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The Impact of Learning Processes on Radical Innovation in Less Successful Innovator Countries: Turkey, Macedonia, Slovenia, and Serbia

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Abstract

Competition that has been accelerating rapidly in domestic and international markets in last decades compels firms to apply new ideas to their activities in order to increase value on their products and processes. Innovation which is a key driver of a success and survival of enterprises provides them competitive adventure in the markets. Learning processes on radical innovation, which is one of the most valuable innovation types is crucial. In this paper we examined the relationship between radical innovation and type of learning processes (learning by doing, learning by training, and learning by searching) with using probit model and firm level data (BEEPS) in relatively less successful innovator countries, namely Turkey, Macedonia, Slovenia, and Serbia. According to our results, the impact of learning process on making radical innovation varies in the less successful innovator countries. Any of the learning processes do not affect radical innovation in Macedonia while Serbia and Slovenia make radical innovation only with learning by searching. Turkish enterprises are making radical innovation with their top manager's experience (learning by training) and their success in export performance (learning by doing).

Key words: Radical Innovation, Learning processes, Business Enterprise and Environment Survey (BEEPS)

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Az Başarılı Yenilikçi Ülkelerde Öğrenme Süreçlerinin Radikal İnovasyon Üzerine Etkisi: Türkiye Makedonya Slovenya ve Sırbistan

Öz

Son yıllarda hızla artan rekabet, yerel ve uluslararası piyasalarda ürün ve süreçlerde değer artışı sağlayabilmek için firmaları yeni fikirler bulmaya zorlamaktadır. Girişimler için işletmelerin başarısı ve sürekliliğinin anahtarı olan inovasyon piyasalarda şirketlere rekabet avantajlar sağlar. En önemli inovasyon türlerinden biri olan radikal inovasyon sürecinde öğrenme süreçleri çok önemlidir. Bu çalışmada radikal inovasyon ve öğrenme süreçleri (yaparak öğrenme, çalışarak öğrenme ve araştırarak öğrenme) arasındaki ilişki göreceli olarak az başarılı yenilikçi ülkelerden olan Türkiye, Makedonya, Sırbistan ve Slovenya için probit model kullanılarak firma düzeyinde (BEEPS) analiz edildi. Makedonya için öğrenme süreçlerinin radikal inovasyon üzerinde etkisi bulunmazken, Sırbistan ve Slovenya için araştırarak öğrenme sürecinin etkili olduğu görülmektedir. Türk işletmelerin radikal inovasyon yapmalarında yöneticilerin deneyimi (çalışarak öğrenme) ve şirketin ihracat performansının (yaparak öğrenme) etkili olduğu gözlemlenmiştir.

Anahtar kelimeler: Radikal inovasyon, öğrenme süreci, işletme girişimciliği ve çevre anketi

1. Introduction

In the last decades, competition has been accelerating rapidly by globalization. Competition in domestic and international markets takes place via all three dimensions of quality, variety, and price. All of these factors compel firm to apply new ideas to the products, processes, or other aspects of its activities that lead to increased "value" (Greenhalgh and Rogers, 2010). All these kinds of applications point innovation for firms. Innovation as a competitive weapon for firms provides them competitive (innovative) adventure in the markets. It is argued that innovation is the outcome of a free-market process that forces firms to compete each other in quality, variety, and price of products on offer. 124

Innovation has been defined in various contexts. The common sense of all definitions of innovation is that innovation adds value to organizations (Narvekar, 2006; Lloyd, 2006), and it is a key driver of success and survival of organizations (Bell, 2005; Gopalakrishnan et al., 1997). In early studies about innovation, many scholars have offered typologies or other classifications of innovation. Gopalakrishnan and Damanpour (1997) give three most frequently used innovation types. They distinguish between radical and incremental; product and process; and technical and administrative innovations. In this study we focus on the distinction between radical and incremental innovations. Radical innovation is a completely new type of production process with a wide range of applications and gives rise to a whole new genre of innovative products (Greenhalgh and Rogers, 2010). Radical innovation affects firm's economic activity in the market and change the market structure. It focuses on the impact in the market as opposed to novelty. On the contrary, incremental innovation makes a small change to an existing process or product, whose performance has been significantly enhanced or upgraded (Greenhalgh and Rogers, 2010). However, Normann (1971) and Ettlie et al. (1984) identify the distinctions between radical and incremental innovations by their degree of novelty. If takes long time to determine of the innovation made by a firm is radical or not. This makes surveys on radical innovation troublesome since the question to firms about making radical innovation in order to collect data is generally within last two years not enough for determining whether the innovation is radical. Dealing with this problem innovation has been defined as degree of novelty, as The Oslo Manual emphasizes. In the most of innovation surveys, innovations are defined as new to the firm or new to the market/world (OECD/Eurostat, 2005). Radical innovation is simply defined as new to the market by the literature on innovation surveys. When radical innovations are compared with incremental innovations, which is defined as new to the firms, it is seen that the riskiness of radical innovations makes it less preferable because of high uncertainty. It is well known that the enterprises' needs of making innovation exist from starting up, surviving and to growing stages. The power of creating new markets or closing existing markets is at the hand of innovative firms (Tellis et al., 2007). It is obvious that creating really new products for markets is risky, and difficult to undertake, on the other hand it strengthens firms' competitiveness (Hatch, 1998).

Lundvall (1992) mentions the importance of learning processes for modern economies "the most fundamental resource in the modern economy is knowledge and, accordingly, the most important process is learning." Malerba (1992) explains the importance of learning of firms into two hypotheses. First hypothesis is that firms can learn from different processes and the learning process changes according to firms' needs of different sources of knowledge. Second hypothesis is that firms have already had a stock of knowledge and the technological advances of firms and cost advantages depend on those stocks of knowledge. Gregerson and Johnson (1997) propound that innovations are simply a result of learning. This means that learning is used to create new knowledge and entrepreneurs use this new knowledge to generate new ideas and projects where some of them end in the form of innovation. Stein (1997) suggests that future innovators can learn from their own previous innovations and improve upon them. If we accept this thought as a start, then it is not wrong to say that various ways of learning could have influence on making radical innovations. One of the indicators of learning processes is firm's obtained experiences. Learning from previous innovation is different from imitation. Imitation is adoption of an innovation that is made by other innovators and exists in the market. For instance, Hekkert et. al. (2007) mention the importance of learning processes for innovation by saying "mechanisms of learning are at the heart of any innovation process." and determines the functions of innovation. According to them the innovation systems work better as long as a platform for learning, experimenting and networking is provided. Knowledge development of enterprises is related to learning by searching and learning by doing, additionally knowledge diffusion is directly related to learning by interacting and learning by using. Besides the previous learning processes, there are several types of learning; learning by doing, learning by using, learning by searching, learning by training, and learning by interacting (Cohen, 1995; Freeman, 1995a and 1995b; Lundvall, 1997a and 1997b). Malerba (1992) uses in his work micro level data to examine the relationships between incremental innovation and learning processes. He finds that learning by firms is the most important key for the appearance of incremental innovations in industries. Hatch (1998) examines whether there is a relationship between process innovation and learning by doing and finds

this relationship significant for the semiconductor industry. Sagar (2006) discusses effects of R&D and learning by doing on technological innovation in a theoretical approach. Amara et al. (2008) examine the presence of the degree of novelty of innovation and the relationships between various types of learning. They find that learning by doing, learning by training, and learning by interacting have the highest impact on the radicalness of innovation of established SMEs in Laval–Lanaudie`re–Laurentides, a region located North of Montre´al (Canada).

In this paper we examine the relationship between radical innovation and learning processes of innovations with using probit model and firm level data (BEEPS) in relatively less successful innovator countries, namely Turkey, Macedonia, Slovenia, and Serbia. This article makes both theoretical and empirical contributions to the literature on the impact of learning processes on radical innovation. We believe that the learning processes of innovation are key factors on decision making of whether an enterprise makes a radical innovation or not. The remainder of the paper is that first we present data, description of variables, summary of statistics, and later we discuss results of probit models.

2. Data

One of the sources of measurement of innovation is provided by survey methods, which have the benefit of allowing the link between occurrence and effects of innovation to a number of firm-level and country characteristics. There exist two well-known cross-national surveys; The Community Innovation Survey (CIS) and The Business Environment and Enterprise Performance Survey (BEEPS). The CIS is one of the main data source for measuring innovation in Europe and is designed to gather information about innovation activities[*]. The Business Environment and Enterprise Performance Survey (BEEPS) is a joint initiative of the European Bank for Reconstruction and Development (EBRD) and the World Bank. In this study we prefer to use data taken from the BEEPS. While we are investigating the relation between innovation and learning processes, using the BEEPS gives

[*] Community Innovation Survey EUROSTAT on-line database

us two advantages. First advantage is that the surveys have a special section which gives information on innovation and innovative activities and second unique aspect of our data is that the surveys contain information on firm characteristics and business attitudes, which help us, when exploring the role of learning behaviors of firms. Although the BEEPS has five waves, the latest round of BEEPS has been used, which includes an Innovation Module, covering product, process, organizational and marketing innovation, as well as management practices in manufacturing enterprises with at least 20 employees for the period of 2012-2015[*]. The survey's sample from the universe of registered businesses in each country is conducted by using standardized survey instruments and follows a stratified random sampling methodology (World Bank, 2011).

Our analysis intends to exploit the advantages of the survey type of data by using the information contained. In addition to show the relationships between radical innovations and learning processes, we believe that comparing some different countries (which have different level of innovation activities) could be beneficial. We have selected following countries according to their scores on the European Innovation Scoreboard; Turkey-Modest, FYR Macedonia-Modest, Serbia-Moderate and Slovenia-Follower. We would like to add a Leader country; unfortunately there are not any surveyed countries in related years. World Bank's above surveys define radical innovation as a new or significantly improved product (good or service) introduced to the market, or the introduction within an enterprise of a new or significantly improved process, as well as marketing or and organizational innovations, including new logistics or distribution methods (Community Innovation Statistics, 2006). According to OSLO manual 2005, questions about new to the market are sufficient to examine the degree of novelty of innovations, which refers to Radical innovation. While we are interested in innovative firms' choice of making radical innovation, first of all we determine innovative firms. If the enterprise gives answer "yes" to the innovation question which is "During the last three years, has this establishment introduced new or significantly improved products or services? ", then we call those firms as innovative

[*] http://ebrd-beeps.com/about/

firms. In this manner we eliminated the sample bias problem. Moreover, non-responses and responses such as "Do Not Know" and "Does Not Apply" were dropped.

3. Empirical Strategies

To estimate the impact of learning processes on radical innovation at the firm level, we follow the literature on learning processes and radical innovation (Amara, 2004; Amara, 2008; Malerba, 1992) and we model innovation as a probit[**] model given the binary nature of the dependent variable (RadInn). We estimate the following equation (1)

$$\begin{aligned} RadInn_{ci} = B_0 &+ B_1 Age_{ci} + B_2 Small_{ci} + B_3 Medium_{ci} + B_5 Large_{ci} \\ &+ B_6 Startup_{ci} + B_7 RDA_{ci} + B_8 Train_{ci} + B_9 Manexp_{ci} \\ &+ B_{10} Edwf_{ci} + B_{11} Exp_{ci} + B_{12} Cert_{ci} + B_{13} Tech_{ci} + u_{ci} \end{aligned}$$

Where c refers to countries and **i** refers to enterprises. **Radinn (Radical Innovation):** Binary variable coded 1 if the firm has an innovation which is new to one of the firm's markets and 0 otherwise: dependent variable. **RDA (R&D Activity):** Binary variable coded 1 if the firm spends on research and development activities and 0 otherwise: indicator of learning by searching. **Exp (Export):** The percentage of sales exported directly and indirectly: indicator of learning by doing. **Train**: Binary variable coded 1 if the firm has formal training programs for its permanent, full-time employees and 0 otherwise: indicator of learning by training. **Edwf (Educated Work Force):** The percentage of permanent full-time employees with a university degree: indicator of learning by training. **Manexp (Managerial Experience):** Top Manager's years of experience working in the sector: indicator of learning by training. **Startup**: Binary variable coded 1 if the firm's age is less than 10 years old and 0 otherwise: control variable. **Age:** Age of the firm measured in years. The difference between the year the survey taken and the year of foundation of the firm: control variable. **Small, Medium, Large (Size):** Binary variables coded 1 for each variable if the **t**otal number of the firm's

[**] For further readings; Cameron & Trivedi (2009)

employees is between 5 and 19 **small,** between 20 and 99 **medium,** over 100 **large** and 0 otherwise: control variables. **Cert (Certification):** Binary variable coded 1 if the firm has an internationally-recognized quality certification: control variable. **Tech (Technology Intensiveness)**: Binary variable coded 1 if the enterprise runs the business in a medium technology sector and 0 if it runs the business in a low technology sector: control variable. (Determined according to OECD's ISIC REV. 3* technology intensity definition 2011)

Table 1. The Description of Variables

Variables' Description				
Name		**Values**	**Name**	**Values**
Dependent Variable			**Learning by searching**	
Radical Inn. (Radinn)		Yes/No	R&D spending (rda)	Yes/No
Control Variables				
Firm Age (lnage)		Logarithms	**Learning by doing**	
Small	0 1	Otherwise >= 5 and<= 19	Exporter (lnexp)	% export
Medium	0 1	Otherwise >= 20 and<= 99	**Learning by training**	
Large	0 1	Otherwise >= 100	Manager Experience (manexp)	Year
Startup	0 1	>= 10 years < 10 years	Educated Workforce (edwf)	% with university degree
Technology Intensiveness (tech)	0 1	Low Medium	Formal training programs (train)	Yes/No
Internationally recognized quality certification (cert)		Yes/No		

* OECD Directorate for Science, Technology and Industry (2011)

Table 2. Summary Statistics of Variables

	Turkey					Macedonia				
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Radinn	166	0.85	0.35	0	1	107	0.68	0.46	0	1
Startup	163	0.20	0.40	0	1	108	0.32	0.47	0	1
Lnage	163	2.76	0.71	0.69	4.51	108	2.56	0.62	1.09	4.09
Small	168	0.31	0.46	0	1	108	0.45	0.50	0	1
Medium	168	0.33	0.47	0	1	108	0.31	0.46	0	1
Large	168	0.32	0.47	0	1	108	0.12	0.32	0	1
Rda	166	0.48	0.50	0	1	108	0.30	0.46	0	1
Train	162	0.57	0.49	0	1	108	0.62	0.48	0	1
Lnexp	118	3.70	0.99	0.69	4.60	51	3.42	1.08	1.09	4.60
Edwf	168	13.86	18.35	0	100	108	19.57	24.22	0	100
Manexp	161	24.01	12.35	1	63	106	18.50	9.10	2	40
Techin	168	0.35	0.48	0	1	108	0.12	0.33	0	1
Cert	168	0.63	0.48	0	1	108	0.35	0.47	0	1
	Serbia					**Slovenia**				
Radinn	129	0.60	0.49	0	1	93	0.46	0.50	0	1
Startup	129	0.24	0.42	0	1	92	0.13	0.33	0	1
Lnage	129	2.68	0.69	0.69	4.77	92	2.96	0.64	1.09	5.03
Small	129	0.42	0.49	0	1	94	0.54	0.50	0	1
Medium	129	0.40	0.49	0	1	94	0.26	0.44	0	1
Large	129	0.15	0.36	0	1	94	0.17	0.37	0	1
Rda	129	0.31	0.46	0	1	94	0.44	0.49	0	1
Train	129	0.49	0.50	0	1	94	0.55	0.49	0	1
Lnexp	65	2.84	1.20	0	4.60	64	2.77	1.39	0	4.60
Edwf	129	20.51	23.77	0	95	94	13.44	19.31	0	100
Manexp	128	17.33	9.18	1	40	90	20.27	9.95	3	45
techin	129	0.16	0.37	0	1	94	0.32	0.47	0	1
cert	129	0.44	0.49	0	1	94	0.40	0.49	0	1

When considering the impact of learning processes on radical innovation the standard approach in the literature is to determine the innovative firms and then to determine radicalness. Our data has been picked out of the sample, that is comprised of product innovators. We are interested in the novelty of product innovations. If the firms are given the answer of yes for the following question, "During the last three years, has this establishment introduced new or significantly improved products or services? ", then they are defined as innovators. To find out radicalness of firms, we check the responses of the following question "Were any of the new or significantly

improved products or services of this establishment new to one of this establishment's markets?" Taking consideration of two questions we have defined our dependent variable as radical innovators. Around 85% of Turkish enterprises, 68% Macedonian enterprises, 60% of Serbian enterprises, and 46% of Slovenian enterprises are radical innovators who introduced or developed new products or services new to the market in our sample.

Table 3. Collinearity diagnostics

Macedonia					Turkey				
Variable	SQRT VIF	VIF	Tolerance	R-Sqr	Variable	SQRT VIF	VIF	Tolerance	R-Sqr
Startup	4.86	2.2	0.21	0.79					
Lnage	4.83	2.2	0.21	0.79	**Startup**	2.5	1.58	0.40	0.60
Small	4.21	2.05	0.24	0.76	**Lnage**	3.01	1.74	0.33	0.67
Medium	4.77	2.18	0.21	0.79	**Small**	1.44	1.2	0.69	0.31
Large	3.63	1.91	0.28	0.72	**Large**	1.52	1.23	0.66	0.34
Rda	1.71	1.31	0.59	0.41	**Rda**	1.1	1.05	0.91	0.09
Train	1.52	1.23	0.66	0.34	**Train**	1.26	1.12	0.79	0.21
Lnexp	1.45	1.2	0.69	0.31	**Lnexp**	1.04	1.02	0.96	0.04
Edwf	1.39	1.18	0.72	0.28	**Edwf**	1.21	1.1	0.83	0.17
Manexp	1.36	1.17	0.74	0.26	**Manexp**	1.36	1.16	0.74	0.26
Techin	1.51	1.23	0.66	0.34	**Techin**	1.09	1.04	0.92	0.08
Cert	1.46	1.21	0.69	0.31	**Cert**	1.35	1.16	0.74	0.26
Mean	VIF	2.73			**Mean**	VIF	1.53		
Serbia					**Slovenia**				
Variable	SQRT VIF	VIF	Tolerance	R-Sqr	Variable	SQRT VIF	VIF	Tolerance	R-Sqr
Startup	2.48	1.57	0.40	0.60	**Startup**	2.18	1.48	0.46	0.54
Lnage	2.43	1.56	0.41	0.59	**Lnage**	2.6	1.61	0.39	0.62
Small	1.35	1.16	0.74	0.26	**Small**	1.62	1.27	0.62	0.38
Large	1.46	1.21	0.69	0.31	**Large**	2.55	1.6	0.39	0.61
Rda	1.43	1.2	0.70	0.30	**Rda**	1.49	1.22	0.67	0.33
Train	1.2	1.09	0.84	0.16	**Train**	1.65	1.28	0.61	0.39
Lnexp	1.18	1.08	0.85	0.15	**Lnexp**	1.72	1.31	0.58	0.42
Edwf	1.28	1.13	0.78	0.22	**Edwf**	1.18	1.09	0.85	0.15
Manexp	1.31	1.14	0.76	0.24	**Manexp**	1.23	1.11	0.81	0.19
Techin	1.11	1.05	0.90	0.10	**Techin**	1.95	1.4	0.51	0.49
Cert	1.45	1.2	0.69	0.31	**Cert**	1.99	1.41	0.50	0.50
Mean	VIF	1.52			**Mean**	VIF	1.83		

The main concern of our study is to determine the impact of learning processes on decision making of whether the firm makes radical innovations or not. To capture firm innovation, we use a dummy variable, Radical Innovation, which takes the value of 1 if the firm developed a new product for the market, and "0" otherwise. Table 2 shows descriptive statistics of control variables, and variables related to learning processes. The high correlations between explanatory variables could have resulted with unreliable regression estimates, which are called multicollinearity. We checked multicollinearity by using a command of "collin" in STATA, which gives variance inflation factors of independent variables (Ender, 2010). Collinearity diagnostics of variables are seen in Table 3. The results of this testing do not indicate significant multicollinearity issues.

Control variables consist of age, size, technology intensiveness and quality certification. The relationship between size and age of a company and the degree of novelty of innovations is still arguable in the literature (Chandy and Tellis, 1998 and 2000; Stringer, 2000; Tether, 2002; Landry et al., 2002; Koberg et al., 2003; Becheikh et al., 2006; Amara, 2008). Some authors who contribute Schumpeter's classic view suggest that large firms are more applicable to obtain radical innovation because of making use of economies of scale in research and development, setting aside the riskiness, and accessing to market and financial resources. In this vein, authors such as Dewar and Dutton (1986) and Germain (1996) have results that size positively and significantly affect radical process innovation, whereas there is a non-significant effect on incremental process innovation. On the other hand Dougherty and Hardy (1996) find that size has negative effects on the adoption of radical innovation performance. They mention that more difficult to connect the necessary capabilities, resources and strategies for larger firms. This is why large firms are less likely to make radical innovation. In one of their work Ettlie et al (1984) find a non- significant effect of size on radical technological innovation and in another work of Ettlie and Rubenstein (1987), they find a bell-shaped relationship between radical innovation performance and size.

Table 4. Industry Distribution

Turkey			**Macedonia**		
Chemicals	12.50	**********	**Construction**	5.56	******
Construction	2.98	*****	**Fabricated Metal Products**	6.48	*******
Fabricated Metal Products	12.50	**********	**Food**	14.81	**********
Food	13.69	**********	**Garments**	5.56	******
Garments	7.74	**********	**Hotel And Rest.**	7.41	********
Machinery And Equipment	7.14	**********	**Retail**	15.74	**********
Non Metallic Mineral Prod.	11.31	**********	**Wholesale**	14.81	**********
Retail	7.14	**********	**Wood**	3.70	****
Textiles	10.71	**********	**Others**	25.93	
Others	14.29				
Serbia			**Slovenia**		
Chemicals	3.88	****	**Construction**	10.64	**********
Construction	4.65	*****	**Fabricated Metal Prod.**	6.38	******
Electronics	3.10	***	**Furniture**	4.26	****
Fabricated Metal Products	5.43	*****	**IT**	5.32	*****
Food	9.30	*********	**Machinery And Equipment**	9.57	*********
Furniture	3.10	***	**Non Metallic Mineral Prod.**	5.32	*****
Garments	3.10	***	**Plastics & Rub.**	8.51	********
Non Metallic Mineral Prod.	6.20	******	**Retail**	22.34	**********
Retail	25.58	**********	**Supporting Transport Act.**	4.26	****
Services Of Motor Vehicles	3.88	****	**Wholesale**	8.51	********
Wholesale	15.50	**********	**Others**	14.89	
Others	16.28				

Forés and Camisón (2015) finalize this conflict by referring that the bureaucratic and cultural sources of structural inertia hamper introducing radical innovation performance. Beside the size of the firm Van de Ven mentions the effect of age on innovation. "The older, larger, and more successful organizations become, the more likely they are to have a large repertoire of structures and systems which discourage innovation" (Van de Ven, 1986: 596).The technology intensiveness of industries is found important to capture different industries' willingness of innovate radically (Amara, 2008). Another control variable in the paper is having internationally recognized quality certification, which is used for exploring the degree of implementation of innovation (Seker, 2009).

Learning by Training: Innovation development process requires an adequate pool of skilled manpower (Romijn, 2002; Darroch, 2002). This knowledge can be enhanced through experienced managers, high educated employees or investments in internal staff training (Romijn, 2002).Trained employees are more capable to have incentive to obtain new knowledge and be radically innovative (Nonaka and Takeuchi, 1995; Hill and Rothaermel, 2003). According to Delgado (2011), firms who have the best human capital are more likely to create the highest number of new ideas. He suggests that the main source for new ideas and knowledge is human capital and human capital have a significant role in the development of radical innovations. **Learning by Searching:** Pini and Santangelo (2010) suggest that radical innovation base upon a problem-solving activity and entrepreneurs develop solutions for selected problems through learning by searching process. Learning by Searching is interconnected to R&D activities. R&D activities create new knowledge and have cumulative effects on the process of increasing the knowledge (Amara, 2004). As Li et al. indicates, "There is more tacit knowledge involved in radical innovation that in incremental innovation." (Li et al. 2008: 263). Forés and Camisón (2015) suggest that if the knowledge base is larger, it is more likely to make radical innovation. **Learning by doing:** Amara points out "This form of learning suggests that firms become more efficient as they get more practice at doing what they do."(Amara 2008:453). Learning by doing has a complementing effect on the previous learning processes (Amara 2004; Malerba 1992). Boso et al.

(2013) argue that firm innovativeness is related to firms' export performance. Jaworski and Kahli (1993) suggest that firms want to satisfy their export customer under the existence of high competitive atmospheres for this reason they willing to show greater innovativeness efforts.

The following hypotheses try to short above arguments;

H1: The larger the company, the lower the likelihood of making radical innovation.

H2: The higher the age of the firm, the less likely to make radical innovation.

H3: The more the technology intensive the firm the more it is capable to make radical innovations.

H4: The firm's human capital endowments influence significantly and positively radical innovation.

H5: Internal knowledge creation capability has a positive effect on radical innovation.

H6: Learning by doing has a complementing effect on the radical innovation.

4. Results

The results shown in Table 5 confirm the hypotheses between learning processes and directions of radical innovation. Radical innovativeness of enterprises is characterized by various variables of learning processes. The average marginal effects after probit models are estimated and the significance level of each coefficient is tested. As control variables are added for robustness check, the effect of firm characteristics consistently results in the firm, which introduces a new product or service to the market. To be able to interpret the effect of continuous variable properly, we have drawn the predicted probabilities.

As anticipated, several of our control variables exhibited significantly different effects across radical innovation for different countries. Graph 1 of A and F illustrate that, as the log of age goes up, the probability of making

radical innovations decreases for Turkey and Serbia. Coefficients of all size variables are statistically significant for Macedonia. However, being a large sized firm decreases the likelihood of successful radical innovations much more than a small sized firms. It seems that the large sized firms are faced with difficulties, which we have expected. In addition to small sized firms, Macedonian young firms are willing to innovate radically. Our results do not give any clue about our expectation of medium tech sector's high willingness of making successful radical innovations, which is found insignificant for Modest countries; Whereas for moderate and follower countries, we find negative and significant effects. Other control variable of having an internationally recognized quality certification (cert) is not found statistically significant.

With regard to our hypotheses based on the rationale that the firm's human capital endowments influence significantly and positively radical innovation, we found that the probability of being successful, while making radical innovations, depends on the learning by searching for moderate and follower countries. In another way, Serbian and Slovenian firms create new knowledge and/ or increase the cumulative knowledge, as we expected, and that yield an increase on the likelihood of successful radical innovations. Whereas learning by doing indicator works well for Turkey, this is found statistically significant.Graph 1-B shows that as the log of export goes up, the probability of making radical innovations increases. This means that internal learning makes enterprises more active on radical innovations.

Table 5. Estimated Probit Model of Learning Processes and Radical Innovation

Varıables	Predicted Prob. Of Turkey	Probit Results Of Turkey	Predicted Prob. Of Macedonia	Probit Results Of Macedonia	Predicted Prob. Of Slovenia	Probit Results Of Slovenia	Predicted Prob. Of Serbia	Probit Results Of Serbia
Startup	-0.086	-0.547	0.389**	1.678*	0.115	0.330	-0.101	-0.329
	(0.102)	(0.668)	(0.195)	(0.978)	(0.273)	(0.787)	(0.216)	(0.700)
Lnage	-0.121**	-0.769**	0.086	0.371	0.182	0.523	-0.201*	-0.653*
	(0.053)	(0.343)	(0.130)	(0.570)	(0.149)	(0.444)	(0.116)	(0.378)
Small	-0.052	-0.331	-0.977***	-4.211***	-0.258*	-0.739*	0.138	0.448
	(0.082)	(0.541)	(0.224)	(0.612)	(0.145)	(0.438)	(0.119)	(0.398)
Medium			-1.209***	-5.213***				
			(0.241)	(0.693)				
Large	-0.030	-0.187	-1.237***	-5.337***	-0.279	-0.799	-0.126	-0.409
	(0.076)	(0.490)	(0.270)	(0.983)	(0.208)	(0.622)	(0.191)	(0.627)
Rda	-0.024	-0.151	0.016	0.069	0.297**	0.851**	0.423***	1.374***
	(0.054)	(0.339)	(0.127)	(0.545)	(0.136)	(0.426)	(0.115)	(0.440)
Train	0.085	0.540	0.072	0.310	-0.105	-0.301	0.061	0.198
	(0.062)	(0.423)	(0.120)	(0.518)	(0.158)	(0.458)	(0.110)	(0.360)
Lnexp	0.055**	0.352**	-0.021	-0.089	0.087	0.249	-0.076*	-0.246*
	(0.025)	(0.156)	(0.057)	(0.247)	(0.058)	(0.174)	(0.042)	(0.144)
Edwf	0.001	0.009	0.003	0.013	-0.001	-0.002	-0.004	-0.013
	(0.001)	(0.008)	(0.004)	(0.016)	(0.003)	(0.009)	(0.003)	(0.009)
Manexp	0.006**	0.038***	-0.007	-0.028	0.004	0.011	-0.002	-0.007
	(0.002)	(0.014)	(0.007)	(0.029)	(0.006)	(0.017)	(0.006)	(0.020)
Techin	-0.024	-0.154	-0.016	-0.068	-0.321**	-0.920*	-0.231*	-0.751*
	(0.062)	(0.399)	(0.156)	(0.676)	(0.156)	(0.486)	(0.119)	(0.413)
Cert	-0.138	-0.873	0.138	0.597	-0.184	-0.527	-0.044	-0.142
	(0.090)	(0.607)	(0.121)	(0.586)	(0.168)	(0.494)	(0.134)	(0.433)
Constant		1.963		4.393***		-1.729		2.537**
		(1.354)		(1.640)		(1.539)		(1.139)
Observations	105	105	49	49	57	57	65	65
Wald Chi2		**249.10*** **		255.10***		345.06***		386.31***
McFadden's R2		**0.202**		0.271		0.121		0.213
Predicted prob.	**89.52%**		83.67%		64.91%		69.23%	

Robust Standard Errors İn Parentheses *** P<0.01, ** P<0.05, * P<0.1

An interesting result is shown for Serbian firms, which is a negative and statistically significant predicted probability of exporting. This result suggests that Serbian companies do not satisfy their export customer under the existence of high competitive atmospheres and they could not show greater innovativeness efforts. In terms of learning by training, not our all three variables are statistically significant. A top manager of a firm's experience has the only statistically significant effect on radical innovations for Turkish companies. Graph 1-C shows an increasing probability of radical innovation when the managers get more experience. This is not surprising, since the more experienced managers the more they take the risk.

5. Conclusion

This paper analyzes the relationship between making radical innovation and learning processes at firm level in the modest (Turkey and Macedonia),

moderate (Serbia) and follower (Slovenia) innovator countries classified by European Innovation Scoreboard 2015. We focused on the effect of three categories of learning processes on radical innovation: Learning by doing, Learning by training, and Learning by searching. This paper makes contributions to the empirical literature of radical innovation by investigating its relationship with learning process in relatively less successful Eastern Europe innovator countries.

According to our results, the impact of learning process on making radical innovation alters in the less successful innovator countries. Any of the learning processes do not affect radical innovation in Macedonia while Serbia and Slovenia make radical innovation only with process of learning by searching. Turkish enterprises are making radical innovation with their top manager's experience (learning by training) and their success in export performance (learning by doing).

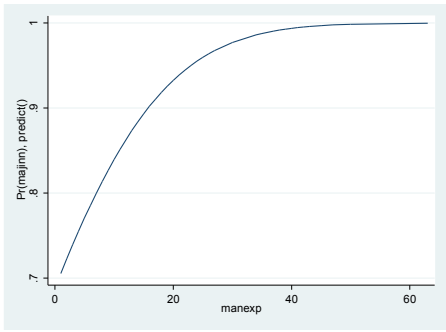
This study also shows interesting evidences related to control variables. As expected, several of our control variables exhibited significantly different effects across radical innovation for different countries. According to results contrary to other countries, Macedonia is the only one that affected by startups and firm's size in pursuing radical innovation, and not affected by any learning processes. Macedonian startups are successful as in leader innovator countries. Pursuing radical innovation for Macedonian enterprises becomes harder as the size of enterprises becomes larger. The younger enterprises are more likely to innovate radically in Turkey and Serbia. Enterprises of medium tech sector when compared to other sectors in Slovenia and Serbia have a disadvantage of making innovations. Lastly, internationally-recognized quality certification has no effect on any country.

There are some limitations in our study. Firstly, we are not able to include high tech firms in the sample because they are almost not existed. Secondly, we worked with a small sample for each country.

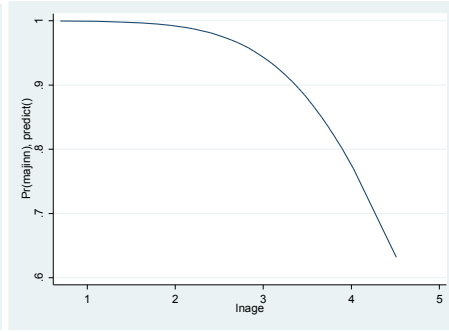
To sum up, in less successful East European innovator countries, there is no common a type of learning processes having impacts on pursuing radical innovation and also no common control variables significant for all countries. Finally, in future research, it will be interesting to examine what learning process affects both radical and incremental innovation in leader innovator countries.

Graph 1

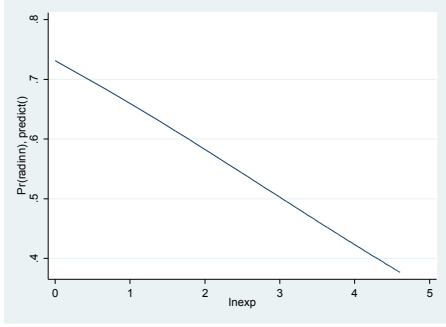
A Turkey



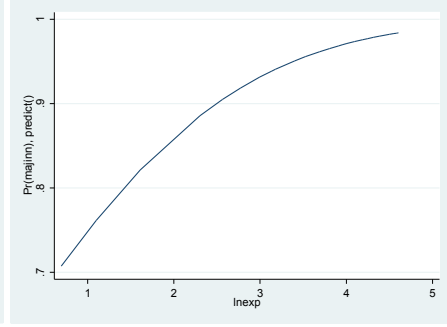
B Turkey



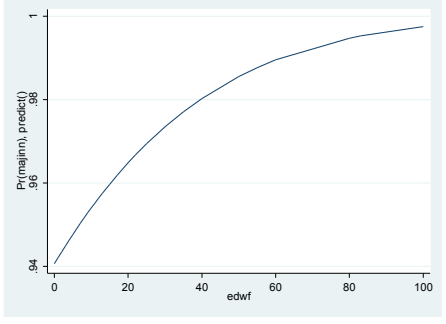
C Turkey



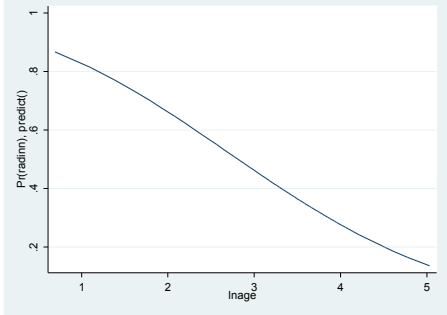
D Turkey



E Serbia



F Serbia



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