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Innovation and entrepreneurship for competitiveness in the EU: an empirical analysis

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Abstract. *The nexus of innovation, entrepreneurship and competiveness represents a real challenge for the European economy, and not only, taking into account the important role of these determinants of inclusive and sustainable development in the context of the Fourth Industrial Revolution. The aim of this article is to explore the relation between innovation, entrepreneurship and national competitiveness, at the EU level, in order to highlight how innovation and entrepreneurship can influence the level of competitiveness and inclusive development in these countries. The results of the comparative analysis based on means-testing using independent samples t-test, at EU level, show that there are significant differences between low-medium innovation performance countries group and high and very high innovation countries performance group in terms of competitiveness, innovative entrepreneurship, productive entrepreneurship and economic and inclusive development, fact which emphasizes the need to take specific actions to improve EU innovation performance, especially in the EU countries included in the low-medium innovation performance countries group for improving national competitiveness and implicitly increasing the level of development. The correlation and regression analysis results suggest that the high level of national competitiveness in some EU countries can be mainly explained by high level of innovation performance, high level of innovative and productive entrepreneurship. The findings of the study can be useful for policymakers to formulate policies for improving national competitiveness within an inclusive development.*

Keywords: competitiveness, innovation, entrepreneurship, inclusive development, EU.

Introduction

The European Innovation Scoreboard report (EU, 2017) highlights that the competitiveness of the European economy and the well-being of European citizens depend on innovation; innovation increases productivity and drives economic growth, creates opportunities for new and better jobs; innovation meaning prosperity.

Reaching the objective set by the European Union (Europe Strategy 2020), turning the European economy into an "intelligent, sustainable and favourable to inclusion economy", respectively improving European competitiveness requires the acknowledgement of the central role that innovation and entrepreneurship play in achieving economic and inclusive development and growth of well-being.

There is widespread agreement that entrepreneurship and innovation are driving forces in competitiveness and all three aspects have been intertwined with sustainable development.

According to The Global Competitiveness Report 2017–2018 (WEF, 2017a), one of the pressing issues related to the health of the global economy and its ability to provide sustained economic growth and well-being is the fact "that more countries are able to innovate, but they must do more to spread the benefits" (WEF, 2017a, p.12), thus it is needed to widely spread innovation's potential economic and societal benefits, in the Fourth Industrial Revolution (4IR) era. Moreover, the same report emphasizes that the

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ability of a country's people and companies to adopt innovations is an important prerequisite for seeing the positive effects of these innovations at economic and societal level.

The nexus of innovation, entrepreneurship and competiveness represents a real challenge for European economy, and not only, taking into account the important role of these determinants of inclusive and sustainable development in the context of the Fourth Industrial Revolution.

In the light of these considerations, *the aim* of this article is to explore the relation between innovation, entrepreneurship and national competitiveness, at the EU level, in order to highlight how innovation and entrepreneurship can influence the level of competitiveness and economic development in these countries.

Literature review

Entrepreneurship and innovation are closely interrelated concepts, being argued that entrepreneurs disrupt market equilibrium "by identifying and exploiting new products, processes or markets" (Ahmad and Seymour, 2008), by better satisfying the needs of both the customers and the environment, and by helping firms which are less productive through by means of their innovations that develop the production process (GERA, 2017). Economies' ability to become competitive depends on innovation capabilities, particularly in higher-productivity sectors.

Different studies (Szirmai et al., 2011) show, on the one hand, that entrepreneurship can contribute to job creation, economic growth and development through innovation. On the other hand, Grilo and Thurik (2005) consider that the entrepreneurial activity is at the heart of innovation, competitiveness, economic growth and job creation.

It is widely recognized that innovation has a positive impact on the entrepreneurial performance and has a significant role in the social and economic development through the created output (Szabo and Herman, 2014). Entrepreneurs are considerably more innovative in innovation-driven economies than in efficiency-driven economies (GERA, 2017), innovative entrepreneurship being considered a key factor of modern economic development (Fagerberg and Sapprasert, 2011). According to Kelley et al. (2016) and EU (2017), innovation levels tend to be positively linked to the development level, thus the average innovation levels increase with the development level. Szabo and Herman (2012) show that at EU level, the existing gaps on the level of economic development can be explained by disparities in innovation performance and innovative entrepreneurship, expressed by innovative SMEs.

The impact of the entrepreneurial activity in economy differs according to the characteristics of entrepreneurship, which in turn depend on the stage of economic development (Korez-Vide and Tominc, 2016). Total early-stage entrepreneurial activity (TEA), an indicator that focuses on the quantity of entrepreneurial activity, tends to be the highest in the factor-driven group of economies, decreasing with higher levels of economic development (GERA, 2017) and is negatively correlated with economic development (Szabo and Herman, 2014), economic growth, economic freedom, and global competitiveness (GEDI, 2017). On the contrary, Global Entrepreneurship Index (GEI), a composite indicator that measures both the quality of entrepreneurship in a country and the extent and depth of the supporting entrepreneurial ecosystem, tends to be the highest in innovation-driven economies and is positively correlated with the level of development (GEDI, 2017). GEI

measures only productive entrepreneurship that makes both entrepreneurs and society better off, on the one hand, and that both creates wealth and is scalable (GEDI, 2017). A strong positive relationship between productive entrepreneurship and an economy's innovativeness as well as its ability to adapt is showed by Douhan and Henrekson (2008).

A country's competitiveness has been considered a complex concept and therefore it has been extensively analyzed from different perspectives (Carayannis and Grigoroudis, 2014). In this paper, competitiveness is analysed according to WEF country's competitiveness definition, as "the set of factors, policies and institutions that determine the level of productivity of a country taking into account its level of development" (WEF, 2014, p.7). Innovation and business sophistication represent an important component of Global Competitiveness Index (WEF, 2017), fact which proves that innovation and entrepreneurship are considered essential factors of national competitiveness, together with other influencing factors of competitiveness such as: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labour market efficiency, financial market development, technological readiness, and market size. These factors affect competitiveness in different ways depending on the economy's stage of development.

Improving competitiveness in less-advanced countries can be achieved by adopting existing technologies or making incremental improvements in other areas, but in the innovation-driven economies this is no longer sufficient for increasing productivity (Szabo and Herman, 2012), firms having to design and develop cutting-edge processes and products to maintain a competitive edge (WEF, 2012). Innovation improves efficiency, increases company productivity and provides significant benefits to consumers (EU, 2017). Higher levels of education and industry sector profiles with higher levels of participation in more complex sectors, for example information and communication technology, can explain a high level of development (Kelley et al., 2016) and competitiveness at national level.

The fundamental question of this research is if, at the EU level, innovation and entrepreneurship influence national competitiveness and to what extent.

Based on the theoretical background and evidence from the literature, we formulated the following hypothesis:

H1: There is a positive link between innovation performance and national competitiveness *in the EU countries*

H2- There are significant differences between low-medium innovation performance countries group and high and very high innovation performance countries group regarding national competitiveness and labour productivity.

H3: There is a positive link between productive entrepreneurship and national competitiveness, in the EU countries.

H4: Higher national competitiveness is associated with higher economic and inclusive development at the EU level.

Methodology

In order to analyse the multiple aspects of the innovation-entrepreneurship-competitiveness relationship we use the indicators described in Table 1. Our approach to competitiveness is based on the premise that a high level of innovation performance and

productive entrepreneurship can contribute to a high level of national competitiveness and implicitly to economic and inclusive development.

To analyse the *national competitiveness* level in the EU countries we use two indicators: nominal labour productivity (LP) per person employed (EU28 = 100%) and Global Competitiveness Index (GCI) which "measures national competitiveness-defined as the set of institutions, policies and factors that determine the level of productivity" (WEF, 2017a, p.11).

For identifying the characteristics of innovation performance in the EU countries, its multiple aspects have been analysed based on Summary Innovation Index- SII [a composite indicator that summarizes the performance of research and innovation systems at country level based on "four main types of indicators and ten innovation dimensions, capturing in total 27 different indicators" (EU, 2017, p.6)]. According to EU (2017), the EU member states are grouped into four innovation performance groups based on their average performance scores relative to the EU average (of 100%): "innovation leaders" (Denmark, Finland, Germany, Netherlands, Sweden and the UK), "strong innovators" (Austria, Belgium, France, Ireland, Luxembourg and Slovenia), "moderate innovators" (Czech Republic, Estonia, Greece, Hungary, Italy, Poland, Portugal, Slovakia, Croatia, Latvia, Lithuania and Spain) and "modest innovators" (Bulgaria and Romania).

Table 1. Variables included in analysis. Descriptive statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
SMEs introducing product or process innovations (SMEs-PP)	26	4.9	48.3	30.131	12.335
SMEs introducing marketing or organisational innovations (SMEs-MK)	26	8.8	54.3	32.204	13.113
IDI	26	3.68	5.87	4.723	0.467
GEI	26	27.8	77.8	54.042	14.592
SII	26	33.1	140.9	90.919	31.029
GCI	26	4.02	5.66	4.861	0.504
LP	26	45.4	190.2	96.431	31.908
GDP/CAPITA	26	49	258	100.154	44.120

Source: Authors' own research based on Eurostat database (2017), WEF (2017a,b), EU(2017) and GEDI (2017).

In the international comparison of countries, entrepreneurship is most frequently expressed in terms of Total Early-stage Entrepreneurial Activity (TEA) rate and SMEs. Taking into consideration that "the most entrepreneurial countries in the world are not those that have the most entrepreneurs" (GEDI, 2016, p.2) and in entrepreneurship, quality matters more than quantity, this article in analysing of the entrepreneurship highlights qualitative aspects of entrepreneurship. Thus, productive entrepreneurship in EU countries has been analysed based on Global Entrepreneurship Index (GEI). GEI is a composite indicator which "measures both the quality of entrepreneurship in a country and the extent and depth of the supporting entrepreneurial ecosystem" (GEDI, 2017, p.11). GEI score has a value between 0% and 100%, where a high value of GEI indicates a high level of productive entrepreneurship. Innovative entrepreneurship is measured by two indicators: SMEs

introducing product or process innovations and SMEs introducing marketing or organisational innovations (as % of SMEs).

For describing the socioeconomic development of EU countries, we use gross domestic product (GDP) per capita (in PPS as % of EU 28 average GDP =100%) and Inclusive Development Index (IDI). IDI is a composite index which comprises three pillars (growth and development, inclusion and equity, and sustainability) including 12 key performance indicators of inclusive development (WEF, 2017b). IDI and GCI scores are based on a 1-7 scale: 1=worst and 7=best.

In order to study the intensity of the relationship between the analysed indicators, at the level of this sample, we have applied the Pearson correlation coefficient (r). We employed the simple regression analysis for identifying a functional relationship between dependent variables (competitiveness and development) and independent variables (innovation, entrepreneurship).

Based on SII data (EU, 2017), two countries groups were designed: the low-medium innovation performance countries group (this group includes 14 countries which are considered modest and moderate innovators)-"L-M group" and high and very high innovation countries group (12 countries)-"H-VH group" which includes those countries which are strong innovators and innovation leaders. To examine whether there were significant differences between the countries groups (L-M group vs. H-VH group) in relation to the indicators analysed, the statistical analysis focused on means-testing using independent samples t-test for equality of means. In case significantly unequal variances (Levene's test) are found between the groups, then equality of variance is not assumed in the means-testing (Pruet et al. 2009).

Our sample consists of 26 countries from EU, without Malta and Cyprus, the countries for which more statistical data are unavailable. The statistical data on the variables analysed in this paper were collected from the Eurostat database (2017), WEF (2017a, b), EU (2017) and GEDI (2017). For data processing and analysis, the SPSS software package was used.

Results and discussions

To reveal the state of national competitiveness of EU countries, the GCI score and level of labour productivity for 2016 have been analysed. Data from Table 1 show that the average score of competitiveness in EU (26 countries) was 4.86, the minimum value being registered by Greece (4.02) and the maximum value by Netherlands (5.66). In terms of labour productivity, the average level of EU competitiveness was 190.2% (EU-28=100%), the lowest level was achieved by Bulgaria (45.4%) and the highest level by Luxembourg (190.2). According to WEF (2017a), Bulgaria is classified as a country at the efficiency-driven stage of development; seven EU countries are classified as countries in transition (from efficiency-driven stage to innovation-driven stage) and the rest of the EU countries as countries at the innovation-driven stage of development. Data from Figure 1 show that some transition countries (Lithuania and Poland) achieved higher levels of competitiveness than some countries at the innovation-driven stage of development (Italy and Portugal). It is also evident that the level of competitiveness differs from one country to the next. Behind these differences in competitiveness there are specific factors that require specific measures.

Taking into account that innovation performance can be a main driver of national competitiveness, being an important component of GCI, Figure 1 presents the results of the statistical analysis of competitiveness-innovation relationship.

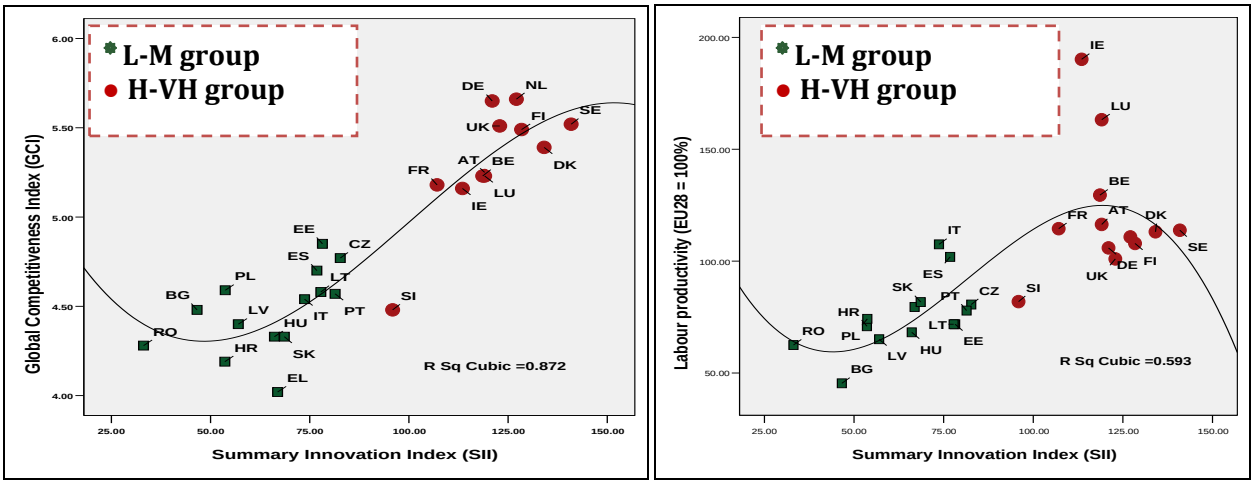

Figure 1. Competitiveness and innovative performance: a). GCI and SII; b). LP and SII

Source: Authors' own research based on Eurostat database (2017), WEF (2017a) and EU (2017).

As for the innovation performance (SII) among the two country groups (L-M group vs. H-VH group), heterogeneity can be observed. Average innovation performance in L-M group is 1.7 times higher than in H-VH group (119.1% against 66.5%). In L-M group, Czech Republic has the highest level of innovativeness (82.7%) among peer countries, followed by countries such as Italy, Spain, Lithuania, Estonia (70-80%); Romania and Bulgaria, having below 50% of the EU innovation performance. Also, in H-VH group there is a high level of heterogeneity, innovation performance ranges from the minimum value of 95.9% (in Slovenia) to the maximum value of 140.9%, in Sweden (Figure 1).

Table 2. Multiple correlation matrix

Variables	SMEs-PP	SMEs-PP	IDI	GEI	SII	GCI	LP	GDP/capita
SMEs-PP	1.000	0.864	0.378	0.686	0.817	0.670	0.693	0.595
SMEs-PP		1.000	0.402*	0.661	0.770	0.609	0.803	0.749
IDI			1.000	0.662	0.703	0.727	0.607	0.752
GEI				1.000	0.914	0.900	0.699	0.614
SII					1.000	0.911	0.721	0.696
GCI						1.000	0.639	0.642
LP							1.000	0.904
GDP/capita								1.000

Note: Correlation is significant at the 0.01 level (2-tailed); *at the 0.05 level (2-tailed).

Source: Authors' own research based on Eurostat database (2017), WEF (2017a,b), EU(2017) and GEDI (2017).

The results of the correlation analysis (Table 2 and Figure 1) regarding the relationship between GCI and SII in EU countries, in 2016, emphasise that there is a strong positive relationship, statistically significant (Person correlation r= +0.914, p<0.01). The

same relationship is set between GCI and labour productivity per person employed, but of a lower intensity (r = + 0.639, p<0.01). The third degree polynomial line explains 87.2% of the variation in the case of the GCI (Figure 1a) and 59.3% in the case of the labour productivity (Figure 1b).

Thus, in the countries where innovation performance is lower, the level of competitiveness is lower too and vice versa, fact which confirms *hypothesis H1.* These results highlight the need for increasing innovative performance, especially in modest and moderate innovators countries in order to enhance competitiveness and national progress.

If we compare the national competitiveness of EU countries relative to innovation performance (Table 3), the results of independent samples t-test show significant differences between low-medium innovation performance countries group and high and very high innovation performance countries group**,** for both GCI [t(24)= -7.797; p=0.000] and LP [t(24)= -5.048; p=0.000]. On average, H-VH group has a much higher GCI score than L-M group (5.313 score as compared to 4.474). Also, the level of LP among H-VH group is much higher than L-M group (120.68% against 75.64%).Taking into account these results, *hypothesis H2* is confirmed.

Table 3. Results of independent samples t-test: low-medium innovation performance countries group (L-M group) versus high and very high innovation performance countries group (H-VH group)

	Mean		Levene's Test [1]		t-test[2]	
Variables	LM group (N=14)	H-VH group (N=12)	F	Sig.	t	Sig. [3]
GEI	42.436	67.583	0.287	0.597	-8.904	0.000
GCI	4.474	5.313	0.341	0.565	-7.797	0.000
IDI	4.414	5.084	0.057	0.813	-5.235	0.000
LP	75.643	120.683	2.335	0.140	-5.048	0.000
GDP/capita	72.571	132.333	4.069	0.055	-4.652	0.000
KIA	11.221	16.733	3.350	0.080	-6.352	0.000
SMEs-PP	22.229	39.350	8.567	0.007	-4.879	0.000
SMEs-PP	23.221	42.683	1.117	0.301	-5.633	0.000

Note: [1]Levene's test for equality of variances delivered a significance value higher than 0.05 for all the variables for which the "equal variances assumed" option was used; df =24; [2]t-test for equality of means; [3]2-tailed.

Source: Authors' own research

The level of competitiveness can be explained by examining the level and type of entrepreneurship. Data from Figure 2 and Table 3 show that entrepreneurship, expressed by GEI, differs significantly at the EU level, there being a high level of GEI in most countries from H-VH group. The Nordic EU countries recorded a high GEI value from 67.9% to 77.8%. Furthermore, Table 3 shows the results of independent samples t-test, which suggest that there is a *positive difference* in entrepreneurship (expressed both by GEI and innovative SMEs) *between* the H-VH group and LM group. Thus, on average, H-VH group has a much higher GEI level than L-M group [67.58% against 42.44%; t(24)= -8.904; p=0.000]. Furthermore, significant differences between the two countries groups were identified in terms of technological-innovative SMEs (SMEs introducing product or process innovations as % of SMEs) and non-technological innovative SMEs (SMEs introducing marketing or organizational innovations as % of SMEs). Countries from H-VH group are characterized by a higher level of innovative SMEs than countries from L-M group [technological innovative

SMEs: 39.3% against 22.2%, t(24)= -4.879; p=0.000; non-technological innovative SMEs: 42.6% against 23.22%, t(24)= -5.633; p=0.000]. The low level of innovative SMEs in the countries in Central, Eastern and Southern EU (LM group) results in a low level of innovation in manufacturing activities (Szabo and Herman, 2012). Thus, our results show that entrepreneurs in innovation-driven economies are considerably more innovative and more productive, fact confirmed by others studies (GERA, 2017; GEDI, 2017).

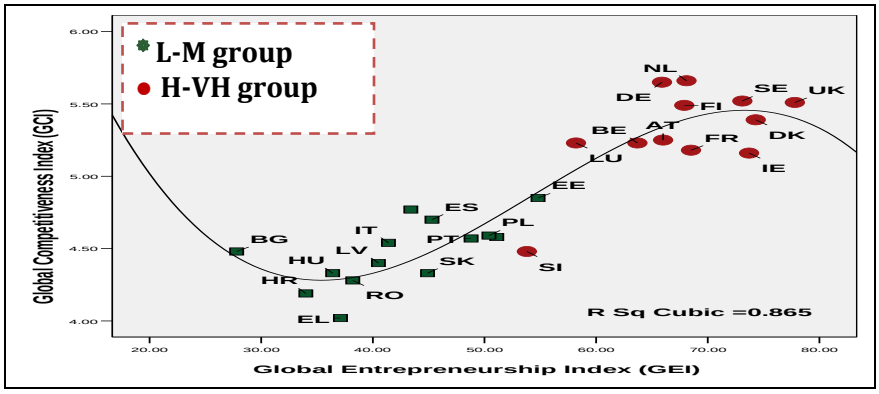

Figure 2. Competitiveness and productive entrepreneurship (GEI)

Source: Authors' own research based on WEF (2017a) and EU (2017).

Examining results of testing *hypothesis H3* analysis between national competitiveness (GCI) and productive entrepreneurship (GEI), a strong positive correlation is revealed (r=+0.900, p< 0.05, see Table 2 and Figure 2). The use of the third degree polynomial trend-line explains 86.5% of the variance between the two indices (Figure 2). Moreover, it is noticed that GCI is positively correlated with innovative entrepreneurship (Table 2), expressed by both technological innovative SMEs (r= +0.670, p< 0.01) and non-technological innovative SMEs (r= +0.609, p< 0.01). In the EU countries where both productive entrepreneurship (GEI) and innovative entrepreneurship are higher, competitiveness is high too, and vice versa, thus *hypothesis H3 is confirmed.*

The results of independent samples t-test (Table 3) show there are significant differences between the H-VH group and L-M group in terms of both economic development [t(277)= -4.652; *p*=0.000] and inclusive development [t(277)= -5.235; *p*=0.000], suggesting that countries with high innovative performance have higher level of economic and inclusive development than countries with lower innovative performance.

Our empirical results confirm that behind a high level of economic and inclusive development there is a high level of national competitiveness. As revealed in Figure 3 and Table 2, there is a positive correlation between the level of *competitiveness (GCI)*, on the one hand, and *economic development*-GDP/capita (r= +0.642, p<0.01) and inclusive development- IDI (r= +0.727, p< 0.01), on the other hand. Furthermore, as it can be seen in the correlation table (Table 2), all innovation and entrepreneurship indicators correlate positively significantly with the GDP/capita and IDI. This finding is not a surprise since all of these indicators can explain different dimensions of development. Also, at EU level, the relationship between *economic development* and inclusive development is positive and significant, as expected (r= +0.752, p< 0.01).

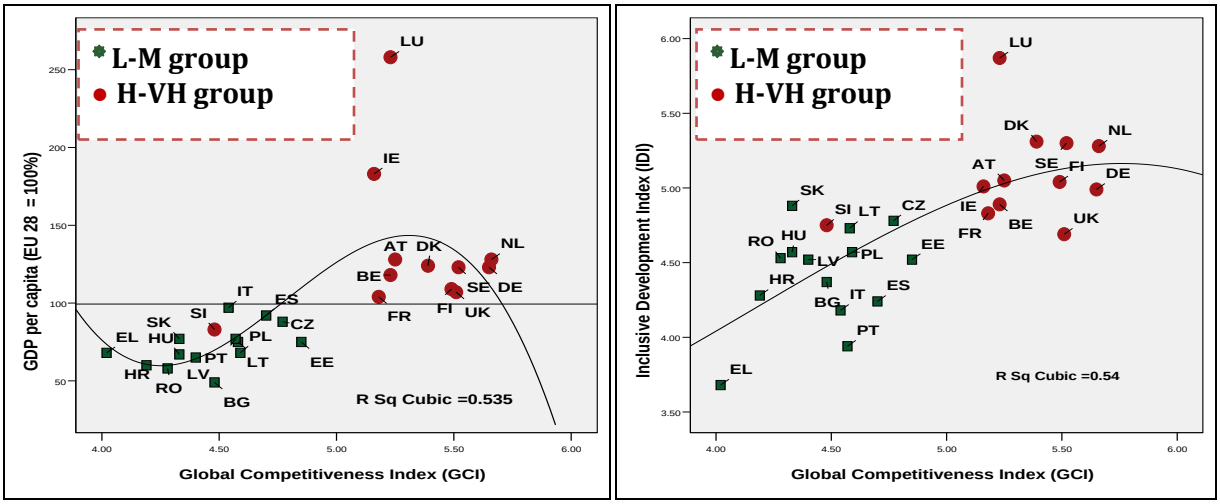

Figure 3. Competitiveness and development: a). GCI and GDP/capita; b).GCI and IDI

Source: Authors' own research based on WEF (2017a,b) and Eurostat database (2017).

These results confirm hypothesis 4 according to which higher competitiveness is associated with higher economic and inclusive development at the EU level.

Conclusion and implications

This study has shed light on the nexus of innovation, entrepreneurship and competiveness, in the EU countries, highlighting the important role of these main drivers of inclusive and sustainable development in the context of the Fourth Industrial Revolution.

The comparative analysis, at EU level, shows that there are significant differences between low-medium innovation performance countries group and high and very high innovation countries performance group in term of competitiveness, innovative entrepreneurship, productive entrepreneurship and economic and inclusive development, fact which emphasizes the need to take specific actions to improve EU innovation performance, especially in the EU countries included in the low-medium innovation performance countries group for improving national competitiveness and implicitly increasing the level of development. These results point out that in the common innovation policy objectives in the EU context, the growth and development strategies may differ across member states and should address a country's specific challenges (Kacprzyk and Doryń, 2017).

The correlation and regression analysis results suggest that the high level of national competitiveness in some EU countries can be mainly explained by a high level of innovation performance, high level of innovative and productive entrepreneurship. Policies to stimulate and encourage innovative and creative mindsets in modest innovators countries (Romania and Bulgaria) and moderate innovators countries are needed. Also, there is need for simultaneous action, both at individual and institutional level, but with a special focus on developing the institutional environment for making entrepreneurship more efficient (Herman and Szabo, 2014).

As a limitative aspect, we point out that our study represents only a partial picture of the innovation-entrepreneurship-competiveness relationship through the analysis of a limited number of indicators specific to innovation performance and entrepreneurship, as

well as to the methods of statistical analysis used based on correlation and simple regression. In this context, further research will be extended.

The findings of the study can be useful for policymakers who can formulate policies that would improve national competitiveness within an inclusive development.

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