

THE ROLE OF UNIVERSITIES IN INNOVATION ECOSYSTEM AND ACADEMIC INNOVATION

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ABSTRACT

Globalization, which is being felt more and more with the developing technology as days pass, has made institutions from education to trade face a competitive environment which is full of hardships. The most effective concept that stands out in terms of competition is accepted as “Innovation”. This concept defines a reformist, creative, dynamic and effective philosophy which can bring a solution to many fields such as universities, public enterprises, private businesses and NGOs (Non-Governmental Organizations). The aim of the study is to search for an answer to the questions related to the interaction situation between shareholders in innovation ecosystem, the collaboration of shareholders in terms of common purposes, the role and place of the universities in ecosystem, and the reflections of academic innovation in ecosystem. The questions prepared for the study with open-ended questions and Likert scale are sent to the academicians via e-mail who are chosen via cluster sampling method at 20 universities chosen randomly among 193 universities enrolled in YÖK (the Council of Higher Education in Turkey). The findings of this study are as follows; (1) the interaction between shareholders inside the innovation ecosystem is very weak, (2) lack of interdisciplinary studies, (3) the weakness in the formation of innovation culture, and (4) the concept of academic innovation is not sufficiently widespread. The study is limited to the academicians working at 20 universities which are chosen randomly. This study reveals the role of universities in forming innovation ecosystem and academic innovation culture from the perspective of academicians. Lack of an extensive study revealing the role of universities in innovation ecosystem makes this study authentic.

Key Words: innovation ecosystems, academic innovation, academic entrepreneurship, 3rd Generation Universities,

JEL: L26, L33, L31, M10, M20.

İnovasyon Ekosisteminde Üniversitelerin Rolü ve Akademik İnovasyon

ÖZET

Gelişen teknoloji ile her geçen gün daha fazla hissedilen küreselleşme, eğitimden ticarete her alanda kurumları zorlu bir rekabet ortamı ile yüz yüze getirmiştir. Rekabette öne çıkmanın en etkin yolu ise “İnovasyon” kavramı olarak kabul görmektedir. Bu kavram üniversitelerden, kamu kurumlarına, özel işletmelerden STK'lara kadar birçok alanda çözüm üretebilen, yenilikçi, yaratıcı, dinamik ve etkili bir felsefeyi ifade etmektedir. Çalışmanın amacı, inovasyon ekosistemi içinde paydaşlar arasında etkileşiminin durumu, paydaşların ortak amaç



ve konulardaki birlikteliği, üniversitelerin ekosistem içindeki yeri ve rolü, akademik inovasyonun ekosistemdeki yansımaları sorularına cevap aramaktır. Çalışma için oluşturulan açık uçlu ve likert ölçeği ile hazırlanmış sorular YÖK bünyesinde kayıtlı 193 üniversite arasından rassal (tesadüfi) şekilde seçilen 20 üniversite ve küme örneklem ile seçilen akademisyenlere mail yolu ile iletilmiştir. Bu çalışmanın bulguları; (1) İnovasyon ekosistemi içerisinde paydaşlar arasındaki etkileşiminin çok zayıf olduğu, (2) disiplinler arası çalışma yetersizliği, (3) inovatif kültürünün oluşumundaki zayıflık ve (4) akademik inovasyon kültürünün yeterince yaygınlaşmadığı şeklinde sıralanmaktadır. Araştırma Rassal seçilen 20 üniversitede görev yapan akademisyenler ile sınırlandırılmıştır. Bu çalışma inovasyon ekosisteminin oluşumundaki üniversitelerin rolünü ve akademik inovasyon kültürünü akademisyenler perspektifinden ortaya koymaktadır. Daha önce inovasyon ekosisteminde üniversitelerin rolünü ortaya koyan kapsamlı bir çalışmaya rastlanmaması bu konuyu alanında özgün kılmaktadır.

Anahtar Kelimeler: inovasyon ekosistemleri, akademik inovasyon, akademik girişimcilik, 3. Nesil üniversite, 3NÜ.

INTRODUCTION

The concepts of innovation and change have an increasing economic effect on the process of globalization. The most fundamental innovation strengthening this effect is accepted as the improvement of Information and Communication Technologies (ICT). Innovation expresses the development of product, process, service, technology or business models more effectively (Maranville, 1992). In the Oslo manual which is internationally accepted, the concept of innovation is defined as "Application of product or process which is new or changed in a significant scale in new business applications, corporate organizations and foreign affairs with a new organizational method" (Eurostat, 2005). Added-value which is formed with the effect of a beneficial solution about life can be called innovation. Innovation improves itself due to corporate and cultural factors as well as technology and investments (Mercan & Göktaş, 2011). Innovation ecosystem is defined as the new and different ideas and environments which are designed to create an economic value from these ideas and to encourage innovation. This kind of corporate environments triggers innovative changes by contributing the formation of high energy when they are supported by innovative cultural structure. Instead of the system approach that is insufficient in defining the relationship between innovation actions and innovation structure, the concept of ecosystem which is inspired by biology has been theorized (Mercan & Göktaş, 2011) and the role of universities in this structure which is properly evaluated in terms of the dynamic structure of innovation is quite effective. Universities are expected to produce ideas related to the solution of the problems that are determined both locally, and globally and to contribute to the improvement of society (Figure 1).

Figure 1. Innovation Process



The qualifications of the academicians and the situation of the innovation ecosystem that the universities have affect the satisfaction of expectations directly.

1. LITERATURE REVIEW

1.1 Innovation Ecosystems

The concept of ecosystem was firstly used by Arthur Tansley who is a ecologist (Willis, 1997). Basically, ecosystem is a biological concept in which producer, consumer and decomposer live



organisms are all together (Tansley, 1935) and which reveals the interaction between each other in the environment that they live. The live organisms in the ecosystem are supported by inorganic components such as energy, water, nitrogen, minerals and, climate and heat (Ecosystem, 2016). Moore (1997), suggested the concept of "business ecosystem" by establishing a systematic correlation between biological world and business world. The economic organisms inside the business ecosystem produce value and services for the consumers. The component organisms inside this system are formed by suppliers, producers, opponents and other actors. In time, different direction tendencies arise due to the improvement of the abilities and roles of the shareholders inside the ecosystem (Moore, 1997). There are businesses, universities, public institutions and private companies inside business ecosystem and they mostly work profit-oriented by managing accumulation, sharing and flow of information (Papaioannou, Wield, & Chataway, 2009).

Innovation systems became a popular subject that was studied by politicians, statesmen and researchers in an environment where the differences of innovative performance was questioned in the European countries in 1990s. Afterwards, the countries affiliated to World Bank and the United Nations adapted this concepts. This concept firstly introduced by Lundvall (1985) as "System of Innovation". However, long before that, List and Colwell (1856) mentioned about "National Innovation Systems" in their work "National Politic Economy System" and the mentioned about a concept which is closer to today's definition of innovation.

The capital stocks, economic improvements, productions of technology, interactions between institutions and innovation cultures of the countries are all in different levels (Metcalf & Ramlogan, 2008). These differences determine product or service production, spreading speed of information, innovation transformation and improvement of innovation culture (Mercan & Göktaş, 2011). Metcalfe and Ramlogan (2008) depict innovation systems as the interaction among SME, universities and public institutions in order to produce new information and develop new technology in a region or country. In innovation systems, the relationship, interaction and co-ordination of each system with one another are emphasized.

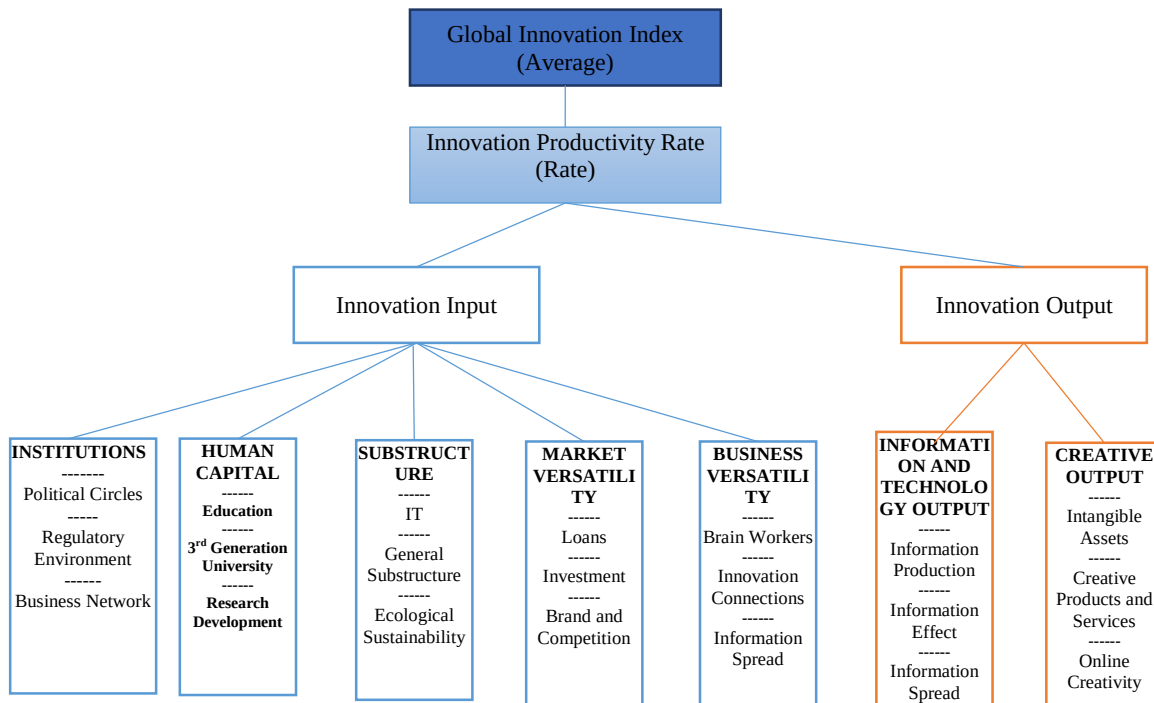
Innovation ecosystems have a more dynamic nature when compared to the stationary innovation systems. Ecosystem expresses an adaptation process which is improved by constant change against the new conditions and needs. Therefore, new formations, ideas and structures make progress more rapidly and decisively under the umbrella of Innovation Ecosystems. Innovation systems are dynamic structures which are not subject to public policies evolving according to changing market conditions and competition.

Every year, Cornell University evaluates innovation events and innovative structure in a different way by analyzing innovation inputs and outputs separately in Global Innovation Index (GII) which is published with the collaboration of INSEAD (The Business School for World) and WIPO (World Intellectual Property Organization). GII analyzes the innovation capacities and activities of 141 world economies which includes 95.1% of the World population in a multidimensional basis. In 2015, Turkey regressed from 54th rank to 58th rank with its score of 37.81 when compared to 2014 in the GII which was published with the theme of "Effective Innovation Policies for Development". The data in the report (Figure 2) are formed by scoring the components of Innovation Input Sub-Index (IISI) and Innovation Output Sub-Index (IOSI) on country basis. Innovation Input Sub-Index consists of five fundamental structures, these are as follows (Soumitra Dutta, 2015);

- (1) Institutions and Organizations (business network, regulatory environment, political circles)
- (2) Human Resources and R&D (higher education, education)
- (3) Substructure (sustainable environment, general substructure, information substructure)
- (4) Market growth (investment, loans, trade, competition)

- (5) Business growth (accumulation of information, brain workers, innovation environment).

Figure 2: 2015 Global Innovation Index Frame



Source: Soumitra Dutta, B. L., Sacha Wunsch-Vincent. (2015). The Global Innovation Index 2015, Effective Innovation Policies for Development.

Whereas, Innovation Output Sub-Index consists of two fundamental components, these are as follows (Soumitra Dutta, 2015);

(1) Information and technology outputs (production, effect and spread of information)

(2) Creative outputs (intangible assets, innovative products and services, online creativity).

All these indicators were separated into 79 sub-components and their weighted scores were added; and GII rankings were formed (Table 1). When all these sub-component scores which are effective in the formation of innovation ecosystems are analyzed, it can be seen that the top five countries are Switzerland, England, Sweden, the Netherlands and USA. The innovation culture having a critical importance for the growth and development of local economies must be adapted and extended by the countries. The major philosophy to support the aim of Turkey about being one of the 10 biggest economies in the World will be extending innovation culture and establishing innovation ecosystem. Turkey is a country that increases its research and development and information substructure investments day by day as well as it is a country that has a large trade volume. However, these investments are insufficient in forming effective innovation outputs. People should switch from consumer public awareness to innovative productive public awareness which plans and applies. This, also, will bring an economy on innovation basis, production policies, culture and ecosystem with it.

Table 1: 2015 Global Innovation Index Ranking



Country/Economy	Score (0–100)	Rank	Income	Rank	Region	Rank	Efficiency Ratio	Rank	Median: 0.71
Switzerland	68.30	1	HI	1	EUR	1	1.01	2	
United Kingdom	62.42	2	HI	2	EUR	2	0.86	18	
Sweden	62.40	3	HI	3	EUR	3	0.86	16	
Netherlands	61.58	4	HI	4	EUR	4	0.92	8	
United States of America	60.10	5	HI	5	NAC	1	0.79	33	
Finland	59.97	6	HI	6	EUR	5	0.77	41	
Singapore	59.36	7	HI	7	SEAO	1	0.65	100	
Ireland	59.13	8	HI	8	EUR	6	0.88	12	
Luxembourg	59.02	9	HI	9	EUR	7	1.00	3	
Denmark	57.70	10	HI	10	EUR	8	0.75	49	
Mexico	38.03	57	UM	12	LCN	4	0.73	61	
Turkey	37.81	58	UM	13	NAWA	6	0.81	23	
Bahrain	37.67	59	HI	44	NAWA	7	0.63	105	
Guinea	18.49	139	LI	20	SSF	30	0.61	109	
Togo	18.43	140	LI	21	SSF	31	0.24	141	
Sudan	14.95	141	LM	34	SSF	32	0.37	136	

Source: Soumitra Dutta, B. L., Sacha Wunsch-Vincent. (2015). The Global Innovation Index 2015, Effective Innovation Policies for Development.

1.2 Construction of a Sustainable Ecosystem

In the construction of a sustainable ecosystem, except for structural and organizational factors, the culture or culture sub-components are effective. These directly affect technology development, information organization and innovation ecosystem and they improve ecosystem. Culture respectively affects economy and innovation and it plays an effective role in innovation process. Innovation culture is suggested through getting inspired by the list of Friedrich. According to this list, Freeman and Soete (2003), found that the major factors determining the development levels of countries were the inventions and innovations made by previous generation. The accumulation of these practices constituted today's intellectual capital. The productivity of countries and adaptation to innovation are improved with the interaction of old and today's generations(Freeman & Soete, 2003). When the top ten countries in GII are analyzed, it can be seen that innovation ecosystems have been adapted and the generations coming from the past have been effective in forming innovation culture. It became harder for the developing countries to catch up with these countries. An innovative ecosystem environment and culture environment based on innovation require constant innovation. Thus, innovative, strong and corporate brand formation in the countries adapting this culture is rapid as well as the competitive capacity is high. To build a sustainable ecosystem: forming corporations supporting Start-up or Spin-off businesses, developing state and administrative policies related to entrepreneurship and innovation, forming collaborator innovation network systems, developing economic policies to meet the finance of innovation, technology and entrepreneurship and, extending science and techno-parks are necessary.

1.3 Entrepreneur and 3rd Generation Universities

The universities which are accepted as qualified in the world are in a radical change with reference to the university model based on science. First Generation Universities (Mediaeval Era) were the institutions that gave classical education and defined as the Latin Schools inside of which there were Plato's Academy and Aristotle's Lyceum (de Ridder-Symoens, 2003). Second Generation Universities focused on basic sciences and adapted "know-how" practice. Whereas, Third Generation Universities aimed to commercialize the created information while focusing on scientific studies and educational aims. The major reason forcing universities to change was the seeking of financial resource caused by the increasing research costs with the technological developments (Wissema, 2009). The leading universities sought for solution to this problem through the collaboration with technology oriented businesses. Thus, the institutions operating in two different worlds has provided with integration with each other as



days pass. Besides, change and competition created by globalization contributed to the phenomenon of 3rd Generation University. The worldwide qualified universities are in a fight in order to attract the most qualified students in the world to their universities by offering opportunities improved for students with the support of state and local administrations in addition to business integration. Therefore, there is a serious competition over worldwide students (Wissema, 2009) with the effects of globalization. This competition formed a chain reaction by triggering the seeking of qualified academicians and made being pioneers faster for the universities in the innovation ecosystem. The gap between the universities inclined to the 3rd Generation innovation ecosystem which adapted to this global competition and the weak universities in this competition is getting bigger and bigger. The traditional function of the universities is to provide public and private sector with the qualified workforce. The increase in human capital need reinforces the role of universities in innovation process in the global environment where competitiveness increase.

2 RESEARCH METHOD AND PROCEDURE

Probabilistic sampling methods have been used in this study. There are totally 193 universities enrolled in the Council of Higher Education (YÖK) in Turkey. The groundmass of the study is the academicians working at universities within YÖK. The academicians are thought to define and offer solutions for innovation ecosystems, the current situation of universities, the interactions between universities and institutions, the situation of innovation and entrepreneurship. "Cluster sampling" and "simple random sampling" methods have been used in the sampling choice. Simple random sampling assumes that the probability of getting into sampling of each factor which forms groundmass equals to the weight to be given to the each factor in the statistical calculations (Arıkan, 2004, p. 141). Whereas in cluster sampling, the groundmass is grouped as clusters and random samplings are chosen from each cluster (Çömlekçi, 2001, p. 90). While the survey questions were formed, 23 academicians, who works at Yaşar University, Ege University, Dokuz Eylül University and Celal Bayar University with the administrative function experience, were asked 8 open-ended questions derived from the literature related to "innovation ecosystem and academic innovation - entrepreneurship" and the survey questions were formed in the light of the answers of these questions.

In this study, 193 universities enrolled in YÖK and their official website addresses were taken from "<http://www.yok.gov.tr/web/guest/universitelerimiz>" and listed in Microsoft (MS) Excel[®] page. 20 universities were chosen randomly among 193 universities by using the "random" decoding in the macro part of the MS Excel[®] page. These universities are Dumlupınar, Tokat, Amasya, Doğu Akdeniz, Dokuz Eylül, Ondokuz Mayıs, Karadeniz Technical, Cumhuriyet, Bingöl, Gaziosmanpaşa, Bozok, Celal Bayar, Ardahan, Atatürk, Düzce, Abdullah Gül, İstanbul Technical, Marmara, Gazi ve Çağ universities. The web pages and tabs "University Home Page", "Faculties", "Institutes", "Schools of Higher Education" and Vocational Schools of Higher Education" of 20 chosen universities were analyzed, and the "names", "sir names", "titles", and "e-mail addresses" of the academicians were taken from each institutions website. These data were saved in MS Excel[®] table in four categories as faculty, school of higher education, vocational school of higher education and institutes. 30% random sampling were taken from the information saved in categories for the second time. The online survey which was designed via Google Drive[®] was sent to 1650 academicians, who were obtained as a result of sampling, with personalized e-mail by using "title", "name" and "sir name". It is known in the literature that the percentage of answering e-mails sent for researches by academicians or other individuals is very low. In the frame of this information, high percentage of reply was aimed with practice of the method of personalized e-mail (title, name, sir name and official e-mail address). The e-mails were sent from the Celal Bayar University's official e-mail address

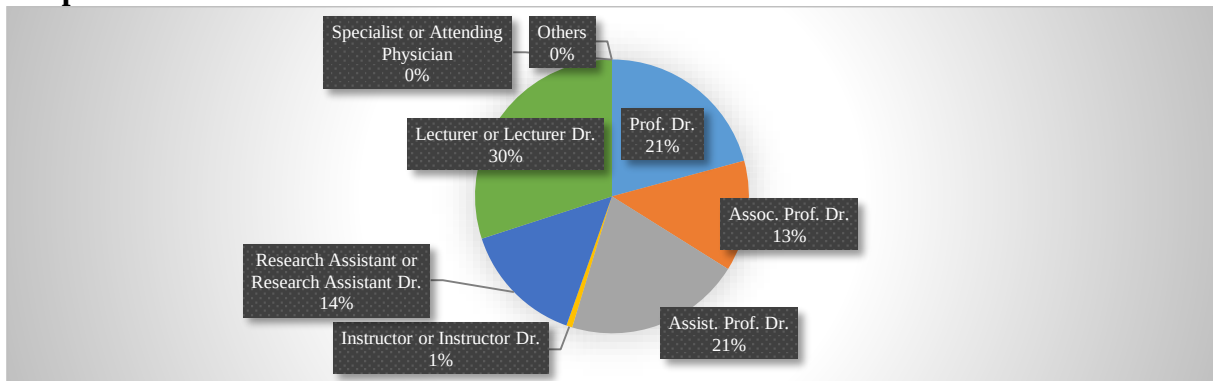


in order to minimize the risk of receiving e-mails as “spam” for the target group. Totally 260 surveys were answered in February and March.

3 FINDINGS

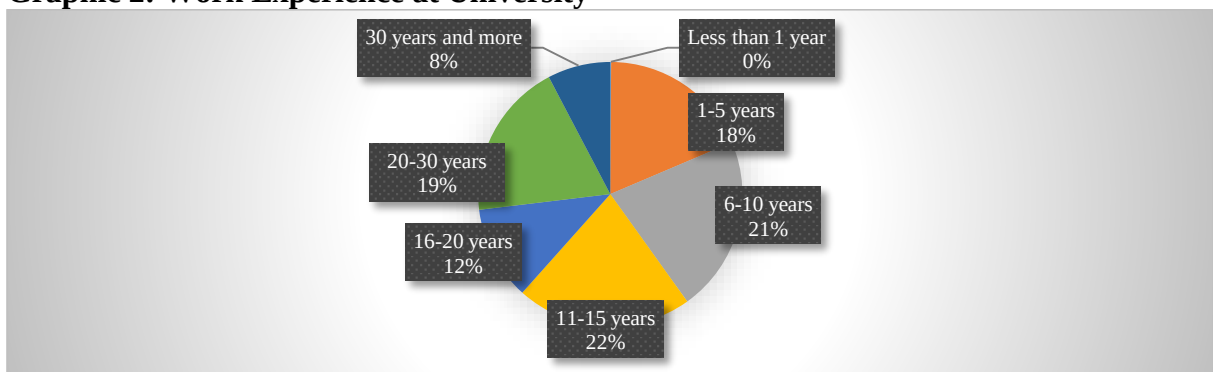
30% of 260 academicians participating to the study from 20 universities are employed in the instructor staff. It is remarkable that the instructors (Prof. Dr., Assoc. Prof. Dr., and Assist. Prof. Dr.) participated in the study with the high rate of 54.7%.

Graphic 1: Academic Title



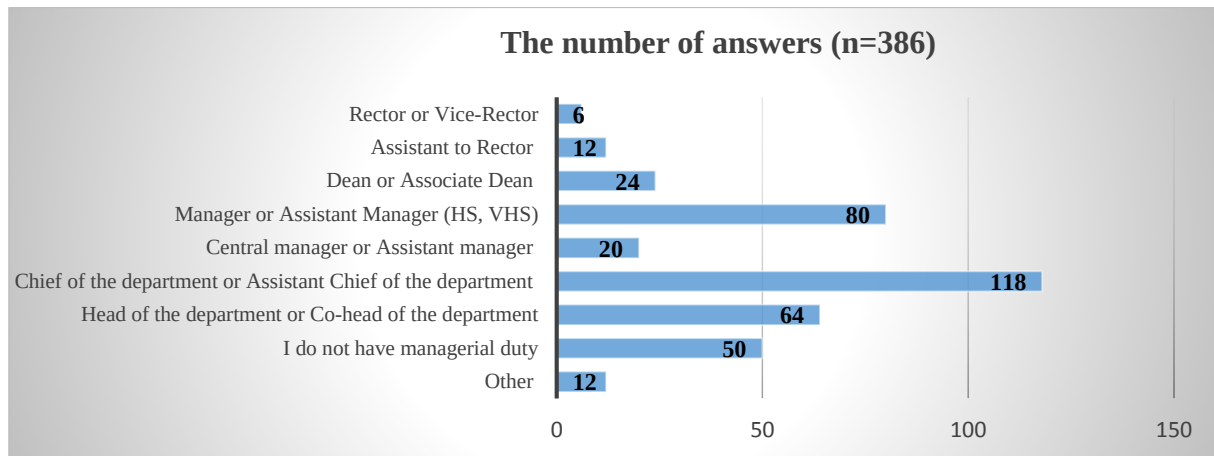
21.5% of the participants have 6-10 years of work experience and 21.5% of them have 11-15 years of work experience at universities. 211 academicians forming the 81.5% of the participants have more than 6 years of work experience at universities. The academicians with less than 1 year of work experience at universities did not participate in the study. Graphic 2 gives the detailed vocational distribution rates of the participant academicians.

Graphic 2: Work Experience at University



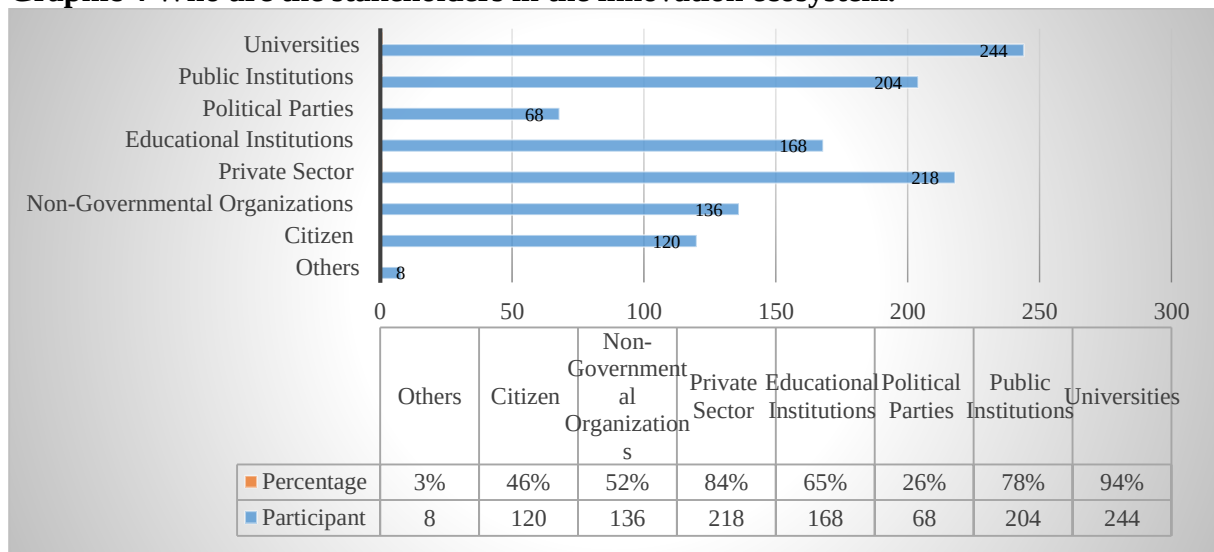
In the study, the academicians were asked if they function in management positions or not. It is found that only 50 academicians among 260 participants did not have administrative function, and 210 academicians have at least one administrative duty experience. It is known that the academicians at managerial positions are active in social life, and that they strengthen their communications with public and private sectors. It is assumed that the academicians at managerial position provide valuable information depending on their experiences and observations about the subjects such as; the situation and development of innovation ecosystems, its integration with environment and the quality of communication among shareholders. In the Graphic 3, the managerial positions of the participant academicians are given in details.

Graphic 3: Your Managerial Position at the University



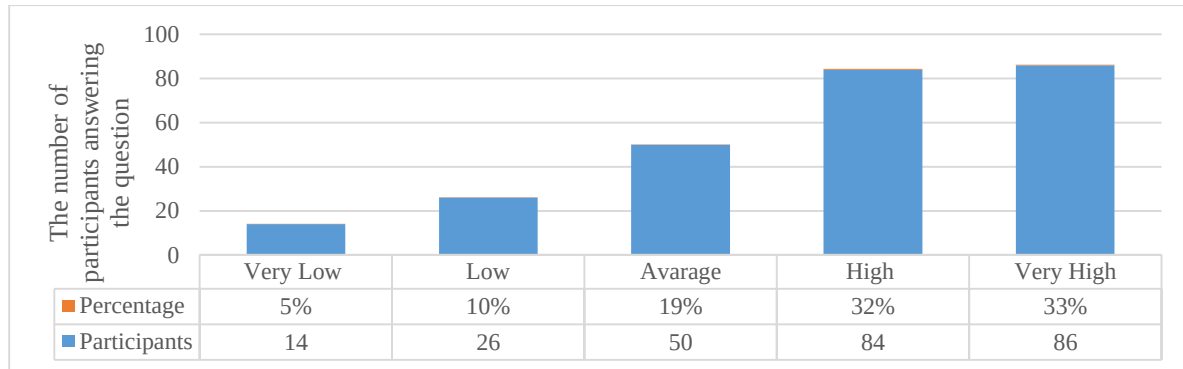
When the academicians were asked about the people who must be the shareholders in the innovation ecosystem (Graphic 4), the first three choice of the academicians are respectively as follows; universities (94%, 244 participants), private sector (84%, 218 participants) and public institutions (78%, 204 participants). The next highest three choice are as follows: educational institutions (65%, 168 participants), non-governmental organizations (52%, 136 participants) and citizens (46%, 120 participants). The rate of political parties remains low in the evaluation inside innovation ecosystem and some participants also suggested that development agencies had to take place among the ecosystem shareholders.

Graphic 4 Who are the stakeholders in the innovation ecosystem.



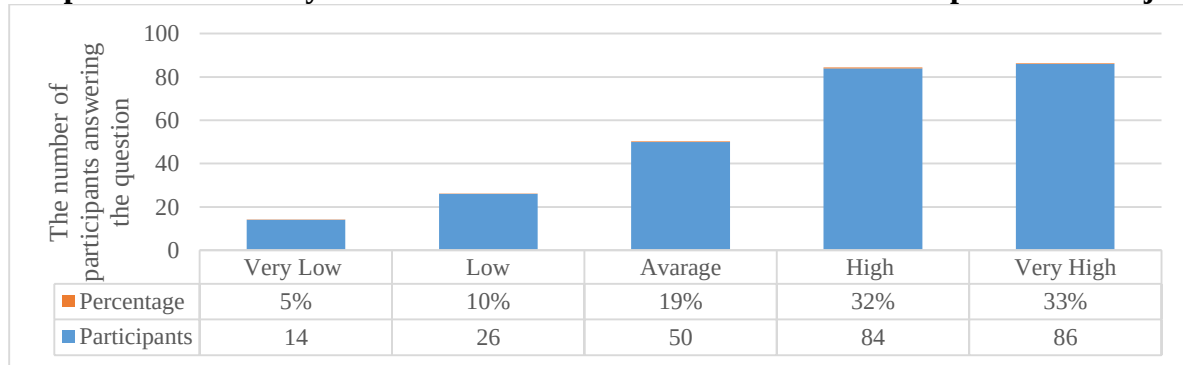
The question "What is the interaction situation among shareholders in the innovation ecosystem?" was answered as low by 45% of the participants (118), as very low by 22% of the participants (58) and as average by 25% of the participants (64) (see. Graphic 5).

Graphic 5: The Interaction Situation Among Shareholders in the Innovation Ecosystem



The question "Can shareholders meet for the common purposes and subjects?" was answered as low by 45% percent of the participants (118), as average by 34% of the participants (88) and as very low by 13% of the participants (34) (see. Graphic 6).

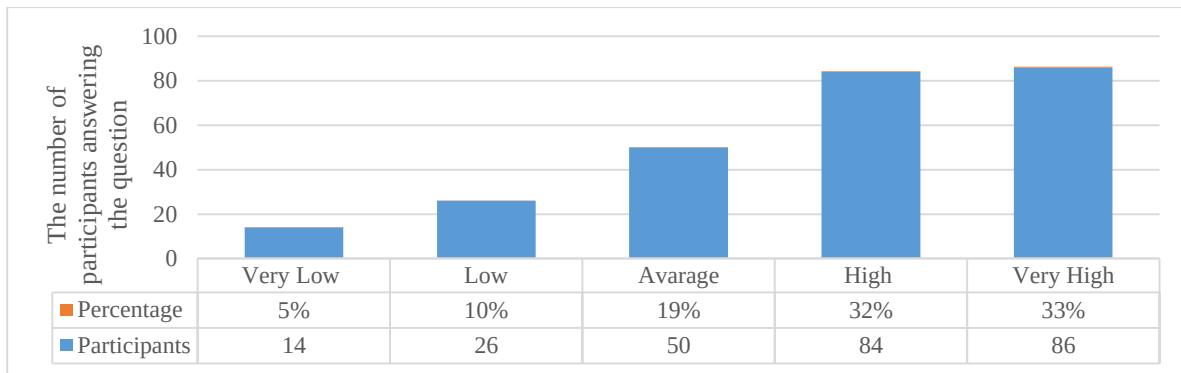
Graphic 6: The Ability of Shareholders to Meet for the Common Purposes and Subjects



3.1 The Role of Universities

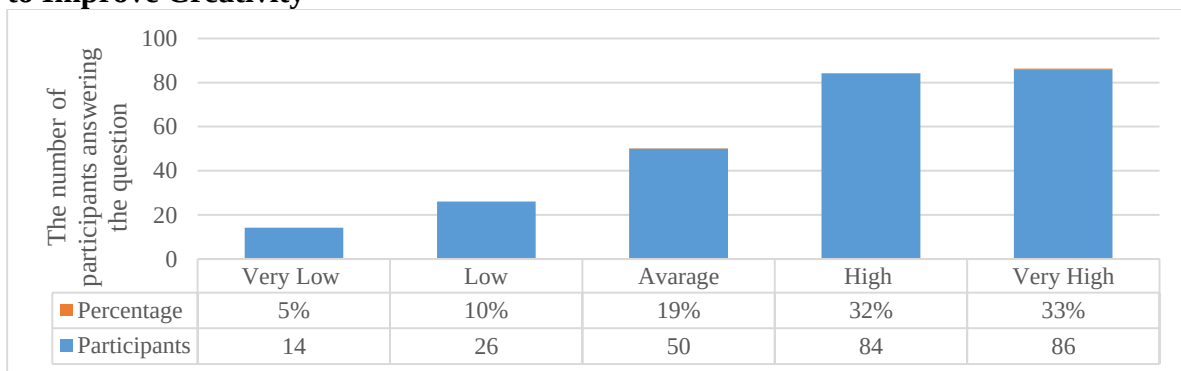
The established universities in USA and Europe take the lead of improvement of the skills of research and development as well as teaching skills. Etzkowitz (2003) put forward the concept of triple spiral (university, state and industry) in order to define the role of universities inside the innovation process. While industry in the spiral focuses on the realization of production activities, government develops stabilized state policies and controls foreign exchange relations. The mission of the universities in the spiral is to contribute to the public by improving new information, technology and innovations inputs. According to Mercan and Göktaş (2011), there is a positive relationship between university-industry collaboration and innovation output. This output is found significant statistically in global data and European sub-samples. The statement "Universities are locomotive and pioneer in innovation ecosystem" was evaluated as high by 35% of the participants (90), and as very high by 32% of the participants (84) (see. Graphic 7). As a consequence, they proportionately emphasized that the universities are at the positions of locomotive and pioneers.

Graphic 7: Universities are Locomotive and Pioneer in Innovation Ecosystem



The statement "The culture and structure of society of universities are convenient in order to improve creativeness." Was evaluated as average by 32% of the participants (84), as low by 26% of the participants (68) and as high by 17% of the participants (44) (see. Graphic 8).

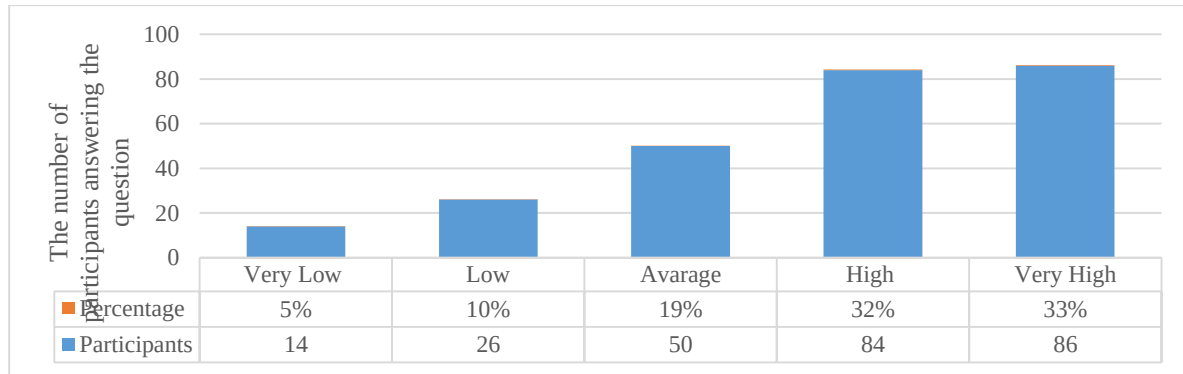
Graphic 8: The Culture and Structure of Society of Universities are Convenient in Order to Improve Creativity



3.2 Academic Innovation and Entrepreneurship

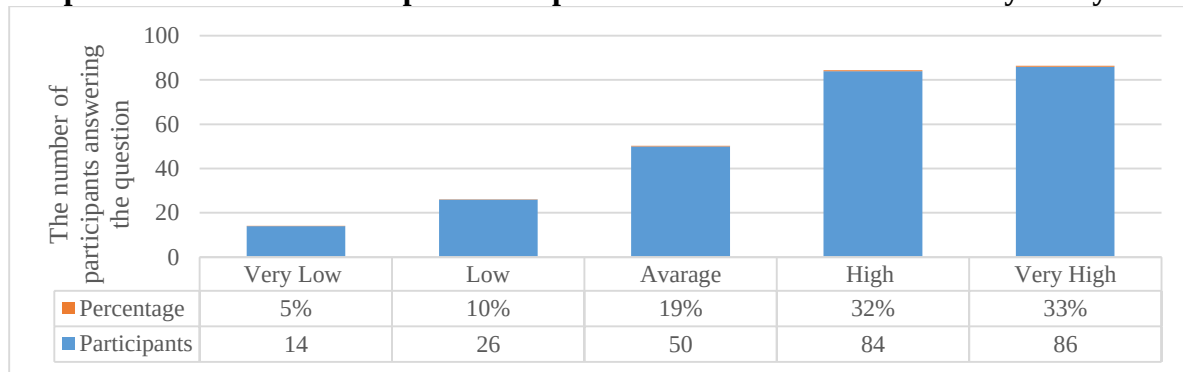
Academic entrepreneurship with traditional perspective is an activity practiced by universities in order to commercialize the knowledge and skills of universities. In a way, it is the total efforts shown for the institutional transfer of researches, technology development and innovation start ups (Barth & Schlegelmilch, 2013). According to Beckman and Cherwitz (2009), academic entrepreneurship is the "intellectual attempt" formed by universities with the collaboration of local communities in order to create new values or ideas. Academic entrepreneur who focuses on the production of information simultaneously acts as both intellectual actor (academic) and entrepreneur actor (company) (Campbell & Guttel, 2005). Academic entrepreneurship is term improving in the spiral of university, academy and entrepreneurship. According to Barth and Schlegelmilch (2013), an academician who develops patent at university profits in return for his patent and also he realizes a non-commercial academic activity with the publishing of his scientific results. The activities such as formation of licensing profits within university, development of patents and establishment of breeding companies improve the concept of academic innovation (Chang, Chen, Hua, & Yang, 2006). The statement "Academic innovation is a pioneer factor in the university ecosystem" was evaluated as very high by the 38% of the participants (98) and as high by 35% of the participants (90) (see. Graphic 9).

Graphic 9: Academic Innovation is a Pioneer Factor in the University Ecosystem.



The statement "Academic entrepreneurship is a pioneer factor in university ecosystem" was evaluated as very high by 33% of the participant (86) and as high by 32% of the participants (84) (see. Graphic 10).

Graphic 10: Academic Entrepreneurship is a Pioneer Factor in University Ecosystem.



DISCUSSION AND CONCLUSION

When ecosystem is evaluated biologically, as species have interactions with each other, they are also in an integrated interaction with the inorganic environment. Just like living organisms, universities have a place inside of the ecosystem and there are institutions and organization that the universities are in an interaction with. When the participant academicians were asked about "shareholder in the innovation ecosystem", these are listed as universities, private sector, public institutions, educational institutions, NGOs, and citizens. Siegel and Wright (2015), emphasized that the universities were the locomotive of all kinds of activities which enhances welfare in the locations that they are in. It is known that the universities at the position of leaders of innovation and improvement positively contribute to the community life as well as teaching and researching. The main actors in the transformation of the universities in a constant change are technology (Bates, 2010) and global competition. The universities are facing rapidly changing social, technological and economic transformations (Zhu, 2015). These changes in universities take nourishment from the synergy of the supportive environmental elements. The high synergy among the shareholders inside the innovation ecosystem forms the essential point of the innovative changes. The most important result found in the study is that the interaction among the shareholders inside the innovation ecosystem is very weak in our country. The biggest obstacle for the establishment of innovation ecosystem is that shareholders cannot meet on common grounds or aims. All the participants agree with the idea that universities should be locomotive and pioneers in the innovation ecosystem. The culture and structure of society and universities are fundamental elements in improvement of creativity. Nonetheless, the participants think that this culture haven't been formed in our country. An important finding of the study is that academic innovation and academic entrepreneurship are pioneer factors in



university ecosystem and that they should be improved. Also, the problems that requires solutions in our country are that hierarchy affect the process of ecosystem adaptation, the lack of interdisciplinary studies, weakness in the formation of innovative culture and insufficient spread of academic innovation culture.

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