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University-Industry Cooperation Interfaces in Turkey from Academicians' Perspective

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Abstract

Competitive economies are characterized by continuous emergence of new products. New products are mainly obtained by production of knowledge at universities and by transformation of this knowledge into new technology. Several interfaces (suitable instruments) have been developed in Turkey in order to transform the knowledge that is produced at universities into technology that can be used by the industry. The most important element of this interface is the academician who is the link between university and industry. While there are several factors encouraging academicians to participate in R&D projects through these interfaces, there are other factors preventing them from doing so. In other words, some interface models facilitate university-industry cooperation, some others have serious disadvantages. This study aims to determine the advantages and disadvantages of various university-industry cooperation interfaces from the perspective of academicians. To evaluate the interfaces, a field survey with academicians was conducted using questionnaires. The perceived positive/negative aspects of the cooperation interfaces have been summarized and assessed based on the responses.

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Keywords: University-industry cooperation, academician, technology, R&D, interface

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1. Introduction

As an emerging economy, Turkey strives to increase the value added in its products and services. Since knowledge is the driver of productivity and economic growth, Turkish economy needs to be based on knowledge and information. Production, distribution and utilization of knowledge is especially important in the high-tech sector. In other words, knowledge has to be transformed into technology. In this view, research and development (R&D) is one of the key factors.

Establishing a viable relationship between academia and industry and forming a national innovation system are important determinants of economic growth. Knowledge produced at universities through basic research has to be transferred to industry to be transformed into new products and services. Thus academia needs industrial partners for innovation.

For this purpose, many interfaces (structures) that may serve as a linkage between universities and industry have been developed in Turkey. The key element in these interfaces are the academicians who lead the R&D projects and who serve as the medium of technology transfer. In this regard, academicians have to be encouraged to take part in the R&D projects to create a more viable innovation ecosystem, in other words, university-industry cooperation interfaces must include factors which tempt university members to participate in the innovative work.

2. Cooperation Interfaces

University-Industry Cooperation is the integration of joint activities carried out by putting together university resources (knowledge, researchers and laboratory etc.) with the resources of the industry (experience, staff and marketing power) in order to contribute to both parties and the society by following a certain methods within a system (Dura, 1994).

The gain from the university-industry cooperation depends on the harmonious and efficient cooperation of actors (state, university and industry) which take part in this process. Due to its structure, the information produced in the university cannot be directly used in the industry. Likewise, few industrial institutions have the infrastructure to develop a new product. Thus, there is a need for a set of interfaces (suitable instruments) to create an environment enabling communication between both parties (Kiper, 2010).

Below are the currently active interfaces in Turkey;

- Use of University Revolving Capital
- Technoparks
- Technology Transfer Offices (TTO)
- Ministry of Science, Industry and Technology- Industry Theses Support Program (San-Tez) and TÜBİTAK TEYDEB 1505 University Industry Cooperation Support Program.
- Development Agencies
- European Union Framework Programs

2.1. University Revolving Capital System

"Revolving Capital" is the capital granted to public administrations and enterprises so that they can carry out their product and service activities (Döner Sermayeli İşletmeler Bütçe ve Muhasebe Yönetmeliği, 2007). The use of university revolving capital is one of the most widespread and oldest mechanisms preferred for university-industry cooperation process in Turkey, as is the case in other countries (Kiper, 2010). Article 58 of the Law on the Council of Higher Education (YÖK) regulates the use of revolving capital in universities. The fundamental aim of this system is to enable academicians to render services to industry on a project basis.

In the Revolving Capital System, institutions and agencies willing to receive services from academicians make a request to the university indicating that they want to get services from the subject academician through the treasury

of the university. With regard to the incoming request, the academician renders services to the subject institution/agency and the service is invoiced by the university accordingly. (Kaya & Garipoğlu, 2015).

In accordance with the Law on Revolving Capital, the project income that academicians are entitled for the services rendered to the industry are subject to deductions (Kiper, 2010). These deductions can be classified as treasury share, Rectorate's share, share of the Dean's Office, share of scientific research project and income tax deduction. The amount of deduction in each university varies. The deductions applied at Yıldız Technical University Revolving Capital is shown in Table 1.

Table 1: Yıldız Technical University Revolving Capital Legislation Legal Deductions and Tax Applications

Deduction	Reason	Amount	
Treasury Share	Legal Deduction	%1	
Share of Scientific Research Project	Legal Deduction	%5	
Share of the Dean's Office	Legal Deduction	%15	
Rectorate's Share	Legal Deduction	%11	
		Over taxable amount	
		Up to 11.000 TL	%15
Income Tax	Tax Cut	11.000-27.000 TL	%20
		27.000-60.000 TL	%27
		97.000 TL and more	%35

Source: Y.T.Ü Döner Sermaye Gelirleri Dağıtım Oranları. (2014). *2014 Yılı Döner Sermaye Gelirleri Dağılım Oranlarının Belirlenmesi Hakkındaki Yönetim Kurulu Kararı*. Yıldız Teknik Üniversitesi.

These deductions are one of the most significant barriers preventing the development of University-Industry Cooperation processes. Altough some changes have been made in the Revolving Capital Legislation recently to remove these disadvantages, the desired result have not been obtained yet (Kaya & Garipoğlu, 2015).

2.2. Technoparks

Technoparks are the organized research and business centers incorporating the academic, economic and social structure, where the research agencies and industrial entreprises carry out their research, development and innovation works in the same environment (Töreli, 1991).

The negative impact of the deductions in the Revolving Capital System created the need to develop different interfaces.Within this framework, the Law on Technology Development Zones numbered 4961 dated 06.07.2001 was enacted and the Regulation on Technology Development Zones Practice had come into effect on 09.06.2002. Thus, Technology Development Zones (Technoparks) began to be commissioned. The aim of a technopark is to enable industrialization by transforming academic knowledge and research potential in the university and research centers into technological products (Yalçıntaş, 2014). As of 2014, the number of technoparks in Turkey is 52 (Bilim Sanayi ve Teknoloji Bakanlığı, 2015).

Academicians working at universities are subject to the Law of Higher Education numbered 2547 (YÖK, 1981). Job definitions as well as competence and responsibilities of academicians working at state universities on tenure are regulated according to the Civil Servants Law numbered 657. According to the above-mentioned laws, academicians working at public universities cannot have commercial activities such as managing a private company (Devlet Memurları Kanunu, 1965). Thus, a need occurred for an interface which will enable academicians in state universities to have commercial activities while transferring their know-how to the industry. So, as stipulated in the Law on Technology Development Zones, upon the approval of the University Board of Directors, faculty members can establish a company, go in partnership in a company and/or take part in the management of a company in order to industrialize the outcomes of their research (Teknoloji Geliştirme Bölgeleri Kanunu, 2001).

With the Law on Technology Development Zones numbered 4691, the below advantages are granted to the institutions located in these zones as well as to the universities, public personnel and local executives working in the zone:

- Exemption from income and corporate tax for the income gained from software development and R&D activities conducted in the zone.
- In accordance with the interim Article 2 of the Law on Technology Development Zones numbered 4691; for a period of five years, half of the employer's share of the insurance premium of the personnel who are exempt from the income tax are covered from the budget of the Ministry of Finance.
- For the period during which the incomes of the entrepreneurs who engage in activities in the Technology Development Zone are exempt from income and corporate taxes, they are also exempt from VAT for the services produced and rendered in these regions such as system management, data management, business practices, industry-specific, internet, mobile and military command and control application software as well as their delivery.
- The papers prepared regarding all R&D and innovation activities defined within the scope of the Law are exempt from stamp tax.

Moreover, the advantages regarding the employment of the personnel attached to the universities, public agencies and institutions are as follows:

- The right to work part-time or full-time in the zone with the permission of the institution where they are attached.
- For academicians, exemption from university revolving capital deductions.
- The right for academicians to establish a company, to go in partnership in a company and/or to take part in the management of a company in order to industrialize the outcome of the research.

2.3. Technology Transfer Offices (TTO)

Technology Transfer Offices are organizations where activities related to efficient and rapid industrialization of academic research outcomes are carried out (Morgül, 2012). Technology Transfer Offices try to realize university-industry cooperation processes by matching appropriate academicians with project proposals obtained as a result of the regular visits made to the industry and the incoming requests from the industry. Academicians contact Technology Transfer Offices in order to participate in this process (Kaya & Garipoğlu, 2015).

In accordance with the vision of Turkey for 2023, the R&D Expenditures, which is currently %0.092 of the gross national product, will be increased to 3% (Bilim Sanayi ve Teknoloji Bakanlığı, 2015). Accordingly, 1513-Technology Transfer Offices Sport Program initiated by TÜBİTAK aims to support various activities of Technology Transfer Offices, which will contribute to the commercialization of the knowledge produced in the universities. As of 2015, there are total 186 Technology Transfer Offices, 34 of which are established with the support of TÜBİTAK 1513 Program (TÜBİTAK, 2015).

Technology Transfer offices provide significant advantages to academicians who want to take part in the projects based on R&D and innovation. Within this context, all industrial enterprises, whether operating in the technology development zones or not, can get service from academicians through TTOs. As these services are carried out within the scope of Law numbered 4691, academicians can earn income for their services, without university revolving capital and income tax deductions. For this, the subject academician is required to receive an assignment order from the faculty, Dean's Office or Rector's Office to which he/she is affiliated with (Kaya & Garipoğlu, 2015).

Academicians can participate in industrial projects through TTOs and benefit from the tax advantages provided that the cooperation project has a R&D component. The activities which are accepted as R&D are listed in "Frascati Manual" (Gök, 2014).

2.4. SAN-TEZ and TÜBİTAK 1505 R&D Support Programs

San-Tez is a support mechanism aiming to enable SMEs to gain R&D and innovation culture while promoting cooperation with the universities. In the San-Tez program, R&D project is developed within the university-industry

cooperation concept and the project application is submitted to the Ministry of Science, Industry and Technology, under the coordination of an academician from the university (Bilim Sanayi ve Teknoloji Bakanlığı, 2015). San-Tez Program is carried out within the context of Law numbered 5593 and "Regulation on Industrial Thesis Support" dated July 7, 2007. The program is controlled by the Ministry of Science, Industry and Technology. Within the context of San-Tez program, support is granted to R&D projects which are at the "Experimental Research" stage. The projects presented to the program are coordinated by academicians working in the university. 65-85% of the project budget is financed by the ministry, while the remaining amount is covered by the industrial enterprise which is a project partner as well. There is no maximum limit of budget for projects presented to the San-Tez program (Bilim Sanayi ve Teknoloji Bakanlığı, 2015). TÜBİTAK 1505 University-Industry Cooperation R&D Program is carried out within the context of the "Regulation on the Scientific and Technological Research Center of Turkey-Technology and Innovation Grant Program" published in the Official Gazette numbered 26405 and dated 16.01.2007. The aim of the program is to enable commercialization of the knowledge produced in the universities.Also, in this program, projects are coordinated by the academicians working at universities. Maximum limit of budget for projects presented to the TÜBİTAK 1505 Program is 1 Million TL; 60-75% of the project budget is financed by TÜBİTAK. The remaining amount of the budget is expected to be covered by the industrial enterprise, which is the project partner as well (TÜBİTAK, 1505 Üniversite-Sanayi İşbirliği Destek Programı, 2015).

2.5. Development Agencies

Development agencies are local agencies which work for the economic development of the region. While there are several definitions given for agencies, agencies may be defined as institutions, which are independent from central governments and financed by public and private sector in order to develop and enliven the entrepreneurial potential of a certain region (Devlet Planlama Teşkilatı, 2000).The goals of agencies can be summarized as; enabling financial support for businesses, increasing competitive capacity and business opportunities, supporting SMEs, encouraging foreign investment, and developing the socio-economic capacity of the region (Kayasu & Yaşar, 2004).As of 2014, there are 26 development agencies in Turkey. Development agencies open calls for project proposals and evaluate the proposed projects in certain periods of the year. Each call has a specific title, scope, amount of grant, and maximum limit of grant. Academicians can serve as scientific advisor for the projects and can participate through university revolving capital system or through the enterprises established in the technology development zones (Technoparks) in accordance with the law numbered 4691 (Kaya & Garipoğlu, 2015).

2.6. European Union Framework Programs

European Union Framework Program (EU FP) is the Community Program, which is formed in order to harmonize science, technology, policy, and practices in Europe. It is initiated in 1984 and is the highest budgeted non-military research program in the world. Framework Programs are carried out in order to reinforce research and development capacity of Europe, to encourage university-industry collaboration, to develop cooperation in different areas relating the EU policies with the EU member countries, EU candidate countries and other countries collaborating with the EU. The program is formed in order to produce future technologies by means of international partnerships. Framework Programs are put into practice with a special funding system. During the period of 2007-2013, the EU 7th Framework Program had been carried out. Horizon 2020, new era Research and Innovation Framework Program of the European Union will be carried out by the European Commission between 2014-2020 (TÜBİTAK, AB HORIZON 2020 Çerçeve Programları, 2015). EU Framework Programs give non-refundable funds (grants) for R&D development projects, support researchers and provide the infrastructure required to put researches into practice (T.C Avrupa Birliği Bakanlığı, 2015). Excluding the individual projects, the main criteria required in all the applications is cooperation. In this context, the cooperation of minimum 3 different EU member/associated country or 3 independent institutions (university, research center, SME etc.) is required (TÜBİTAK, AB HORIZON 2020 Çerçeve Programları, 2015). Academicians being subject to the law on higher education number 2547 can participate in projects carried out within the context of the European Union Framework Program as instructor, coordinator, specialist, or researcher. The only condition of participation is that they have to be assigned by the institution where they work in accordance with the law they are subject to (Merkez Finans İhale Birimi, 2013). The assignment can be made with a request submitted by the academician directly to the university board of directors.

Therefore, academicians who are individually or institutionally granted funds by the European Union can collaborate with other universities, research institutions and companies without using other interfaces such as TTOs or university revolving capital.

3. Methodology

3.1. Research Goal

This study aims to determine the advantages and disadvantages of university-industry cooperation interfaces from the perspective of the academicians.

3.2. Data Collection

Qualitative research method of the "in-depth interview technique" has been used to obtain the evaluation of academicians about university-industry cooperation. An interview form which comprises 14 questions was prepared for the interviews. This form has been examined and approved by an Associate Professor and an Assistant Professor who are in the field of qualitative research methods and analysis. In order to confirm the competence of the interview form, a trial interview has been conducted with two academicians, one professor and one associate professor and following the affirmative results, the form was put to use. In this sense, 36 academicians, from various fields, geographies, titles, disciplines, and type of universities have been interviewed. Before the interviews, academicians were informed by phone. Afterwards, interview permission and disclosure form have been sent by e-mail and the interviews were conducted face to face or by phone.

The distribution of the interviewed academicians are given in the tables below. The term "non-cooperating" refers to an academician who has never participated to a university-industry cooperation project.

Table 2: Distribution of Academicians according to titles

	Cooperating		Non-Cooperating		
	Foundation Univ.	Public Univ.	Foundation Univ.	Public Univ.	**Total**
Prof. Dr.	4	4	1	-	9
Associate Prof.	6	6	3	-	15
Assistant Prof.	4	3	1	2	10
Dr.	1	1	-	-	2
Total	15	14	5	2	

Table 3: Distribution of academicians according to fields

	Cooperating		Non-Cooperating		
	Foundation Univ.	Public Univ.	Foundation Univ.	Public Univ.	**Total**
Engineering	4	7	1	1	13
Physical Sciences	-	3	1	1	5
Social Sciences	11	4	3	-	18
Total	15	14	5	2	

Table 4: Distribution of Academicians According to Regions

	Cooperating		Non-Cooperating		
	Foundation Univ.	Public Univ.	Foundation Univ.	Public Univ.	**Total**
Marmara Region	13	6	5	1	25
Central Anatolia Region	2	-	-	-	2
Aegean Region	-	4	-	1	5

South Eastern Anatolia Region	-	4	-	-	4
Total	15	14	5	2	

Table 5: Distribution of Academicians According to Interfaces

	Prof.Dr.	Associate Professor	Assistant Professor	Dr.	Total
Revolving Capital System	5	4	4	1	14
TEKNOPARK	-	1	1	-	2
TTO	-	3	-	-	3
SANTEZ/TÜBİTAK	2	5	5	-	12
Development Agency	-	1	2	1	4
EU Projects	2	-	-	-	2
Without Interface	1	5	2	-	8
Total	10	19	14	2	

3.3. Analyses and Results

In the in depth interviews, academicians are asked to evaluate university-industry cooperation interfaces. The perceived advantages and disadvantages of each interface as per their responses, as well as their recommendations to improve their functioning are given in the tables below;

Table 6: Evaluation of the Revolving Capital System

	ADVANTAGES	DISADVANTAGES	RECOMMENDATIONS
REVOLVING CAPITAL SYSTEM	Interface suitable for social sciences Direct funding Suitable for tests and certifications that the firms need to be done	Very high rates of deductions Excessive bureaucracy Processing under the initiative of the university administration The lack of discretion of the academician coordinating the project on budget allocation decisions Decrease in the academician's net salary due to the raise in the tax bracket Forcing academicians and enterprises to have unofficial cooperation because of increased project costs Obligation of academicians to share at high rates with the university the project revenues originating from their personal social network	Budget allocated for equipment purchases should be under the discretion of the academician coordinating the project not of the Dean's Office Deduction rates should be decreased and the budget reserved for academicians should be increased

Table 7: Evaluation of Technoparks

	ADVANTAGES	DISADVANTAGES	RECOMMENDATIONS
TECHNOPARK	Ease of cooperation with the industry Synergies as companies who constitute the technopark are in the university campus Enabling academicians to transform their theoretical knowledge into practice and help produce better trained students The opportunity for faculty members to establish their own companies Facilitating innovation activities as it provides infrastructure	Suitable only for projects in the field of engineering and physical sciences Not suitable for activities outside the scope of research and development and in Social Sciences Lack of desired levels of diversity due to dominance of software companies in choosing technoparks Lack of preference towards technoparks of companies that are truly capable of carrying out research and development and their preference to establish their own centers Difficulties in projects caused by incompetent administrators in some technoparks Difficulties in commercial activities faced by faculty members without commercial experience	The technopark system should be well-presented to businessmen and academicians Products produced in technoparks should get incentives Academicians should be prepared for commercial activities Technoparks should be used in the field of social sciences and social sciences should be included in the scope of research and development

Table 8: Evaluation of Technology Transfer Offices

	ADVANTAGES	DISADVANTAGES	RECOMMENDATIONS
TECHNOLOGY TRANSFER OFFICES (TTO)	Speedy process, fewer procedures No tax deductions Technical, financial, and legal consultancy for academicians Support for academicians in protecting intellectual property rights Success in directing enterprises to national and international funds Success in defining the problems in industry and matching it with the academicians Equal protection of the rights of businessmen and academicians	Insufficient recognition Insufficient command of process and legislation by some technology transfer officials The level of detailed in the reports that must be prepared Insufficient time and resources provided for academicians who have administrative functions in the offices No support for social sciences	TTOs can be publicized more TTO officials must be trained about process and legislations TTOs must have more resources Social sciences must be supported in the TTO Universities, which do not rank in top 50 in the annual entrepreneurship index of YÖK have to establish TTOs without the support of state. However, as the top 50 in the index do not change, the state support is always granted to the same universities, therefore, the only criteria in supporting universities to establish TTOs should not be based on the entrepreneurship index. Universities must be supported sequentially.University students must also be included in the TTO projects.

Table 9: Evaluation of SANTEZ/TÜBİTAK Projects

	ADVANTAGES	DISADVANTAGES	RECOMMENDATIONS
SANTEZ/TÜBİTAK	Suitable for research and development activities and experiment related equipment purchased by academicians How the process will progress is clear since the application stage Ease of obtaining external funds SANTEZ: Presence of businessmen, university students, and academicians in the same project TÜBİTAK: Project control under academician's initiative	Equipment remains with the company although the company can donate them to the university in the SANTEZ project High rate of financial contribution to the project by the company (25-30 %) Exclusion of social sciences Academicians get the impression that evaluations are sometimes subjective in the refereeing process of TÜBİTAK project applications Sometimes delays in the processes of project Maximum limits in the budgeted items of projects	SANTEZ and TÜBİTAK projects should be publicized more Bureaucratic procedures should be reduced Support should also be given in institutional issues and budget should be allocated for data collection Projects should not be directed only to research and development activities, but should also support the construction of infrastructure (lab. etc.) Feedback should be received from the project beneficiaries and updates should be made accordingly

Table 10:Evaluation of Development Agencies

	ADVANTAGES	DISADVANTAGES	RECOMMENDATIONS
DEVELOPMENT AGENCY	Opportunity to construct infrastructure and transfer of new technologies Enabling cooperation of academicians with non-governmental institutions and public institutions	Obligation to use revolving capital for prepayments	Recognition should be increased Procedures should be shortened

Table 11:Evaluation of EU Framework Programs

	ADVANTAGES	DISADVANTAGES	RECOMMENDATIONS
EU FRAMEWOE	Much more flexible compared to other interfaces	Need legal support due to its international dimension	-Information should be better disseminated -Recognition should increase -Procedures should shortened

Some methods in cooperation with the industry other than the above-mentioned interfaces have been found in the interviews with academicians. These are:

- Preparing research reports in exchange for royalty rate,
- Provision of consultancy services,
- Cooperating with industry in accordance with the external actions directive,
- Establishing their own companies,
- Signing special bilateral agreements with the enterprise,
- Connecting with the industry via university's business development unit.

4. Conclusion

In this study, the interfaces that contribute and coordinate university-industry cooperation are examined from academicians' perspective.As a result, it has been found that currently employed interfaces do not support social sciences but rather science and engineering fields and technical cooperation based on research and development. The only interface that enables university-industry cooperation for academicians in social sciences is the revolving capital system. For this reason, it becomes difficult for social sciences to cooperate with industry compared to other fields of sciences. Since this is the case, it would be beneficial to accept social sciences as research and development activities and accept them in all interfaces, and advocating the concept of "SOCIOPARK" and establishing such institutions. The general perception about interfaces is that they are not well known, and they need to be better publicized. It has been found that both the academicians and businessmen do not receive sufficient information and face with problems in the research and development process as well as in preparation and management of projects. In terms of providing work products and services with high value added in university-industry cooperation, rather than academicians producing individual solutions and projects, it is really important to form with a multidisciplinary approach, teams composed of academicians from various fields. The most significant advantage of the revolving capital system as the oldest interface is to enable social science-industry cooperation. However, the high deduction rate from the project funds results in higher costs and this significant disadvantage causes it to be less preferred and gives both parties incentives for unofficial cooperation.Even though TECHNOPARKs have an advantage of creating synergy thanks to its constituent companies being located within the university and providing opportunities for academicians to establish their own companies, they have a disadvantage of not being supportive of non-research and development activities and social sciences, as well as not being able to create the desired levels of diversity as they are mostly preferred by the software companies.TTOs can be described as the most advantageous and effective interface thanks to speediest progress, fewest number of procedures, having no tax deduction, as well as providing technical, financial and legal consultancy to academicians. The most important disadvantage of TTOs is that they are not well known and they do not support social sciences.While the greatest advantage of SANTEZ is the possibility of businessmen, university students and academicians taking part in the same project, the greatest advantage of TÜBİTAK is the fact that academicians are the project leaders. Having extended project processes time periods and capped fees in budget items are the critical disadvantages of these two interfaces. The greatest advantages of the development agencies include allowing for infrastructure construction and transfer of new

technologies and providing an environment for academicians to cooperate with non-governmental organizations and public institutions. The greatest disadvantage is the obligation to use revolving capital for preliminary payments. The EU Framework Programs are advantageous due to their flexibility when compared to other interfaces but their need for legal support due to their international dimension stands out as a disadvantage.University-Industry Cooperation is very significant in increasing the level of prosperity in a country, producing products and services with high value added as well as enabling competitive advantage at the national and international levels. For this reason, future research can include ideas to develop and increase the number of interfaces, which are significant suppliers of the subject cooperation, with more detailed site and survey studies.

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