firms. Finding new financial resources for academic research was also a strong impetus for informal interactions. In short, entrepreneurial (monetary) and traditional (non-monetary) motivations co-exist in certain contexts; and nanoscientists displayed hybridized motivations mixing entrepreneurial motivations with more traditional ones.

Jain et al. (2009) observed that scientists did not give up their academic role identity when they were involved in entrepreneurial undertakings. Just like in Beyhan and Rickne (2015), scientists adopted a “hybrid role identity that comprised a focal

academic self and a secondary commercial persona". Their findings suggested that university scientists took steps to preserve their academic role identity even when they participated in the technology transfer process. Therefore, the role identities of scientists ranged from a pure scientist of the Mertonian world to pure entrepreneur who had a commercial mindset.

The same study defined two terms, 'delegating' and 'buffering', which constituted two key mechanisms that AEs put into play in order to mitigate the negative effects of identity interference. Delegating means that scientists focus on establishing appropriate links with other individuals – in our out of the university – who possess skills required to commercialize their technologies. Examples for delegating are hiring business people to manage the business tasks, perhaps CEO to manage the company or seeking the assistance of the TTO to commercialize in-house technologies. Buffering means that scientists take steps to protect their academic role identity and make sure that norms typically associated with commercialization do not influence their cherished values. Buffering is best described by the notion "academics come first", hence prioritizing the university work rather than the commercial activity. Giving up on an entrepreneurial project to save more time and resources for academic work or speaking up in public about a new technology in opposition to patenting concerns are good examples for buffering (Jain et al. 2009).

After testing eight hypotheses they have constructed, Krabel and Mueller (2009) stated that there was a positive relationship between patenting activity and entrepreneurship among the Max Planck Institute scientists. They also indicated that scientists with close ties to industry possessed a strong entrepreneurial perspective. They went on to indicate that scientists who had already collaborated in the past with private companies in research projects were more perceptive to entrepreneurial opportunities including starting up a business. They further stated scientists who had past career experience in firm founding and business ownership had a tendency to pursue entrepreneurial activities again. Another result they reached was that commercialization activities of colleagues working in the same research field influenced their decision to start a

business. Finally, they stated that the personal attitude towards commercialization activities might influence the decision to pursue entrepreneurial activities. In addition to these positive relationships, the authors found two negative links not in favor of taking up commercial activities. Firstly, scientists who strongly agreed that science was a public good to be freely available to anyone were significantly less likely to engage in entrepreneurship. Secondly, past work experience in the private sector as an employee or a consultant did not seem to be important for pursuing commercialization activities.

According to Mosey and Wright (2007), AEs with prior business ownership experience can build broader social networks and are more effective in developing network ties. AEs with less experience in business ownership, however, encounter structural holes between their scientific research networks and industry networks. Structural holes are obstacles that constrain the development of nascent and novice entrepreneurs. For example, nascent entrepreneurs appeared unable to engage with industry actors to match their nascent technologies to a market need. Moreover, entrepreneurs' ability to gain entrepreneurial commitment, opportunity recognition, venture credibility and venture reorientation appear to be constrained by structural holes between faculty members and financiers and professional managers. The authors also found an association between the nature of social capital and the academic discipline base. It is easier for novice entrepreneurs from engineering and the material sciences to build network ties than those from biological sciences. Finally, they reported that AEs appeared distinctive from their non-academician commercial sector peers in terms of the relationships with research colleagues but this also differed according to business ownership experience: less experienced entrepreneurs valued them as potential role models while experienced entrepreneurs valued them as potential sources of technological opportunities.

Göktepe-Hulten and Mahagaonkar (2010) found that expectation of financial benefits was not related with the patenting activities of scientists without industrial cooperation; on the contrary their patenting and disclosures activities were correlated with their expectation to gain/increase reputation through commercial activities. Increase in

reputation may in turn increase the possibility to gain academic promotion, financial benefits through industrial collaboration etc., rather than the immediate personal financial gains. The scientists think that patenting can benefit the firm[9] but not the individual himself/herself, therefore a non-cooperating scientist's expectation for greater income lies elsewhere. However, the scientists involved in industrial cooperation seem to be driven by the firm in context and its motives, i.e. by financial gains.

D'Este and Perkmann (2011) presented results from a large scale survey of physical and engineering faculty members at UK universities and found that the main purpose of academics in engaging with industry was to support their academic research activities. Commercialization ranked as the least important motivation while research-related reasons dominated. They also found that the academics' motivations differed depending on the channel of engagement. While patenting (especially in life sciences) and spin-off founding were motivated by commercialization, collaboration was dominated by research-related motivations, including learning from industry and fund-raising. After identifying four main motivations as "commercialization (commercial exploitation of technology or knowledge); learning (informing academic research through engagement with industry); access to funding (complementing public research monies with funding from industry); and access to in-kind resources (using industry-provided equipment, materials and data for research)", they found that most academics engage with industry in order to further their own research, either through learning or through access to funds and other resources. In addition, commercialization on average was ranked lowest by their survey respondents. Academics motivated by learning frequently engaged in joint research, contract research and consulting, while motivations related to commercialization of research led to engagement in activities such as patenting, spin-offs and consulting. Lastly, they came to the conclusion that the nature of academic researchers' interactions with industry is complex and the vision of entrepreneurial university is far from neatly capturing these interactions.

[9] Companies draw benefits from patents in terms of investment, firm growth, resource use and knowledge sharing.

2.4. Challenges faced by AEs

In transferring their research know-how into the commercialization phase, AEs may have to face challenges beyond those faced by non-academic entrepreneurs. The academic entrepreneurship process may be inhibited by a lack of business experience and commercial skills among academics (Vohora et al., 2004). Faculty members may skillfully innovate within the research domain but this skill may not be sufficient for identifying opportunities within the commercial context (Lockett et al., 2003). An AE's field of research and the extent to which the TTO supports the AE's commercialization efforts directly affects the magnitude of these challenges. Challenges may be due to lack of finance or time and they may contradict with the AE's support of open science (Bönte, 2011). AEs may have difficulties in raising social capital due to remaining within the walls of a university which is traditionally a noncommercial environment. (Mustar et al., 2006; Nicolaou & Birley, 2003). As such, AEs may not have developed the capability to move from scientific networks to commercial networks (Vohora et al., 2004).

Jain et al. (2009) mentioned some challenges reported by the scientists included in the study. One concern was that a scientist was a scientist and had no time for tasks such as patenting and licensing as these tasks interfered with an AE's teaching and research efforts. Another concern was about the hurdles related to delays in dissemination of results, an issue that is bolstered by the secrecy agreements signed with TTOs, something that did not fit well into the Mertonian world. Another challenge raised was that the scientists did not know how to create markets to take their products to success. Concerns about the administrative side of commercial pursuit, such as project management, decent documentation, a need to have well-defined procedures were also raised by the AEs. According to Jain et al. (2009), the challenges that academics face in adopting a hybrid role identity manifest themselves at multiple levels between being the focal academic self on one end and developing a secondary commercial persona on the other. Pragmatically, this duality necessitates that the AEs allocate time and effort across a larger set of activities. Normatively, this causes dilemmas about what

constitutes appropriate professional conduct. Functionally, it requires the development of new abilities and skills more relevant to the new role. For example, one challenge reported is the interference of the time required by patenting and licensing work with the AE's research and teaching efforts. Another challenge is the hurdles concerning the delay in the dissemination of results. For example, the TTO asks AEs to maintain secrecy regarding their discovery to ensure patent protection and avert scientific findings from being prematurely disclosed in conferences. Moreover, attributes and skills required for commercialization effort, such as financial skills or ability to create markets may not be required for carrying out academic activities (Jain et al., 2009). Examination of the key challenges that had to be faced by the nascent AEs at the Massachusetts Institute of Technology (MIT) revealed a number of significant results. One result is that research-based ventures first have to demonstrate that the technology development is complete prior to the commercialization phase. However, AEs spend years in the research phase, therefore the challenges can be exacerbated if these nascent AEs are perceived as typical high-technology startups. Identification of a clear business opportunity in order to trespass into a technology-based phase poses another challenge because that opportunity may not yet be clearly visible for the nascent AE. Especially if the entrepreneurial pursuit is curiosity-driven, the AEs may develop an idea for which somebody else would assume the commercialization effort, which means that there is no dedication to the technology-based phase. Each phase requires different focus of the nascent AEs, thus transition from the research-based phase to the technology-based phase is the utmost challenge. Furthermore, the findings also indicate that nascent AEs may find themselves stuck in the research-based phase if they fail to identify a clear entrepreneurial opportunity and do not act to reconfigure themselves as per the requirements of the transition process (Lubynsky, 2013).

Current challenges of academic startups were listed in another study as lack of commitment towards internationalization, lack of managerial experience and skills and lack of resources for the internationalization (Gómez-Gras et al., 2007). Since technological innovations reduce the cost of international collaboration, hence facilitate international activities, creating a global vision emerges as a target to be achieved by

AEs. Without such vision, AEs may not be able to recognize and exploit international business opportunities as they have little or no management experience although they have massive research-based experience. However, taking up international activities requires knowledge of international markets and an international network which may not be reached by AEs at the early stage of the firm. Furthermore, global academic startups have to deal with the lack of resources, such as time, money and credibility. Especially in terms of finances, high R&D expenditures accrued by the startup may not often be offset by only a small domestic market especially when the product life-cycle is short (McDougall and Oviatt, 1996). Therefore, AEs need to develop a network of foreign collaborators and to do that they need to travel a lot which requires both money and time in an environment already dedicated to academic work (Gómez-Gras et al., 2007).

Nyeko and Sing (2015) tackled the challenges faced by academic-entrepreneurs and reported that academics perception of the original purpose of university existence, legislative and policy issues and lack of organizational-owned resources for entrepreneurial ventures were the major challenges faced by academic-entrepreneurs. The loss of time originally allocated for the traditional academic roles of research and teaching led many academics argue that the role of the university was not to do business, but to support business (Henrekson and Rosenberg, 2001). Different legislative systems and policies across the nations can hinder cross border academic-entrepreneurship by preventing the AEs from moving temporarily between private and public sectors to develop their discoveries (McDougall and Oviatt, 1996).

The three competencies, opportunity refinement, leveraging and championing, I discussed in Section 2.1. with reference to Rasmussen et al. (2011) actually constitute distinctive challenges for AEs. Opportunity refinement competency, defined as discovering and distinguishing between opportunities seems to be a challenge for AEs since this competency is less likely to be present in AE firm founders but it is open to development through iteration with industry partners and customers. Moreover, a lack of leveraging competency in form of not being able to access resources from industrial

partners and communicate to external investors is also a challenge for AEs. But again AEs can acquire this from actors both internal and external to the university. Lastly, having a championing competency constitutes a challenge for the AE, because gaining external champions residing within industrial partners or other resource providers may be particularly difficult for AEs who lack entrepreneurial experience (Rasmussen et al., 2011).

2.5. A wrap up of the literature review

In Chapter 2, I first tried to provide a review of what academic entrepreneurship is. Secondly, I provided a review of how universities play the role of facilitator in spawning private businesses. Thirdly, I focused on the literature covering the motivations of AEs in engaging commercialization activities. Lastly, I put forward the literature explaining the challenges that AEs had to face throughout the innovation system. I will now try to wrap up the main assumptions and findings covered in this chapter.

Table 4. A wrap-up of the literature review

Definition of AE	Academic entrepreneurship refers to activities carried out by universities to promote commercialization on campus and in surrounding regions of the university **(Siegel and Wright, 2015).** **Meyer, 2003, Dickson et al., 1998** AEs are: • academicians who engage in entrepreneurship activities in addition to their academic work • entrepreneurs who start a business and occupy themselves full-time with it in dedication to their scientific fields of interest • individuals who manage their scientific business enterprise owing to their scientific and business know-how.
Scope of academic entrepreneurship	**Krabel and Mueller (2009), Gulbrandsen (2005)** Patenting, Licensing, Consulting, Firm founding
Types of AEs	**Nyeko and Sing, 2015** **Academic entrepreneurs** are academic faculty members who engage in the commercialization of academic intellectual property. **Entrepreneurial academics** are managerial change agents in universities who establish research and teaching enterprises outside the walls of the university by utilizing external funding sources. **Academic-entrepreneurs** are faculty members who undertake commercial activities outside the academic circle with or without the involvement of the university. **Etzkowit, 1998** The **"hands-off"** AEs leave the commercialization matters to the hands of the TTO. AEs as the **"knowledgeable participants"** who are willing to play a significant role in participation to the commercialization process. The **"seamless web",** i.e. the integration of campus research groups with company research programs. **Liminality:** AEs are actually a liminal (in-between) group, i.e. at a boundary between the industry and academics rather than inside both of them. This allows them to develop a flexible networking and commercialization process.

Table 4. Cont'd

Phases of academic entrepreneurship	**Tijssen, 2006** **Application-driven–science-oriented phase** in which the entrepreneurship awareness in the university or the industry perception of the researchers are augmented. **Product-oriented–utility-driven phase.** Prototype implementation associated with the R&D work is undertaken in line with the customer demands; business ideas and concepts are developed; maintenance and support mechanisms are sought; administrative, financial and organizational capabilities and strategies are strengthened. **Business-oriented–market-driven phase** during which market studies are conducted, business plans are drawn up, intellectual property right issues are clarified and resolved and the first sales efforts yielding income generation are carried out.
Competencies of AEs	**Rasmussen et al., 2011** **Opportunity refinement:** Discovering and distinguishing between opportunities in order to transform scientific research into viable business concepts by attracting new employees with industrial experience who can identify and interact with industrial partners. **Leveraging competency:** AEs evolve their credibility and entrepreneurial experience to integrate the internal and external resources by also receiving help from the university, TTO and public support schemes. **Championing competency:** Developing an ability to include external champions as resource providers by convincing them to contribute to the venture's development. Competency development process is 'an entrepreneurial ability to identify, develop and complete new combinations of existing asset bundles or new unmet opportunities (**Godfrey and Gregerson, 1999).** Firm-founding and successful management is closely associated with specific resources and capabilities, such as: • intellectual human capital **(Zucker et al., 1998),** • technological resources **(Heirman and Clarysse, 2004),** • academic characteristics **(Di Gregorio and Shane, 2003)** • routines like teaching, research and publications **(Lockett and Wright, 2005).** **Rahim et al. (2015):** Risk taking, bravery, sufficient knowledge, values, strategic thinking and self-confidence.

Table 4. Cont'd

<table>
<tr><td rowspan="5">Universities as key elements of the innovation system</td><td colspan="3">Today universities have three missions:
• Teaching
• Research
• Entrepreneurship

The third mission ensures competitiveness and economic development either by interacting with the industry or by implementing other types of commercialization activities such as the establishment of new firms (Gómez-Gras et al.).

This transformation of the role to include a third mission for a university is referred to in the literature as "from ivory towers to engines of economic growth" (D'Este & Perkmann, 2011). Priorities and scope of university-industry collaboration differ significantly between developed and developing countries (Guimon, 2013).</td></tr>
<tr><td></td><td>Most developed countries</td><td>Least developed countries</td></tr>
<tr><td>Teaching University</td><td>• Private participation in graduate programs
• Joint supervision of PhD students</td><td>• Curricula development to improve undergraduate and graduate studies
• Student internships</td></tr>
<tr><td>Research University</td><td>Research consortia and long term research partnerships to conduct frontier research.</td><td>• Building absorptive capacity to adopt and diffuse already existing technologies
• Focus on appropriate technologies to respond to local needs</td></tr>
<tr><td>Entrepreneurial University</td><td>• Spin-off companies, patent licensing
• Entrepreneurship education</td><td>• Business incubation services
• Entrepreneurship education</td></tr>
</table>

Table 4. Cont'd

Universities as key elements of the innovation system	**D'Este & Perkmann, 2011)** Critics to this entrepreneurial university phenomenon: • Academic science is being instrumentalized and even manipulated by industry • 'Entrepreneurial science' might have a detrimental effect on the long-term production of scientific knowledge. • Universities may become 'knowledge businesses' that serve the interests of specific stakeholders rather than generating public goods for national audiences. • Other risks may also emerge such as a shift from basic research towards more applied topics and less academic freedom, lower levels of research productivity among academics and a slowing-down of open knowledge diffusion. Announcements of the 'entrepreneurial university' may be premature and based on an overstated generalization of insights from the life sciences **(D'Este & Perkmann, 2011).** In fact, the growth of polyvalent research fields with simultaneous theoretical, technological, and commercial potential is the reason why entrepreneurial universities that retain the classic features of the "ivory tower" research universities have been emerging **(Etzkowitz, 2008)**. The entrepreneurial university is a contemporary phenomenon where academia takes a leading role of production based on continuous organizational and technological innovation **(Etzkowitz, 2008)**. **Etzkowitz (2008)** listed five norms of the entrepreneurial university and stated that the optimal result would be reached when there was a balance between them. • Capitalization • Interdependence • Independence • Hybridization • Reflexivity In accepting this new task, universities become part of a coherent system involving the interaction among industry, government, innovation and economic progress **(Etzkowitz and Leydesdorff, 2000).**

Table 4. Cont'd

Universities as key elements of the innovation system	An entrepreneurial university is one that welcomes a culture of entrepreneurship and installs an entrepreneurial mindset in every graduate, 'no matter what their interests, dreams and values happen to be' **(Thorp and Goldstein, 2010).** **Zhou (2007)** state the three primary characteristics of an entrepreneurial university as: • systematic acceptance of and support for entrepreneurship activities • intermediary structures, such as a technology transfer offices • a significant number of faculty members willing to form firms **Siegel and Wright, 2015** Key elements of the university ecosystem facilitating entrepreneurship include: • the rise of institutions such as business incubators and science/technology/research parks in support of technology transfer and entrepreneurship, • significant increase in the on-campus entrepreneurship courses and programs (in multiple faculties/schools) • establishment and growth of entrepreneurship centers, • a rise in the number of "surrogate entrepreneurs" on campus to stimulate commercialization and start-up creation, • an increase in the support of entrepreneurial ecosystem by alumni commercialization funds and student business plan competitions. **Meyers & Pruthi, 2011** A set of criteria for a sound entrepreneur university: • Top-down vision, strategy and leadership of the university administration • clearly defined entrepreneurship learning objectives that drive the curriculum • robust internal and external networks • a culture of innovation; and • experiential learning and knowledge-transfer opportunities **De Silva et al. (2012)**: Resource constraints did not totally inhibit entrepreneurial efforts of the AEs in a resource-constrained environment because AEs overcame various resource barriers. **Franklin et al. (2001)**: Old universities with well-established research reputations where the most suitable policies have been adopted in favor of entrepreneurs generate the most startups.

Table 4. Cont'd

Motivating forces behind academic entrepreneurship	**Frey (1997)** • Financial incentives have the potential to **"crowd in" intrinsic motivation** and increase the work effort if researchers perceive those financial incentives as supportive. • An opposite effect occurs if financial incentives are perceived as controlling, and this time the **intrinsic motivation is ''crowded out''** eventually causing a decrease in the work effort despite the increasing financial incentives. **Andersen and Pallesen (2008)** • A positive correlation between the financial incentives perceived as supportive and the number of publications. • However, not the perceived supportiveness per se but its combination with the strength of the financial incentives led to the increase in publications. • When the incentives are perceived as controlling, stronger financial incentives to publish more scientific work reduce the number of publications. **Markman et al. (2004)** • A negative relation between monetary incentives given to scientists who had successfully licensed inventions and the number of new licenses granted by young ventures as well as the number of startups. • Sharing revenues with scientists' departments is negatively related to the number of incubators. • TTO salary was positively related to the number of equity licenses and to the number of new ventures, but not to the number of university business incubators. **Lam (2011)**: Rewards for motivation: **'ribbon'**: using commercial activities as a means to generate resources for their research. **'gold'**: putting the emphasis on pecuniary rewards, although not completely irrelevant, is seen as important by a much smaller proportion of the scientists. **'puzzle':** intrinsic satisfaction, problem solving. The great majority of the scientists were motivated by the rewards of the 'ribbon'. 'Gold' is seen as important by a much smaller proportion of the scientists. Policies designed to promote research commercialization often favor financial incentives tied to successful exploitation of ideas. If this is the case, academics motivated by a complex mix of extrinsic and intrinsic rewards can benefit little from policy initiatives focusing on providing financial rewards.

Table 4. Cont'd

Motivating forces behind academic entrepreneurship	**Clarysse et al. (2011)** • **"Opportunity recognition capacity":** The capability to identify a chance to combine resources in a way that might generate a profit • Such entrepreneurial capacity is the single most important variable explaining entrepreneurs' engagement in commercial activities. • The role of the TTOs in increasing the entrepreneurial activities of academics appears to be rather limited, or even non-existent. **Bercovitz and Feldman (2008)** • Individuals are more likely to pursue commercialization activities if they have been trained at institutions that had been active in technology transfer. • The longer the time that had elapsed since graduate training, the less likely the individual was to accept commercialization norms. • When the chair of the department is active in the technology transfer, other members of the department are also likely to participate, but only for symbolic reasons. • Technology transfer behavior is directed by the experience of those who have already undertaken technology transfer activities. **Beyhan and Rickne (2015)** Identified three main motivations for motivations of academic nanotechnology scientists to interact with industry: • to increase resources for academic research; • to learn from firms • to commercialize research results. Entrepreneurial (monetary) and traditional (non-monetary) motivations co-exist in certain contexts; and nanoscientists hybridized entrepreneurial motivations with more traditional ones. **Jain et al. (2009)** **Delegating:** Scientists establish appropriate interfaces with other actors whom they view as possessing skills related to commercializing their technologies. Examples for delegating are hiring business people to manage the business side, perhaps even a CEO to run the company or seeking more involvement from the TTO to commercialize in-house technologies. **Buffering:** Scientists take steps to protect their academic role identity and preserve certain cherished values from the influence of norms typically associated with commercialization.

Table 4. Cont'd

Motivating forces behind academic entrepreneurship	**Krabel and Mueller (2009)** • There is a positive relationship between patenting activity and entrepreneurship among the Max Planck Institute scientists. • Scientists with close ties to industry firms possessed a strong entrepreneurial perspective. • Scientists who had already collaborated in the past with private companies in research projects were more alert to entrepreneurial opportunities including starting up a business. • Past career experience in firm founding and business ownership signaled scientists' tendency to engage in entrepreneurial pursuit again. • Commercialization activities of colleagues working in the same research field influenced their decision to start a business. • The personal attitude towards commercialization activities might influence entrepreneurial action. • Scientists who strongly agreed that science was a public good to be freely available to anyone were significantly less likely to engage in entrepreneurship. • Past work experience in the private sector as an employee or a consultant did not seem to be important for pursuing commercialization activities. **Mosey and Wright (2007)** • AEs with prior business ownership experience can build broader social networks and are more effective in developing network ties. • AEs with less experience in business ownership, however, encounter structural holes between their scientific research networks and industry networks. **D'Este and Perkmann (2011)** • Main purpose of academics in engaging with industry is to support their academic research activities. • Commercialization ranked as the least important motivation while research-related reasons dominated. • The nature of academic researchers' interactions with industry is complex and the vision of entrepreneurial university is far from neatly capturing these interactions.

Table 4. Cont'd

Challenges faced by AEs	Lack of business experience and commercial skills among academics **(Vohora et al., 2004).** Faculty members may skillfully innovate within the research domain but this skill may not be sufficient for identifying opportunities within the commercial context **(Lockett et al., 2003).** Challenges may be due to lack of finance or time and they may contradict with the AE's support of open science **(Bönte, 2011).** AEs may have difficulties in raising social capital due to remaining within the walls of a university which is traditionally a noncommercial environment. **(Mustar et al., 2006; Nicolaou & Birley, 2003).** As such, AEs may not have developed the capability to move from scientific networks to commercial networks **(Vohora et al., 2004).** **Jain et al. (2009)** • A scientist is a scientist and has no time for tasks such as patenting and licensing as they interfere with teaching and research efforts. • There are hurdles related to delays in dissemination of results, an issue that is bolstered by the secrecy agreements signed with TTOs, • Scientist did not know how to create markets to take his/her products to success. Lack of commitment towards internationalization, lack of managerial experience and skills and lack of resources for the internationalization **(Gómez-Gras et al., 2007)**. **Lubynsky, 2013** • Research-based ventures first have to demonstrate that the technology development is complete prior to the commercialization phase. • However, AEs spend years in the research phase, therefore the challenges can be exacerbated if these nascent AEs are perceived as typical high-technology startups. • AEs may find themselves stuck in the research-based phase if they fail to identify a clear entrepreneurial opportunity and do not act to reconfigure themselves as per the requirements of the transition process.

Table 4. Cont'd

Challenges faced by AEs	Global academic startups have to deal with the lack of resources, such as time, money and credibility. Especially in terms of finances, high R&D expenditures accrued by the startup may not often be offset by only a small domestic market especially when the product life-cycle is short **(McDougall and Oviatt, 1996)**. Academics perception of the original purpose of university existence, legislative and policy issues and lack of organizational-owned resources for entrepreneurial ventures are the major challenges faced by **academic-entrepreneurs (Nyeko and Sing, 2015).** Different legislative systems and policies across the nations can hinder cross border academic-entrepreneurship by preventing the AEs from moving temporarily between private and public sectors to develop their discoveries **(McDougall and Oviatt, 1996).** **Rasmussen et al., 2011** • Opportunity refinement competency: Discovering and distinguishing between opportunities seems to be a challenge for AEs since this competency is less likely to be present in AE firm founders but it is open to development through iteration with industry partners and customers. • A lack of leveraging competency: Not being able to access resources from industrial partners and communicate to external investors is also a challenge for AEs. But again AEs can acquire this from actors both internal and external to the university. • Championing competency constitutes a challenge for the AE, because gaining external champions residing within industrial partners or other resource providers may be particularly difficult for AEs who lack entrepreneurial experience.

CHAPTER 3

METHODOLOGY

3.1. The sequence of work carried out

A sequence of activities carried out within the scope of this thesis is summarized in the below figure:

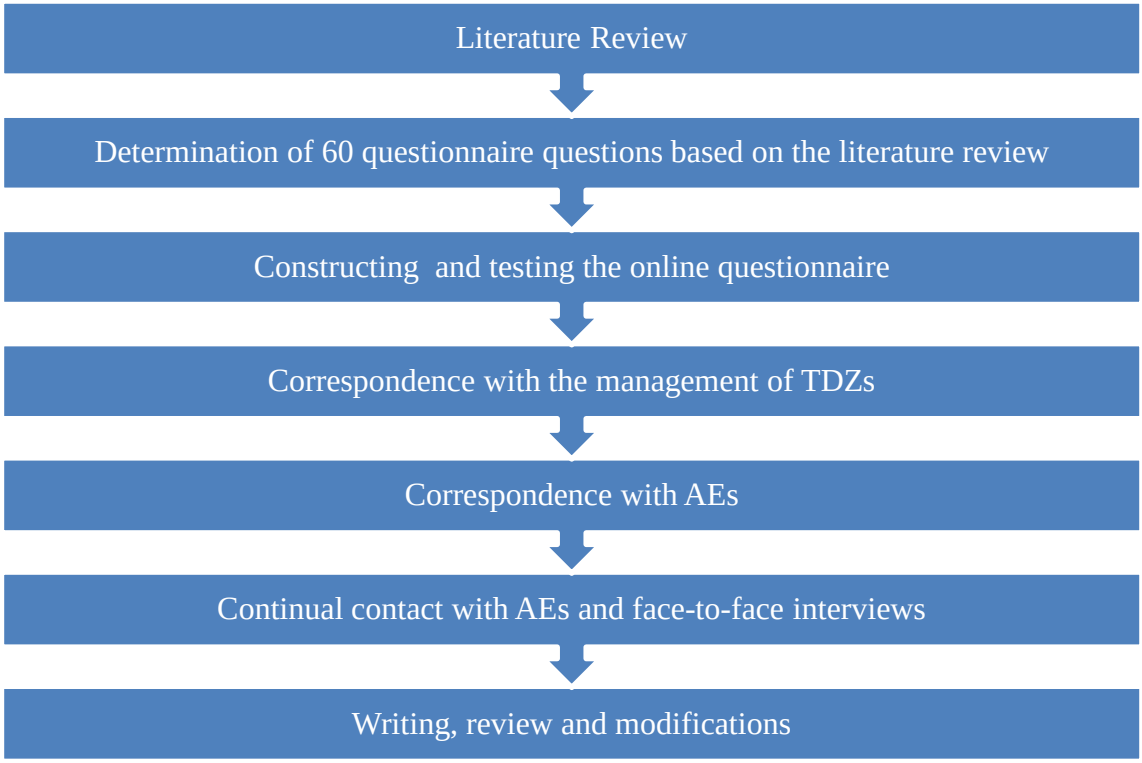


Figure 1. The sequence of work carried out

A thorough literature review provided the basis to construct the questions for the online questionnaire. 60 questions were selected and the online questionnaire to be answered anonymously was constructed on the online survey system “surveey.com”. Before the

questionnaire was casted for open access of the AEs, it was tested for validity, functionality and possible errors. The validity test was performed by three individuals. The first one was myself. The second person was an electronics engineer with a Ph.D. degree who worked for an R&D company. The third individual was one of the AEs who was among the respondents of the questionnaire and also was one of the interviewees. This pilot test phase made sure that there were not any errors in the questionnaire and that it functioned properly and generated proper result files. The content of the online questionnaire can be seen in Appendix 1.

The next phase comprised writing an official letter from the Chair of the Science and Technology Policy Studies (STPS) to the administrations of five prominent technology development zones, namely, Ankara University Teknokent Inc., Bilkent University Teknopark Inc., Gazi University Teknopark Inc., Hacettepe University Teknokent Inc., and Middle East Technical University (METU) Teknokent Inc. The letters can be found in Appendix 2. The TDZ administrations were requested to forward the online questionnaire link to the AEs active on their respective premises and send me the names and contact details of the AEs so that I could visit them for face-to-face interviews. Reminder e-mails were also sent to the TDZ administrations following a period of one month after the letters were sent out. The METU Teknokent Inc. kindly wrote an e-mail to the AEs active on its premises and informed them of my request. The METU Teknokent Inc. also provided me with the names and details of a total of 76 AEs operating on its premises after signing and submitting to it a confidentiality agreement which can be found in Appendix 3. It later turned out that the TDZ administrations other than that of METU have not forwarded the STPS letter to the AEs active on their premises despite all the reminding efforts. This led to a very small number of AEs to fill out the online questionnaire. A total of only 23 replies were received. Most of these were from the METU Teknokent and after personal efforts a few were provided by AEs active at other TDZs. The number of AEs who have accepted my face-to-face interview request was even less. After contacting the AEs present on the list provided by the METU Teknokent Inc. and some other that I have found with my personal efforts from other TDZs, I was able to visit a total of 18 AEs

who have accepted my interview request. A single case design analysis method was adopted in the analysis of the results obtained. The findings obtained from both the questionnaire and face-to-face interviews were used to make an analysis of the motivational aspects of AEs, the challenges they face, their success criteria and finally come up with reasonable policy recommendations in this regard.

3.2. Research design

The primary question reflecting the aim of this study can be summarized as "what are the elements affecting the establishment and management of businesses run by university scientists?" In this respect, this thesis focuses on the motivational aspects of academicians in starting their own businesses, the challenges that they face in their business environment as well as their success criteria. The behavioral patterns and other factors driving these three elements (motivational factors, challenges faced and success criteria) would very much affect the university and government policies aiming to promote university-industry collaboration. In so doing, the validity of six propositions were explored in this thesis and consequently policies for the government, industry actors and universities were announced.

For this reason, the research design of this thesis was initially intended to be **“Conclusive Research”**, because this study aims to generate findings that are practically useful in reaching conclusions or decision-making. Moreover, research objectives and data requirements in Conclusive Research are clearly defined. Conclusive research design usually involves the application of quantitative methods of data collection and data analysis. Moreover, conclusive studies tend to be deductive in nature and research objectives in these types of studies are achieved via testing hypotheses. When the features of Conclusive Research are compared with the characteristics of this thesis, the following information comes about.

Table 5. Comparison between conclusive research and the characteristics of this thesis

Factor	Conclusive Research	This Thesis
Objectives	To test hypotheses and relationships.	Partially valid: Initial objective was to test hypotheses but ended up exploring propositions due to insufficient sample size.
Characteristics	• Information needs are clearly defined. • Research process is formal and structured. • Large representative sample. • Data analysis is quantitative.	• Valid. • Valid • Not valid. • Valid for the questionnaire findings.
Findings	Conclusive.	Valid.
Outcome	Findings used as input to decision-making.	Valid.

While many aspects of Conclusive Research are valid for this thesis, one important requirement is missing. A large representative sample could not be attained. Despite lack of such requirement, the research design of this thesis in my opinion may be considered to be in line with the Conclusive Research method.

3.3. Research method

A comprehensive online questionnaire and face-to-face interviews have been used in this thesis as data collection tools. The sampling method used in the thesis falls under the "**non-probability sampling"** (also known as non-random sampling) method where not all members of the population has a chance to participate in the study. This is contrary to probability sampling, where each member of the population has a known, non-zero chance of being selected to participate in the study.

Necessity for non-probability sampling can be explained in a way that for some studies it is not feasible to draw a random probability-based sample of the population due to

time and/or cost considerations or simply because it is not possible to constitute the desired sample due to the inexistence of a sample frame or to the refusal to answer of potential sampling units. In these cases, sample group members have to be selected on the basis of accessibility or personal judgment of the researcher. Therefore, the majority of non-probability sampling techniques include an element of subjective judgement. Non-probability sampling is the most helpful for exploratory stages of studies such as a pilot survey. However, disadvantages of non-probability sampling include the following all of which are true for this thesis:

- Unknown proportion of the entire population is not included in the sample group i.e. lack of representation of the entire population,
- Lower level of generalization of research findings compared to probability sampling,
- Difficulties in estimating sampling variability and identifying possible bias.

3.3.1. The questionnaire

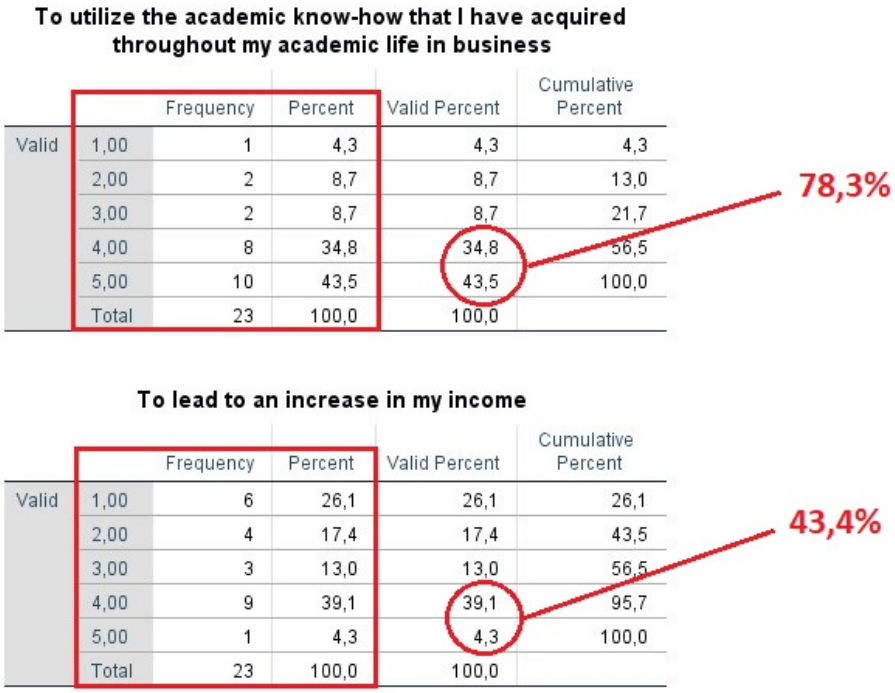
The online questionnaire consists of the following types of 60 questions:

- Multiple choice questions: Respondents are offered a set of answers they have to choose from.
- Dichotomous Questions: This type of questions gives two options to respondents – yes or no, to choose from.
- Scaling Questions. Also referred to as ranking questions, they present an option for respondents to rank the available answers to the questions on the scale of given range of values (e.g. from 1 to 10).

The sampling method used in the online casting of the questionnaire falls under the **“quota sampling”** method which is a non-probability sampling and can be defined as a sampling method of gathering representative data from a group. Application of quota sampling ensures that sample group represents certain characteristics of the population

chosen by the researcher. Quota sampling can be divided into two groups: controlled and uncontrolled. Controlled quota sampling involves introduction of certain restrictions in order to limit researcher's choice of samples. Uncontrolled quota sampling, on the other hand, allows the researcher to freely choose sample group members according to his/her will. Therefore, the sampling method in the application of the online questionnaire is **"uncontrolled quota sampling"**.

The structured questionnaire which contained 60 questions comprised four main sections, namely questions about personal information on AEs, questions inquiring their motivations, questions inquiring the challenges they face and questions designed to understand their success criteria throughout their entrepreneur lives. The three comprehensive questions, the first being "What were the motivational determinants that caused you to take on entrepreneurship activities?", the second "What are the main challenges that you have encountered throughout your entrepreneurship?" and the third "What are your success criteria in context of your firm activities?" were structured to have multiple answers to score (13 answers for the first question, 15 answers for the second question and 13 answers for the third question). For each of the three mentioned questions, AEs were asked to score each answer as follows: 1 point if the answer is "Not effective" in contributing to the question asked, 2 points for "Very little effective", 3 points for "Little effective", 4 points for "Quite effective", and 5 points for "Very effective". In other words, the voting was based on a scoring system from 1 to 5 points. The evaluation of the replies aimed to understand which factors contributed the most to the three above-mentioned questions. Then, I calculated the descriptive statistics which put forward the percentages of each score that corresponded to each contributing factor. To clarify this method, let us focus on 2 of the 13 answers given to the question "What were the motivational determinants that caused you to take on entrepreneurship activities?" The two sample answers are "to utilize the academic know-how that I have acquired throughout my academic life in business" and "to lead to an increase in my income."



To utilize the academic know-how that I have acquired throughout my academic life in business

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	1	4,3	4,3	4,3
	2,00	2	8,7	8,7	13,0
	3,00	2	8,7	8,7	21,7
	4,00	8	34,8	34,8	56,5
	5,00	10	43,5	43,5	100,0
	Total	23	100,0	100,0	

78,3%

To lead to an increase in my income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	6	26,1	26,1	26,1
	2,00	4	17,4	17,4	43,5
	3,00	3	13,0	13,0	56,5
	4,00	9	39,1	39,1	95,7
	5,00	1	4,3	4,3	100,0
	Total	23	100,0	100,0	

43,4%

Figure 2. Sample screenshot displaying the calculation of the percentages of "effective" contributing factors to the question "What were the motivational determinants that caused you to take on entrepreneurship activities?"

- **To utilize the academic know-how that I have acquired throughout my academic life in business:** Note that out of 23 AEs who responded to the questionnaire, 10 AEs voted "Very effective" (5 points, 43,5%), 8 AEs voted "Quite effective (4 points, 34,8%)", 2 AEs voted "Little effective (3 points, 8,7%)", 2 AEs voted "Very little effective (2 points, 8,7%)" and 1 AE voted "Not effective (1 point, 4,3%)" for "utilizing the academic know-how that I have acquired throughout my academic life in business" as a motivational determinant that caused them to take on entrepreneurship activities.
- **To lead to an increase in my income:** Also note that out of 23 AEs who responded to the questionnaire, 1 AE voted "Very effective" (5 points, 4,3%), 9 AEs voted "Quite effective (4 points, 39,1%)", 3 AEs voted "Little effective (3 points, 13,0%)", 4 AEs voted "Very little effective (2 points, 17,4%)" and 6 AEs voted "Not effective (1 point, 26,1%)" for "leading to an increase in my income" as a motivational determinant that caused them to take on entrepreneurship activities.

Then I ignored the AEs who have scored from 1 to 3 to disregard factors which did not have a significant effect on the question asked and took into account the AEs who have scored only “Quite effective” (4 points) and “Very effective” (5 points). This revealed the sum of percentages of AEs who assigned either 4 points or 5 points to contributing factors. For example, I concluded that 78,3% (43,5% + 34,8%) of AEs who responded to the questionnaire thought that utilizing the academic know-how acquired throughout academic life in business” had a major effect on their decisions to pursue entrepreneurship activities. In contrast, only 43,4% (4,3% + 39,1%) of AEs voted in favor of leading to an increase in income as a motivational factor to pursue entrepreneurship activities. Lastly, after calculating the percentages of all contributing factors to the three comprehensive questions mentioned earlier as per the above-explained method, I simply ranked the contributing factors.

In addition, some questions were constructed on a Likert Scale with five response levels which are “I strongly disagree”, “I disagree”, “I am indecisive”, “I agree” and “I strongly agree”. A number of further questions were structured to be answered on “Yes” or “No” basis. While some of the questions asked were independent from other questions, some questions were designed to verify other questions asked earlier. In other words, I occasionally tried to cross-check the validity of answers via multiple questions.

With a large sample size, it would have been possible to run a factor analysis which describes variability among observed, correlated variables in terms of a potentially lower number of unobserved variables called factors. Factor analysis could have been used to determine whether motivations, challenges and success variables grouped together on significant factors. Having identified the main motivating factors, a binary logistic regression could have been conducted to examine the relative importance of the top three motivating factors for AEs’ engagement in commercial activities. Moreover, a Probit Analysis could have been conducted to analyze the relationship between a stimulus (dose) and the quantal (all or nothing) response. All these detailed analyses would also have allowed me to prove the statistical significance in the associations

between variables. However, the small sample size (n = 23) prevented the construction of a statistical model and further statistical analysis. For this reason, I had no choice but to obtain only the descriptive statistics in order to come up with logical results. Therefore, the evaluation of the questionnaire results was done in light of the descriptive statistics.

3.3.2. Face-to-face interviews

Structured interviews consist of a series of pre-determined questions that all interviewees answer in the same order. Data analysis usually tends to be more straightforward because researcher can compare and contrast different answers given to the same questions. Face-to-face interviews in this thesis consisted of structured interviews.

The sampling method used for face-to-face interviews falls under the **"convenience sampling"** (also known as availability sampling) method which is a specific type of non-probability sampling method that relies on data collection from population members who are conveniently available to participate in study.

Convenience sampling is a type of sampling where the first available primary data source will be used for the research without additional requirements. In other words, this sampling method involves getting participants wherever you can find them and typically wherever is convenient. In convenience sampling, no inclusion criteria identified prior to the selection of subjects. All subjects are invited to participate. Convenience sampling offers simplicity of sampling and the ease of research, is helpful for pilot studies and for hypothesis generation, and facilitates data collection in short duration of time.

It is important to hear from the AEs themselves about what motivated them into running their own businesses, the challenges they face as double-hatted individuals, what drew their path to become successful business persons, how all these relate to the

university-industry collaboration in order to develop the right strategies to render the AEs more successful in their commercialization efforts. Questionnaire results enable the researcher to reach statistical results but in-depth interviews are still necessary to look into the ins and outs of the subject researched and learn different perspectives spelled out by the interviewees. For this reason, face-to-face interview is an important component of any work involving a case analysis.

When I first decided on the topic of this thesis, it was my intention to make an embedded multiple-case design analysis with multiple units of analysis and construct and test a number of hypotheses with the involvement of dozens of companies on the premises of five TDZs. The insufficient return from the TDZ administrations and AEs limited the face-to-face interviews to 18 only. The time allocated to each interview varied between 30-60 minutes depending on the availability of time for AEs, the extent of information they wished to share with me and their mood on the day of the interview. While some AEs were very enthusiastic to talk, some preferred to provide only basic and little information in response to the questions asked. AEs who refused the interview had their own reasons. Mostly, their excuse was their intensive work schedule but some AEs just did not have the habit of responding positively to interview requests. There were a number of them who openly told me that they did not want to be involved in any kind of interview. Some were on sabbatical leave, hence were unable to meet me. Some did not even bother to reply and ignored my efforts to contact them.

In the end, I picked the single case design analysis as my method which was based on a single unit of analysis involving a limited number of companies active at the premises of METU TDZ supported by only a few from other TDZs, namely, Hacettepe and Gazi. I made interviews with 18 AEs and took notes during the interviews which comprised open-ended questions and further discussion on them. I finally classified the statements according to their headings and subject of interest.

CHAPTER 4

FINDINGS FROM THE QUESTIONNAIRE AND THE INTERVIEWS

In this Chapter, I will put forward and examine, in light of the results obtained from the questionnaire and face-to-face interviews, the main findings of this study in terms of motivational aspects of AEs, the challenges they face and their success criteria. I will also try to relate my findings to the work of authors covered in Chapter 2 (Literature Review). Section 4.1. will examine the findings obtained from the evaluation of the questionnaire, hence provide a quantitative perspective and Section 4.2. will look into the interviews from a qualitative point of view. The findings reported in this chapter will be useful in designing policy recommendations later in this thesis.

4.1. Findings from the questionnaire

Some demographic characteristics of the 23 AEs who have replied to the online questionnaire are given in Table 6 below.

Table 6. Characteristics of the 23 AEs who have replied to the questionnaire

Department at the University	Current Academic Title	Gender	Years of Service at the Department	Year the Firm was Founded	TDZ the firm is Located
Civil Engineering	Professor	Male	21 - 25	2014	METU
Chemistry	Professor	Male	36 - 40	2012	METU
Pharmacy	Professor	Female	21 - 25	2015	Hacettepe
Pharmacy	Professor	Male	36 - 40	2000	Hacettepe
Electric-Electronic Engineering	Instructor (Ph.D.)	Male	1 - 5	2001	METU + Hacettepe
Computer Engineering	Assist. Prof.	Male	6 - 10	1999	METU + Hacettepe
Aerospace Engineering	Professor	Male	16 - 20	2014	METU
Mechanical Engineering	Assist. Prof.	Male	1 - 5	2014	Hacettepe
Mechanical Engineering	Professor	Male	36 - 40	2010	METU
Civil Engineering	Professor	Male	11 - 15	2001	METU
Aerospace Engineering	Assoc. Prof.	Male	6 - 10	2007	METU
Electric-Electronic Engineering	Professor	Male	36 - 40	2011	METU
Electric-Electronic Engineering	Professor	Male	36 - 40	1993	METU
Food Engineering	Professor	Male	36 - 40	2003	METU
Medicine (Internal Medicine)	Professor	Male	21 - 25	2010	Gazi U.
Mechanical Engineering	Assist. Prof.	Male	6 - 10	2012	METU
Medicine (Internal Medicine)	Professor	Male	21 - 25	2006	METU
Informatics	Assoc. Prof.	Female	6 - 10	2012	Hacettepe
Informatics	Assoc. Prof.	Male	11 - 15	1997	METU + Hacettepe
Computer Education and Instructional Technology	Professor	Male	16 - 20	2006	METU
Computer Engineering	Professor	Male	16 - 20	2006	Gazi U. + METU
Electric-Electronic Engineering	Professor	Male	16 - 20	2013	METU
Information Systems	Assoc. Prof.	Male	6 - 10	2011	METU

Source: Based on the results obtained from the questionnaire completed by 23 AEs.

4.1.1. Towards a hybrid persona with more emphasis on non-pecuniary values

Hybrid persona can be defined as a person who has mixed desires in his/her entrepreneurial undertakings, i.e. he/she is motivated by both pecuniary and non-pecuniary factors and may lean more towards one of the sides as he/she desires. Non-pecuniary aspects can be linked to problem solving and utilization of tacit academic/scientific knowledge for self-improvement rather than pecuniary rewards or acquirement of prestige. At this point, it might the right time to construct the first two propositions. Let the first two propositions be:

P1: AEs would tend to have a hybrid persona mixing the pecuniary and non-pecuniary values but with more weight on non-pecuniary values.

P2: The ultimate purpose of AEs differs from their non-academic counterparts in the sense that creating societal benefit is more important than making profit in the former.

Motivational determinants that caused AEs to take on entrepreneurship activities are listed in Table 7 below which shows the ranking of the motivational factors and percentages of AEs who have scored them on a scale of 1-5 points. The replies to questionnaire revealed that four motivational factors among all others came forward as the primary motivations of becoming an AE: a) easily commercialize academic research findings (91,3%), b) utilizing academic/scientific know-how in commercial activities (78,3%), c) pure intellectual curiosity: more research through problem solving (65,2%), and d) self-improvement through acquiring new skills (60,8%).

Table 7. Motivational determinants that caused AEs to take on entrepreneurship activities

Ranking	Motivation	Percentages of AEs
1	To easily commercialize and disseminate my research findings and/or inventions.	91,3%
2	To utilize the academic know-how that I have acquired throughout my academic life in business.	78,3%
3	Pure intellectual curiosity: R&D via problem solving.	65,2%
4	To improve myself by gaining new skills.	60,8%
5	Create an opportunity to transfer technology and know-how from outside.	52,2%
6	To establish ties with business/ industry networks.	52,1%
7	To lead to an increase in my income.	43,4%
8	To have control over my research findings and/or inventions via intellectual property rights.	34,7%
9	To create additional funding for my academic work.	30,4%
10	To be my own boss.	30,4%
11	To create a business that I can sell to others in the future.	26,1%
12	To boost my prestige/fame in the scientific society.	17,4%
13	To provide job opportunities for my family members.	4,3%

Source: Based on the results obtained from the questionnaire completed by 23 AEs.

As discussed in Chapter 2, Lam (2011) has offered three motivational classifications for AEs, namely, **'ribbon'**: using commercial activities as a means to generate resources for their research and gaining vast recognition and prestige from peers; **'gold'**: putting the emphasis on pecuniary rewards, and **'puzzle'**: intrinsic satisfaction. Evaluating my findings in context of Lam's definition of motivations would return the following interpretations as displayed in Table 8.

Table 8. Comparison of Lam (2011)'s motivational classification and my findings on motivational factors for AEs

Lam's motivational classification	My findings in context of Lam's definition
Ribbon	• To create additional funding for academic work, 30,4% • To boost prestige/fame in the scientific society, 17,4%
Gold (extrinsic)	• To lead to an increase in income, 43,4%
Between Gold and Puzzle	• To utilize the academic know-how acquired throughout academic life in business, 78,3%
Puzzle (intrinsic)	• Pure intellectual curiosity: R&D via problem solving, 65,2% • Self-improvement by gaining new skills, 60,8%

Source: Lam (2011) and findings from the questionnaire.

An extrinsic **'gold'** factor in Lam's (2011) words which is "increasing income" is not the factor that has received the lowest number of votes from the AEs included in this thesis, but with 43,4% of the AEs voting in its favor, it did not emerge as a prominent one either. I can say that an increase in income remains a secondary motivational factor among others. As far as Lam's **'ribbon'** is concerned, creating additional funding for academic work and boosting prestige/fame in the scientific society received 30,4% and 17,4% of the votes respectively. Therefore, 'ribbon' does not seem to be a significant motivation for AEs who replied to my questionnaire. On the other hand, most of the AEs voted for factors which fall into Lam's **'puzzle'** classification. Utilizing the academic know-how acquired throughout academic life in business has both 'gold' and 'puzzle' characteristics and was favored by 78,3% of AEs. AEs may utilize their tacit academic know-how in business for two reasons. Firstly, they may be curious about how their tacit knowledge would be put into use for public benefit. This is the 'puzzle' side. Secondly, AEs may be in pursuit of monetary gains when they utilize their academic know-how in business. This is the 'gold' side. Therefore, utilizing the academic know-how acquired throughout academic life in business can be attributed to both pecuniary and non-pecuniary motivation factors. Finally, pure intellectual

curiosity: R&D via problem solving was favored by 65,2% of AEs, and self-improvement by gaining new skills was favored by 60,8% of AEs (Table 8).

Lam (2011) has found that the great majority of the scientists were motivated by the rewards of the 'ribbon', using commercial activities as a means to generate resources for their research while the 'gold' which put the emphasis on pecuniary rewards, although not completely irrelevant, was seen as important by a much smaller proportion of the scientists. My findings share a common with those of Lam in terms of 'gold' since I also found that leading to an increase in income did not emerge as a prominent motivational factor. However, my findings are not in agreement with those of Lam in terms of 'ribbon' since the motivational factors that fall under the definition of 'ribbon' were evaluated as insignificant by AEs included in this thesis. Keeping in mind that utilizing the academic know-how acquired throughout academic life in business can be attributed to both pecuniary and non-pecuniary motivation factors, it can be concluded that a majority of AEs who replied to my questionnaire favored motivational factors that fall under Lam's definition of 'puzzle'. These results point to a "hybrid-type persona" of the AEs in terms of their motivations but that which heavily leans towards non-pecuniary factors. The least important motivational factor was found to be creating job opportunities for family members with 4,3% of AEs voting in its favor.

My results are commensurate with those of Beyhan and Rickne (2015) whose study revealed that while 88% of nanoscientists mentioned that testing the academic research findings in practice was important for interaction with industry, 70% of the respondents mentioned that motivations related to commercialization of research outcomes were important. My findings also suggest that utilizing the academic know-how acquired throughout academic life in business was favored by 78,3% of AEs, whereas easily commercializing and disseminating research findings and/or inventions was favored by 91,3% of AEs and listed as the top motivational factor. These motivations influence positively and significantly the propensity of AEs to interact with industry through research-based interactions. Even the top motivating factor, which is easily

commercializing academic research findings, albeit being an pecuniary factor, depends heavily on the academic know-how of the AE, therefore it should also be considered a research-based interaction.

D'Este and Perkmann (2011) have explained that the main purpose of academics in engaging with industry is to support their academic research activities and that commercialization ranked as the least important motivation while research-related reasons dominated. My findings are in disagreement with the conclusions of D'Este and Perkmann because I found that creating additional funding for academic work was favored by only 30,4% of AEs and easily commercializing and disseminating research findings and/or inventions was favored by 91,3% of AEs.

The hybrid nature of motivations was further assessed by two questions. The first question was whether the AEs should focus on the societal benefits of their entrepreneurship activities rather than seeking profit. The second question was whether even in a business environment where income accruing from entrepreneurial activities was the main determinant, the public utility to be entailed by their product/service was more important than the profit it would bring along. The results are interesting in the sense that the answers given to these two questions point to different directions. Only 39,1% of the respondents replied positively to the first question, while 47,8% replied negatively and 13% were indecisive. However, 60,8% replied positively to the second question, while 26% replied negatively and 13% were again indecisive.

In response to the question whether the faculty members should be able to engage in entrepreneurship activities in any form they wish to do or whether a faculty member's entrepreneurship should be confined to making an invention and patenting it, 87% of the respondents favored the former. In other words, inventing and patenting a product, a pecuniary motive, seems to be less important than undertaking research activities as the AEs deemed appropriate, a non-pecuniary motive. When the AEs were asked whether the R&D findings should be freely accessible and commerciable by everyone or whether to the contrary should be protected by intellectual property rights (IPR),

91,3% of the respondents chose the latter. This finding supports Krabel and Mueller (2009) who have concluded that scientists who strongly agreed that science was a public good to be freely available to anyone were significantly less likely to engage in entrepreneurship. Favoring the protection by IPR versus free access to know-how means that while the mindset of the AEs may lean towards a societal utility concern after a certain point in the life cycle of the firm, AEs do not want their know-how to be freely exploited by others even if such exploitation may entail a greater societal benefit in the future. Jain et al. (2009) have reported that there are hurdles related to delays in dissemination of results, an issue that is bolstered by the secrecy agreements signed with TTOs. When asked about whether the AEs would feel the need to protect the know-how which has accumulated as a result of their entrepreneurial activities at the cost of refraining from sharing their findings at scientific congresses, interestingly, 52,2% of AEs were not sure about their course of conduct because they thought that such a decision would vary according to the product/service in question. 26,1% stated that when they have to choose between IPR protection and presentation of findings at scientific events prior to obtaining a patent, they would surely chose the latter and present their findings. However, none of the AEs interviewed brought up the issue of secrecy agreements signed with TTOs as mentioned by Jain et al. (2009).

Speaking of the IPR, while only 39,1% of the respondents have applied for at least one patent or utility model prior to their entrepreneurship endeavor, this rate increased to 47,8% after the AEs started their own businesses. However, only 43,5% reported that at least one of their applications were approved and a patent was granted by the national patent authority. My findings do not present a parallel to those of Krabel and Mueller (2009) who have found a positive relationship between patenting activity and entrepreneurship among the Max Planck Institute scientists.

Results supporting the notion that AEs seem to be interested in research-based interactions rather than business-based activities are bolstered by another finding. 73,9% of the AEs said that if they had to choose between staying as an academician and a business person one day, they would go for the former while 17% were

indecisive and 8,7% voted for the latter. This is in agreement with Jain et al. (2009) who have defined "buffering" as steps taken by scientists to protect their academic role identity and to make sure that norms typically associated with commercialization do not influence their cherished values.

In light of the information covered in this section, the proposition suggesting that AEs would tend to have a hybrid persona mixing the pecuniary and non-pecuniary values but with more weight on non-pecuniary values (P1) seems to be justified and supported by the findings. However, the proposition which suggests that the ultimate purpose of AEs differs from their non-academic counterparts in the sense that creating societal benefit is more important than making profit (P2) is not supported.

4.1.2. Challenges faced

When we come to the challenges faced by the AEs throughout their entrepreneurial lives, my findings suggest the top four challenges as follows: a) access to capital required for the commercialization to succeed (78,2% for short-term capital and 69,6% for long-term capital), b) the cumbersome state bureaucracy (60,8%), c) lack of experience in finance, management and marketing (I am a scientist, not a business person) (47,8%), and d) inability to reach the commercialization/ dissemination targets set (39,1%). The respondents seem to be not affected by the challenge defined as the inability to transfer academic know-how into business activities (zero votes, thus no affect at all). Table 9 below shows the rankings and AE percentages pertaining to the challenges faced by the AEs who responded to the online questionnaire.

Table 9. Challenges faced by the AEs throughout their entrepreneurial activities

Ranking	Challenge Faced	Percentages of AEs
1	Access to short-term capital. Access to long-term capital.	78,2% 69,6%
2	Cumbersome state bureaucracy.	60,8%
3	Lack of experience in finance, management and marketing (I am a scientist, not a business person).	47,8%
4	Inability to reach the commercialization/ dissemination targets set.	39,1%
5	Problems borne by the overall economic situation in the country.	39,1%
6	Problems related to the personnel hired.	30,4%
7	Problems stemming from patent and licensing procedures.	21,7%
8	Negative reactions received from academics from departments other than my own.	21,7%
9	Having not sufficiently developed business/industry networks	17,4%
10	Negative reactions received from academics from my department.	17,3%
11	The need to protect the know-how which has accumulated as a result of entrepreneurial activities at the cost of refraining from sharing findings at scientific congresses.	17,3%
12	Too much competition in the firm's field of operation.	8,7%
13	Insufficient assistance from the TTO.	4,3%
14	Decline in the efficacy and output of the work undertaken at the university.	4,3%
15	Inability to transfer academic know-how to business.	Null

Source: Based on the results obtained from the questionnaire completed by 23 AEs.

4.1.2.1. Financial problems

McDougall and Oviatt (1996) have stated that academic startups have to deal with the lack of resources including money and that especially in terms of finances, high R&D expenditures accrued by the startup may not often be offset by only a small domestic market especially when the product life-cycle is short. Bönte (2011) has agreed with this opinion by pointing out that challenges may be due to lack of finance or time and they may contradict with the AE's support of open science. According to Rasmussen et al. (2011), a lack of leveraging competency in form of not being able to access resources from industrial partners and communicate to external investors is also a challenge for AEs but AEs can acquire this from actors both internal and external to the university. As can be seen in Table 9, evaluation of the questionnaire has revealed that access to capital is the top challenge faced by AEs. Short-term capital generally refers to the capital needed to design, implement, test and validate the product whereas long-term capital refers to the capital needed to commercialize and disseminate the product in the market. Short-term capital and long-term capital can also be considered requirement for funding in the short-term and in the long-term respectively. Short-term funding is most of the times provided by the Small and Medium-sized Enterprise Development and Support Administration (KOSGEB), Directorates of Scientific Research Projects (BAP) of universities and the Scientific and Technological Research Council of Turkey (TÜBİTAK) when financing is sought by submitting a project proposal. An entrepreneur needs funding when he/she initiates a project to develop a product. **Short-term funding** is necessary to cover the costs accrued throughout a project life cycle. They are as follows:

- personnel costs (salaries and insurance premium of employees),
- cost of devices, machinery and equipment required to design, implement and test the product developed,
- travel costs required for the project partners to pay visits to each other for consultation purposes,
- consulting costs if there is a need to obtain consultancy from an outside source,

- sub-contracting costs if there is a need to assign a part of the job to another organization,
- other costs required to acquire consumables and early dissemination tools.

On the other hand, long-term financial challenges point to the fact that there exists a lack of investment opportunities that prevents the firms from undertaking mass production activities following the completion of the development and test phases. Long-term funding, therefore, is necessary to initiate and sustain the mass production phase and the costs accrued may be massive due to a need for a production facility, workshop, machinery or laboratory equipment. This calls for a well-designed investment scheme that drives its funding from own-funding of the AE's company, the government or business angels or a combination of these sources. Obviously, the long-term investment plan must be a profitable one for the enterprise to survive. If the product is software or a technical method which does not require mass production, then smaller long-term costs are accrued.

4.1.2.2. Lack of experience in business and marketing issues

According to Vohora et al. (2004), lack of business experience and commercial skills among academics is a major challenge in taking up entrepreneurial activities. Jain et al. (2009) has suggested that a scientist is a scientist and has no time for tasks such as patenting and licensing as they interfere with teaching and research efforts. Scoring by 47,8% of the AEs who replied to my questionnaire placed the lack of experience in finance, management and marketing (I am a scientist, not a business person) as the third challenge faced by the AEs. Almost half of the AEs stated that they had inadequate administrative and financial skills required to run their businesses. They try to solve this drawback either by developing their own competencies in this respect or by hiring employees to take care of such tasks. As discussed in Chapter 2, Clarysse et al. (2011) has stated that "opportunity recognition capacity" was the capability to identify a chance to combine resources in a way that might generate a profit and that such entrepreneurial capacity was the single most important variable explaining

entrepreneurs' engagement in commercial activities. According to Rasmussen et al. (2011), "opportunity refinement" competency, defined as discovering and distinguishing between opportunities seems to be a challenge for AEs since this competency is less likely to be present in AE firm founders but it is open to development through iteration with industry partners and customers. When asked about how the AEs defined themselves in terms of identifying innovative ideas and opportunities to found a new business, 21,7% reported that they were not interested in such competencies and that they only cared about the scientific research-associated side of the business. In contrast to this statement, 52,2% said that they possessed the competency to identify opportunities directed towards founding a new business, whereas 69,6% said that they possessed the capacity to identify potential products and services that would later become commerciable. In other words, 69,6% of AEs have stated that they did have the "opportunity recognition capacity" as defined by Clarysse et al. (2011). This finding does not seem to be in support of the concern raised by Lockett et al. (2003) suggesting that faculty members may skillfully innovate within the research domain but this skill may not be sufficient for identifying opportunities within the commercial context. My findings also show that AEs included in this study did not fail to identify a clear entrepreneurial opportunity and act to reconfigure themselves accordingly and that AEs did not find themselves stuck in the research-based phase as voiced by Lubynsky (2013).

While startups tend towards the competency development option, firms which are able to grow to a certain level tend towards hiring expert personnel. Jain et al. (2009) have explained "delegating" as scientists' efforts to focus on establishing appropriate links with other individuals – in our out of the university – who possess skills required to commercialize their technologies. Examples for delegating are hiring business people to manage the business tasks, perhaps a CEO to manage the company. In this thesis, 52,2% of the AEs hired expert personnel to manage the financial and administrative affairs.

Krabel and Mueller (2009) have stated that past career experience in firm founding and business ownership signaled scientists' tendency to engage in entrepreneurial pursuit again. This is because the past entrepreneurship experience may be expected to have a positive effect on developing financial and administrative skills. Mosey and Wright (2007) have stated that AEs with prior business ownership experience could build broader social networks and were more effective in developing network ties. However, only 26,1% of the respondent AEs who replied to my questionnaire had entrepreneurship experience in the past, i.e. they took part in a private business as either a founder or a partner. According to Krabel and Mueller (2009), past work experience in the private sector as an employee or a consultant did not seem to be important for pursuing commercialization activities. My results indicate that 52,2% of the respondents had a previous private sector experience, hence hired by a private business in capacity of employer or consultant. Krabel and Mueller (2009) have also found that scientists with close ties to industry firms possessed a strong entrepreneurial perspective and that scientists who had already collaborated in the past with private companies in research projects were more alert to entrepreneurial opportunities including starting up a business. In line with this finding, my findings also suggest that 95,7% of the respondents stated that they have undertaken in collaboration with private industry partners various scientific or business projects/partnerships in the past. However, the insufficient number of respondents renders it impossible to construct an association between past entrepreneurship experience and current administrative and financial experience.

4.1.3. Success criteria of the AEs from their own perspectives

It is worth mentioning that it would be a better idea to make an assessment of the above challenges by also considering the perception of the success criteria as seen by the AEs. Actually, making a comparison between motivational aspects, challenges and success criteria could be a good idea to make a correct assessment of the overall situation by taking into account the interaction between them.

The AEs included in the study were asked about the relative importance of several factors in their success, i.e. what criteria determined their success (i.e. when did AEs believe or estimate that they were successful). As displayed in Table 10 below, the top four success criteria turned out to be as follows: a) the capacity to utilize the academic know-how in private business activities (82,6%), b) introduction of innovative products to the market or the fact that the products concerned have not been previously offered in the market by other suppliers (73,9%), c) advantages of being located on a university technology development zone (69,6%), d) having developed sufficient business/industry collaborations/networks (69,5%). Lastly, the least important factor for the AEs in their success was found to be their marketing efforts/activities. Table 10 below shows the rankings and AE percentages pertaining to the success criteria of the AEs who responded to the online questionnaire.

Table 10. Success criteria of the AEs throughout their entrepreneurial activities

Ranking	Success Criterion	Percentages of AEs
1	The capacity to utilize the academic know-how in private business activities.	82,6%
2	Introduction of innovative products to the market or the fact that the products concerned have not been previously offered in the market by other suppliers.	73,9%
3	Advantages of being located on a university technology development zone.	69,6%
4	Having developed adequate links to and collaborations with industry /business networks.	69,5%
5	Right choice of personnel in the firm.	60,9%
6	Meeting the target in commercializing products/ services.	52,2%
7	Competitive pricing of products/ services introduced to the market.	47,8%
8	New publications emerging as a result of the research results reached during the firm work.	47,8%
9	Obtaining at least one patent for the output created in the firm.	39,1%
10	Past private sector work experience.	34,7%
11	Easy access to finances.	30,4%
12	Competence in administrative and financial issues.	17,4%
13	Successful marketing strategies.	13,0%

Source: Based on the results obtained from the questionnaire completed by 23 AEs.

When we take a look at the comparison of motivations, challenges and success criteria interlinked to each other, we obtain Figure 3 below.

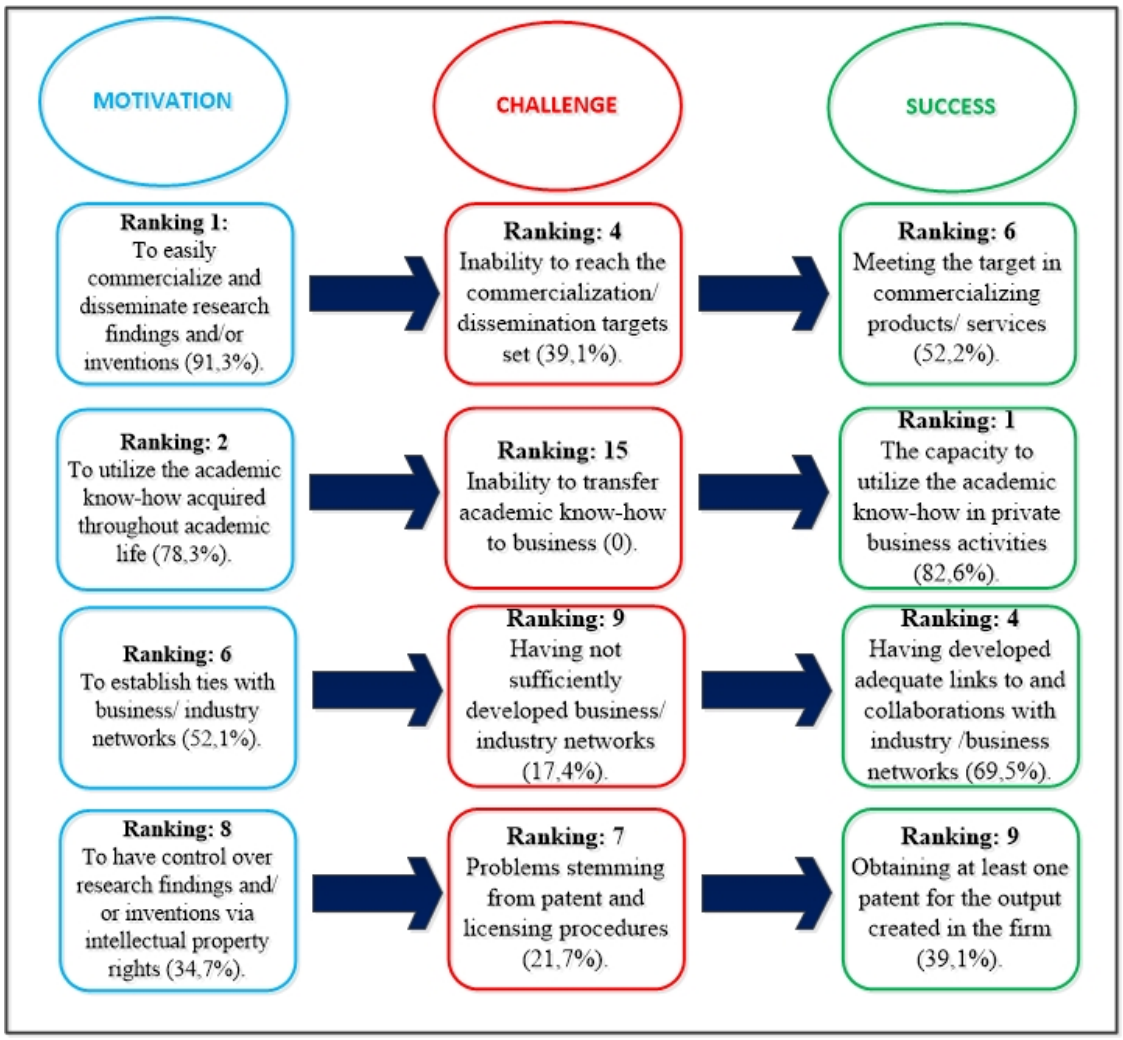


Figure 3. An overview of the motivations, challenges and success criteria interlinked to each other

Source: Based on the results obtained from the questionnaire completed by 23 AEs.

While the commercialization purpose ranked top and received votes from 91,3% of AEs for motivational factors, 39,1% of AEs seem to have experienced problems in reaching commercialization/dissemination targets. Furthermore, 52,2% of AEs considered themselves successful (sixth ranking among all success criteria) in terms of meeting the targets in commercializing products/services, which seems to indicate that almost half of the AEs do not perceive their commercialization activities as success and that commercializing the products/services continues to be a challenge. Moreover, 65,2% of the respondents agreed that founding a firm helped them commercialize their academic research-based findings. It would be logical to conclude that the top motivational priority of the AEs is far from satisfaction.

Utilizing the academic know-how acquired throughout academic life is the second ranking cause of motivation with votes from 78,3% of AEs. Let us remember here from the previous section that the inability to transfer academic know-how into business activities was the challenge not affecting the AEs at all (0). Also, the capacity to utilize the academic know-how in private business activities is the top success criterion (82,6 %). Therefore the emergence of the academic know-how in commercialization activities as the most prominent success criterion is very much in agreement with both the least important challenge and the second top cause of motivation. The purpose of utilizing the academic know-how in business has been to a great extent fulfilled. Expectedly, when asked whether being an academician positively affected their entrepreneurship success, 87% of the respondents agreed while the remaining were indecisive, i.e. there were no disagreements to this proposal.

Before proceeding any further, I will construct the third proposition at this point as it will directly involve one of the interactions between motivations, challenges and success criteria.

P3: AEs were successful in building up sound business/industry networks after engaging in entrepreneurial activities.

Vohora et al. (2004) has suggested that AEs may not have developed the capability to move from scientific networks to commercial networks. According to my findings, establishing ties with business/industry networks received 52,1% of the votes and ranked sixth among the motivational factors. On the other hand, having not sufficiently developed business/industry networks received a vote percentage of only 17,4% and ranked ninth among the challenges faced by the AEs. With 69,5% of the votes, the result showing that sufficient business/industry collaborations/networks played a role in the perception of business success of the AEs ranked fourth among the success criteria and partially concurred the previous result. Regardless of to what extent AEs see the establishment of industry networks as success, questionnaire results state that 82,6% of AEs were able to develop business/industry networks throughout their

entrepreneurship. However, the results also show that there is still room for improvement although this was not a priority for the AEs when they first started their businesses.

Therefore, my third proposition suggesting that AEs were successful in building up sound business/industry networks after engaging in entrepreneurial activities (P3) seems to be satisfied, hence supported by the findings.

Having control over research findings and/or inventions through IPRs seems to be a lesser cause of motivation and a minor challenge for the AEs but still 39,1% of the votes indicate that some of them consider obtaining a patent for the output created in the firm a success. As mentioned in Section 4.1., while only 39,1% of the respondents have applied for at least one patent or utility model prior to their entrepreneurship endeavor, this rate increased to 47,8% after the AEs started their own businesses. However, only 43,5% reported that at least one of their applications were approved and a patent was granted by the national patent authority. More on the patenting issue can be read in Section 4.1.

Figure 3 showed the relationship between certain motivations, challenges and success criteria. However, the present study also revealed the relationship between more challenges and success criteria without the involvement of related motivational aspects. These can be seen in Figure 4 below. The results indicate that the challenges faced are in a way reiterated by the success criteria as the votes received for both headings are in agreement with each other.

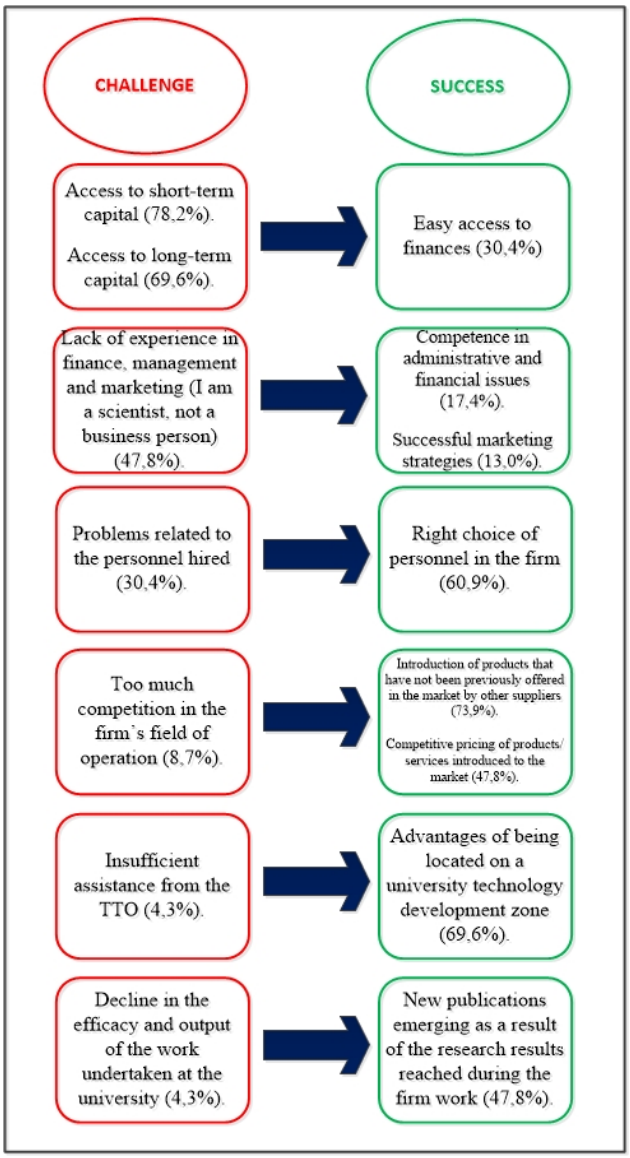


Figure 4. An overview of other challenges and success criteria interlinked to each other

Source: Based on the results obtained from the questionnaire completed by 23 AEs.

Access to short/long-term funding that was looked into in detail in Section 4.1.2.1 is the top challenge for the AEs. A reiteration of this finding is that easy access to capital expectedly received only 30,4% of the votes and constituted only the eleventh success criterion. Similarly, the lack of experience in finance, management and marketing found in Section 4.2.3 as the third ranking challenge was confirmed by the results indicating that competence in administrative and financial issues (17,4%) and successful marketing strategies (13%) became the two least voted success criteria.

Another confirmation is that the problems related to the personnel hired turned out to be the sixth ranking challenge and the right choice of the personnel ranked fifth among the success criteria.

Too much competition in the firm's field of operation received only 8,7% of the votes to emerge as an unimportant challenge. Expectedly, introduction of innovative products to the market or the fact that the products concerned have not been previously offered in the market by other suppliers is the second top success criterion (73,9%), whereas competitive pricing of products/services introduced to the market ranked seventh in the success criteria (47,8%). Moreover, 60,9% of the AEs reported that their product or intended output subject to commercialization has not been presented to the market by other suppliers so they would be the first to market the product/service in question. The majority of the AEs interviewed seem to have directed their R&D work towards niche markets. It may be the right time to construct the fourth proposition now.

P4: Having developed products for a niche market enabled the AEs to reach their commercialization goals.

It is usually the common sense to think that companies that delve into the niche market have a better chance of marketing their products, especially if they have adopted the right pricing policies. In other words, a situation where the intended output subject to commercialization has not been offered to the market by other suppliers previously may be expected to be the basis for a good commercialization outcome. In this study, 64,2% of the AEs who have reported that their output subject to commercialization has not been previously offered to the market by other suppliers, have also reported that founding a firm has helped them commercialize their academic findings. In light of this information, we can conclude that the fourth proposition suggesting that having developed products for a niche market enabled the AEs to reach their commercialization goals (P4) is supported by the findings.

With 4,3% of the votes received, not being able to receive sufficient assistance from the TTO was one of the two least important challenges for the AEs. Expectedly, advantages of being located on a university technology development zone, on the other hand, constituted the third ranking success criterion (69,6%). Therefore the AEs mostly enjoyed the advantages of their location and indeed received sufficient assistance from the TTO when they needed. Furthermore, 65,2% of the AEs stated that being located on a university development zone helped them with their commercial success, but only 39,1% agreed that they have received sufficient assistance from the TTO. However, a large share (39,1%) of the AEs remained indecisive as regards to the assistance received from the TTO. In fact the votes in favor of the TTOs could have been higher but as per the statements of the AEs, they did not have to work with the TTO or did not need to ask for help, they rather did things all by themselves without the need to solve issues with the help of the TTO. This pushed the percentages to a lower place on the overall ranking.

Another least voted challenge that received 4,3% of the votes and ranked fourteenth is the decline in the efficacy and work undertaken at the university. Therefore, it may be the right time to make my fifth proposition as:

P5: Entrepreneurial activities of AEs cause a decline in their academic performances.

In contrast to Henrekson and Rosenberg (2001) who have argued that the loss of time originally allocated for the traditional academic roles of research and teaching led many academics argue that the role of the university was not to do business, but to support business, in this thesis, a decrease in academic performance due to loss of time does not seem to be a significant challenge for the AEs. 87% of the AEs reported that after engaging in entrepreneurial activities, there has been no decline in their efficiencies in connection to their academic performances at their departments. 65,2% of the respondents stated that they were able to make use of their commercialization activities to create input for their academic work. Running a business may enable AEs to

improve their academic responsibilities such as teaching and research. This improvement is somehow utilized as input for university activities and often manifests itself in a number of forms such as direct transfer of know-how to university projects, new masters/doctorate thesis topics for graduate students hired, contribution to lecture content and publication of new scientific articles. An example for this input among others is the publication of new scientific articles. 47,8% of AEs place the emergence of new publications as a result of the research results reached during the firm work as the eight success criterion. 47,8% of the respondents reported that at least one article (co)-authored by them which tackled issues of interest to the entrepreneurial activities has been published in journals listed under the Science Citation Index (SCI). This ratio dropped to 21,7% for articles published in national journals.

In light of the above findings, it seems like the fifth proposition (P5) suggesting that the entrepreneurial activities of AEs cause a decline in their academic performances is not retained.

4.2. Findings from the interview

Some demographic characteristics of the 18 AEs who have accepted my interview request are given in Table 11.

Table 11. Demographic characteristics of the 18 AEs who have been interviewed

AE #	Department at the University	Current Academic Title	Gender	TDZ the firm is Located
AE1	Civil Engineering	Professor	Male	METU
AE2	Electric-Electronic Engineering	Professor	Male	METU
AE3	Pharmacy	Professor	Female	Hacettepe
AE4	Mechanical Engineering	Assist. Prof.	Male	METU
AE5	Informatics	Assoc. Prof.	Male	METU + Hacettepe
AE6	Pharmacy	Professor	Male	Hacettepe
AE7	Aerospace Engineering	Assoc. Prof.	Male	METU
AE8	Chemistry	Professor	Male	METU
AE9	Electric-Electronic Engineering	Professor	Male	METU
AE10	Mechanical Engineering	Professor	Male	METU
AE11	Mechanical Engineering	Assist. Prof.	Male	Hacettepe
AE12	Aerospace Engineering	Professor	Male	METU
AE13	Civil Engineering	Professor	Male	METU
AE14	Computer Engineering	Professor	Male	Gazi U. + METU
AE15	Computer Education and Instructional Technology	Professor	Male	METU
AE16	Food Engineering	Professor	Male	METU
AE17	Medicine (Internal Medicine)	Professor	Male	Gazi U.
AE18	Statistics	Professor	Male	METU

Source: 18 AEs interviewed.

The quotations from the AEs interviewed will henceforth be referenced according to the first column of Table 11.

4.2.1. Towards a hybrid persona with more emphasis on non-pecuniary values

As explained later in this study, acquirement of short to long term funding required to develop a product and then find ways to sell it in the market is a major challenge for AEs. In line with this fact, a majority of the AEs stated against the argument that they should focus more on societal benefits rather than seeking profits. A common argument repeated by many AEs interviewed was that there shall be no distinction between the notions of 'sole profit' and 'sole societal benefits', that profit is essential but only after some time it can turn into societal benefit and that societal benefit without profit in the first place is a utopia. Another argument meaning exactly the same as the mentioned one was, "If you have created something that would entail societal benefit at the end of the day, you surely must have made a profit out of it too" (AE1). As specified by the interviewed AEs, profit emerges as not something to pursue relentlessly but as a natural component of the everyday business life, hence in no way in contradiction with the desire to acquire societal benefits.

Keeping the profit-making purpose in mind, a majority of the AEs interviewed voted in favor of the argument that in a business environment where money was the main determinant, the public utility to be entailed by their product/service was more important than the sole profit it would bring along. This does not exclude the requirement for funding but reinforces the notion that after the company develops the capability to sustain itself, the purpose of profit-making becomes secondary to societal benefits. "I am a professor with grandchildren. I think I have already passed the point where I should be seeking an increase in my income. I do this simply because I have the opportunity to put my knowledge to test in the industry and see the fruits it bears" said AE2 in support of this argument. AE3 enthusiastically said:

> No, it is not all for money. What I achieved was my dream ever since I have submitted my doctorate thesis. I have been working on this for 15 years. I first wanted to cooperate with the faculty but I experienced resistance. One day I found another colleague working on a similar subject for her doctorate thesis and that was it. We became partners and everything proceeded well.

In general, startups have difficulties in transferring their prototypes to the market which emerges as a major obstacle in securing funding. These obstacles will be presented in the forthcoming section but one thing is worth mentioning here. The AEs managing the startups mostly emphasize the lack of investors and investment opportunities needed for the commercialization effort and how this prevents them from making money. Their general attitude in their own words can be summarized as “What money? There are things in my mind which I want to solve. It is like a dream that I am trying to make come true. I earn almost nothing from all this effort” (AE3, AE4, AE5).

Further results also indicate that the overview of the AEs included in this study leans towards a hybrid persona with more emphasis on non-pecuniary values. The interviewed AEs seem to present a hybrid persona as regards to their approach to academic entrepreneurship. AE6 who has spent most of his life undertaking basic and applied research activities with the aim of creating societal utility categorized scientists under three classifications: a) Scientists who perform science for title and fame, as seen mostly in developing countries, b) scientists who perform science for science, c) scientists who perform science for economic activity (commercialization). He said that if there was no science for economic activity in a country, that country could not achieve economic development. He further stated that countries where science was done for prestige and fame in addition to profit-making constituted scientific input for countries where science was done solely for economic activity. AE6 said “in undertaking my R&D efforts and seeking ways and means to find commercialization channels for their dissemination, I have always made sure that the name of my country preceded my name.” hammering out his non-pecuniary intentions.

There exists reluctance among the AEs in terms of filing an application for patents. This is mainly due to the fact that many of the firms included in this study are software development companies. When asked about why they have not yet filed any patents for any of their products, the common answer is that they are a software company and software cannot be patented. AE7 for example has not attempted to patent its software solutions for two reasons. Firstly, he thought a software product was not eligible to be

protected by a patent because intellectual property in form of copyrights already provided sufficient protection of software solutions. Secondly, according to the AE7, software differed from other “patentable” products such as electro-mechanic devices and novel engineering methodologies in the sense that software developers do not design the executable software's physical structure but merely provide the functional terms. It is not the purpose of this thesis to look into whether these statements are entirely true or not, but this kind of reply stood out as a legitimate answer among the software development companies.

AE5 pointed out that as a modest scientist and academician, he preferred to focus on the IT procedures which included not only the design, coding and test phases of projects that needed to be taken care of in the firm but the core methodological lectures as well. Interestingly, he taught the members of the project development and software development teams a number of academic course subjects such as Object-Oriented Analysis and Design, Iterative Incremental Development, Software Engineering Standards, Unified Modeling Language application, etc. “I take the work environment as some kind of an academy and not as some place that you come to finish your work for salary only” said AE5, hammering out his intentions towards non-pecuniary values.

AE8 explained his discontent towards being too money-centric. He said that many Turkish company owners/managers visit Silicon Valley in the United States and learn the procedures and mechanisms prevalent in the U.S. business environment. One such procedure he said was selling the company after bringing it up to a point where the company was making profits. The motive underlying such move he said was to make lots of money without thinking too much about what would come next in the future. While such behavioral pattern may seem logical in the U.S., local imitation of mechanisms prevalent in a foreign business environment may not end up with good results. “Why would a Turkish professor sell his company to become rich? Yes, his income from the university is limited, but he may choose to continue with the company and create new research avenues for both himself and the university?” said AE2 implying that he gives priority to non-pecuniary values.

73,9% of the AEs said that if they had to choose between staying as an academician and a business person one day, they would go for the former. AE9 supports this result by saying that “I became an entrepreneur because I was an academician in the first place. I never thought about leaving the university to become a businessman.” AE10 concurs this statement by saying “I owe everything that I did in this private business to my department and my position as an academician.” However, there is a flip side to the coin for a few AEs. The Turkish academic environment is a rough world. There exists the problem of extended waiting periods before being promoted to an associate professor or later a full professor grade. A research assistant may have to wait for years before being granted the title of assistant professor without knowing when he/she will be assigned this title. This situation also affects the income received and can become discouraging at times eventually leading to a psychological disengagement from the university. It is my understanding that AEs who are below the associate professor grade and have been waiting for years to be granted their new higher-grade titles may tend to lean towards pecuniary values. AE11 puts it well by saying:

> I have studied so hard days and nights to be granted my rightfully deserved position but I regret that I do not know if this will ever happen. But I have this business now which pays me better than the university, so it has become an option for me if I have to choose between academics and private business one day.

Therefore, two factors, namely extremely long waiting periods before being promoted to a higher academic position and a business with reasonable financial returns, together may push an AE towards adopting a money-centric persona.

Similar to the findings from the questionnaire, interview results also concur that the proposition suggesting that AEs would tend to have a hybrid persona mixing the pecuniary and non-pecuniary values but with more weight on non-pecuniary values (P1) can be justified. Again similar to the findings from the questionnaire, interview results fail to support the proposition which suggests that the ultimate purpose of AEs differs from their non-academic counterparts in the sense that creating societal benefit is more important than making profit (P2). In short, although AEs think that a great

deal of thought should be given to the creation of societal benefits, profits and societal benefit are complementary to each other and that yielding societal benefit automatically points to profit-making. While AEs admit that societal benefit is more important than financial rewards, it should not be the purpose of an entrepreneur to seek societal benefits without making profits.

4.2.2. Challenges faced

4.2.2.1. Financial problems

Regarding the difficulties encountered in accessing short-to-long term capital AE6 explains that despite the high potential to commercialize certain useful products, his company was not able to succeed in its marketing efforts. AE6 attributed this a great deal to the investment environment in Turkey and he had lots to say about this. He said his responsibility as a scientist was to invent new products for public benefit but he could not mass-produce the outcome without external financing. “There are several financing platforms to support basic research but almost none to support production in this country.” he complained. He named three existing opportunities in this respect. First is the Industrial Application Support Program of KOSGEB, second is the Technology Development Foundation of Turkey (TTGV) and the third is the support from the Undersecretariat of Defense Industries (SSM). TTGV, under the Advanced Technology Projects Support Program (ITEP), provides up to three-million US dollars-worth loan given that the company also slates an equal amount for financing of production activities. SSM provides front payment with zero interest for defense R&D. “All three support schemes have their setbacks for companies like us.” he emphasized. “The KOSGEB support is little, TTGV support requires equal amount of self-financing which we do not have and SSM support is irrelevant for us.” he reproached. “And they all take it back!” he exclaimed hoping for a more effective support mechanism by the state and/or an increase in the venture capital provided by business angels in the future.

AE11 pointed out that Technology Transfer Offices (TTOs) were of great importance in this setting because they eased the matching process between the know-how owner (academic entrepreneur) and the capital owner (investor). At this point, he offered something interesting. He stated that it would be a more effective setting if KOSGEB only supported the start-ups for 2-3 years and some of its remaining responsibilities were transferred to the TTOs. For example, the TTO and not KOSGEB should be the authorized body to finance Industrial Application Support Programs and all companies operating in TDZs could benefit from this setting. As the owners of a startups, AE4 and AE13 agreed on the fact that the period of one year for which KOSGEB provides support was too short. Although AE13 explained that he would not have become an entrepreneur if he had not received techno-entrepreneur support from KOSGEB, he wished that the support has continued for one more year. “Only one year to develop something with a serious R&D effort is not enough.” he complained.

Regarding the main issues and challenges in the innovation process, AE12 defined the insufficient support mechanisms as the main culprit in creating financial resources. He said that the R&D process was a long one but the investors in Turkey did not have the patience to wait. “The investors are very money-centric. The R&D timelines are too long for them. They want you to be in the right place, at the right time, with the right solution already available to serve them.” he explained with discontent. AE12 further explained that large enterprises received massive support from the state and this allowed them to use sub-contractors to complete a portion of the task. At this point, he recommended that a mechanism that would ensure the matching of large firms with the right start-ups be constructed.“TÜBİTAK strongly encourages collaboration between the industry and the universities. A similar matching mechanism would be ideal between the large companies and the start-ups, especially those managed by academicians.” he offered. He further expressed that adoption of such scheme could create the short-term financial support which the start-ups desperately needed.

Another opinion voived by AE8 was that even large companies sometimes tended to underpay their sub-contractors which meant that the start-up might have to make

spending from its own pocket. Therefore, due to the invisibility of the start-ups in the market plus price-cutting strategies adopted by many large companies in many cases, income generated by a start-up would be spent for the personnel costs and there would be no profits. A recommendation that emerged at this point was that, instead of providing grants, state could fully finance the development projects of start-ups. “State may transfer the funds to the start-up rather than the university.” AE8 offered.

In terms of short-term capital, problems tied to financing also occur during the management of projects financed by local or international project platforms. Project funding authorities (TÜBİTAK, European Commission, etc.) curb the project budgets without any reasonable justifications. This causes unexpected situations in the project cycle and untoward situations from the purchase of equipment needed for the project to personnel issues. Problems with TÜBİTAK are not limited to the curbing of the project budgets only. Almost all AEs who have submitted projects to TÜBİTAK for funding have reported that the referees assigned by TÜBİTAK for passing or failing a project in the first place sometimes become an obstacle standing in the way of funding. Many AEs stated that the referees appointed by the authorities sometimes lack the knowledge and experience needed to evaluate the projects. AE5 for example, sensed a change in the attitudes of some of the referees recently assigned by TÜBİTAK to evaluate the project proposals despite the company’s positive relations with TÜBİTAK ever since the company’s inception. AE5 explained in astonishment:

> They happened to give us hard time a couple of times, but not from an academic perspective. One referee assigned to our project on obstetrics informatics said that what we were trying to do was interfering with God’s business and he was not happy at all with the project theme. We try to explain our projects to them in detail with no avail sometimes (AE5).

AE14 expressed that as project owners, they also scored the reviewers and that he gave the highest scores to reviewers who have presented their knowledge through tough logical discussions and good questions. “This is how you end up with a perfect project outcome at the end of the day.” he said. Many AEs interviewed go on to complain that

the European Commission often declines project proposals as they do not want anything less than perfect (AE3, AE5, AE6, AE8, AE11, AE13).

Startup companies often lack the financial resources to finish a project that they have started. Furthermore, office rents on certain TDZs (e.g. METU-Teknokent) are too high and AEs expect the office rents to be reduced in the future. AE11 proposes that the startups should be provided with free-of-charge consultancy and mentorship to be delivered by renowned businessmen. He adds that if there is a cost to be accrued in this regard, TÜBİTAK may be asked to finance this effort. He explained that the existing funding mechanisms are directed towards the development phase but not towards the production phase. The solution he offered was that in order to overcome the difficulties in reaching short-term capital, small-scale assembly workshops could be established within TDZs with minimum equipment such as a turning machine, 3D printer, etc. Such mechanism could be realized with support from KOSGEB or TÜBİTAK. Another AE agrees with this and says:

> There used to be a repair/maintenance center at METU once to repair broken equipment. Today the broken equipment is sent to other countries for repairs. It is too much waste. Recently founded universities procure million-dollar worth equipment just to sit on the work bench (AE9).

In accordance with the previous interview results, an AE complains that they developed a prototype but were never able to produce it in numbers due to the high production costs. They asked for production support from TÜBİTAK but did not receive an answer. “Everyone expects us to carry out the production phase ourselves, yet they do not know how we can do it” is the common argument among the interviewed AEs (AE6, AE8, AE11). Such argument is especially valid for companies which produce machines, equipment and pharma products rather than software solutions. AE15 said that although he shook hands with people at the OSTİM[10] Organized Industry Area for mass production, they could not get along with it because it was not clear if they would be able to sell the products after producing them.

[10] The OSTIM Industrial Zone is a large industrial park in Ankara benefiting small and medium enterprises (SMEs).

> Support for capital is a must but we did not have it. It is not a good idea for firms like us to produce in numbers and try to sell it in the market. It is better to build your own production facility but you need a lot of money for that (AE11).

As far as the pharmaceutical industry is concerned, AE6 fully explained why drugs developed in Turkey could not be brought into the market due to lack of investments. The AE once in the past has come up with the idea to locally produce a new low-cost flu prevention medicine which would stand as a rival to Roche's Tamiflu. If realized, this could have been a major breakthrough and an invaluable source of income for the Turkish pharmaceutical industry. It did not materialize. The causes of not proceeding with the project are multi-faceted. The AE said that all major pharmaceutical companies were managed by marketing people. He further explained that R&D departments, while assuming the most crucial and difficult task within pharmaceutical companies, were often left in the dark and that marketing people had the highest wages whereas R&D people had the lowest wages. "If a researcher develops a new drug, there is no way to bring it to the market unless the marketing manager gives a green light to invest in its promotion." AE6 explained and added that this was exactly where the state had to step in to maintain the balance. The modality for such intervention, he offered, would be by establishing autonomous regulatory organizations and putting in charge the right people with the merit.

4.2.2.2. State bureaucracy

State bureaucracy is the second top problem challenging the AEs. There are several channels through which state may negatively affect the entrepreneurial activity. Problems stem from unreasonably long government procurement processes, bureaucratic entanglements, and modification of project requirements. "The latter is the worst as the new requirements do not appear in the original contract, they are added later on, hence requires a new system design, implementation and test phase" says AE12. Another important problem arises due to unreasonable timelines. "They issue a system requirements document to be satisfied three months later! This is nonsense!" complains AE12. This seems to be a common issue faced by most AEs.

> Government's demands for modifications at latter stages of projects can be troubling. We may have to keep project personnel that we had earlier arranged for the normal project cycle waiting due to the shifts in work packages. This further causes delays in the payments and we may have to face certain loss (AE14).

At this point, AE12 mentions something that constitutes the core of problems experienced throughout procurement contracts, namely the 'non-existence of capabilities in some intermediate enabling technologies.' Intermediate enabling technologies are crucial technologies that are needed to produce key sub-systems that would later be integrated to the other components of the product. The end-product would not be complete without them. An example is the new generation Turkish fighter aircraft that the government hopes to fly by 2023. There are a bunch of intermediate enabling technologies to master while building a full-fledged fighter aircraft and the Turkish industry lacks some of them. "The question is whether we should get our hands on every little technological detail of each sub-component or just pick a number of them and master only those." hammers out AE12 hoping for the latter.

KOSGEB has organized a coordination meeting where the government's 2023 Goals were discussed in context of R&D projects. According to AE12, the lack of coordination between TÜBİTAK and KOSGEB was so obvious. He said "there is no technology roadmap, no detailed long-term planning. There is nothing about how to handle intermediate enabling technologies which do not exist at all. Somebody has to start an investment scheme to cover these technologies." He emphasized the importance of establishing and supporting new firms that would focus on intermediate enabling technologies. He added that these new firms could become the backbone of state-of-the-art technologies required by many sectors in Turkey. In his own words, it is ridiculous to assign each and every task to a single major entity (e.g. Aselsan) which is already occupied by dozens of ongoing projects. "We definitely need more start-ups to take over a part of the task and share the burden." AE12 said.

According to AE5, bureaucratic instability is one of the most pressing issues in the commercialization phase. The majority of his company's customer base consists of

government health institutions (e.g. Turkish Red Crescent and state hospitals). However, personnel rotation, irrational and mostly subjective decisions by key decision makers in the state organizations remain as obstacles before the effectiveness of the company's innovative capacity. "One day an undersecretary promises to go along with your business plan, the other day there is someone else sitting in his chair, who is totally unaware of the project." AE5 supported his statement. "Of course, the decision-making process at the ministries often takes ages and we sometimes have to wait for over a year before getting anything started." he complained. Furthermore, state organizations' reluctance to work with companies outside their business networks causes isolation of firms which would in fact successfully meet the project requirements. In many occasions, state organizations tend to opt for the 'direct procurement from outside'[11] method rather than the open tender method.

> If a state organization is already acquainted with a company, i.e. if it has successfully collaborated with that company in a past project, it often prefers to receive services from it in a future work too. They consider the other candidates disturbance even if you give them a modest price offer. Such behavior destroys the chances of startups which are in need of new projects.

pointed out AE15 in disappointment. AE14 agreed by saying that "under such circumstances, they call us and ask us to make a partnership with the firm they have in mind." AE8 repeated the same concern and said "We once agreed to form a consortium but the doors were suddenly shut on our faces after some time." Apart from the other interviewees, AE11 experienced some difficulties as regards to the customs bureaucracy in Turkey. He said that although he had an expert in charge of clearing materials from the customs, he sometimes experienced problems in clearing even samples from the customs. He explained in disappointment that one of his samples was still under customs custody after four months and that the papers needed for clearance were communicated to him by the officials only in installments rather than at once.

[11] "Direct procurement from outside" refers to a procurement scheme where a state organization skips the usual tender process and instead hand-picks a private supplier to procure products or services.

AE5 explained that during the course of a turn-key infrastructure construction project under the coordination of a reputable state university, the university's insistence to take over a part of the work resulted in a poorly constructed dysfunctional facility. Reluctance to ease paperwork, delays in approvals, signing of documents and payments stemming from the state university have also been detrimental to the company's work plan. Speaking of bureaucratic entanglements in state universities, some unexpected situations sometimes cause undesired changes in time schedules of the R&D processes. For example, AE4 says:

> Sometimes the duration allowed for Scientific Research Projects (known as BAP in Turkish academic circles) of universities turn out to be less than it should be. They think a certain research project could be completed within 24 months but in fact it may require 40 months.

A further challenge reported by AE16 was that the university administration has not approved the request of AEs for sabbatical leave and offered leave without pay instead. The justification was that the AEs have owned their respective companies. A major challenge that AE17 had to face was that the field of his company's operation has not been defined under the national TDZ legislation. This has caused him to deal with lots of bureaucratic work before finding a space on the Technopark premises.

> They thought that my work in the field of pharmacoeconomics/pharmacovigilance would not constitute an R&D effort. I had to explain to them that what I intended to do was really important and that it involved a great deal of R&D work in a respectable field (AE17).

Another challenge is the requirement by the TDZ administrations to scan faces of the R&D personnel twice a day so that they can prove that they were in the office supposedly undertaking R&D activities. As AE18 explains:

> R&D is a life style, hence does not have to be undertaken in the office environment. Face recognition system which counts the hours spent in the office in this respect is illogical." AE5 agrees and says "we have system support and maintenance personnel who have to work out of office, at our

> customers' sites. It is a big hassle for them to come here and have their faces scanned twice a day.

Although AEs are in favor of state support, their wish is not without limitations. As much as they voice their support to the involvement of the state in regulating loan credits for R&D activities and the production phase that would follow as well as establishment of a favorable environment for a sound system of innovation, many AEs are equally against the management of this chain of events by the state. AE6 believed that the state should be only a regulator and an inspector, and not an omnipotent administrator meddling in all stages of the production and procurement process. AE6 explains:

> An advanced innovation effort necessitates an advanced R&D infrastructure. Something that looks simple from outside may actually require lots and lots of work and time. All we need is a good investment and loan environment that seems charming to entrepreneurs. If the conditions are set right, we can even assume the mass-production task ourselves.

4.2.2.3. Lack of experience in business and marketing issues

However, as the business life necessitates, all AEs interviewed reported that they had a sworn-in certified public accountant that they worked with. "Yes, I had to develop myself in financial issues too. I learned as much as I could about all these accounting ledgers and financial sheets and procedures. I attended one or two workshops to get a grip on how to handle a project budget." expressed AE3, while AE14 said that neither he nor the other company partners were keen on dealing with the administrative and financial affairs of the company so they decided to employ expert personnel to take care of such issues. Most startup AEs reported that although they did not know anything about the accounting methods, they formulated their own Excel tables to keep track of finances. "This is more than enough for the time being, the rest is handled by the sworn-in accountant consultant." AE3 and AE4 pointed out. As far as the projects funded by national and international funding agencies are concerned, their financial draw-up and monitoring are often done by graduate level students employed in the firm. While some of these students are hired on project basis, some end up becoming

permanent full-time employees of companies run by AEs. Administrative and financial issues can sometimes become overwhelming. AE4 expressed his concern about the administrative paper work that he had to deal with after establishing his firm. “We are only two persons here and I have lots of work to do as an academician and a businessman” he said and added that the administrative burden of such endeavor was so immense that he has had to relinquish his authority to sign for the company to his colleague. Similar mishaps are lived in business development activities too. AE5 pointed out that the company had no marketing procedures or a dedicated marketing team.

> Our sales efforts mainly depend upon industry networks, personal or institutional references and personal visits paid by the General Manager to the parties concerned.” he said. “I really don’t have what it takes to be an entrepreneur. I am more of an academic type. I just cannot become profit-oriented. All these financial things and marketing efforts are not meant for me. If you are like me, you can either quit the business or let others do it for you (AE15).

This statement was agreed by AE5 who said that he never dealt with such competencies in his life, thus left all financial and administrative tasks to the hands of other company partners.

AEs who are able to develop their own financial and administrative competencies may actually be expected to owe this primarily to their past industry experiences. “Without my past experiences in other companies, I would not have had the courage to start this business.” AE11 and AE17 said while the latter pointed out that his earlier duty as a clinical manager in a private firm encouraged him to found his own company and that without such experience he would hesitate to become an entrepreneur himself.

4.2.2.4. Inability to reach the commercialization targets set (non-financial issues)

As shown in Table 9, inability to reach the commercialization targets is the fourth top challenge faced by the AEs. The causes underlying the challenges in reaching the commercialization targets are many. The commercialization challenge is a multi-

faceted one comprising both financial and non-financial issues. The financial aspects relating to this challenge have been covered in Section 4.1.2.1 as they firmly stepped forward in the replies to the questionnaire. Financial challenges mainly mean that there exists a lack of investment opportunities that prevents the firms from undertaking mass production activities following the completion of the development and test phases. Therefore this section will dwell on the non-financial components of the commercialization challenge which can be summarized as customer-centric problems and the customer tendency towards foreign commodities as well as the small size of the firms which prevent them from developing commerciable products in the short-term.

The customer-centric reasons of the commercialization challenge stem from the fact that customers simply underestimate or do not understand the benefits of an innovative product. According to the AEs, such viewpoint suggests that using the product would bear no significant benefits to justify its adoption as an everyday tool. Instead, they either do not use the product at all or end up purchasing the product from a foreign supplier with a renowned brand name. The voice raised by many AEs interviewed point to the fact that building up a common sense with the customer is often a difficult task. AEs expect the customer to understand and come to terms with their detailed, comprehensive and technical knowledge regarding the product/service you offer, but most of the times, the customer cannot think at the entrepreneur's level. It may be so hard to explain to the potential customers why purchasing a product would serve their best interests. They may not grasp the future benefits with the snap of a finger. AE5, AE11 and AE16 believed that the low awareness level of the potential customers was a huge problem in the commercialization process. AE5 for example said that there was a belief in the society based on the false assumption that using an automated system would bring no advantages to the procedures run in an organization. AE5 explains:

> We have developed a comprehensive IT tool for effective and efficient farm and herd management. Also consider that there are no other similar software solutions on the market in Turkey, so this was a niche market too. But the farm owners mostly think they are better off with their old school methods than with using a sophisticated software system. They could not grasp how

> an IT system supported by decision support tools would boost their efficiency. They think their money is not worth it.

The hardest challenge in the innovation process in another AE's words is the difficulties in speaking the same language with the customer. "The end-users are not engineers. Their definition of a requirement is subjective whereas our definitions are based on objective engineering rules and algorithms." AE11 says and goes on saying "They say they need 'this' or 'that' and it takes a lot of effort to figure out what 'this' or 'that' really means. Besides, what they require may not be something commerciable, in that case that product would not materialize." AE2, AE11, AE16 and AE17 complained that definition of innovation remained different across various actors in the industry and said that it was important to reach a clear and comprehensible agreement on its definition. "Otherwise", AE11 continued, "the industry does not know what to request from the AE and the nascent AE does not know what to supply the industry with." AE2 explained that while design, implementation and validation phases were undertaken by R&D companies, they often had to hand over the task of commercialization to other companies. He then talked about the diversification problem. "There are certain standards that we have to comply with. There are two guys whose shoe sizes are 38 and 44 but you provide both with a 40-size, this is something which does not satisfy the customer." AE2 pointed out and added that digitizing everything did not always yield good results in terms of commercialization.

As I pointed out before, customers may sometimes end up purchasing the product from a foreign supplier with a renowned brand name rather than purchasing it from a national supplier. This is a common complaint raised by many AEs interviewed. From several AEs' viewpoint, this mishap regarding the commerciability of innovative products lied with the narrow-minded customers who always sought foreign brands even though the foreign products concerned were inferior in quality to those developed by Turkish firms. "They would go and buy a product bearing the brand name of a German company." AE8 explained in frustration. "There is this tendency to think that foreign systems are always top-notch which is a really big problem hampering the growth of startups." says AE4.

> Customers want the product to be tested over and over for an undefined period. They do not want to implement it themselves. After some time they say that they prefer to buy a foreign brand. This actually is a waste of time and money for them as they have to pay enormous support and maintenance fees to foreign companies (AE4).

A good example of the local customers' choice of foreign over national services was described by AE5 as follows:

> We had a financial and administrative tasks software efficiently used in the Ministry of Foreign Affairs and the embassies attached to it. After using it for some time they decided to get a similar software tool developed by Microsoft. There were no technical glitches or price issues involved.

AE6 expressed that this unpleasant situation partially stemmed from Turkish Standards Institute (TSE)'s procrastination in publishing updated lists of standards for many commodities. "If TSE had the habit of updating and publishing the standards for commodities on regular basis, people would realize that many products of Turkish companies did meet the highest standards." he explained.

In line with the questionnaire results which have supported the fourth proposition suggesting that having developed products for a niche market enabled the AEs to reach their commercialization goals (P4), a majority of the AEs interviewed provided information in support of this proposition. A further cause of the failure to easily commercialize new products is the small size of R&D firms. An example is a start-up aviation company managed by AE12 that enjoyed the benefits of having delved into a niche market by attracting the attention of end-users from different sectors. The company has been approached by many potential customers who sought innovative solutions like geometric molds that would minimize icing, water-repellant materials, materials that generate heat when deformed, etc. However, these demands were saved for future as the start-up company was not yet ready to satisfy all these demands at once. Just like many other AEs interviewed in this study, AE4 who is the owner of another startup explained that although he was on the right track to develop a

sufficiently big industry network, his company lacked the resources to satisfy all demands that came from the customers. AE4 expressed his case by saying:

> I want the company to grow but income-generating business connections can only be made in the long term. I do not have a problem with that though as we are only two people at the company right now and we at this point in time might not be able to respond to all demands coming from many customers simultaneously. Better grow slow but healthy than fast and uncontrolled.

4.2.3. Success criteria of the AEs from their own perspectives

AEs to a great extent owe their ability to carry out the company works to their academic domain and the tacit academic know-how inherited in them. AEs establish businesses that operate in their respective academic disciplines and utilize their tacit academic knowledge in creating new products or providing services. An example among many others is that AE6's R&D work and the know-how that has accumulated as a result have enabled the production and commercialization of a drug called 'Sultamicillin'. AE9 has an additional academic source for the work undertaken at the firm: Graduate and doctorate dissertations. "I apply some of the students' findings to my company work and results may be surprising." he explains. He thinks that this is a win-win situation for both the AE and the graduate/doctorate students, hence the faculty. Interaction with students enabled him to come up with new applicable industry ideas. The general consensus among the interviewed AEs is that they would not have become entrepreneurs without being academicians in the first place.

Let us recall that the questionnaire results have supported the third proposition suggesting that AEs were successful in building up sound business/industry networks after engaging in entrepreneurial activities (P3). As to how the AEs built up their business/industry networks, the replies were mostly common in terms of method. As the business development efforts mainly depend upon industry and business networks, the AEs had a lot to say about this issue. Many AEs explained that networking links were established through various channels such as international EU projects,

participation to events (workshops, meetings, fairs, etc.), information casted on company web site, and self-introductory business development efforts. AE16 stated that every time a new company or organization operating in the related field was detected, he either paid a visit to their offices or contacted them via e-mail. Furthermore, a company has become a member of the Defense Industries Cluster, another has become a member of the Defense Industry Manufacturers Association. Such memberships helped the companies in attaining their sales goals. A company was involved in an EU project in capacity of a sub-contractor. The task distribution within certain projects enabled the AEs to gain access to the knowledge created throughout the project lifetime. In this context, several AEs likened this incoming knowledge to technology transfer and stated that this was the only knowledge transfer they have had from external resources which pointed to the network created due to the project partnership. These methods have been put into use by almost all AEs interviewed. However, according AE4, personal efforts are not enough and business/industry networks should be supported by systematic tools. AE4 explained how a leading tractor manufacturer came to his company in search of a vibration test it needed but expressed concern by saying “They have found me via a personal reference. Why should they find me via personal contacts? They should be able to locate me within a well-constructed electronic database just by entering the right key words (e.g. vibration test).” As an AE becomes more experienced and renowned in private business life, it becomes easier for him/her to build up on the business/industry networks. AE17, for example, is in continuous contact with about 30 pharmaceutical companies already and aims to increase the number of customers through face-to-face contacts at scientific congresses or seminars. Being an academician helped him develop a serious chain of business network on national and international level. “Having been acquainted with me at scientific events, they sometimes contact me for a consulting work they need.” says AE17, hinting at the power of business networks. Similarly, the president of an auto test center (AE2) who is considered an authority in the automotive industry enjoys the benefits of a sound network. The center is renowned not only in the automotive sector but also in the defense industry. Owing to the high level recognition, the center most of the times does not have to bother to carry out business development activities because

the customers directly contact the center when they need a service in the center's area of operability. The center often attends auto/industry fairs and AE2 is often invited to deliver speeches in seminars and congresses. Operating in a niche market is also an advantage in developing networks. "We are the only expert company in seismic isolation in Turkey. Therefore, all potential solution seekers find us themselves. They even get directed by the ministry" says AE13. Another method in building up business/industry networks is hiring an expert with vast knowledge of the industry. A military rehab mechanics company owned by AE11 has hired a retired colonel as a business developer consultant who was responsible for all market introduction activities. AE11 was able to set up a sound network for his business owing to the military consultant. The network enabled him to learn the 'do's and 'don't's in the industry and pinpoint potential sales targets.

The problems with the personnel often stem from the fact that the rotation rates of qualified personnel are quite high. AE5 says "The bad thing is when the employee rotation frequency is high and these people quit, I happen to have low spirits about teaching everything all over again when a newbie starts, say a month later." AE14 states that their biggest issue was human resources, i.e. finding the right people for the right projects and says "Our graduates are often hasty to go and work at private companies outside and even overseas so we have hard time finding personnel for the university projects." He added that they should be able to attract students or graduates who prefer to go to foreign countries. AE11 agrees with this statement and points out that the real bottleneck is in finding qualified supporting engineers but he has found a solution to the problem. "I employ engineers before they graduate from university and give them profit partnership in addition to their salaries. In this way, they do not leave." (AE11).

For example, AE1, AE7 and AE18 have received only little assistance from the TTO. This is not because the TTO was incapable of responding to the company's requests, but simply because the company, just like many other AEs interviewed, did not need assistance from the TTO. While the owners of several firms stated that the TTO's

assistance was not so crucial to their activities, some of them added that they sought support from the TTO on various issues such as rules and regulations, patent applications, network contacts, tax issues, other legal issues and supportive information which would otherwise require a lot of paper work. This finding is in agreement with that of Clarysse et al. (2011) who have stated that the role of TTOs in increasing the entrepreneurial activities of academics appears to be rather limited, or even non-existent. “Teknokent Inc. and TTO are very meticulous and they spot even the tiniest material mistake that we may make and immediately take corrective action” explains AE12. TTOs seem to better benefit some firms which initiated patent procedures for their products. In this respect, AE3 emphasized the role of the TTO in obtaining patents. “We worked with the TTO throughout the whole period. They have a patent office. At the end of the day, TTO owns 20% share of the patent and assumes all costs and reporting work. They also work with an expert patent organization.” (AE3). However, such exemplary cooperation may not always be the case.

> I made a patent application but the TTO was newly established then so I did not receive much help from them. The TTO did not have a patent pool and refrained from helping me out. Instead I trained a research assistant on this complicated patent process and we do things ourselves now (AE15).

AE18 admits that TDZs were stages to development of top-notch R&D outcomes especially in developed countries. He continued to explain that as the related national law on TDZs grants the faculty members many opportunities in undertaking their corporate work and commercialization efforts in Turkey, it remains an important milestone in boosting the national innovation level. If a faculty member is not associated with hence subject to the national law on TDZs (i.e. if he/she is just a faculty member but not a company owner/partner), he/she may not get the monetary reward of an academic R&D work which constitutes the basis for a commercialized product.

Let us once again recall that the findings from the questionnaire have not supported my fifth proposition suggesting that the entrepreneurial activities of AEs cause a decline in their academic performances (P5). The interview results are in agreement with the findings from the questionnaire. For the majority of the AEs interviewed, the research activities conducted at the company and the academic background needed to undertake

them are very much nested one within the other. AE12 who works in the field of aviation has opened a graduate level course specifically on icing. He is now the academic advisor to two graduate students as well as a doctorate student, the latter also working at TUSAŞ. He has also utilized the know-how gained at the company in a SANTEZ[12] project managed by the university. A total of four scientific articles were published in reputable journals and over 20 scientific proceedings/communiques were presented as a result of the research work conducted at the company. This is an example of how the university can benefit from the work of an AE.

This flow of information from the AE to the faculty enabled AE7 to assume the role of thesis advisor for more graduate/doctorate students, but also resulted in an increase in the number of publications he (co)-authored. “Sometimes the university administration may worry that entrepreneurship would cause a decline in our academic performance, but this worked just the other way round for me.” he expressed with confidence. AE4 stated that as far as his work was concerned, there was no ‘holding back’ in terms of know-how creation between his tasks as an academician and his work as an entrepreneur. Referring to his double-hatted position, “The two are the components of a single whole and they complement each other.” he pointed out and went on to say that he incorporated a software module that was developed at his company for vehicle vibration testing purposes to a SANTEZ project managed by the university. “I share my corporate know-how with the university. There are no secrets.” (AE4). He pointed out that academic entrepreneurs carry their universities to a higher position in entrepreneurship rankings and that this was something that university administrations really liked. AE14 informed that there existed almost 100% overlap in the work undertaken at the company and the domain of the academic work carried out at the university. He explained that the results of the work done at the company have a definite impact on the courses delivered at the university; hence the company’s activities did contribute to the academic and scientific standing of the university. Most of the other AEs expressed similar attitudes towards the spillover effects of the

[12] SANTEZ (Industry Theses) Technoentrepreneurship Program was earlier administered by the Ministry of Science, Industry and Technology but administration of the program was transferred to TÜBİTAK by 2017.

corporate work on the faculty. Several AEs pointed out that the findings and results that emerged as a result of company work were transferred to the university and used in university projects.

Questionnaire results have indicated that 95,7% of the AEs have hired graduate and doctorate students as employees. AE7 and AE14 pointed out that masters and doctorates students played an important role in this setting as the university activities and those of the company shared a common domain which ended up in a bidirectional[13] knowledge transfer.

This also allowed for better student success at the university as well as input for graduate level theses. AE2 defines this interaction between the firms and the faculty as beneficial and inevitable and goes on to say "Publication of articles bearing the names of graduate students working for me is an invaluable award and a decent motivation for them." However, a return of benefits to the university may not always be the case. AE17 has kept his company work apart from his work at his university. He refrained from using the know-how created in the firm in university projects or academic publications. He said that the university's attitude towards pharmacoeconomics/pharmacovigilance was that of an all-knowing being, shutting down all other ideas. However, he is employing medical school graduate students as part-time project personnel for a number of projects. AE11's undertakings have also not been reflected on the university activities in form of university projects, post-graduate theses or new publications. AE11 believes this is because the company is only start-up and an impact on the university activities would take some time to materialize. "There is one student currently writing a thesis in relation to the company activities though." he says and hopes for more in the future.

[13] Both from the company to the university and from the university to the company.

4.2.4. Where do product ideas originate from?

A typical development process in a product's lifecycle involves several stages such as the research work, design phase, implementation and test phases, verification and modification phase and lastly the commercialization and dissemination phase. However, preceding all these phases comes the emergence of the original idea. Development of a product cannot be realized before someone comes up with the idea to produce something in the first place. The emergence of ideas may come from various sources but when we are dealing with AEs, one could think that unlike the non-academic entrepreneurs, the product ideas of AEs would originate from their academic activities and knowledge rather than market needs and customer demands, mainly because the primary concern of AEs is to utilize their academic know-how in the industry. For this reason, our sixth proposition will be:

P6: The innovative product ideas of AEs originate primarily from their academic activities and knowledge.

There are not any questions regarding this issue in the online questionnaire. Therefore all related information was obtained from the interviews. The replies given by the AEs to the question "how do the original ideas for products/services come about?" are summarized below.

A common opinion voiced by many interviewees was that the ideas for new products often came from the customers and not from within the company. Customers asked for customized solutions tailored to their needs and the company gave them what they needed. AE10 explains that although he closely followed the related important developments in the sector and in academia, the main source of innovation in the company remained to be the end-users. "The end-users are very much interested in customized products that would satisfy their needs." he said and added that the design work was implemented in accordance with these requirements. Therefore, notwithstanding that it is sometimes hard for AEs to agree on the definition and

characteristics of the potential product as discussed in Section 4.2.2.4, the main source of innovation continued to be the customers. As for the development and consequent dissemination of a highly-commerciable new product or service, AE12 says that they have not given a thought to this issue. “We did not dwell on an innovative product or method which would have a very high potential of sales in the market because such strategy would not fit a software company which is only a couple of years old.” (AE12).

Besides, the company, AE12 says, currently responds to the needs of the defense industry which prevents it from coming up with an innovative product with high sales potential. This indicates that unlike his counterparts in developed countries, AE12 does not give priority to the development and sales of highly profitable products but instead prefers to stay confined within the perimeter drawn by the defense industry customers.

Several AEs displayed hybrid characteristics in terms of coming up with new product ideas. In other words, the customer demands, other industry actors and their own academic background all played a role in determining what product to work on. For example, the sources of innovative ideas for AE17 were various such as himself, demands from customers and developments in pharmacovigilance and drug interactions on international level. Similarly, other AEs talked about multiple factors as new ideas for future projects. Drivers for new ideas could be the academic literature closely followed by the company staff, the customers’ flexible and customized demands as well as monitoring of the rivals’ activities. Other sources for innovative ideas for AEs are information obtained within the industry networks, fairs, public open tenders as well as their own decisions to implement products which have not been previously offered in niche markets. Several AEs stated that a number of projects they managed in the faculty were then transferred to their respective companies and became products. AE5 said that the company has made use of various valuable sources to come up with innovation ideas. These he explained were scientific/technical experts working in the related field, academicians from the related departments of the universities who would assume the role of scientific consultants in projects, project calls of funding agencies,

customers in search of a customized product as well as the company's General Manager, a medical doctor who has assumed the role of company's dedicated business developer. The role of company employees in creating ideas however was not significant. Another noteworthy source was the government officials, especially those at the Ministry of Health; given that the company's primary area of operation is the health sector.

While his company's new innovative ideas were shaped by the customer demands, AE4 had an additional source: Graduate and doctorate dissertations. "I apply some of the students' findings to my company work and results may be surprising." he said. AE4 thought that this was a win-win situation for both the academic entrepreneur and the graduate/doctorate students, hence the faculty. Interaction with students enabled him to come up with new applicable industry ideas and in return he could offer new topics for the dissertations of more students.

AE6 had a lot to say about this. According to him, not all product ideas originated from a specific customer and products could also emerge as original ideas of the AE. He explained how he came up with some ideas as follows:

> You observe what is needed by people and then you start brainstorming about how to meet their needs. You discuss it with academic people around you and decide to continue with your plans. You do the literature search, check the existing patents, sort out what cannot be done in the process, and then you go ahead with the design phase (AE6).

AE6 stated that the idea for innovation often resided in two individuals. The first is the company manager who may develop an idea while looking into customer demands during the market analysis phase. The second is the researcher. He then went on to define what an 'innovator researcher' should mean. In his opinion, he/she had to be someone who has performed science either for science or for commercialization, and not for title and fame; only then he/she should be considered an 'innovative researcher'.

> When this innovative researcher transforms into a company manager, he/she becomes the ultimate source of innovation that can be disseminated." he stated but "unfortunately the possibility for such transition is quite low in our country. The best innovator is the one who is capable of detecting deficiencies and drawbacks in existing patents, hence careful examination of patents is the way to go for an innovative researcher (AE6).

When we turn to our sample of 18 interviewees, the following results were obtained:

Table 12. Sources of ideas for innovative products

Idea for an innovative product	Quantity and percentage of AEs	Involvement of academic background in the decision	Sources of ideas
Customer-shaped only	6 33,3%	-	End-users
Depends upon multiple factors	12 66,6%	5 27,7%	**Non-academic** - end-users, - industry networks, - fairs, - developments in the sector, - tenders, - project calls, - rivals' activities, - niche market opportunities - non-academic experts **Academic** - masters/ doctorate theses, - university projects, - academic literature, - colleagues at the faculty, - academic know-how / tacit knowledge

Source: Based on the results obtained from the interview of 18 AEs.

Table 12 shows that 6 AEs reported that their ideas for innovative ideas were shaped by the customers (end-users) only, whereas 12 reported that their ideas depended upon multiple factors. Of these 12 AEs, only 5 reported that there was a certain level of academic background involvement in their decision to come up with new products. Therefore, out of a total of 18 AEs interviewed, only 27,7% have reported that their innovative product ideas originate from academic know-how and background. In light of these findings, it seems like the sixth proposition (P6) suggesting that the innovative product ideas of AEs originate primarily from their academic activities and knowledge is not supported by the findings. This result seems to be somewhat in contradiction with our previous findings suggesting that (i) the respondents seem not to be affected by the challenge defined as the inability to transfer academic know-how into business activities (zero votes) (please see Table 9), and (ii) 82,6% of AEs were able to utilize their academic know-how in entrepreneurial activities and they perceived this ability as a success criterion on their part (please see Table 9). However, the explanation to this contradiction could be that a majority of AEs are able to utilize their academic background in the design and implementation phase of the product (which AEs think is a success), rather than coming up with the idea of developing it in the first place. AEs may have dreams about developing a new innovative product but their dreams may not always come true because the product in mind of an AE may not be sought by 'irrational' customers, hence it may not be profitable to initiate a lengthy research, development and commercialization work for it. Furthermore, let us recall that when asked about how the AEs defined themselves in terms of identifying innovative ideas and opportunities to found a new business, 21,7% reported that they were not interested in such competencies and that they only cared about the scientific research-associated side of the business.

4.3. Wrap-up of findings

Before I conclude this chapter, it would be a good idea to summarize the results that I have reached through evaluation of the questionnaire and the interviews with AEs. Analysis of replies to the questionnaire points to four main motivations for becoming

an AE: a) easy commercialization of academic research findings (91.3%), b) utilization of scientific experience in commercial activities (78.3%), c) pure intellectual curiosity: more research through problem solving (65.2%), and d) self-improvement through acquiring new skills (60.8%). In light of the interviews, **Proposition 1** stating that AEs would tend to have a hybrid persona mixing the pecuniary and non- pecuniary values but with more weight on non-pecuniary values is supported by the findings. **Proposition 2** which suggests that the ultimate purpose of AEs differs from their non-academic counterparts in the sense that creating societal benefit is more important than making profit is not retained. In short, although AEs think that a great deal of thought should be given to the creation of societal benefits, profits and societal benefit are complementary to each other and that yielding societal benefit automatically points to profit-making. While AEs admit that societal benefit is more important than financial rewards, it should not be the purpose of an entrepreneur to seek societal benefits without making profits.

As to the challenges faced by the AEs throughout the innovation process, our findings suggest the following top four challenges: a) access to capital required for the commercialization to succeed (78.2% for short-term capital and 69.6% for long-term capital), b) cumbersome state bureaucracy (60.8%), c) lack of experience in finance, management and marketing (I am a scientist, not a business person) (47.8%), and d) inability to reach the commercialization/ dissemination targets set (39.1%). The respondents seem not to be affected by the challenge defined as the inability to transfer academic know-how into business activities.

AEs were asked about the relative importance of various factors in their success, i.e. what criteria determined their success. The top four success criteria turned out to be as follows: a) the capacity to utilize the academic know-how in private business activities (82.6%), b) introduction of innovative products to the market or the fact that these products have not been previously introduced to the market by other suppliers (73.9%), c) advantages of being located on a university technology development zone (69.6%), and d) developing sufficient business/industry collaborations networks (69.5%). Lastly,

the least important factor for the AEs in their success was found to be their marketing efforts. **Proposition 3** stating that AEs were successful in building up sound business/industry networks after engaging in entrepreneurial activities was supported by the findings. **Proposition 4** stating that having developed products for a niche market enabled the AEs to reach their commercialization goals was also supported. **Proposition 5** suggesting that the entrepreneurial activities of AEs cause a decline in their academic performances is not supported by the findings. Finally, **Proposition 6** stating that the innovative product ideas of AEs originate primarily from their academic activities and knowledge was also not supported. All findings obtained through assessment of the questionnaire have been supported by the statements of AEs which have been noted during face-to-face interviews.

CHAPTER 5

CONCLUSION

5.1. Novelty

The aim of this thesis is to determine the elements affecting the establishment and management of businesses run by university scientists referred to as academic entrepreneurs (AEs). In so doing, the study focuses on the motivational aspects of academicians in starting their own businesses, the challenges that they subsequently face in their business environments as well as their subjective success criteria. The behavioral patterns and other factors driving these three elements (motivational factors, challenges faced and success criteria) may affect the university and state policies aiming to promote university-industry collaboration. Therefore, the present study aims to assess these three elements (motivational factors, challenges faced and success criteria), explore a number of propositions based on this assessment to see whether they are supported by the findings and finally come up with policy recommendations for the state organizations, industry, TTOs and universities.

There are many studies conducted in developed countries tackling many characteristics of AEs. Some of these have been mentioned in Chapter 2 – Literature Review. However, the number of studies conducted in Turkey about this topic is really scarce. Although there are few other studies conducted in Turkey as regards to the AEs, this thesis differs from them in terms of a number of characteristics. Beyhan and Rickne (2015) explored the motivations of academic nanotechnology scientists to interact with industry and identified three main motivations. Cansız (2016) explored the academic entrepreneurship in Turkey from the sociological point of view by taking Bourdieu's

"practice theory" as the basis for its analysis and further making a holistic analysis involving concepts such as habitus, field and capital.

I was unable to find a study which dealt with one or more of the three issues of interest covered in this thesis, i.e. the motivational aspects of AEs in Turkey, the challenges they face and their success criteria in general. While a few questions in the questionnaire of Cansız (2016) coincide with my questions, the questions asked in my questionnaire and the answers designed to be scored and/or selected by AEs are unique and differ a great deal. Finally, to the best of my knowledge, the six propositions selected to be explored in connection to the AEs in this thesis have not been tackled earlier in Turkey. These features in my opinion may satisfy the novelty aspect of this thesis. This thesis is expected to contribute to the literature in terms of the three above-mentioned issues and help policy makers come up with relevant and consistent policy solutions.

In the rest of this chapter, I will put forward policy recommendations relating to the motivational factors and challenges faced which have been assessed in previous chapters.

5.2. Policy recommendations about the motivational factors

In terms of motivational aspects, I have found that the top four factors for AEs are to easily commercialize and disseminate research findings and/or inventions; to utilize the academic know-how acquired throughout academic life; pure intellectual curiosity; R&D via problem solving; and self-improvement by gaining new skills. Observing the hybrid nature of motivations combining pecuniary and non-pecuniary factors, but leaning towards non-pecuniary factors implies that motivations influence positively and significantly the propensity of AEs to interact with industry through research-based interactions. Even the top motivating factor, which is to easily commercialize academic research findings, albeit being a pecuniary motivation, depends heavily on the academic know-how of the AE, therefore it should also be considered a research-based

interaction. In accordance with the non-pecuniary nature of motivations, majority of the AEs stated that even in a business environment where income was the main determinant, the public benefits to be entailed by their product/service was more important than the sole profit it would bring along. In response to the question whether the faculty members should be able to engage in entrepreneurship activities in any form they wish to do or whether a faculty member's entrepreneurship should be confined to making an invention and patenting it, a majority of the respondents favored the former. In other words, inventing and patenting a product, a pecuniary motive, seems to be less important than undertaking research activities as the AEs deemed appropriate, a non-pecuniary motive. Non-pecuniary motives were clearly visible in the statements given by the AEs during the interviews as well. Expectedly, findings supporting the assumption that AEs seem to be interested in research-based interactions rather than business-based activities are bolstered by another finding. Majority of the AEs said that if they had to choose between staying as an academician and becoming a business person one day, they would go for the former. This is in agreement with Jain et al. (2009) who have defined "buffering" as steps taken by scientists to protect their academic role identity and to make sure that norms typically associated with commercialization do not influence their cherished values. My proposition stating that AEs would tend to have a hybrid persona mixing the pecuniary and non-pecuniary values but with more weight on non-pecuniary values seems to be justified and supported by the findings. However, the proposition which suggested that the ultimate purpose of AEs differed from their non-academic counterparts in the sense that creating societal benefit was more important than making profit seems not to be retained. This is because while AEs admitted that societal benefit was more important than financial rewards, they also pointed out that it should not be the purpose of an entrepreneur to seek societal benefits without making profits.

As far as the policy recommendations are concerned, given the hybrid nature of AE motivations, in my opinion policies that would favor the pecuniary characteristics only would bear little fruit. As AEs are heavily motivated by non-pecuniary factors, it would be natural to think that university policies to be developed to promote academic

entrepreneurship should target the non-pecuniary persona of the AEs, rather than promoting financial rewards only. For one thing, policies adopted by university and TDZ administrations should be designed to ease the lives of the AEs, not make them any harder. Today sabbatical leave is not granted to AEs simply because they have their own companies. Universities should reconsider this issue and grant the AEs their right to sabbatical leave. Sometimes the duration allowed for Scientific Research Projects (known as BAP in Turkish academic circles) of universities turn out to be less than it should be. A research and development work may require 40 months but when the BAP Directorate fixes the project duration to 24 months, desirable project outcomes cannot be achieved. A more meticulous and reasonable approach should be adopted in setting the project timelines. All approval processes during the firm-founding stage involving lots of paper work should be fastened and a more convenient approach should be adopted. Successful commercialization efforts of the AEs should be announced across the university bulletins. Adoption of "AE of the year" practice, handing out letters of appreciation and plaques should become common practices of the university administrations. Universities should encourage academic publications tackling issues related to company activities as well as patents by assigning more scores to them. Most importantly, successful commercialization results should be rewarded by better academic performance scores. This is especially important for AEs below the grade of associate professor as they have to achieve certain academic thresholds to be promoted. They may have been waiting for years to be granted their new higher-grade titles and such situation may cause them to lean towards pecuniary values, hence disengagement from the university.

Another major obstacle is that the national legislation on TDZs has its own definition and domain of R&D activities and some very important fields of operation, such as the pharmaceutical industry, have been left outside this defined domain. This causes AEs operating in such areas to deal with lots of annoying bureaucratic work before finding a space on the TDZ premises. Therefore, the TDZ legislation should be revised to encompass all important scientific disciplines under the definition of R&D. A broader coverage of different technology fields should be included in the TDZ legislation.

Another challenge is the requirement by the TDZ administrations to scan faces of the R&D personnel twice a day so that they can prove that they were in the office supposedly undertaking R&D activities. Such practice does not make sense especially for the support/maintenance personnel of the firms because they mostly work outside to deliver support to customers. There is a need to amend this practice.

5.3. Policy recommendations mitigating the effects of challenges

5.3.1. Policy recommendations regarding financial challenges

The challenges affecting the AEs the most were found to be access to short-to-long-term capital required for the commercialization to succeed; the cumbersome state bureaucracy; lack of experience in finance, management and marketing (I am a scientist, not a business person); and inability to reach the commercialization/ dissemination targets set. It turned out that the reasons for not being able to access short and long term capital differed in nature.

The sources of short-term capital has most of the times been KOSGEB and TÜBİTAK. However, KOSGEB support is little and covers only one year of the development phase. The support from TÜBİTAK is subject to irrational budget cuts and may occasionally be failed by evaluator referees for no good reason. Problems arising from the inability to access long-term capital, on the other hand, mainly result from the incapacity to commercialize/disseminate the product upon completion of the development phase. In other words, AEs often experience serious problems in passing to the mass production phase due to the lack of funding.

Policy recommendations should be designed in a way to mitigate the effects of challenges. Here is a support mechanism which may be convenient for the AEs in accessing both the short-term and the long-term capital:

- The support from KOSGEB should last two years instead of one in order to enable a more meticulous development phase. Because as the AEs spell out, only one year to develop something that involves intensive R&D effort is not enough.
- After the completion of the two years under KOSGEB supervision, firms may move to the TDZ premises to have their own offices. Starting at this point, TTOs should play a more proactive role in dealing with the R&D companies. An example is small-scale assembly workshops that could be established within TDZs with minimum equipment such as a turning machine, 3D printer, etc. Such a mechanism which could be realized by TTOs with additional support from KOSGEB would help the companies overcome their short-term production needs.
- The device/equipment repair/maintenance facility at the METU campus should be reestablished. This facility should be responsible for repairing and calibrating the equipment used by the AEs. At present, the broken devices and equipment are sent out to other countries and this necessitates massive financial resources. Similar facilities could be established on other TDZs as well.
- At this point, TTOs should build their database of companies managed by AEs. These databases should contain the area of operation and contact details of the AEs so that when industry partners are interested in implementing a related project, they can conveniently contact the AEs listed in the database.
- In parallel to the previous point, KOSGEB should start a matching effort between the AEs and large companies that operate in the same field. That would enable the large companies to pinpoint startups that they might want to work with in possible projects.
- The government should encourage and take measures to establish a “business angels” modality which works fine in many developed countries. The business angels could contribute to the venture capital of startups and support them in their development and production efforts. In this context, startups should be provided with free-of-charge consultancy and mentorship to be

delivered by renowned businessmen. If there is a cost to be accrued in this regard, KOSGEB may be asked to finance this effort.

- Office rents on certain TDZs (e.g. METU-Teknokent) are too high and AEs expect the office rents to be reduced in the future. The office rents could be reduced for the benefit of AEs only.
- A more convenient credit and loan scheme should be arranged for the startups managed by AEs. Such plan should cover not only the development phase but also the production phase.
- Referees assigned by TÜBİTAK for passing or failing a project sometimes become an obstacle standing in the way of funding. Many AEs stated that the referees appointed by the authorities sometimes lack the knowledge and experience needed to evaluate the projects. Therefore, TÜBİTAK should be more selective in enlarging the pool of referees. Scientists with merit and high scientific profile should be included in the pool.

5.3.2. Policy recommendations regarding cumbersome state bureaucracy

Cumbersome state bureaucracy is the second top challenge faced by AEs included in this thesis. Policy recommendations pertaining to state bureaucracy are listed below:

- Most importantly, management of the development and production phases by the state is not really necessary. The state should be only a regulator and an inspector, and not an omnipotent administrator meddling in all stages of the production and procurement process. For example, as mentioned before if a researcher develops a new drug, there is no way to bring it to the market unless the marketing manager gives a green light to invest in its promotion. This is exactly where the state has to step in to maintain the balance. The modality for such intervention would be by establishing autonomous regulatory organizations and putting in charge the right people with the merit.

- Throughout the project cycle of sophisticated and lengthy projects involving intermediate enabling technologies which are crucially needed to produce key sub-systems that would later be integrated to the main outcome, the government organizations should optimally decide whether to try to produce every little technological detail of each sub component or just pick a few of them and master only those. Depending on the project concerned, the benefits of the latter may outweigh the benefits of the former or vice versa. The government should also structure an investment scheme to produce the crucial intermediate enabling technologies.
- Again throughout the project cycle of complicated and lengthy projects, the government should not put the whole burden on a renowned single entity but instead find ways to include the startups in the development process. Firms managed by AEs should take the priority under such circumstances.
- There exists no broad and detailed technology roadmap or detailed long-term planning in Turkey. There are hundreds of guidelines, workshops, coordination meetings, speeches but they all fall short in providing a concrete roadmap. According to the AEs interviewed, university-industry cooperation in Turkey is yet in its crawling phase. Some think that technology advancement is not in our genes or we are just in the process of learning it. All those overestimated coordination meetings are most of the time a loss of time. What we need is solid steps to be taken. One cannot promote innovation by spelling out wishes and desires, the government must pave the way first. The national plans should be based on concrete steps, not advises like “we should promote local input share in projects by increasing local input.”
- Government organizations should strictly recommend university-industry collaboration at the onset of an R&D project. For instance, the Undersecretariat of Defense Industries is an exemplary state organization in this respect, that it is very sensitive about this process. Such a mechanism has to be up and running for other sectors too.

- Just like universities, state organizations should do their best to evade troubling bureaucracy and paper work.

5.3.3. Policy recommendations on other challenges

Let me remind that lack of experience in finance, management and marketing (I am a scientist, not a business person) was the third challenge faced by the AEs. Almost half of the AEs stated that they had inadequate administrative and financial skills required to run their businesses. They try to solve this drawback by either developing their own competencies in this respect or hiring employees to take care of such tasks. Every entrepreneur must have a certain level of basic accounting and book keeping competency. This is especially true for startup owners who are not in a position to hire expert personnel to take care of finances. This is where the TTOs can walk into the picture. Periodic workshops and training events on financial issues for the benefit of AEs would be very helpful in providing them with basic finance tools.

Last but not least, inability to reach the commercialization targets was found to be the fourth top challenge faced by the AEs. In fact, this setback is greatly affected by all the factors that were mentioned earlier, from financial issues to cumbersome bureaucratic practices which have been already explained. However, there remain two more steps that could be taken by the governments on ministerial level. State organizations' reluctance to work with companies outside their business networks leads to isolation of firms which would in fact successfully meet the project requirements. In many occasions, state organizations tend to opt for the 'direct procurement from outside' method rather than the open tender method. If a state organization is already acquainted with a company, i.e. if it has successfully collaborated with that company in a past project, it often prefers to receive services from it in a future work too. They consider other candidates as disturbance or trouble-makers even if they offer a modest price. Such behavioral pattern is detrimental to the companies left outside the loop. State organizations should try to opt for the open tender method or find other ways not to

isolate other R&D firms. Although forming project consortiums is sometimes a remedy, it does not always play out right.

It would be a crucial assistance if the government increased the number of project funding schemes to allow for the commercialization of project outcomes. An exemplary project platform that enables commercialization is Central Finance and Contracts Unit (CFCU) attached to the Undersecreteriat of Treasury of Turkey. What differs CFCU from other project platforms is that after a long tender process, it grants the winner-consortium European Union funds for commercialization purposes. The project scheme stipulates that the outcome of the project be put in use in a state organization. There is a beneficiary state organization in this project scheme (e.g. a ministry) and the winners of such tenders must make sure a system developed earlier is fully installed and operational at the beneficiary's attached centers. For example, if the beneficiary is the Ministry of Health, a medical system developed is installed and becomes operational at the hospitals attached to the ministry. The training necessary to use the system is also delivered by the project consortium to the end users. This is a commercialization mechanism rather than a system development platform. However, not the consortium member organizations but the CFCU determines the tender topic; therefore AEs should closely monitor the CFCU web site to see if there is a topic that would match their areas of activities. Similar schemes and/or platforms that aim at commercialization should be made effective by the government.

The role of TÜBİTAK in this regard should be considered in context of a policy change. Forcing innovation across sectors may be another means to transform the society. For example, the Turkish animal livestock raising industry manages itself in an old fashioned manner. There are not any smart herd and farm management software solutions and associated electronic devices used by the farm owners/managers. If one day the government declares that the electronic monitoring of farming processes are mandatory and provides incentives to the farm owners who use these electronic tools, this would inevitably lead to better commercialization activities by R&D companies. This is just an example from a single industry. Similar adoption of policies in many

sectors would definitely have positive spillover effects in terms of commercialization on the manufacturers including the AEs.

Figure 5 below displays a wrap-up of the policy recommendations discussed in detail in Chapter 5.

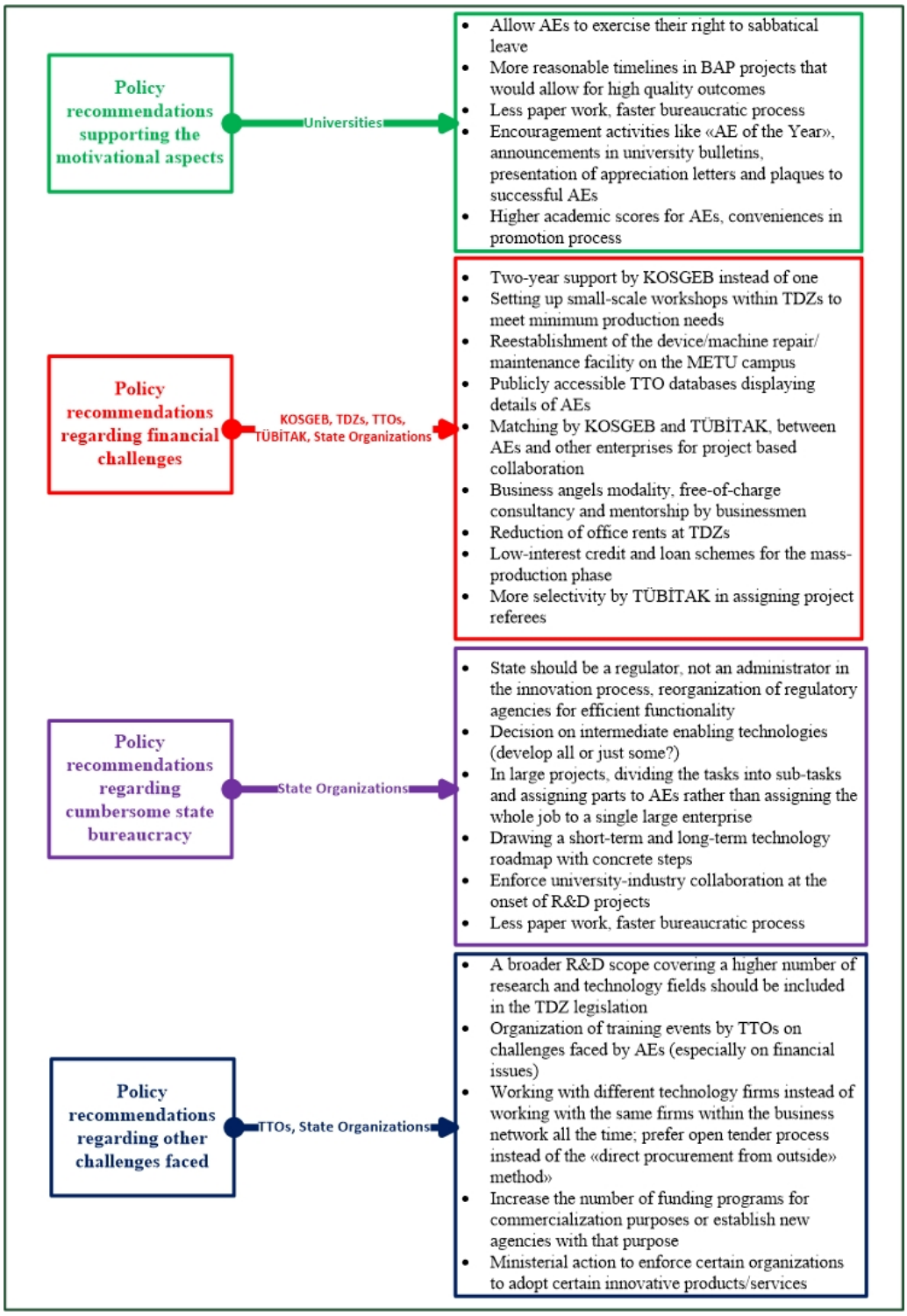


Figure 5. A wrap-up of policy recommendations

5.4. Future Work

As mentioned in Chapter 3, the limited number of AEs which replied to the online questionnaire and accepted my interview request is the biggest problem of this thesis. Small sample size not only prevented a thorough statistical analysis like a factor analysis or probit analysis, it also directed the case study towards a single case design analysis instead of a multiple-case design analysis. However, the results that I received from both the questionnaire and the interviews are in agreement and revealed consistent conclusions. It seems like I was able to reach prevalent results which I tried to interpret properly. I take solace in hoping that if the sample size was much larger (>100), the results to be obtained would converge towards my present findings. I explored six propositions and came up with the following results:

Table 13. Review of Propositions

P1: AEs would tend to have a hybrid persona mixing the monetary and non-monetary values but with more weight on non-pecuniary values.	Supported by findings.
P2: The ultimate purpose of AEs differs from their non-academic counterparts in the sense that creating societal benefit is more important than making profit in the former.	Not supported by findings.
P3: AEs were successful in building up sound business/industry networks after engaging in entrepreneurial activities.	Supported by findings.
P4: Having developed products for a niche market enabled the AEs to reach their commercialization goals.	Supported by findings.
P5: Entrepreneurial activities of AEs cause a decline in their academic performances.	Not supported by findings.
P6: The innovative product ideas of AEs originate primarily from their academic activities and knowledge.	Not supported by findings.

As discussed earlier in this thesis, academic entrepreneurship encompasses activities such as firm-founding, consulting services, patenting and licensing. Patenting and licensing are important parts of academic entrepreneurship in developed countries, especially in the U.S. My findings regarding IPR issues in general or patenting and licensing activities in particular, however, led me to believe that patenting and licensing may not be as important for Turkish AEs as they are for their peers in the U.S. When

AEs were asked whether the R&D findings should be freely accessible and commerciable by everyone or whether to the contrary should be protected by IPR, 91,3% of the respondents voted in favor of the latter, but some other replies received from AEs point to the fact that patenting and licensing may not be primary concerns for Turkish AEs.

- When the AEs were asked whether the R&D findings should be freely accessible and commerciable by everyone or whether to the contrary should be protected by IPR, 91,3% of the respondents chose the latter,
- When asked about whether the AEs would feel the need to protect the know-how which has accumulated as a result of their entrepreneurial activities at the cost of refraining from sharing their findings at scientific congresses, interestingly, 52,2% of AEs were not sure about their course of conduct because they thought that such a decision would vary according to the product/service in question,
- 26,1% stated that when they have to choose between IPR protection and presentation of findings at scientific events prior to obtaining a patent, they would surely chose the latter and present their findings,
- While only 39,1% of the respondents have applied for at least one patent or utility model prior to their entrepreneurship endeavor, this rate increased to 47,8% after the AEs started their own businesses. However, only 43,5% reported that at least one of their applications were approved and a patent was granted by the national patent authority,
- Only 21,7% of AEs reported that they have granted licensing rights to other parties at least once throughout their entrepreneurship lives.

For these reasons, an in-depth analysis of IPR issues was not tackled in this thesis. In fact, IPR is a huge topic on its own; hence it was never the aim of this thesis to look into this subject. Future studies to be conducted on AEs in Turkey, however, may put the IPR at the heart of the research and provide detailed information on patenting and licensing activities carried out by Turkish AEs.

Again, the small sample size which led to a lack of a thorough statistical analysis that would generate statistically significant results prevented me to construct and test hypotheses which require a proper sample procedure. Instead, I had to make a number of propositions and explore whether or not my findings supported them. For this reason, future large-sample studies may consider converting the above-listed propositions into hypotheses and test them by using the right statistical procedures. Moreover, there are so many other hypotheses to come up with regarding the motivations, challenges and success criteria of AEs. For the above-mentioned reasons, a possible future work on this subject should include a greater sample size, preferably nearly equal number of AEs[14] from different TDZs so that the conceptual and behavioral differences among different TDZs and their host universities can also be displayed.

[14] See Table 2 on page 4 to see the details of distribution of AEs among the five university-based TDZs in Ankara.

REFERENCES

Acs, Z. J., Szerb, L., Lloyd, A. (2018), “Global Entrepreneurship Index 2018”, The Global Entrepreneurship and Development Institute, Washington, D.C., http://thegedi.org/global-entrepreneurship-and-development-index/

Allen, S. D., Link, A. N., Rosenbaum, D. T. (2007), "Entrepreneurship and Human Capital: Evidence of Patenting Activity from the Academic Sector", Entrepreneurship: Theory and Practice, 31 (6), 937-951.

Andersen, L. B. and Pallesen, T. (2008), “Not Just for the Money?”, How Financial Incentives Affect the Number of Publications at Danish Research Institutions”, International Public Management Journal, 11:1, 28-47.

Audretsch, D. B. (2000), ‘Is University Entrepreneurship Different?’, Working Paper, Indiana University.

Arrow, K. (1962)., “The economic implications of learning by doing”, Review of Economic Studies, 29, 155–173.

Bercovitz, J. & Feldman, M. (2008), “Academic Entrepreneurs: Organizational Change at the Individual Level”, Organization Science, 19-1, 69–89.

Beyhan, B. and Rickne, A. (2015), “Motivations of academics to interact with industry: the case of nanoscience”, Int. J. Technology Management, 68 (3-4), 159-175.

Bönte, W. (2011), "What do scientists think about commercialization activities?", in Audretsch, D. B., Falck, O., Heblich, S., Lederer, A. (eds.), Handbook of Research on Innovation and Entrepreneurship, Cheltenham: Edward Elgar Publishing, Chapter 21, 337-353.

Brint, S. (2005), “Creating the Future: ‘New Directions’ in American Research Universities”, Minerva 43, 23-50.

Cansız, M. (2016), "Türkiye'de Akademik Girişimcilik", T.C. Kalkınma Bakanlığı, Sosyal Sektörler ve Koordinasyon Genel Müdürlüğü, Yayın No. 2692, Ankara.

Clark, B. R. (1998), Creating Entrepreneurial Universities; Organizational Pathways of Transformation - Issues in Higher Education, Oxford: Emerald.

Clarysse, B., Tartari, V., Salter, A. (2011), "The impact of entrepreneurial capacity, experience and organizational support on academic entrepreneurship", Research Policy, Volume 40, Issue 8, 1084-1093.

Cohen, W. and Levinthal, D. (1990), "Absorptive capacity: a new perspective on learning and innovation", Administrative Science Quarterly, 35, 128–52.

Colyvas, J., Crow, M., Gelijns, A., Mazzoleni, R., Nelson, R. R., Rosenberg, N., Sampat, B. N. (2002), "How do University Inventions Get into Practice?", Management Science, 48, 61– 72.

De Silva, L. R., Uyarra E., Oakey R. (2012), "Academic Entrepreneurship in a Resource-Constrained Environment: Diversification and Synergistic Effects", in Audretsch, D. B., Lehmann, E. E., Link, A. N., Starnecker, A. (eds.), Technology Transfer in a Global Economy, London: Springer, 73-98.

D'Este, P., Mahdi, S., Neely, A. (2010), "Academic entrepreneurship: What are the factors shaping the capacity of academic researchers to identify and exploit entrepreneurial opportunities", Danish Research Unit for Industrial Dynamics Working Paper, No. 10, 5.

D'Este, P. and Patel, P. (2007), "University–industry linkages in the UK: what are the factors underlying the variety of interactions with industry", Research Policy, vol. 36, 1295-1313.

D'Este, P. and Perkmann, M. (2011), "Why do academics engage with industry? The entrepreneurial university and individual motivations", J. Technol Transf, 36, 316–339.

Dickson, K., Coles, A., Smith, H. (1998), "Science in the marketplace: the role of the scientific entrepreneur", in: During, W. and Oakey, R. (eds.), New Technology-based Firms in the 1990s, London: Paul Chapman, 27-37.

Di Gregorio, D. and Shane, S. (2003), “Why do some universities generate more start-ups than others?”, Research Policy, 32 (2), 209–227.

Doutriaux, J. (1987), “Growth patterns of academic entrepreneurial firms”, Journal of Business Venturing, 2(4), 285-297.

Etzkowitz, H. (1998), “The norms of entrepreneurial science: cognitive effects of the new university-industry linkages”, Research Policy, 27, 823-833.

Etzkowitz, H. (2003), “Research groups as ‘quasi-firms’: the invention of the entrepreneurial university”, Research Policy, 32-1, 109–121.

Etzkowitz, H. (2004), “The evolution of the entrepreneurial university”, International Journal of Technology and Globalization, 1, 64-77.

Etzkowitz, H. and Leydesdorff, L. (2000), “The dynamics of innovation: From National Systems and ‘‘Mode 2’’ to a Triple Helix of university-industry-government relations”, Research Policy, 29(2), 109–123.

Etzkowitz, H. (2008), The Triple Helix: University–Industry–Government Innovation in Action, New York/London: Routledge.

Evans, D. J. and Klosten, M. (2000), “Comparing academic entrepreneurship in Europe: the case of Sweden and Ireland”, Small Business Economics, vol. 14, no. 4, 299-309.

Franklin, S. J., Wright, M., Lockett, A. (2001), “Academic and surrogate entrepreneurs in university spin- out companies”, Journal of Technology Transfer, 26 (1–2), 127–41.

Frey, B. S. and Oberholzer-Gee, F. (1997), ‘‘The Cost of Price Incentives: An Empirical Analysis of Motivation Crowding Out’’, American Economic Review 87(4), 746–755.

Godfrey, P. C. and Gregerson, H. B. (1999), “Where do resources come from? A model of resource generation”, The Journal of High Technology Management Research, 10 (1), 37-60.

Gómez-Gras, J. M., Pastor-Ciurana, J. T., Galiana-Lapera, D., Mira-Solves, I., Verdú-Jover, A. J. (2007), “Indicators of Academic Entrepreneurship: Monitoring determinants, start-up activity and wealth creation”, Universidad Miguel Hernández de Elche, http://studylib.net/doc/18499301/indicators-of-academic-entrepreneurship

Göktepe-Hulten, D. and Mahagaonkar, P. (2010), “Inventing and patenting activities of scientists: in the expectation of money or reputation?”, Journal of Technology Transfer, 35, 401–423.

Guimon, J. (2013), “Promoting University-Industry Collaboration in Developing Countries”, The Innovation Policy Platform, Policy Brief, World Bank, http://innovationpolicyplatform.org/sites/default/files/rdf_imported_documents/PromotingUniversityIndustryCollaborationInDevelopingCountries.pdf

Gulbrandsen, M. (2005), “'But Peter’s in it for the money' – the liminality of entrepreneurial scientists", VEST Journal for Science and Technology Studies, 18 (1-2), 49-75.

Heirman, A. and Clarysse, B. (2004), “How and Why do Research-Based Start-Ups Differ at Founding? A Resource-Based Configurational Perspective”, Journal of Technology Transfer, 29 (3/4), 247-268.

Henrekson, M. and Rosenberg, N. (2001), “Designing efficient institutions for science-based entrepreneurship: lessons from the US and Sweden”, Journal of Technology Transfer, 26, 207–231.

Hesse, N. (2014), "Academic Entrepreneurs: Attitudes, Careers and Growth Intensions", Doctorate Dissertation, Gottfried Wilhelm Leibniz University, Hannover, https://www.wigeo.uni-hannover.de/uploads/tx_tkpublikationen/Dissertation_Hesse-N_2014.pdf

Hottenrott H. (2012), “The Role of Research Orientation for Attracting Competitive Research Funding”, in Audretsch, D. B., Lehmann, E. E., Link, A. N., Starnecker, A. (eds.), Technology Transfer in a Global Economy, London: Springer, 35-50.

Jaffe, A. (1989), “Real effects of academic research”, American Economic Review, 79 (5), 957–970.

Jain, S., George, G., Maltarich, M. (2009), “Academics or entrepreneurs? Investigating role identity modification of university scientists involved in commercialization activity”, Research Policy, 38 (2009), 922–935.

Kenney, M. and Goe, W. R. (2004), “The role of social embeddedness in professional entrepreneurship: a comparison of electrical engineering and computer science at UC Berkley and Stanford”, Research Policy, 33, 679-844.

Krabel, S. and Mueller, P. (2009), “What drives scientists to start their own company? An empirical investigation of Max Planck Society scientists”, Research Policy, 38, 947–956.

Lam, A. (2011), “What motivates academic scientists to engage in research commercialization: ‘Gold’, ‘ribbon’ or ‘puzzle’?”, Research Policy, 40, 1354–1368.

Lockett, A. and Wright, M. (2005), “Resources, capabilities, risk capital and the creation of university spin- out companies”, Research Policy, 34 (7), 1043–57.

Lockett, A., Wright, M., Franklin, S. (2003), ‘Technology transfer and universities’ spin- out strategies’, Small Business Economics, 20 (2), 185–201.

Lubynsky, R. M. (2013), “From Lab Bench to Innovation: Critical Challenges to Nascent Academic Entrepreneurs”, Ewing Marion Kauffman Foundation, http://www.kauffman.org/-/media/kauffman_org/research-reports-and-covers/2013/05/fromlabbenchtoinnovation.pdf

Mansfield, E. (1995), “Academic research underlying industrial innovation”, Review of Economics and Statistics, 77, 55–65.

Markman, G. D., Gianiodis, P. T., Phan, P. H., Balkin, D. B. (2004), “Entrepreneurship from the Ivory Tower: Do Incentive Systems Matter?”, Journal of Technology Transfer, 29, 353–364.

McDougall, P. P. and Oviatt, B. M. (1996), “New venture internationalization, strategic change and performance: a follow-up study”, Journal of Business Venturing, vol. 11, no. 1, 23-40.

Meyer, M. (2003), “Academic entrepreneurs or entrepreneurial academics? Research-based ventures and public support mechanisms”, Research and Development Management, 33, 107-115.

Meyers, A. D. and Pruthi, S. (2011), “Academic entrepreneurship, entrepreneurial universities and biotechnology”, Journal of Commercial Biotechnology, 17, 349–357.

Mosey, S. and Wright, M. (2007), “From Human Capital to Social Capital: A Longitudinal Study of Technology-Based Academic Entrepreneurs”, Entrepreneurship: Theory and Practice, 31 (6), 909-935.

Mustar, P., Renault, M., Colombo, M., Piva, E., Fontes, M., Wright, M. (2006), “Conceptualising the heterogeneity of research-based spin-offs: A multi-dimensional taxonomy”, Research Policy, 35, 289–308.

Nicolaou, N. and Birley, S. (2003), “Academic networks in a trichotomous categorization of university spinouts”, Journal of Business Venturing, 18, 333–359.

O’Neal, T., Ford C., Lasrado V., Sivo S. (2012), “The Effect of Regional Characteristics on the Relationship Between University Resources and Knowledge-Based Startup’s Performance”, in: Audretsch, D. B., Lehmann, E. E., Link, A. N., Starneckes, A. (eds.), Technology Transfer in a Global Economy, London: Springer, 233-250.

O’Shea, R., Allen, T., Arnaud, A. (2005), “Entrepreneurial orientation, technology transfer and spin- off performance of U.S. universities”, Research Policy, 34 (7), 994–1009.

Penrose, E. (1959), “The Theory of the Growth of the Firm”, Oxford: Blackwell.

Perlman, B., Gueths, J., Weber, D. A. (1998), The Academic Intrapreneur: Strategy, Innovation and Management in Higher Education, New York: Praeger.

Rahim, N. A., Mohamed, Z. B., Amrin, A. (2015), “Commercialization of Emerging Technology: The Role of Academic Entrepreneur”, Procedia - Social and Behavioral Sciences, 169, 53–60.

Rasmussen, E., Mosey, S., Wright, M. (2011), “The evolution of entrepreneurial competencies: A longitudinal study of university spin-off venture emergence”, Journal of Management Studies, 48, 1314–1345.

Rasmussen, E.; Mosey, S., Wright, M. (2014), “The influence of university departments on the evolution of entrepreneurial competencies in spin-off ventures”, Research Policy, 43, 92-104.

Rasmussen, E. and Wright, M. (2015), “How can universities facilitate academic spin-offs? An entrepreneurial competency perspective”, Journal of Technology Transfer, 40, 782-799.

Roberts, E. B. (1991), Entrepreneurs in High Technology, Lessons from MIT and Beyond, New York: Oxford University Press.

Siegel, D. S. (2011), “The rise of university technology transfer and academic entrepreneurship: managerial and policy implications, in Audretsch, D. B., Falck, O., Heblich, S., Lederer, A. (eds.), Handbook of Research on Innovation and Entrepreneurship, Cheltenham: Edward Elgar Publishing, 300-314.

Siegel, D. S. and Wright, M. (2015), “Academic entrepreneurship: time for a rethink?”, British Journal of Management, Vol. 26, Issue 4, 582-595.

Su, D., Zhou, D., Liu, C., Kong, L. (2015), “Government-driven university-industry linkages in an emerging country: The case of China”, Journal of Science and Technology Policy Management, Volume 6, Issue 3, 263-282.

The Higher Education Academy Art Design Media Subject Centre and the National Endowment for Science, Technology and the Arts (2007) http://www.nesta.org.uk

Tengeh, R. K. and Rorwana, A. (2017), “Influence of Spin-off and Private Companies in the Process of Technology Creation and Transfer at a University of Technology in South Africa”, Economica, Vol. 13, No. 3, 139-154.

Thorp, H. and Goldstein, B. (2010), Engines of Innovation: The Entrepreneurial University in the Twenty-first Century, Chapel Hill, NC: The University of North Carolina Press.

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

Vohora, A., Wright, M., Lockett, A. (2004), “Critical junctures in the development of university high-tech spinout companies”, Research Policy, 33, 147–174.

Wakkee, I. A. M. and van der Sijde, P. C. (2002), “Supporting entrepreneurs entering a global market”, in van der Sijde, P. C., Wirsing, B., Cuyvers, R., Ridder, A. (eds.), New Concepts for Academic Entrepreneurship, Proceedings of the USE-it! Conference, Enschede: Twente University Press, 129-149.

Wood, M. S. (2011), “A process model of academic entrepreneurship”, Business Horizons, 54 (2), 153-161.

Wright, M., Clarysse, B., Mustar, P., Lockett, A. (2007), “Academic entrepreneurship in Europe”, Cheltenham: Edward Elgar Publishing.

Zhou, C. (2007), “The entrepreneurial university and the future of higher education in China”, https://www.researchgate.net/profile/Chunyan_Zhou4/publication/269390186_The_Entrepreneurial_University_and_the_Future_of_Higher_Education_in_China/links/54881cb80cf289302e2efd97/The-Entrepreneurial-University-and-the-Future-of-Higher-Education-in-China.pdf?origin=publication_detail

Zucker, L. G., Darby, M. R., Brewer, M. B. (1998), “Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises”, American Economic Review, 88 (1), 290-305.

APPENDICES

APPENDIX A: Online Questionnaire Content (Turkish)

1-Lütfen çalıştığınız üniversiteyi seçiniz.	
2-Lütfen üniversitede çalıştığınız ana bilim dalını seçiniz.	
3-Lütfen şu andaki akademik unvanınızı seçiniz.	
4-Lütfen cinsiyetinizi seçiniz.	
5-Kaç yıldır bu bölümde çalışmaktasınız?	
6-Çalıştığınız üniversite yönetiminin, öğretim üyelerinin girişimcilik faaliyetlerine karşı olan tutumu sizce nasıldır?	Olumsuz Nötr Olumlu
7-Çalıştığınız bölüm/ana bilim dalındaki akademik personel sizin girişimcilik faaliyetinizi nasıl karşılamakta?	Olumsuz Nötr Olumlu
8-Çalıştığınız bölüm/ana bilim dalında sizden başka girişimcilik faaliyetinde bulunan çalışma arkadaşınız var mı?	Evet Hayır Bilmiyorum
9-Lütfen kurucusu ve/veya ortağı olduğunuz firmanın faaliyet alanını seçiniz.	
10-Lütfen firmanın kuruluş yılını seçiniz.	
11-Firmadaki çalışan sayısı	
12-Firma faaliyetleri kapsamında sizin kişisel ortalama haftalık çalışma saatiniz.	
13-Firmanızın finansman kaynakları nelerdir?	Proje fon otoritelerinden (TÜBİTAK, Avrupa Komisyonu, Kalkınma Ajansları, vb.) elde edilen finansman Ürün satışı Bakım – Destek Danışmanlık Hizmetleri Distribütörlük Diğer
14-Lütfen firmanız ve varsa şubelerinin konuşlu olduğu teknoloji geliştirme bölge(ler)ini seçiniz.	

15-Firmanızı bir Ar-Ge firması olarak tanımlayabilir misiniz?	Evet Hayır
16-Bu sizin ilk girişimcilik faaliyetiniz mi?	Evet Hayır
17-Daha önce özel sektör firmalarında çalışan olarak görev aldınız mı?	Evet Hayır
18-Akademik çalışma hayatınız boyunca hiç özel sektör firmalarıyla ortaklaşa Ar-Ge, altyapı, bilimsel proje yaptınız veya yürüttünüz mü?	Evet Hayır
19-Akademik çalışma hayatınız boyunca özel sektör firmalarıyla iş ortaklığı, bilimsel çalışma ortaklığı ve buna benzer bağlantılar geliştirme imkânına sahip oldunuz mu?	Evet Hayır
20-Şu anda kurucusu/ortağı olduğunuz firma faaliyetleriniz başlamadan önce, hiç patent/faydalı model başvurusunda bulundunuz mu?	Evet Hayır
21-Şu anda kurucusu/ortağı olduğunuz firma faaliyetleriniz başlamadan önce, hiç patent/faydalı model sahibi olduğunuz bir ürün/yöntem için başka kişilere lisans hakkı verdiniz mi?	Evet Hayır
22-Ticarileştirme/yaygınlaştırma faaliyetleri, sizin araştırma/geliştirme alanınıza giren konularda oldukça sık rastlanan bir husus mudur?	Evet Hayır
23-Sizin araştırma alanınıza düşen konularda, Ar-Ge faaliyetleri sonucunda elde edilen bilgiler kamu yararı için herkese ücretsiz açık mı olmalıdır?	Evet, Ar-Ge sonuçları herkese ücretsiz açık olmalı ve başkalarınca da ticarileştirilebilmelidir. Hayır, kendi Ar-Ge sonuçlarımı fikri mülkiyet hakları kapsamında koruma altına almak isterim.
24-Yeni bir iş kurmaya dönük fırsatları ve yenilikçi fikirleri belirleme konusunda kendinizi nasıl tanımlarsınız?	Kendim sonradan o işi kurmak için çaba sarf etmeyecek olsam bile, yeni bir firma kurmaya dönük fırsatları görür ve tanımlarım. Kendim sonradan o ticarileştirme faaliyeti konusunda çaba sarf etmeyecek olsam bile, yeni ürün ve hizmetlere dönüşecek fırsatları kolayca görür ve tanımlarım. Kâr getirebilecek iş kurmaya dönük fırsatları ve yenilikçi fikirleri tanımlama konusuyla ilgilenmiyorum; beni daha çok işin bilim ve araştırma yönü ilgilendiriyor.

25-Akademik girişimciler ile ilgili olarak aşağıdaki seçeneklerden hangisi sizin fikrinizi yansıtıyor?	Bir akademisyen için girişimcilik, sadece buluş yapmak ve o buluşu patentlemeyi içermelidir. Bunun dışındaki tüm faaliyetler bilim yapmaktan uzaklaşmak anlamına gelir. Akademisyenler de dilediklerince girişimcilik faaliyetlerinde bulunabilirler. Bu durum onları bilimden uzaklaştırmaz.
26-Akademisyenlerin teknoloji transferi sürecinde rol alabilecek potansiyel anahtar aktörler olduklarına inanıyor musunuz?	Kesinlikle inanıyorum İnanıyorum Kararsızım İnanmıyorum Kesinlikle inanmıyorum
27-Akademisyenlerin üniversite-sanayi işbirliği sürecinde rol alabilecek potansiyel anahtar aktörler olduklarına inanıyor musunuz?	Kesinlikle inanıyorum İnanıyorum Kararsızım İnanmıyorum Kesinlikle inanmıyorum
28-Üniversite-Sanayi işbirliği ulusal düzeyde Ar-Ge faaliyetlerinin iyileştirilmesinde çok önemlidir.	Kesinlikle doğru Doğru Kararsızım Yanlış Kesinlikle yanlış
29-Akademik girişimciler, kâr amacı gütmek yerine, girişimcilik çabalarının toplumsal faydaları üzerine odaklanmalıdırlar.	Kesinlikle katılıyorum Katılıyorum Kararsızım Katılmıyorum Kesinlikle katılmıyorum
30-Akademik girişimcilerin şirketleri, üniversitelerde yapılan salt bilimsel araştırma sonuçlarının, toplumun yararına dönük nihai kullanıma alınması için gereken süreyi azaltmakta ve araştırma sonuçlarının daha kısa sürede ulusal pazara çıkmasına yardımcı olmaktadırlar.	Kesinlikle katılıyorum Katılıyorum Kararsızım Katılmıyorum Kesinlikle katılmıyorum

31-Bir akademisyen olarak sizi girişimciliğe yönlendiren etkenler neler oldu? Lütfen 1-5 arası derecelendiriniz. 1- Etkisiz / 2- Çok az etkili / 3- Az etkili / 4- Epey etkili / 5- Çok etkili	Kendi kendimin patronu olmak Akademik kariyerim boyunca elde ettiğim bilimsel birikimi iş hayatında kullanmak Gelirimde artış sağlamak Fikri mülkiyet hakları aracılığıyla kendi araştırma sonuçlarım ve buluşlarım üzerinde kontrol sahibi olmak Ailemdeki bireylere iş imkânı sağlamak Yeni yetenekler kazanmak suretiyle kendi kendimi geliştirmek İleride başkalarına devredebileceğim bir iş yaratmak Kendi araştırma sonuçlarımı veya buluşlarımı kolayca ticarileştirmek ve yaygınlaştırmak Bilimsel topluluk içerisindeki itibarımı artırmak Akademik çalışmalarım için ek finansman kaynağı yaratmak Katıksız entelektüel merak: Problem çözmek suretiyle araştırma-geliştirme yapmak Networks: Araştırma ve sanayi ağları ile bağlarımı geliştirmek Bilgi ve/veya teknoloji transferi için olanak sağlamak

32-Girişimcilik kariyeriniz boyunca karşılaştığınız en önemli/ciddi engeller nelerdir? Lütfen 1-5 arası derecelendiriniz. 1- Etkisiz / 2- Çok az etkili / 3- Az etkili / 4- Epey etkili / 5- Çok etkili	Kısa dönem sermayeye ulaşma konusunda sorunlar Uzun dönem sermaye birikimi oluşturulması konusunda sorunlar Devlet bürokrasisi ve hantallığı Çalıştığım üniversitede kendi bölümümden olmayan akademisyenlerden aldığım olumsuz tepkiler Çalıştığım üniversitede kendi bölümümdeki çalışma arkadaşlarımdan aldığım olumsuz tepkiler Üniversitedeki iş verimimde ve iş çıktımda düşüş İşletme, muhasebe ve pazarlama konusundaki tecrübesizliğim (ben bilim insanıyım, işletmeci değilim) TTO'dan yeterli yardım alamamış olmam Beklediğim ürün ticarileştirme hedefine varamamış olmam Şirketimin faaliyet alanında çok fazla rekabet olması Araştırma/iş/sanayi bağlantılarımı yeterince geliştirememiş olmam Uzun ve karmaşık süreçler nedeniyle patent veya lisanslar hakkında ortaya çıkan zorluklar Ekonominin gidişatı ile ilgili sorunlar Ürün/yöntemlerimi fikri mülkiyet hakları ile koruma altına almamdan dolayı, araştırma sonuçlarımı bilimsel toplantılarda sunamamam Şirkete aldığım personel ile alakalı sorunlar Akademik birikimimi bu işe yansıtamamış olmam

33-Firma faaliyetleri kapsamında başarı kriterleriniz neler oldu? Lütfen 1-5 arası derecelendiriniz. 1- Etkisiz / 2- Çok az etkili / 3- Az etkili / 4- Epey etkili / 5- Çok etkili	İdari/mali konulardaki yeterliliğim Bir akademisyen olmam nedeniyle akademik mesleki birikimimi özel işimde başarıyla kullanabilmiş olmam Faaliyetlerimi finanse edecek fonlara kolay erişim Bu firmamdan önce elde etmiş olduğum geçmiş özel sektör çalışma deneyimi Pazarlama yöntemlerimin başarılı olması Networks: Araştırma ve iş/sanayi çevreleriyle yeterli bağlantı ve işbirliğimin olması Pazara sunduğumuz ürün/hizmetlerin rekabetçi fiyatlara sahip olması Firmamın bir üniversite teknoloji geliştirme alanında konuşlu olmasının sağladığı avantajlar Firmamda ortaya çıkan araştırma sonuçlarım sayesinde yeni bilimsel makalelerimin yayınlanmış olması Ürün ticarileştirme hedefine varmış olmam Firmamda ortaya çıkan ürün/yöntem/hizmetler için en az bir patent/faydalı model alabilmiş olmam Firmam için uygun personel seçimi yapmış olmam Firmamızca pazara sunulan ürün/hizmetlerin yenilikçi olması ve benzerlerinin başka rakip firmalarca pazara sunulmaması

34-Sahibi/ortağı olduğum firmanın faaliyetlerine baktığımda, firmamı genel olarak başarılı görüyorum.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
35-Bir iş yeri sahibi/ortağı olarak, iş yeri kaynaklı stres hayatımın bir parçası oldu.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
36-Yakın çevrem (aile ve arkadaş) girişimcilik atılımımı olumlu karşıladı.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
37-Üniversitede bölümdeki çalışma arkadaşlarım girişimcilik atılımımı olumlu karşıladılar.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
38-Girişimcilik kariyerim aile yaşantımı olumsuz yönde etkiledi.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
39-Girişimcilik kariyerim boş zaman/ hobi /dinlenme için kendime ayırdığım zamanda azalışa sebep oldu.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
40-Akademisyen olmam, girişimcilik başarım üzerinde kayda değer olumlu etki yapmadı.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
41-Firma faaliyetleri kapsamında akademik nitelikli çalışmalarıma kaynak/girdi üretmede başarılı oldum.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
42-Firmam sayesinde akademik nitelikli çalışma sonuçlarımı/bulgularımı ticarileştirebildim/yaygınlaştırabildim.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum

43-Girişimcilik kariyerim sırasında araştırma ve sanayi bağlantıları/işbirlikleri geliştirdim.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
44-Girişimcilik kariyerim sırasında yurt dışından şirketime teknoloji transferi yaptım.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
45-Firmada yürütülen çalışmaların bir sonucu olarak en az bir patent/faydalı model başvurusunda bulundum.	Evet Hayır
46-Firmada yürütülen çalışmaların bir sonucu olarak en az bir patent/faydalı model başvurum olumlu sonuçlandı ve patent/faydalı model aldım.	Evet Hayır
47-Girişimcilik kariyerim boyunca ürün/hizmetlerim için diğer taraflara en az bir kez lisans hakkı verdim.	Evet Hayır
48-Firmamın üniversite teknoloji geliştirme bölgesinde konuşlu olması, firma hedeflerine ulaşmamda bana yardımcı oldu.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
49-Firmamın faaliyete geçtiği andan itibaren Teknoloji Transfer Ofisi'nden yeterli yardım aldım.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
50-Firma faaliyetleri sonucunda ortaya çıkan araştırma sonuçlarını içeren ve yazarları arasında olduğum en az bir bilimsel makale SCI'ya kayıtlı uluslararası dergi(ler)de yayınlandı.	Evet Hayır
51-Firma faaliyetleri sonucunda ortaya çıkan araştırma sonuçlarını içeren ve yazarları arasında olduğum en az bir bilimsel makale SCI'ya kayıtlı ulusal dergi(ler)de yayınlandı.	Evet Hayır
52-Firma işlerimin yoğunluğu nedeniyle üniversitedeki verimliliğim ve iş çıktımda düşüş meydana geldi.	Evet, artık üniversitedeki işlerime eskisi kadar vakit ayırmakta zorlanıyorum Hayır, üniversitedeki işlerimi de aynen aynı verimlilikte sürdürüyorum

53-Firmamdaki çalışmalar sonucunda ortaya çıkan ürün/yöntemleri ve/veya bunlarla ilgili bilimsel bulguları, fikri mülkiyet hakları kapsamında koruma altına alma ihtiyacı nedeniyle, bilimsel seminer/kongre bildirisi olarak sunmadım.	Evet, fikri mülkiyet hakları, bulguların bilimsel aktivitelerde tebliğ edilmesine engeldir ve ben de buna uyarım Hayır, böyle bir ikileme düştüğümde, fikri mülkiyeti umursamam ve bilimsel seminer/kongre tebliğlerine daha çok önem veririm. Emin değilim, kararım elimdeki ürün/yöntem/bulguya göre değişecektir
54-Fırsat olarak gördüğüm birçok proje veya ürün çeşitli sebeplerle sonuçlandırılamadı.	Evet Hayır
55-Firmanız ile ulusal pazara sunduğunuz ürün/hizmetler, sahip oldukları özellikleriyle halihazırda başka firmalarca da pazara sunulmuş durumda mı? Rekabet durumu nedir?	Evet, aynı özelliklere sahip tüm ürün/hizmetlerimizi ulusal pazara sunan firma(lar) mevcut Hayır, firmamız ile sunduğumuz ürün/hizmetler ile aynı özelliklere sahip benzer ürün/hizmetler ülkemizde yok Ürün/hizmete göre durum değişiyor, sunduğumuz kimi ürün/hizmetlerimiz başkalarınca da sunuluyor ancak ulusal pazara sunmuş olduğumuz en az bir yenilikçi ürün/hizmetimiz mevcut
56-Bir gün akademisyen ve iş adamı/kadını rollerimden birini seçmek zorunda kalsam, akademisyenliği seçerim.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
57-Firmadaki idari/mali işlerin yürütülmesi için bu konuda uzman personeli işe aldım.	Evet Hayır

58-Firmamız kurumsallaşma sürecini tamamladı veya kısa sürede tamamlayacak.	Evet, kurumsallaşma konusuna önem verdim ve bu konudaki adımları (ortaklarımla beraber) attım Hayır, firmamız için kurumsallaşmaya gerek olmadığına inanıyorum
59-Şirketteki araştırma-geliştirme işleri için gerek gördüğümde yüksek lisans/doktora öğrencilerini işe aldım.	Evet Hayır
60-Ticari hayatın şartlarını biliyorum ama şirket işi bile olsa, benim için ürünümün/hizmetimin sağlayacağı toplumsal fayda, getireceği kârdan daha önemlidir.	Kesinlikle katılmıyorum Katılmıyorum Kararsızım Katılıyorum Kesinlikle katılıyorum
61-Anket içerisinde kapsanmamış olabilecek fakat sizin belirtmek istediğiniz hususları bu alanda yazabilirsiniz.	

APPENDIX B: Online Questionnaire Content (English)

1-Please select the university you work at.	
2-Your department	
3-Your current academic title.	
4-Your gender.	
5-Years served at the department.	
6-How would you define the university administration's attitude towards the entrepreneurial activities undertaken by academicians?	Negative Neutral Positive
7- How would you define the attitude of other acedemics at your department towards your entrepreneurial activities?	Negative Neutral Positive
8-Are there any other academicians engaging in entrepreneurial activities at your department?	Yes No I don't know
9-Please select your firm's area of operation.	
10-Your company's inception date.	
11-Number of employees in the firm.	
12-Your weekly average hours of work devoted to company work.	
13-What are your firm's sources of income?	Project grant/funding platforms (TÜBİTAK, European Commission, Development Agencies, etc.) Product/services sales Maintenance/Support services Consulting services Distributorship Other
14-Please select the technology development zone(s) your firm is located.	
15-Can you define your firm as an R&D firm?	Yes No

16-Is this your first entrepreneurial attempt?	Yes No
17-Have you ever been employed in private sector companies?	Yes No
18-Have you ever undertaken with private sector companies any joint R&D, infrastructure, scientific projects throughout your academic life?	Yes No
19-Have you ever formed any business or scientific partnerships with private sector companies throughout your academic life?	Yes No
20-Have you ever applied for any patents/utility models prior to starting your entrepreneurial activities with your current firm?	Yes No
21- Have you ever granted licensing to any parties prior to starting your entrepreneurial activities with your current firm?	Yes No
22-Are commercialization activities common in your area of research/operation?	Yes No
23-Should the outcome of the R&D work in your area of research publicly accessible free-of-charge by everyone for public benefit?	Yes, R&D outcomes should be accessible to everyone free-of-charge and commerciable by others. No, I prefer to protect my R&D outcomes with IPR.
24-How would you evaluate yourself in terms of identifying opportunities to establish a business and picking innovative ideas?	I would identify opportunities to establish a new business even if I may not later pursue such action. I would easily identify opportunities that would later turn into new products/services, even if I may not later pursue such action. I do not care about identifying opportunities to establish new profitable businesses or innovative commercial ideas. I care about the scientific research dimension.

25-Which of the following best matches your idea of AEs?	Faculty members' entrepreneurship should be confined to making an invention and patenting it only. Commercialization activities other than that mean distancing oneself from making science. Faculty members should be able to engage in entrepreneurship activities in any form they wish to do. Such behavior does not distance them from making science.
26-Academicins are potential key actors who would take part in the technology transfer process.	Strongly agree Agree Undecided Disagree Strongly disagree
27- Academicins are potential key actors who would take part in the university-industry collaboration.	Strongly agree Agree Undecided Disagree Strongly disagree
28-University-Industry collaboration is crucial in improving R&D activities on national level.	Strongly agree Agree Undecided Disagree Strongly disagree
29-Academicians should focus on public benefits of entrepreneurial activities rather than seeking profits.	Strongly agree Agree Undecided Disagree Strongly disagree
30- Corporate work of academic entrepreneurs reduces the time required for the academic research results to reach the end-users and the national technology market for the benefit of the society.	Strongly agree Agree Undecided Disagree Strongly disagree

31- What were the motivational determinants that caused you to take on private entrepreneurship activities? Please score from 1 to 5. 1- Not effective / 2- Very little effective / 3- Little effective / 4- Quite effective / 5- Very effective	To be my own boss. To utilize the academic know-how that I have acquired throughout my academic life in business. To lead to an increase in my income. To have control over my research findings and/or inventions via intellectual property rights. To provide job opportunities for my family members. To improve myself by gaining new skills. To create a business that I can sell to others in the future. To easily commercialize and disseminate my research findings and/or inventions. To boost my prestige/fame in the scientific society. To create additional funding for my academic work. Pure intellectual curiosity: R&D via problem solving. To establish ties with business/ industry networks. Create an opportunity to transfer technology and knnow-how from outside.

32- What are the main challenges that you have encountered throughout your entrepreneurship? Please score from 1 to 5. 1- Not effective / 2- Very little effective / 3- Little effective / 4- Quite effective / 5- Very effective	Access to short-term capital. Access to long-term capital. Cumbersome state bureaucracy. Negative reactions received from academics from departments other than my own. Negative reactions received from academics from my department. Decline in the efficacy and output of the work that I undertake at the university. Lack of experience in finance, management and marketing (I am a scientist, not a business person) Insufficient assistance from the TTO. Inability to reach the commercialization/dissemination targets set. Too much competition in my firm's field of operation. Having not sufficiently developed business/industry networks Problems stemming from patent and licensing procedures. Problems borne by the overall economic situation in the country. The fact that I feel the need to protect the know-how which has accumulated as a result of my entrepreneurial activities at the cost of refraining from sharing my findings at scientific congresses. Problems related to the personnel hired. Inability to transfer my academic know-how to business.

33- What are your success criteria in context of your firm activities? Please score from 1 to 5. 1- Not effective / 2- Very little effective / 3- Little effective / 4- Quite effective / 5- Very effective	Competence in administrative and financial issues. The capacity to utilize the academic know-how in private business activities. Easy access to finances. Past private sector work experience. Successful marketing strategies. Having developed adequate links to and collaborations with industry /business networks. Competitive pricing of products/ services introduced to the market. Advantages of being located on a university technology development zone. New publications emerging as a result of the research results reached during the firm work. Meeting the target in commercializing products/services. Obtaining at least one patent for the output created in the firm. Right choice of personnel in the firm. Introduction of innovative products to the market or the fact that the products concerned have not been previously offered in the market by other suppliers.

34-Considering the activities undertaken so far, I find my company successful.	Strongly disagree Disagree Undecided Agree Strongly agree
35-As an enterprise owner, I experience work-related stress as a part of my life.	Strongly disagree Disagree Undecided Agree Strongly agree
36-The attitude of my close circle of family and friends towards my entrepreneurial move was positive.	Strongly disagree Disagree Undecided Agree Strongly agree
37- The attitude of my colleagues at my university department towards my entrepreneurial move was positive.	Strongly disagree Disagree Undecided Agree Strongly agree
38-My entrepreneurial career negatively affected my family life.	Strongly disagree Disagree Undecided Agree Strongly agree
39- My entrepreneurial career caused a decline in the time I spent for leisure/hobbies/rest.	Strongly disagree Disagree Undecided Agree Strongly agree
40-Being an academician did not have a significant impact on my commerciliziation success.	Strongly disagree Disagree Undecided Agree Strongly agree
41-My entrepreneurial activities enabled me to create resources/input for my academic research.	Strongly disagree Disagree Undecided Agree Strongly agree
42-My entrepreneurial activities enabled me to commercialize/disseminate my academic research findings.	Strongly disagree Disagree Undecided Agree Strongly agree

43- My entrepreneurial activities enabled me to develop business/industry collaborations.	Strongly disagree Disagree Undecided Agree Strongly agree
44-I transferred technology from foreign countries during my entrepreneurial activities.	Strongly disagree Disagree Undecided Agree Strongly agree
45-I applied for at least one patent/utility model as a result of the activities carried out in the firm.	Yes No
46-At least one of my patent/utility model applications was approved by authorities.	Yes No
47-I granted licensing rights to other parties at least once during my entrepreneurial career.	Yes No
48-The location of the firm on the premises of a technology development zone helped me reach my company goals.	Strongly disagree Disagree Undecided Agree Strongly agree
49-I obtained sufficient assistance from the TTO during my entrepreneurial career.	Strongly disagree Disagree Undecided Agree Strongly agree
50-At least one scientific article (co)-authored by me tackling outcomes obtained as a result of company activities was published in an international journal under SCI.	Yes No
51- At least one scientific article (co)-authored by me tackling outcomes obtained as a result of company activities was published in a national journal under SCI.	Yes No
52-There was a reduction in my academic efficiency and work output at the university due to the intensive work schedule at the company.	Yes, I cannot spare as much time for my academic work at the university as I did in the past. No, I continue my academic responsibilities at the university with the same efficiency.

53-I did not present my company's products/services and associated findings at scientific seminars/congresses due to my concerns about future IPR protection.	Yes, IPR prevents the research findings from being disclosed at scientific events and I comply with this principle. No, if I face such dilemma, I would not care about the IPR and present my findings at scientific events. I am not sure, my decision would depend upon the product/service/finding in question.
54-Some projects that I saw as promising were not successfully completed due to various reasons.	Yes No
55-Have the products/services presented to the market by your firm been previously presented to the national market by other companies? What is the competition like?	Yes, products/services/findings bearing the same chracteristics as ours have been presented to the national market by other companies. No, there are not any similar products/services presented to the market in our country. It depends. While some of our products/services have been presented to the market by other suppliers, we have at least one innovative product/service presented to the national market.
56-If one day I have to choose between my roles as an academician and a business person, I would go for academics.	Strongly disagree Disagree Undecided Agree Strongly agree
57-I hired expert personnel to manage administrative and financial affairs.	Yes No

58-Our company has completed its corporate organizational structure or it will do so in the short-term.	Yes, this is an important issue and we took the necessary steps in that direction. No, I do not think there is a need for corporate organizational structuring at this point in time.
59-I hired masters/PhD students for the research work at the company.	Yes No
60-I am aware of the circumstances surrounding business life but the societal benefit to be born by the products/services created by my firm is more important than the profit they would bring along.	Strongly disagree Disagree Undecided Agree Strongly agree
61-Please write about other issues (if any) that you may wish to bring to my attention.	

APPENDIX C: Official Letters From the Department Head of the STPS to the Administrations of Five Prominent TDZs in Ankara

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

ODTÜ TEKNOKENT A.Ş. YÖNETİMİ
GENEL MÜDÜRLÜK MAKAMINA

26.10.2015

ODTÜ Sosyal Bilimler Enstitüsü Bilim ve Teknoloji Politikası Çalışmaları Anabilim Dalı Yüksek Lisans Programı öğrencimiz Enver Hakan Konaç "Girişimci Akademisyenler: Ankara'daki Teknoloji Geliştirme Bölgelerinde Motivasyon Nedenleri, Karşılaşılan Zorluklar ve Başarı Kriterleri" başlıklı tez çalışmasını yürütmektedir. Anketin hedef kitlesi, hem bir üniversitede öğretim üyesi, hem de üniversite teknoloji geliştirme bölgelerinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızdır. Tez çalışması, internet üzerinden erişilebilecek bir ankete katılım ve öğrencimizle yüz yüze görüşme safhalarını kapsayacaktır.

Yapılacak çalışma tamamen anonim nitelikte olacak, hocalarımızın ve şirketlerinin adları çalışma içerisinde kesinlikle geçmeyecektir. Ayrıca anket ve yüz yüze görüşmeler, şirketlerin rakamsal bilgilerini (ciro, hasılat, gider, vb.) içermeyecektir. Anket yapılacak kişilere ve şirketlere dair hiçbir bilgi kesinlikle üçüncü taraflarla paylaşılmayacaktır. Bu bağlamda aşağıdaki hususlarda ODTÜ Teknokent Yönetiminin destek ve yönlendirmesine ihtiyaç doğmuştur:

1. Hem bir üniversitede öğretim üyesi, hem de ODTÜ Teknokent bünyesinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızın ad-soyadları, öğretim üyesi oldukları üniversite ve ana bilim dalı ile şirketlerinin adları ve e-posta adreslerini içeren şirket iletişim bilgilerini içeren listenin tarafımıza aşağıda yazılı olan e-posta adresleri üzerinden iletilmesi

2. Aşağıda verilen anket adresinin internet üzerinden doldurulması amacıyla, ilgili öğretim üyelerine gönderilerek anketi doldurmalarının istenmesi

için gereğini arz ederim. Desteğiniz için teşekkürlerimizi sunarım.

Saygılarımla,

Prof. Dr. Teoman Pamukçu
ODTÜ Bilim ve Teknoloji
Politikası Anabilim Dalı
Başkanı

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

Anket linki: (Çalışmanın amacı anketin giriş sayfasında okunabilir).
http://www.surveey.com/SurveyStart.aspx?lang=1&surv=d69fc42b99e240d2b7d1030a864c2cc6

İletişim Bilgilerimiz:

Prof. Dr. Teoman Pamukçu: pamukcu@metu.edu.tr
ODTÜ TEKPOL, MM Binası, 220 ODTÜ 06800 Çankaya, Ankara
Cep tel: 05[redacted]

Enver Hakan Konaç: hakankonac@gmail.com
Cep tel: 05[redacted]

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

HACETTEPE TEKNOKENT A.Ş. YÖNETİMİ
GENEL MÜDÜRLÜK MAKAMINA

26.10.2015

ODTÜ Sosyal Bilimler Enstitüsü Bilim ve Teknoloji Politikası Çalışmaları Anabilim Dalı Yüksek Lisans Programı öğrencimiz Enver Hakan Konaç "Girişimci Akademisyenler: Ankara'daki Teknoloji Geliştirme Bölgelerinde Motivasyon Nedenleri, Karşılaşılan Zorluklar ve Başarı Kriterleri" başlıklı tez çalışmasını yürütmektedir. Anketin hedef kitlesi, hem bir üniversitede öğretim üyesi, hem de üniversite teknoloji geliştirme bölgelerinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızdır. Tez çalışması, internet üzerinden erişilebilecek bir ankete katılım ve öğrencimizle yüz yüze görüşme safhalarını kapsayacaktır.

Yapılacak çalışma tamamen anonim nitelikte olacak, hocalarımızın ve şirketlerinin adları çalışma içerisinde kesinlikle geçmeyecektir. Ayrıca anket ve yüz yüze görüşmeler, şirketlerin rakamsal bilgilerini (ciro, hasılat, gider, vb.) içermeyecektir. Anket yapılacak kişilere ve şirketlere dair hiçbir bilgi kesinlikle üçüncü taraflarla paylaşılmayacaktır. Bu bağlamda aşağıdaki hususlarda Hacettepe Teknokent Yönetiminin destek ve yönlendirmesine ihtiyaç doğmuştur:

1. Hem bir üniversitede öğretim üyesi, hem de Hacettepe Teknokent bünyesinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızın ad-soyadları, öğretim üyesi oldukları üniversite ve ana bilim dalı ile şirketlerinin adları ve e-posta adreslerini içeren şirket iletişim bilgilerini içeren listenin tarafımıza aşağıda yazılı olan e-posta adresleri üzerinden iletilmesi

2. Aşağıda verilen anket adresinin internet üzerinden doldurulması amacıyla, ilgili öğretim üyelerine gönderilerek anketi doldurmalarının istenmesi

için gereğini arz ederim. Desteğiniz için teşekkürlerimizi sunarım.

Saygılarımla,

Prof. Dr. Teoman Pamukçu
ODTÜ Bilim ve Teknoloji
Politikası Anabilim Dalı
Başkanı

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

Anket linki: (Çalışmanın amacı anketin giriş sayfasında okunabilir).
http://www.surveey.com/SurveyStart.aspx?lang=1&surv=d69fc42b99e240d2b7d1030a864c2cc6

İletişim Bilgilerimiz:

Prof. Dr. Teoman Pamukçu: pamukcu@metu.edu.tr
ODTÜ TEKPOL, MM Binası, 220 ODTÜ 06800 Çankaya, Ankara
Cep tel: 05[redacted]

Enver Hakan Konaç: hakankonac@gmail.com
Cep tel: 05[redacted]

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

GAZİ ÜNİVERSİTESİ TEKNOPARK YÖNETİMİ
GENEL MÜDÜRLÜK MAKAMINA

26.10.2015

ODTÜ Sosyal Bilimler Enstitüsü Bilim ve Teknoloji Politikası Çalışmaları Anabilim Dalı Yüksek Lisans Programı öğrencimiz Enver Hakan Konaç "Girişimci Akademisyenler: Ankara'daki Teknoloji Geliştirme Bölgelerinde Motivasyon Nedenleri, Karşılaşılan Zorluklar ve Başarı Kriterleri" başlıklı tez çalışmasını yürütmektedir. Anketin hedef kitlesi, hem bir üniversitede öğretim üyesi, hem de üniversite teknoloji geliştirme bölgelerinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızdır. Tez çalışması, internet üzerinden erişilebilecek bir ankete katılım ve öğrencimizle yüz yüze görüşme safhalarını kapsayacaktır.

Yapılacak çalışma tamamen anonim nitelikte olacak, hocalarımızın ve şirketlerinin adları çalışma içerisinde kesinlikle geçmeyecektir. Ayrıca anket ve yüz yüze görüşmeler, şirketlerin rakamsal bilgilerini (ciro, hasılat, gider, vb.) içermeyecektir. Anket yapılacak kişilere ve şirketlere dair hiçbir bilgi kesinlikle üçüncü taraflarla paylaşılmayacaktır. Bu bağlamda aşağıdaki hususlarda Gazi Teknopark Yönetiminin destek ve yönlendirmesine ihtiyaç doğmuştur:

1. Hem bir üniversitede öğretim üyesi, hem de Gazi Teknopark bünyesinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızın ad-soyadları, öğretim üyesi oldukları üniversite ve ana bilim dalı ile şirketlerinin adları ve e-posta adreslerini içeren şirket iletişim bilgilerini içeren listenin tarafımıza aşağıda yazılı olan e-posta adresleri üzerinden iletilmesi

2. Aşağıda verilen anket adresinin internet üzerinden doldurulması amacıyla, ilgili öğretim üyelerine gönderilerek anketi doldurmalarının istenmesi

için gereğini arz ederim. Desteğiniz için teşekkürlerimizi sunarım.

Saygılarımla,

Prof. Dr. Teoman Pamukçu
ODTÜ Bilim ve Teknoloji
Politikası Anabilim Dalı
Başkanı

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

Anket linki: (Çalışmanın amacı anketin giriş sayfasında okunabilir).
http://www.surveey.com/SurveyStart.aspx?lang=1&surv=d69fc42b99e240d2b7d1030a864c2cc6

İletişim Bilgilerimiz:

Prof. Dr. Teoman Pamukçu: pamukcu@metu.edu.tr
ODTÜ TEKPOL, MM Binası, 220 ODTÜ 06800 Çankaya, Ankara
Cep tel: 05[redacted]

Enver Hakan Konaç: hakankonac@gmail.com
Cep tel: 05[redacted]

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

BİLKENT ÜNİVERSİTESİ CYBERPARK YÖNETİMİ
GENEL MÜDÜRLÜK MAKAMINA

26.10.2015

ODTÜ Sosyal Bilimler Enstitüsü Bilim ve Teknoloji Politikası Çalışmalar7ı Anabilim Dalı Yüksek Lisans Programı öğrencimiz Enver Hakan Konaç "Girişimci Akademisyenler: Ankara'daki Teknoloji Geliştirme Bölgelerinde Motivasyon Nedenleri, Karşılaşılan Zorluklar ve Başarı Kriterleri" başlıklı tez çalışmasını yürütmektedir. Anketin hedef kitlesi, hem bir üniversitede öğretim üyesi, hem de üniversite teknoloji geliştirme bölgelerinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızdır. Tez çalışması, internet üzerinden erişilebilecek bir ankete katılım ve öğrencimizle yüz yüze görüşme safhalarını kapsayacaktır.

Yapılacak çalışma tamamen anonim nitelikte olacak, hocalarımızın ve şirketlerinin adları çalışma içerisinde kesinlikle geçmeyecektir. Ayrıca anket ve yüz yüze görüşmeler, şirketlerin rakamsal bilgilerini (ciro, hasılat, gider, vb.) içermeyecektir. Anket yapılacak kişilere ve şirketlere dair hiçbir bilgi kesinlikle üçüncü taraflarla paylaşılmayacaktır. Bu bağlamda aşağıdaki hususlarda Bilkent Cyberpark Yönetiminin destek ve yönlendirmesine ihtiyaç doğmuştur:

1. Hem bir üniversitede öğretim üyesi, hem de Bilkent Cyberpark bünyesinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızın ad-soyadları, öğretim üyesi oldukları üniversite ve ana bilim dalı ile şirketlerinin adları ve e-posta adreslerini içeren şirket iletişim bilgilerini içeren listenin tarafımıza aşağıda yazılı olan e-posta adresleri üzerinden iletilmesi

2. Aşağıda verilen anket adresinin internet üzerinden doldurulması amacıyla, ilgili öğretim üyelerine gönderilerek anketi doldurmalarının istenmesi

için gereğini arz ederim. Desteğiniz için teşekkürlerimizi sunarım.

Saygılarımla,

Prof. Dr. Teoman Pamukçu
ODTÜ Bilim ve Teknoloji
Politikası Anabilim Dalı
Başkanı

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

Anket linki: (Çalışmanın amacı anketin giriş sayfasında okunabilir).
http://www.surveey.com/SurveyStart.aspx?lang=1&surv=d69fc42b99e240d2b7d1030a864c2cc6

İletişim Bilgilerimiz:

Prof. Dr. Teoman Pamukçu: pamukcu@metu.edu.tr
ODTÜ TEKPOL, MM Binası, 220 ODTÜ 06800 Çankaya, Ankara
Cep tel: 05[redacted]

Enver Hakan Konaç: hakankonac@gmail.com
Cep tel: 05[redacted]

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

ANKARA ÜNİVERSİTESİ TEKNOKENT YÖNETİMİ
GENEL MÜDÜRLÜK MAKAMINA

26.10.2015

ODTÜ Sosyal Bilimler Enstitüsü Bilim ve Teknoloji Politikası Çalışmaları Anabilim Dalı Yüksek Lisans Programı öğrencimiz Enver Hakan Konaç "Girişimci Akademisyenler: Ankara'daki Teknoloji Geliştirme Bölgelerinde Motivasyon Nedenleri, Karşılaşılan Zorluklar ve Başarı Kriterleri" başlıklı tez çalışmasını yürütmektedir. Anketin hedef kitlesi, hem bir üniversitede öğretim üyesi, hem de üniversite teknoloji geliştirme bölgelerinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızdır. Tez çalışması, internet üzerinden erişilebilecek bir ankete katılım ve öğrencimizle yüz yüze görüşme safhalarını kapsayacaktır.

Yapılacak çalışma tamamen anonim nitelikte olacak, hocalarımızın ve şirketlerinin adları çalışma içerisinde kesinlikle geçmeyecektir. Ayrıca anket ve yüz yüze görüşmeler, şirketlerin rakamsal bilgilerini (ciro, hasılat, gider, vb.) içermeyecektir. Anket yapılacak kişilere ve şirketlere dair hiçbir bilgi kesinlikle üçüncü taraflarla paylaşılmayacaktır. Bu bağlamda aşağıdaki hususlarda Ankara Üniversitesi Teknokent Yönetiminin destek ve yönlendirmesine ihtiyaç doğmuştur:

1. Hem bir üniversitede öğretim üyesi, hem de Ankara Üniversitesi Teknokent bünyesinde faaliyet göstermekte olan şirket sahibi veya şirket ortağı olan değerli hocalarımızın ad-soyadları, öğretim üyesi oldukları üniversite ve ana bilim dalı ile şirketlerinin adları ve e-posta adreslerini içeren şirket iletişim bilgilerini içeren listenin tarafımıza aşağıda yazılı olan e-posta adresleri üzerinden iletilmesi

2. Aşağıda verilen anket adresinin internet üzerinden doldurulması amacıyla, ilgili öğretim üyelerine gönderilerek anketi doldurmalarının istenmesi

için gereğini arz ederim. Desteğiniz için teşekkürlerimizi sunarım.

Saygılarımla,

Prof. Dr. Teoman Pamukçu
ODTÜ Bilim ve Teknoloji
Politikası Anabilim Dalı
Başkanı

SOSYAL BİLİMLER ENSTİTÜSÜ
GRADUATE SCHOOL OF SOCIAL SCIENCES
BİLİM VE TEKNOLOJİ POLİTİKASI ÇALIŞMALARI
SCIENCE AND TECHNOLOGY POLICY STUDIES

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
MIDDLE EAST TECHNICAL UNIVERSITY

DUMLUPINAR BULVARI
06800 ÇANKAYA/ANKARA
T: +90 312 210 38 10
F: +90 312 210 79 93
stps@metu.edu.tr
www.stps.metu.edu.tr

Anket linki: (Çalışmanın amacı anketin giriş sayfasında okunabilir).
http://www.surveey.com/SurveyStart.aspx?lang=1&surv=d69fc42b99e240d2b7d1030a864c2cc6

İletişim Bilgilerimiz:

Prof. Dr. Teoman Pamukçu: pamukcu@metu.edu.tr
ODTÜ TEKPOL, MM Binası, 220 ODTÜ 06800 Çankaya, Ankara
Cep tel: 05[redacted]

Enver Hakan Konaç: hakankonac@gmail.com
Cep tel: 05[redacted]

APPENDIX D: Confidentiality Agreement with METU - Teknokent Inc.

ODTÜ·TEKNOKENT
"FuturMaker"

27/10/2015

BİLGİ TALEBİ GİZLİLİK ANLAŞMASI

Kurumunuzdan, ODTÜ Teknokent ile ilgili temin ettiğim her türlü bilgiyi;

1. Y. Lisans / Doktora tez çalışmaları veya benzeri araştırmalar için kaynak belirtmek suretiyle ve sadece eğitim amacıyla kullanacağımı,
2. Kurumunuzdan almış olduğum bilgileri kullanarak hazırlamış olduğum çalışmayı tamamladıktan sonra elektronik ortamda kurumunuz ile paylaşacağımı,
3. Kurumunuzdan edinmiş olduğum her türlü bilgiyi yukarıda belirtilen maddeler haricinde hiçbir amaç ile kullanmayacağımı,
4. Yukarıda belirtilen maddelere aykırı bir durumun olması halinde her türlü işlemin hakkımda yapılabileceğini ve bu işlemlere itiraz hakkımın olmadığını

kabul ve taahhüt ederim.

Ad Soyad	Enver Hakan Konaç
T.C. No	[redacted]
Telefon Numarası (GSM)	+90 5[redacted]
E – Posta Adresi	hakankonac@gmail.com
Üniversite	ODTÜ
Bölüm	Bilim ve Teknoloji Politika Çalışmaları
Çalışmanın Türü (Y. Lisans / Doktora Tezi, vb.)	Yüksek Lisans Tezi
Çalışmanın Adı	"Girişimci Akademisyenler: Ankara'daki Teknoloji Geliştirme Bölgelerinde Motivasyon Nedenleri, Karşılaşılan Zorluklar ve Başarı Kriterleri"
İmza	[redacted]

1/1

APPENDIX E: TURKISH SUMMARY / TÜRKÇE ÖZET

AKADEMİK GİRİŞİMCİLER:
ANKARA'DAKİ TEKNOLOJİ GELİŞTİRME BÖLGELERİNDE MOTİVASYON FAKTÖRLERİ, KARŞILAŞILAN ZORLUKLAR VE BAŞARI KRİTERLERİ

Üniversite-sanayi işbirliği çerçevesinde ele alınan akademik girişimcilik, bilim ve teknoloji politikalarının önemli bir bileşenidir. Akademik bilgi ve fikirlerin, ticarileştirilebilir ürün veya hizmetlere dönüştürülmesi yoluyla, bilimsel bilgi tabanının iyileştirilmesi, piyasada rekabeti artıran bir faktördür. Üniversite-sanayi işbirliğinin bir bileşeni olarak akademik girişimciliğin desteklenmesi, geçtiğimiz birkaç on yılda, gelişmiş ülkelerde öne çıkan bir etken olmuştur. Üniversite-sanayi işbirliğinin daha yüksek seviyede yenilikçiliğe ve ekonomik rekabet yeteneğine olanak tanıdığına inanılmaktadır. Akademik girişimcilik, 60 yıllık gelişimi boyunca köklerini ABD üniversitelerinden almıştır. ABD'deki akademisyenler yıllardır üniversitelerdeki geleneksel öğretim ve araştırma görevlerine ilaveten girişimcilik faaliyetlerinde bulunmaktadırlar. Laboratuvar yönetimi, araştırmacıların buralarda işe alınması, ek kaynak için projelerin geliştirilmesi bu girişimcilik faaliyetlerine örnek olarak verilebilir. ABD'de akademisyenler, yıllardır politikacılarla ve sanayi ortaklarıyla etkileşim içinde bulunmaktadırlar. Ayrıca, özel şirketlerin yönetim kurullarında yer alarak, bilimsel disiplinlerini ve araştırma alanlarını, ticari amaçlar için kullanma özgürlüğüne sahiptirler (Cansız, 2016). Akademik girişimciliğin doğum yeri olan ABD, Amerikan ulusal inovasyon sistemine büyük ve sürekli katkıları olan, iyi organize edilmiş, 1951'de kurulan Stanford Araştırma Parkı, 1959'da kurulan Research Triangle Park ve bunları izleyen birçok benzerleri gibi üniversite bilim parkları ile ünlüdür (Kenney ve Von Burg, 1999; Zou ve Zhao, 2014). ABD'de, üniversite bilim parkları, ileri teknoloji yayılımına etkileri, akademik araştırma sonuçlarının sanayiye uygulanması, ortak araştırma sözleşmeleri ve diğer üniversite-sanayi etkileşim yolları vasıtasıyla, ulusal/bölgesel inovasyon sistemlerinin temel bileşenleri olmuşlardır (Su ve arkadaşları, 2015). 1980 yılında Bayh-Dole Yasası'nın yürürlüğe girmesi ile de lisans

anlaşmaları, ortak araştırma girişimleri ve universite-konuşlu yeni firmaların kurulması yollarıyla, ABD üniversitelerinden özel firmalara ticari bilgi transferinde hızlı bir artış meydana gelmiştir (Allen ve arkadaşları, 2007).

Böyle bir potansiyelin avantajlarından yararlanmak üzere, gelişmiş ülkelerdeki birçok üniversite, geleneksel üniversite modelinden sanayi ile güçlü bağları olan ve akademisyenlerinin girişimcilik faaliyetlerini destekleyen üniversite modeline geçmişlerdir (Krabel ve Mueller, 2009). Üniversitelerin girişimcilik ekosisteminin en önemli bileşenlerinden olduğu gerçeği ışığında, araştırmaların ticarileştirilmesi kavramı, yeni bir terimi tanımlamak üzere kullanılmaya başlanmıştır: "Girişimci Üniversite". Bu terim aslında bilgi toplumuna ve bilgi ekonomisine geçişin bir sonucudur. Bercovitz ve Feldman (2008), akademisyenlerin teknoloji transferi faaliyetlerinde bulunma kararlarının, aslen üniversitelerin akademik girişimcilik insiyatiflerini kabul ettikleri anlamına geldiğini belirtmektedir. Etzkowitz (2003)'e göre, girişimci üniversite, geleneksel öğretim ve araştırma görevlerine ek olarak, üçüncü bir göreve daha sahiptir: Üniversitede üretilen bilgiyi, ekonomik ve sosyal faydaya dönüştürme yeteneği ile sanayi ve topluma direk katkı. Bu bağlamda, akademik girişimcilerin (AG'ler) ticari faaliyetlerinin, akademik araştırma sonuçlarının toplum yararına dönük olarak ulusal teknoloji pazarına ve son kullanıcılara ulaştırılması için gerekli olan zamanı kısalttığına şüphe yoktur. Diğer yandan Beyhan ve Rickne (2015), bazı akademisyen ve üniversitelerin, akademik girişimciliğin üniversitelerin temel görevleri ile bağdaşmadığı düşüncesiyle, akademik girişimciliğe karşıt görüş bildirdikleri durumlar olduğuna dikkat çekmişlerdir. Örneğin, akademik girişimcilik faaliyetleri nedeniyle öğretim ve araştırma görevlerinde meydana gelen zaman kaybı, birçok akademisyenin, üniversitelerin rolünün ticari iş yapmak değil, ticari işleri desteklemek olduğu şeklinde argüman geliştirmelerine sebep olmuştur (Henrekson and Rosenberg, 2001).

Türkiye'de inovasyona dayalı girişimcilik 1980'lerde başlamış ve 1990'larda internet ve küresel mobil teknolojilerin hızlı yayılımı eşliğinde e-ticaret ve telekomünikasyon alanındaki girişimcilerin pazara girmeleri ile devam etmiştir. 2000'li yıllar boyunca bir

yandan gelişmiş ülkelerle işbirliği artarken, bir yandan da devlet sanayiye olan desteğini artırmıştır. Gelişmiş ülkeleri örnek alan Türkiye, bilgi ekonomisine geçiş çabaları ile doğan fırsatı, tanınmış üniversitelerin bünyesinde girişim kuluçka merkezleri, teknoloji geliştirme bölgeleri (TGB) ve teknoloji transfer ofisleri (TTO) kurmak suretiyle akademik girişimciliği destekleyerek kullanmıştır. 2001 yılında yürürlüğe giren 4691 sayılı Teknoloji Geliştirme Bölgeleri Yasası, bu tür bir düzenlemenin yasal çerçevesini oluşturmuştur. Yasanın etkileri 2003 yılından itibaren görülmeye başlanmıştır. Aşağıdaki tablo, 2003-2015 yılları arasında kümülatif olarak Türkiye'deki TGB ve AG'lerce kurulan işletme sayısını göstermektedir. TGB sayısı 2003 yılında sadece 3 iken, 2015 yılında 42 olmuştur. AG'lerce kurulan işletme sayısı ise 2003-2015 yılları arasında 15'den 656'ya yükselmiştir.

Tablo 1. Türkiye'de akademik girişimcilik ile ilgili indikatörler (kümülatif)

	Aktif TGB sayısı	**AG'lerce Kurulan İşletme Sayısı**
2003	3	15
2004	6	22
2005	11	44
2006	14	100
2007	18	130
2008	18	151
2009	23	217
2010	28	279
2011	32	373
2012	34	497
2013	39	382
2014	42	542
2015	42	656

Kaynak: Cansız, M. (2016), "Türkiye'de Akademik Girişimcilik", T.C. Kalkınma Bakanlığı, Sosyal Sektörler ve Koordinasyon Genel Müdürlüğü, Yayın No. 2692, Ankara, p. 110.

Ankara, Türkiye'nin önde gelen üniversitelerinin yanı sıra, savunma sanayi, yazılım geliştirme ve makine imalatı gibi kalifiye eleman çalıştıran yüksek teknoloji girişimlerinin bulunduğu bir kenttir. Bu nedenle Ankara, devlet Ar-Ge desteğinden en

çok yararlanan ve en çok Ar-Ge harcaması yapan kent olma durumundadır. Ankara aynı zamanda performansları en yüksek düzeyde olan ve en fazla sayıda AG'nin aktif olarak bulunduğu TGB'lere ev sahipliği yapmaktadır. Aşağıdaki tablo, 2015 yılı itibarıyla Ankara'daki beş üniversite konuşlu TGB'lere ilişkin bazı önemli indikatörleri göstermektedir. Bu üniversite konuşlu TGB'lerde toplam 888 özel işletme faaliyet göstermektedir ve bunların içinden 140 işletme AG'lere aittir veya ortakları arasında AG'ler bulunmaktadır. Türkiye'deki 42 aktif üniversite konuşlu TGB'nin 5'i, TGB'lerde faaliyet gösteren şirketlerin yaklaşık %27'si, AG'lerce kurulan şirketlerin yaklaşık %21'i ve toplam çalışanların yaklaşık %34'ü, Ankara'daki üniversite konuşlu TGB'lerde faaliyettedir (Cansız, 2016).

Tablo 2. Ankara'daki üniversite konuşlu TGB'lere dönük bazı indikatörler

	İşletme Sayısı	**Çalışan Sayısı**	**Patent Sayısı**	**AG'lerce Kurulan İşletme Sayısı**
Bilkent	197	3281	58	25
Ankara	89	492	0	19
Gazi	111	844	9	27
Hacettepe	204	1698	17	18
METU	287	5120	89	51
Ankara Toplam	888	11435	173	140
Türkiye Toplam	3325	33380	496	656
Ankara'nın payı (%)	26,7	34,3	34,9	21,3

Kaynak: Cansız, M. (2016), "Türkiye'de Akademik Girişimcilik", T.C. Kalkınma Bakanlığı, Sosyal Sektörler ve Koordinasyon Genel Müdürlüğü, Yayın No. 2692, Ankara, p. 29.

TGB'leri düzenleyen 4691 sayılı kanun, üniversitelerde görevli akademisyenlerin, TGB sınırları içerisinde kalmak şartıyla özel girişimcilik faaliyetlerinde bulunabileceklerini ifade etmektedir. Günümüzde Türkiye'deki birçok akademisyen, TGB bünyesindeki şirketlerinde, iş ekosistemine dâhil olmuşlardır. T.C. Kalkınma Bakanlığınca yayımlanan bir rapor, Türkiye'de girişimci üniversitelerin ortaya çıkışının, üniversitelerde oluşturulan bilgi birikiminin daha hızlı bir şekilde sanayiye ve topluma aktarıldığını ifade etmektedir (Cansız, 2016). Aynı rapor, bu durumun, üniversitelerle

ilgili kantitatif indikatörlerde (örneğin, aktif TGB sayısı, akademik girişim sayısı, AG sayısı) önemli iyileşmelere yol açtığını ve kalitatif indikatörlerde (örneğin inovasyon kapasitesi, teknoloji geliştirme kapasitesi) gözlemlenecek benzer iyileşmelerin, ülkenin kalkınmasında hayati öneme sahip olduğunu bildirmektedir. Rapora göre Temmuz 2015 itibarıyla Türkiye'deki TGB'lerde toplam 3325 şirket faaliyet halindedir. Bunların yaklaşık %20'sine tekabül eden 656 işletme AG'ler tarafından kurulmuştur. AG sayısının, şirket ortaklarının da hesaba katılmasıyla beraber yaklaşık 1500 civarında olabileceği tahmin edilmektedir. Türkiye 2018 Global Girişimcilik Endeksinde 137 ülke içerisinde 44,5 puanla 37inci sırada[15] bulunmaktadır (Acs ve arkadaşları, 2018). Bu sıralamaya paralel şekilde, gerek Türkiye'deki TGB sayısının, gerek ise girişimcilik faaliyetleri yürütmekte olan akademisyen sayısının, gelişmiş ülkelerdekine göre alt sıralarda olduğu aşikârdır (Cansız, 2016). Bir akademisyeni kendi girişimini kurmaya iten etkenler ve bu süreçte karşılaşılan zorluklar bugün gelişmiş ülkelerde bile literatürde irdelenen konulardır. Dolayısıyla bu konuların, yıllık 2,2 milyar ABD doları tutarındaki ileri teknoloji ihracatının, toplam yıllık ihracat içindeki payının %1,4'ten[16] az olduğu Türkiye gibi gelişmekte olan bir ülkede de detaylı olarak incelenmesi yararlı olacaktır.

AG'lerin kendi girişimlerini başlatmalarındaki motivasyon etkenlerini anlamak önemlidir çünkü ancak bu şekilde akademik dünyadaki teşvik sistemi ve bilgi üretiminin sürekli değişen doğası ile bağlantılar kurulabilir. Tüm bu hususlar, üniversitelerde görevli bilim insanlarının toplumdaki rollerini nasıl algıladıklarını, akademisyenlerin ticarileştirmeye dönük faaliyetlerinin meşrulaştırılması konusunu ve hükümet organları ve üniversite yönetimlerinin uyguladıkları ilke ve stratejileri etkileme potansiyeline sahiptir (Beyhan and Rickne, 2015). Ticarileştirme sürecinde AG'lerce karşılaşılan zorlukları anlamak da önem arz etmektedir, çünkü ancak bu şekilde üniversite-sanayi bağlantılarını pürüzsüz bir şekilde korumaya ve ulusal ekonomi ve inovasyon sistemi üzerindeki faydaları daha kısa zamanda ve daha verimli

[15] ABD, 83,6 puanla ilk sıradadır.

[16] Türkiye İstatistik Kurumu (TÜİK) 2017 verilerine göre hesaplanmıştır.

bir şekilde elde etmeye yönelik çözümler üretilebilir. Son olarak, AG'lerin ticarileştirme faaliyetlerinde daha başarılı hale getirilmesine dönük önlemlerin alınabilmesi için AG'lerin kendilerini ne kadar başarılı gördüklerini gösteren başarı kriterlerini anlamak da önem arz etmektedir. Bu tezde incelenmiş olan bu faktörlerden sadece birini veya kombinasyonlarını veya hepsini dikkate alan geçerli strateji ve politika tavsiyelerinin oluşturulabilmesi, motivasyon, karşılaşılan zorluklar ve başarı kriterlerinin titiz bir analizinin yapılması ile mümkündür.

Krabel ve Mueller (2009), patentleme, lisanslama ve firma kurma faaliyetlerinin olası ticarileştirme yollarını oluşturduğunu belirtmiştir. Firma kurma, üniversite araştırmacılarının, akademik bilgi birikimlerini inovasyona dönüştürme yollarından biridir. Bu tezdeki hedef popülasyon olan AG'ler, gerek firmalarının tek sahipleri olarak gerek ise firma ortağı (üniversitenin yan kuruluşu veya bağımsız şirket) olarak kendi ticari işlerini yürütmekte olan üniversitelerde görevli akademisyenleri tanımlamaktadır (bir diğer ifadeyle Krabel ve Mueller'in tanımıyla firma kurmuş olan AG'leri). Bu tezin amacını en iyi şekilde ifade edecek bir ana başlık belirtmek gerekirse, bu "üniversite bilim insanları tarafından idare edilmekte olan girişimlerin kuruluş ve yönetimini etkileyen faktörler nelerdir?" olur. Bu bağlamda, bu tez (i) akademisyenlerin kendi firmalarını kurma kararlarındaki motivasyon faktörleri, (ii) girişimcilik faaliyetleri sırasında karşılaştıkları sorunlar, (iii) kendilerine dönük olarak algıladıkları başarı kriterleri konuları üzerinde yoğunlaşmaktadır. Bu üç hususu yönlendiren davranışsal kalıp ve diğer faktörler, üniversite-sanayi işbirliğini iyileştirmeyi amaçlayan üniversite ve hükümet politikaları üzerinde önemli etkiye sahiptir. Bu nedenle, bu tezde yukarıdaki üç konunun değerlendirilmesi paralelinde, altı öneri oluşturularak, tezdeki bulgular tarafından desteklenip desteklenmedikleri incelenecek ve nihayetinde hükümet, sanayi aktörleri ve üniversitelere dönük bir dizi politika tavsiyelerinde bulunulacaktır. AG'lerin kendi girişimlerini kurmalarındaki motivasyon faktörleri, girişimcilik faaliyetleri sırasında karşılaştıkları sorunlar ve kendilerine dönük olarak algıladıkları başarı kriterlerini, iki ayrı faaliyeti aynı anda yürütmekte olan AG'lerin kendilerinden öğrenmek, üniversite-sanayi işbirliği ile

bağlantının kurulması bakımından büyük önem arz etmektedir. Tezde oluşturulan altı öneri şunlardır:

- AG'ler parasal ve parasal olmayan değerlerin karışımından oluşan hibrit bir kişilik yapısına sahip olmakla beraber, parasal olmayan özellikleri daha ağır basmaktadır (Ö1),
- toplumsal fayda yaratılmasının, girişimlerinin kâr elde etmesinden daha önemli olduğunu düşünmeleri nedeniyle AG'lerin amaçları, akademik olmayan girişimcilerden farklılık arz etmektedir (Ö2),
- AG'ler girişimcilik faaliyetlerine başladıktan sonra sağlam iş/endüstri ağları oluşturmada başarılıdırlar (Ö3),
- AG'lerin niş pazarlara sunulacak ürünler geliştirmeleri, ticarileştirme hedeflerine ulaşmalarını sağlamaktadır (Ö4),
- AE'lerin girişimcilik faaliyetleri akademik performanslarında bir düşüşe sebep olmaktadır (Ö5),
- AG'lerin ürünlere dönük yenilikçi fikirler oluşturmaları, birincil olarak akademik bilgi birikimlerine dayanmaktadır (Ö6).

Bölüm 2'de, geniş bir literatür taraması kapsamında, akademik girişimciliğin tanımı, inovasyon sisteminin anahtar bileşenleri olarak üniversiteler, akademisyenlerin kendi firmalarını kurma kararlarındaki motivasyon faktörleri ve girişimcilik faaliyetleri sırasında karşılaştıkları sorunları incelemiş olan yayınların bir derlemesi yapılmıştır. Bu bölümde sunulan bilgilerin, sadece bu tezde elde edilen bulgular ve bu bağlamda incelenen öneriler ile literatürdeki tanım, özet ve kritik değerlendirmeler arasındaki bağlantıyı kurması değil, aynı zamanda tezde elde edilen bulguların, daha geniş kapsamda dünyada yapılan araştırmalarla nasıl bağdaştığını ortaya koyması beklenmektedir. Bölüm 3, tez kapsamındaki araştırmalarım sırasında kullanmış olduğum yöntemleri açıklamaktadır. Bölüm 4'te akademisyenlerin kendi firmalarını kurma kararlarındaki motivasyon faktörleri, girişimcilik faaliyetleri sırasında karşılaştıkları sorunlar ve kendilerine dönük olarak algıladıkları başarı kriterleri konularında elde edilen araştırma sonuçları incelenmiştir ve hangilerinin AG'ler için

daha önemli olduğu ortaya konulmaktadır. Son olarak sonuç bölümünü oluşturan Bölüm 5'te, elde edilen bulguları gözden geçirilmekte, hükümet, üniversite yönetimleri ve sanayi aktörlerine dönük bir dizi politika önerisinde bulunulmakta, çalışmanın kısıtları üzerinde durulmakta ve gelecekte bu konuda yapılabilecek çalışmalara yönelik temel oluşturulmaktadır.

Türkiye'de AG'ler üzerine yapılan çalışmalar gerçekten az sayıdadır. Bu az sayıdaki çalışmalar da, bu tezde incelenen konulardan birçok yönden ayrılmaktadır. Örneğin Beyhan ve Rickne (2015), nanoteknoloji alanında faaliyet gösteren akademiklerin, sanayi ile etkileşimlerindeki motivasyonlarını incelemiş ve üç temel motivasyon tanımlamıştır. Cansız (2016) ise Türkiye'deki akademik girişimciliği, Bourdieu'nun "Uygulama Teorisi" temelinde sosyolojik açıdan incelemiş ve habitus, kapital ve alan gibi kavramları içeren bütüncül bir analiz gerçekleştirmiştir. Bildiğim kadarıyla, bu tezin ana araştırma konusunu oluşturan üç husus hakkında, yani Türkiye'deki akademisyenlerin kendi firmalarını kurma kararlarındaki motivasyon faktörleri, girişimcilik faaliyetleri sırasında karşılaştıkları sorunlar ve kendilerine dönük olarak algıladıkları başarı kriterleri konularından herhangi biri hakkında yapılmış bir diğer çalışma mevcut değildir. Ayrıca, anket sırasında sorulan sorular ve sorulara verilen cevaplar daha önce Türkiye'de benzer bir çalışmada kullanılmamıştır. AG'ler ile ilgili olarak oluşturulmuş olan altı öneri de daha önceki çalışmalarda oluşturulan öneri veya hipotezlerden farklıdır. Tüm bu özellikler, benim fikrime göre, tezin özgünlük gereksinimini karşılayabilecek niteliktedir. Bu tez, yukarıda bahsedilen üç konu hakkında literatüre katkı yapmayı amaçlamakta ve politika belirlemeden sorumlu otoritelere uygun politika çözümleri oluşturmada yardımcı olmayı hedeflemektedir.

Bu tez kapsamında yapılan çalışmaların, önceleri sadece Orta Doğu Teknik Üniversitesi (ODTÜ) – Teknokent bünyesinde faaliyet göstermekte olan AG'lerin katılması planlanmış, ancak veri toplama amacıyla internet ortamında oluşturulan 60 sorudan oluşan kapsamlı ankete katılımın arzu edilen seviyenin altında gerçekleşmesi nedeniyle, diğer üniversitelerin TGB'lerinde faaliyet göstermekte olan az sayıdaki AG de çalışmaya dâhil edilmiştir. ODTÜ – Bilim ve Teknoloji Politikaları Çalışmaları

Anabilim Dalı Başkanlığınca ODTÜ Teknokent A.Ş. Yönetimi'ne resmi bir yazı yazılarak, Teknokent'te faaliyet göstermekte olan AG'leri tez konusu hakkında bilgilendirmesi ve anketi cevaplamaları için, teze ait internet bağlantısını AG'lere bildirmesi rica edilmiştir. Daha sonra diğer dört üniversite TGB başkanlıklarına (Bilkent, Ankara, Hacettepe, Gazi) da aynı yazı gönderilmiştir. Ne yazık ki, diğer üniversite TGB'lerinde (Hacettepe Üniversitesi ve Gazi Üniversitesi) faaliyette olan az sayıdaki AG'nin katılımından sonra bile arzu edilen cevap sayısına ulaşılamamış ve anket sadece 23 AG'nin katılımı ile sonuçlandırılmıştır. ODTÜ Teknokent A.Ş. ile yapılan gizlilik anlaşması kapsamında ODTÜ Teknokent bünyesinde faaliyet göstermekte olan toplam 76 AG'nin bilgileri tarafıma iletilmiş ve bu bilgiler kullanılarak AG'ler ile iletişime geçilerek yüz-yüze görüşme talebim iletilmiştir. Yüz yüze görüşme talebimi kabul eden toplam 18 AG ile konu hakkında daha kapsamlı ve detaylı bilgi edinilmesi amacıyla mülakat yapılmıştır. Tezde tek vaka tasarım analizi yöntemi kullanılmıştır.

Ankete verilen cevapların analizi sonucunda, akademisyenlerin kendi firmalarını kurma kararlarındaki motivasyon faktörleri arasından dört faktör ön plana çıkmıştır: a) akademik araştırma bulgularının ticarileştirilmesi (91,3%), b) bilimsel bilgi birikiminin ticarileştirme faaliyetlerinde kullanılması (78,3%), c) entelektüel merak, problem çözme yoluyla daha çok araştırma yapmak (65,2%), ve d) yeni becerilerin elde edilmesiyle kendini geliştirme (60,8%). Gerek anket sonuçlarının, gerek ise yüz yüze görüşmeler sonucu elde edilen bilgilerin değerlendirilmesi sonucunda, "AG'ler parasal ve parasal olmayan değerlerin karışımından oluşan hibrit bir kişilik yapısına sahip olmakla beraber, parasal olmayan özellikleri daha ağır basmaktadır" şeklindeki **Öneri 1 (Ö1),** tezde elde edilen bulgularca desteklenmektedir. "Toplumsal fayda yaratılmasının, girişimlerinin sadece kâr elde etmesinden daha önemli olduğunu düşünmeleri nedeniyle AG'lerin amaçları, akademik olmayan girişimcilerden farklılık arz etmektedir" şeklindeki **Öneri 2 (Ö2)** ise tezde elde edilen bulgularca desteklenmemektedir. AG'ler, toplumsal fayda yaratılması konusuna büyük önem vermekle beraber, kâr elde etme amacı ile toplumsal fayda yaratılmasını birbirlerini tamamlayan unsurlar olarak görmekte ve toplumsal fayda yaratılmasının, kâr elde

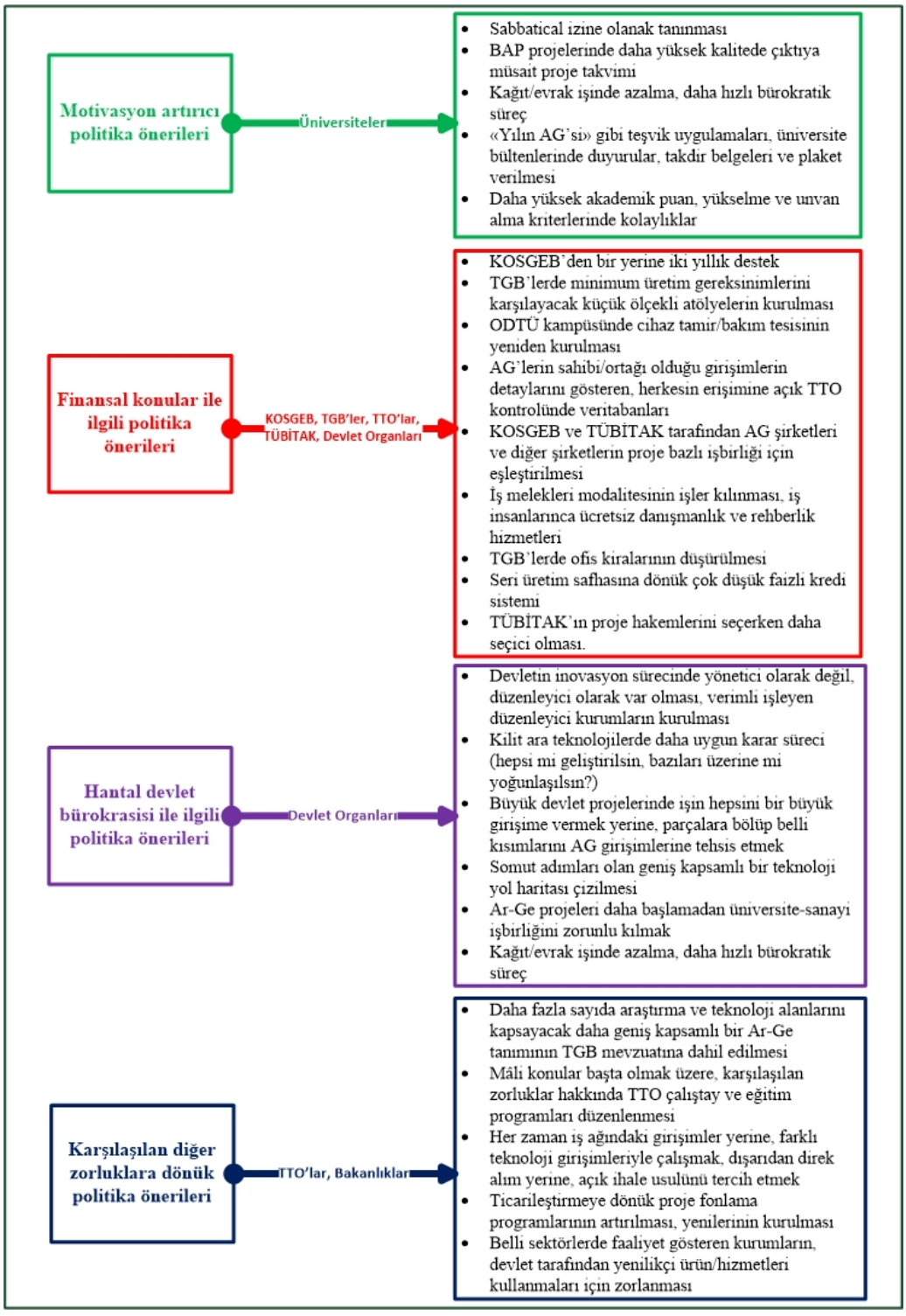
etmeyi dışlamadığını, aksine içinde barındırdığını düşünmektedirler. AG'ler toplumsal faydayı parasal ödülden daha önemli olarak görmekle beraber, kâr güdüsü olmadan toplumsal fayda aramanın bir girişimcinin amacı olmaması gerektiğini ifade etmektedirler.

Girişimcilik faaliyetleri sırasında AG'lerin karşılaştıkları sorunlar incelendiğinde, yine dört önemli zorluk ön plana çıkmaktadır: a) ticarileştirme faaliyetinin başarıya ulaşması için gerekli olan fonlara (sermaye) erişim (78,2% kısa dönem fon, 69,6% kısa dönem fon), b) hantal devlet bürokrasisi (60,8%), c) finans, işletme ve pazarlama konularında tecrübesizlik (ben bir bilim insanıyım, iş insanı değilim) (47,8%), ve d) ticarileştirme hedeflerine ulaşamama (39,1%). Diğer yandan, akademik bilgi birikiminin girişimcilik faaliyetlerinde kullanılamaması olarak tanımlanabilecek zorluğun, katılımcı AG'ler için geçerli olmadığı sonucuna ulaşılmıştır.

AG'lere kendilerine dönük olarak algıladıkları başarı kriterlerinin neler olduğu, bir diğer ifadeyle başarılarını hangi kriterlerin etkilediği sorulmuştur. Ön plana çıkan ilk dört başarı kriteri şunlardır: a) akademik bilgi birikiminin girişimcilik faaliyetlerinde kullanılabilme kapasitesi (82,6%), b) Daha önce başka girişimlerce pazara sunulmamış olan yenilikçi ürünlerin pazara sunulabilmesi (73,9%), c) Üniversite konuşlu bir TGB bünyesinde faaliyet göstermekten kaynaklanan avantajlar, ve d) yeterli iş/sanayi işbirliği ağları geliştirebilmek (69,5%). Pazarlama faaliyetleri ise AG'lerin başarı kriterleri arasında en son sırada yer almıştır. "AG'ler girişimcilik faaliyetlerine başladıktan sonra sağlam iş/endüstri ağları oluşturmada başarılıdırlar" olarak oluşturulan **Öneri 3 (Ö3)** tezde elde edilen bulgularca desteklenmektedir. "AG'lerin niş pazarlara sunulacak ürünler geliştirmeleri, ticarileştirme hedeflerine ulaşmalarını sağlamaktadır" şeklindeki **Öneri 4 (Ö4)** de tezde elde edilen bulgularca desteklenmektedir. "AE'lerin girişimcilik faaliyetleri akademik performanslarında bir düşüşe sebep olmaktadır" şeklindeki **Öneri 6 (Ö6)** tezde elde edilen bulgularca desteklenmemektedir. Son olarak, "AG'lerin ürünlere dönük yenilikçi fikirler oluşturmaları, birincil olarak akademik bilgi birikimlerine dayanmaktadır" şeklindeki **Öneri 6 (Ö6)** tezde elde edilen bulgularca desteklenmemektedir. Anketin

değerlendirilmesi sonucunda oluşan bulgular, AG'lerle yapılan yüz yüze görüşmelerle desteklenmiştir.

Son olarak, tezde yapılan analizlere dayalı olarak, hükümet organları, sanayi aktörleri ve üniversite yönetimlerine dönük olarak sunmuş olduğum politika önerileri aşağıdaki gibidir:



Daha önce de belirtildiği üzere, anketi cevaplayan ve yüz yüze görüşme talebimi kabul eden kısıtlı AG sayısı, bu tezin araştırma safhasındaki en büyük sorunu oluşturmuştur. Yetersiz örneklem büyüklüğü, faktör analizi veya probit analizi gibi kapsamlı bir

istatistiksel analiz yapılmasına engel olmakla kalmamış, aynı zamanda, araştırmanın çoklu vaka tasarım analizi yerine, tek vaka tasarım analizi yöntemi ile yapılmasına neden olmuştur. Bununla beraber, anketten ve yüz yüze görüşmelerden ulaştığım sonuçlar birbiriyle uyumludur ve tutarlı sonuçlar sunmaktadırlar. Bu çalışmada geçerli sayılabilecek sonuçlara ulaşabilmiş ve sonuçları doğru bir şekilde yorumlayabilmiş gibi görünüyorum. Örneklem büyüklüğünün yeterli olması durumunda (>100) ulaşılacak sonuçların, benim bu tezdeki bulgularıma doğru yönelebileceğini umut ederek teselli bulmaktayım.

Örneklemin yeterli büyüklükte olmaması ve bunun beraberinde getirdiği istatistiksel olarak anlamlı sonuçlar verecek istatistiksel analiz eksikliği, uygun istatistiksel süreç gerektiren hipotez kurma ve test etme işlemini yapmama engel teşkil etmiştir. Bunun yerine, bu tezde bazı önermelerde bulunma ve tezde elde edilen bulguların bu önermeleri destekleyip desteklemediklerini inceleme yoluna gidilmiştir. Bu nedenle, gelecekte AG'ler üzerine yapılacak çalışmalar, bu tezde oluşturulan önerileri daha büyük örneklemler üzerinden hipoteze dönüştürerek, doğru istatistiksel süreçler doğrultusunda test etmeyi amaçlayabilirler. Ancak, motivasyonlar, karşılaşılan zorluklar ve başarı kriterleriyle ilgili olarak başka birçok hipotez de oluşturularak test edilebilir. Bu nedenle, gelecekteki çalışmalar, bir yandan daha büyük örneklemleri dikkate alırken, bir yandan da farklı üniversite TGB'lerinde faaliyet göstermekte olan AG'ler arasından birbirine yakın sayıda AG'yi araştırma konusuna dâhil edebilmelidir. Böylece, farklı TGB ve üniversitelere yönelik kavramsal ve davranışsal farklar da ortaya konabilecektir.

APPENDIX F: TEZ İZİN FORMU

TEZ İZİN FORMU / THESIS PERMISSION FORM

ENSTİTÜ / INSTITUTE

Fen Bilimleri Enstitüsü / Graduate School of Natural and Applied Sciences ☐

Sosyal Bilimler Enstitüsü / Graduate School of Social Sciences ☒

Uygulamalı Matematik Enstitüsü / Graduate School of Applied Mathematics ☐

Enformatik Enstitüsü / Graduate School of Informatics ☐

Deniz Bilimleri Enstitüsü / Graduate School of Marine Sciences ☐

YAZARIN / AUTHOR

Soyadı / Surname : KONAÇ
Adı / Name : ENVER HAKAN
Bölümü / Department : BİLİM VE TEKNOLOJİ POLİTİKA ÇALIŞMALARI

TEZİN ADI / TITLE OF THE THESIS (**İngilizce** / English) : Academic Entrepreneurs: Motivational Aspects, Challenges and Success Criteria in Technology Development Zones in Ankara

TEZİN TÜRÜ / DEGREE: **Yüksek Lisans** / Master ☒ **Doktora** / PhD ☐

1. **Tezin tamamı dünya çapında erişime açılacaktır. /** Release the entire work immediately for access worldwide. ☐
2. **Tez iki yıl süreyle erişime kapalı olacaktır.** / Secure the entire work for patent and/or proprietary purposes for a period of **two year. *** ☐
3. **Tez altı ay süreyle erişime kapalı olacaktır.** / Secure the entire work for period of **six months**. * ☒

***** *Enstitü Yönetim Kurulu Kararının basılı kopyası tezle birlikte kütüphaneye teslim edilecektir.*
A copy of the Decision of the Institute Administrative Committee will be delivered to the library together with the printed thesis.

Yazarın imzası / Signature ..... **Tarih** / Date .....