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The Effects of University-Industry Collaboration in R&D on the Growth of Innovative Companies

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Abstract

Technological changes and innovations based on the Research and Development (R&D) are vital role to increase the competition level and economic growth for both firms and countries. For this reason, university-industry collaboration in R&D has important role for the growth of innovative companies. In this context, main of this study is the effects of university-industry collaboration in R&D on the growth of innovative companies. According to the empirical results, the mean of growth innovative companies increases as the level University industry collaboration in RD increases. As a result, it is critical to strengthen University industry collaboration in RD in order to increase the sustainable competition level and economic growth for both firms and countries.

Keywords: Research and Development, Innovation, University-Industry Collaboration

Yenilikçi Firmalarının Büyümesi Üzerinde Üniversite-Sanayi Ar-Ge İşbirliğinin Etkileri

Özet

Araştırma ve Geliştirmeye (AR-GE) dayanan teknolojik değişiklikler ve yenilikler hem firma hem de ülkeler için rekabet düzeyini ve ekonomik büyümeyi arttırmada hayati bir rol oynamaktadır. Bu nedenle Ar-Ge'de üniversite-sanayi işbirliği, yenilikçi firmaların büyümesinde önemli rol oynamaktadır. Bu bağlamda, bu çalışmanın ana amacı Ar-Ge'deki üniversite-sanayi işbirliğinin yenilikçi firmaların büyümesine etkisini incelemektir. Ampirik sonuçlara göre, Ar-Ge'de üniversite sanayi işbirliğinin seviyesi arttıkça, yenilikçi şirketlerin büyüme ortalaması artmaktadır. Sonuç olarak, hem firma hem de ülkeler için sürdürülebilir rekabet düzeyini ve ekonomik büyümeyi arttırmada Ar-Ge'de üniversite endüstri işbirliğini güçlendirmek çok önemlidir.

Anahtar Kelimeler: Araştırma ve Geliştirme, Yenilik, Üniversite-Sanayi İşbirliği

1. INTRODUCTION

Technological changes and innovations based on the Research and Development (R&D) are vital role to increase the competition level and economic growth for both firms and countries. For this reason, university-industry collaboration in R&D has important role for the growth of innovative companies. In this context, main of this study is the effects of university-industry collaboration in R&D on the growth of innovative companies.

2. LITERATURE

It is critical importance of the production and transferring scientific knowledge from university to the economy in order to support sustainable economic development and to increase the competitiveness of the firms and the nations. There are huge literature studying on the university-industry collaboration. They focus on the importance of collaboration, the models and types of collaborations, the barriers in university–industry collaborations by focusing country and regional experiences and positive and negative effects on the academic researches.

Lee (1996) stated that "*university-industry collaboration has different dimensions, such as positive effects on the regional economic development and facilitate commercialization of academic research but negative effects on the to interfere with academic freedom — the freedom to pursue long-term, disinterested, fundamental research".*

Barnes et al (2002) stated that *"there is a growing world-wide trend toward greater collaboration between academia and industry, an activity encouraged by govern-*

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ments as a means of enhancing national competitiveness and wealth creation".

Meyer-Krahmer and Schmoch (1998) stated that *"the co-operation between industrial firms and universities has increased considerably, but the interaction pattern in different technological fields is not uniform. In science-based fields, university departments have a distinct focus on basic research and the major interest of industry is the observation of science. In less science-based fields, the solution of technical problems is a major concern of industry. In all fields, the exchange of knowledge in techno-scientific communities is a crucial element of interaction. In Germany, strong intra-disciplinary ties between universities and industry in mechanical engineering obviously imply an insufficient openness to, and integration of, new technologies. The particular combination of a long-standing culture of co-operation and the economic success in the mechanical industry can be interpreted in terms of a specific path-dependant evolution of a stable sector of the national system of innovation, but with the tendency to lock-in effects".*

Siegel et al (2003) claimed that "*although there has been a rapid rise in commercial knowledge transfers from universities to practitioners or university–industry technology transfer, through licensing agreements, research joint ventures, and start-ups, there are numerous barriers to effective university–industry technology transfer were identified, including culture clashes, bureaucratic inflexibility, poorly designed reward systems, and ineffective management of university technology transfer offices".*

Dooley and Kirk (2007) stated that university-industry partnerships build on government-university funding, that university-industry relationships foster new university capabilities, and moreover, that academic publication is not displaced by the requirements of industry partners.

Thune (2007) stated that "*collaborative relationships are formed in several distinct ways depending on the availability of pre-existing resources and incentives, and that successful collaborations grow out of prior established ties".*

Ponds et al (2009) claimed that "*the impact of academic research on regional innovation is not only mediated by geographical proximity but also by networks stemming from university–industry collaboration".*

Abramo et al (2009) stated that *"Public–private research collaboration has also effects on the scientific production of individual university researchers. The analyses demonstrate that university researchers who collaborate with those in the private sector show research performance that is superior to that of colleagues who are not involved in such collaboration. But the impact factor of journals publishing academic articles co-authored by industry is generally lower than that concerning co-authorships with other entities".*

Bruneel et al (2010) claimed that "*there are some barriers in university–industry collaborations and Bruneel et al (2010) stated that prior experience of collaborative research lowers orientation-related barriers and that greater levels of trust reduce both types of barriers studied. It also indicates that breadth of interaction diminishes the orientation-related, but increases transaction-related barriers".*

Lee (2000) stated that "*Participants in university–industry collaborations appear to realize significant benefits, some expected and others unexpected. The most significant benefit realized by firms is an increased access to new university research and discoveries, and the most significant benefits by faculty members is complementing their own academic research by securing funds for graduate students and lab equipment, and by seeking insights into their own research".*

Laursen et al (2011) claimed that *"Firms' decisions to collaborate with universities for innovation are influenced by both geographical proximity to universities and the quality of these universities. Being located close to a lower-tier university reduces the propensity for firms to collaborate locally, while co-location with top-tier universities promotes collaboration. Firms appear to give preference to the research quality of the university partner over geographical closeness. This is particularly true for high-research and development intensive firms."*

Gertner et al (2011) stated that "*The analysis provides evidence to support the value of conceptualising the process of knowledge transfer between universities and industry as one of learning taking place within communities in which the development of mutual engagement, joint enterprise and shared repertoires play important roles facilitating successful collaborations. the analysis highlights the significance of the boundary spanning roles of the* knowledge transfer partnerships *partners in facilitating the knowledge transfer process through engagement in both the university and industry communities".*

Freitas et al (2013) stated that *"the contexts and role of university–industry collaboration in mature and emergent industries are diverse. Knowledge networks are underdeveloped in emerging industries, and public support for research projects is dispersed. This means that university research and development projects with firms in emergent industries are less likely than projects with firms in mature industries to be the result of academic initiatives and public calls for research projects, or to be wholly financed by major public research sponsors. In emergent industries, the role of students and firm employees is crucial for mediating between public research organizations and companies".*

Steinmo and Rasmussen (2018) stated that "*Firms find it challenging to develop and sustain successful university-industry collaboration. University-industry collaboration can be facilitated through cognitive and relational*

social capital. Firms use different paths to develop social capital depending on their university-industry collaboration experience. This provides a more precise understanding of how social capital dimensions interplay over time".

Abdulai et al (2019) stated that "*while university–industry collaboration is positively related to innovation performance in firms, informal mechanisms of university knowledge transfer do not and negatively moderate the positive association between university–industry collaboration and innovation performance in firms. It is also found that to facilitate innovation outcomes, formal, legal binding contracts are required.*"

3. DATA AND METHOD

The data is obtained from the Global Competitiveness Index Report for the year 2018 and 140 countries. The variables are University-industry collaboration in R&D and Growth of innovative companies (for the both variable the scale is 1-7 scale, 7 is the best).

The method is ANOVA test. The countries are classified into three groups by University-industry collaboration in R&D, low, medium and high. It is analysed that whether Growth of innovative companies changes on the average or not, as University-industry collaboration in R&D changes on the average

4. EMPIRICAL RESULTS

Table.1 shows descriptive statistics for Growth of innovative companies. According to the results, the mean of the Growth of innovative companies for the countries with low University-industry collaboration in R&D is 3,43 (the scale is 1-7, 7 is the best), with University-industry collaboration in R&D is 3,86 and with high University-industry collaboration in R&D is 4,78.

Table.1 Descriptive Statistics For Growth innovative companies

	University industry collaboration in RD		
	Low	Medium	High
Mean	3,433	3,865	4,781
Median	3,350	3,900	4,700
Variance	0,175	0,129	0,192
Std. Deviation	0,419	0,359	0,439
Minimum	2,600	2,800	3,700
Maximum	4,200	4,700	5,800
Range	1,600	1,900	2,100
Interquartile Range	0,675	0,500	0,500
Skewness	-0,014	-0,305	0,134
Kurtosis	-0,839	0,554	0,560

Table.2 shows the normality test results for Growth innovative companies. According to the results, variables distribute normally at the 0.01 significant level.

Table.3 shows the Levene test results for Growth innovative companies. According to the results, Levene's test showed that the variances are equal.

Table.2 Normality Test Results For Growth innovative companies

University industry collaboration in RD	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Low	,125	36	,170	,965	36	,315
Medium	,120	62	,027	,984	62	,588
High	,097	42	,200*	,978	42	,591
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Table.3 Levene Test Results For Growth innovative companies

Levene Statistic	df1	df2	Sig.
1,501	2	137	,226

Table.4 shows ANOVA Test results, according to the results, the null hypothesis is rejected at the significant level 0.01, the mean of Growth innovative companies is not equal by the different level University industry collaboration in RD.

Table.4 ANOVA Test Results

Ease finding skilled employees					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	38,199	2	19,100	119,554	,000
Within Groups	21,887	137	,160		
Total	60,086	139			

Table.5 shows the multiple comparisons test results, according to results, the null hypothesis is rejected at the significant level 0.01 for all pairwise group comparisons, the mean of Growth innovative companies is not equal by the different level University industry collaboration in RD for all pairwise group comparisons.

Table.5 Multiple Comparisons Test Results

Dependent Variable: Growth innovative companies					
	(I) University industry collaboration in RD	(J) University industry collaboration in RD	Mean Difference (I-J)	Std. Error	Sig.
Tukey HSD	Low	Medium	-,43118*	,08375	,000
		High	-1,34762*	,09078	,000
	Medium	Low	,43118*	,08375	,000
		High	-,91644*	,07988	,000
	High	Low	1,34762*	,09078	,000
		Medium	,91644*	,07988	,000
*. The mean difference is significant at the 0.05 level.					

Table.6 shows homogeneous subsets for the variable Growth innovative companies, according to results, the mean of groups has a different subset.

Table.6 Homogeneous Subsets For The Variable Growth innovative companies

	University industry collaboration in RD	N	Subset for alpha = 0.05		
			1	2	3
Tukey HSD[a,b]	Low	36	3,4333		
	Medium	62		3,8645	
	High	42			4,7810
	Sig.		1,000	1,000	1,000
Means for groups in homogeneous subsets are displayed.					
a. Uses Harmonic Mean Sample Size = 44.302.					
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.					

Figure.2. shows the relationship between Growth innovative companies and University industry collaboration in RD. According the results there is a positive relationship between the variables.

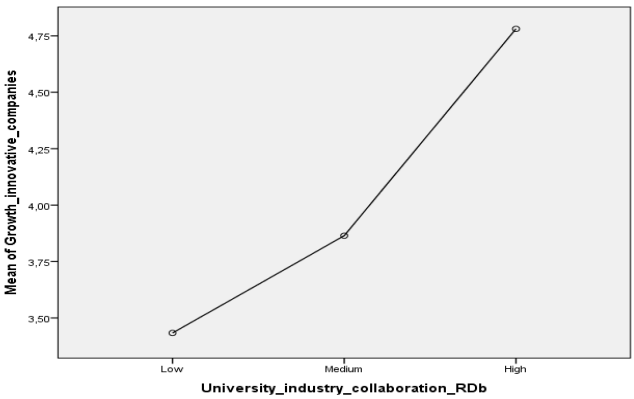

Figure.2. The relationship between ease finding of skilled employees and skillset of university graduates

5. CONCLUSION

Nowadays, the structure of the competition among the firms and countries mainly depends on the disruptive technological innovations. Technological changes and innovations based on the Research and Development (R&D) are vital role to increase the competition level and economic growth for both firms and countries. For this reason, university-industry collaboration in R&D has important role for the growth of innovative companies. In this context, main of this study is the effects of university-industry collaboration in R&D on the growth of innovative companies. According to the empirical results, the mean of growth innovative companies increases as the level University industry collaboration in RD increases. As a result, it is critical to strengthen University industry collaboration in RD in order to increase the sustainable competition level and economic growth for both firms and countries. For this reason, universities, business sector and public sector must develop efficient strategies for the collaboration in R&D and technological innovations.

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