UNIVERSITY – INDUSTRY COOPERATION IN CENTRAL AND EASTERN EUROPE: A COMMON PAST, A DIFFERENT FUTURE?*

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Abstract: *The aim of this paper is to map the position of the Central and Eastern Europe (CEE) region for university – industry cooperation in research and development. (R&D) To meet this goal, we use the Global Competitiveness Index 2011 database and consider those indicators describing the knowledge production and the knowledge absorption potential of 142 participating countries. Based on a discriminant analysis, we classify the countries and synthesize their performances for the selected indicators. The results confirm our hypothesis regarding the heterogeneity of the CEE countries' performances for university – industry cooperation and identifies the factors that explain the variations.*

Keywords: university – industry cooperation, CEE region, Global Competitiveness Index 2011, discriminant analysis
JEL Classification: O3

INTRODUCTION - CEE COUNTRIES' R&D PROFILES

Despite the fact that 'the transition is over' for Central and Eastern European (CEE) countries that joined the EU in 2004 and 2007 (Alam et al., 2008), a significant number of constraints to innovation and development trajectories still remain. According to Koschatzky (2002), during the socialist period, these countries were characterized by a linear innovation model according to the soviet-type science push mode. This tradition survived the collapse of communism too and policy actions during the 1990s are good examples of the linear innovation model, where the underlying idea is that policy should focus on commercializing the results of the R&D system. As a result, the CEE countries have failed to capitalize on their science – base, despite potential large assets in terms of the R&D labour force and policy initiatives aimed at enhancement of science – industry linkages (Radosevic, 2011).

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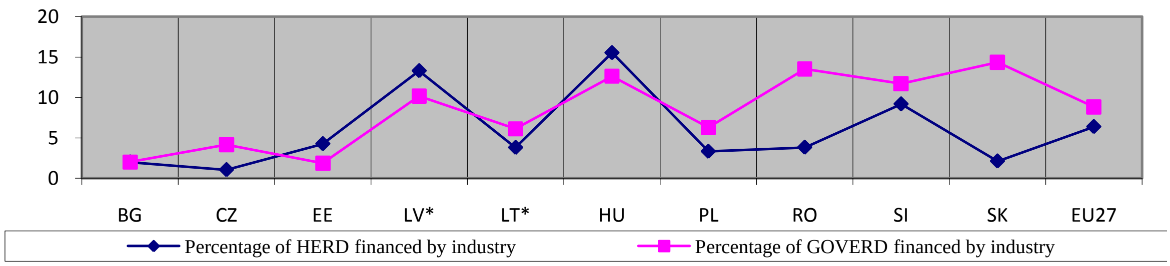
Despite their common past, CEE countries have nowadays a very heterogeneous profile for university – industry cooperation agreed indicators: funding flows (industry funding in Higher Education R&D Expenditure - HERD - and Government R&D Expenditure - GOVERD), CIS data and bibliometric analyses.

In what concerns the *funding flows*, in Hungary firms fund research activities both at universities and public research organizations to a notably extent: in 2009, 15,52% of higher education expenditures on R&D (HERD) had been financed by firms, more than double of the EU27 average (6,38%) and 10 times higher than in the Czech Republic (1,05%). As regards to the % of GOVERD financed by industry, Slovakia (14,35%) and Romania (13,52%) are the performers, with percentages significantly higher than the EU 27 avg. (8,81%), indicating thus a concentration of R&D in public research organizations (PROs) (OECD, 2011; EC, 2011) (Figure 1).

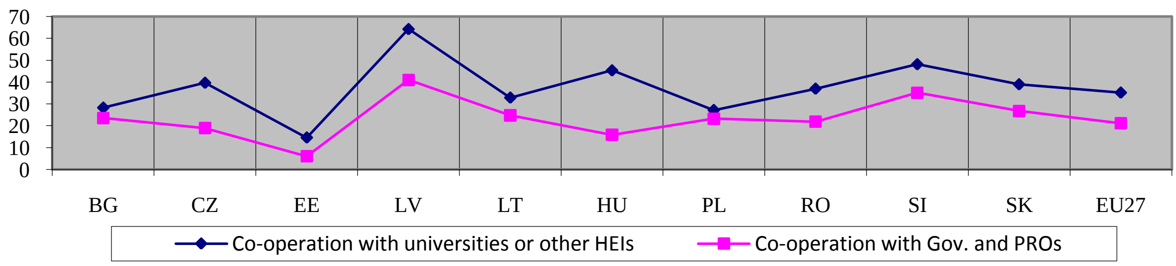
The frequency of *innovative firms cooperating with universities* is the highest in Latvia, where 64,2% of enterprises with technological innovations collaborate with HEIs; in contrast, only 14,5% of Estonian firms have such collaborative engagements. As regarding the % of *innovative firms cooperating with PROs*, we can observe it is much lower than the % of innovative firms cooperating with universities for all the CEE countries, so that we can suppose a predominance of non – R&D collaborative engagements (CIS, 2008) (Figure 2).

Figure 1 - Knowledge circulation by funding flows in CEE countries, 2009



Source: *OECD Science, Technology and Industry Scoreboard 2011; Innovation Union Competitiveness Report 2011.*
*Latvia (LV), Lithuania (LT) – 2006

Figure 2 - % of enterprises with technological innovations cooperating with HEIs and PROs, 2006 - 2008



Source: *Community Innovation Survey 2008*

Finally, the bibliometric analyses also suggest a high heterogeneity in the CEE group: while Slovenia has reported 51 public – private co-publications per million persons, Bulgaria, Latvia, Lithuania and Poland have each reported less than five similar co-publications (EC, 2011).

According to Formica, Mets and Varblane (2008), the lack of knowledge flows between universities and enterprises in CEE countries has at least two explanations: on the one hand, there is a low innovation literacy of business, which cannot formulate its own ideas or find sophisticated partners and is not open to cooperation; on the other hand, one has to recognize the unsatisfactory business literacy level of academic society, with its accompanying inability and unwillingness to offer cooperation.

As regarding the *supply-side constraints*, generally speaking, the role of universities in CEE post-communist countries is weaker than in more developed countries of the EU. According to Gál and Ptaček (2011) before 1989, universities were focused on teaching, while both basic and applied research was mostly concentrated in academies of sciences or in applied research institutes in industry. After 1990s, the situation did not change so much and universities were mostly facing the pressure of the state to increase their educational role. Nowadays, according to Erawatch country reports (2011), the main challenges in the knowledge production function are related to **institutional policies** (*high degree of institutional fragmentation* – Bulgaria, *moderate attention for economic impact and exploitability of knowledge in research quality assessment* - Estonia, Hungary, *fragmented support for RTDI, without understanding of demand for knowledge* – Hungary, *lack of competitive culture in science and research* - Poland), **human resources** (the *"brain-drain" phenomenon* - Bulgaria, Romania, *the low number of researchers* or *HRST* - the Czech Republic, Hungary, *shortage of high quality, industry – relevant skills* - Lithuania), **research infrastructures** (*underdeveloped research and innovation infrastructures* - Bulgaria, *lack of funding for the modernisation of the research infrastructure* - Hungary, *poor perspective of significant improvement of research infrastructures to attract young researchers* – Romania and **R&D funding** (*inefficient distribution of funds* - Bulgaria, *continuing generic support to all R&D disciplines disregarding excellent disciplines, institutes, teams and national thematic R&D priorities* - The Czech Republic, Slovakia, *inefficient incentives leading to a further national tailing off in terms of research and innovation output quality and quantity* – Latvia). To these one can add the risks of abandoning or delaying the reforms due to political instability (Hungary, Poland), the insufficient policy coordination (Slovenia) or the lack of mechanisms based on stakeholder involvement to identify drivers for knowledge demand (Lithuania).

As regards to the *demand-side constraints*, the capacity to generate demand for innovation is the weakest aspect of the national innovation capacity of the CEE countries in the EU. For example, in the Czech Republic, innovation activities are restricted to a few larger enterprises or to micro- or small newly established firms, while local universities remain indeed an important source of qualified labour, yet not of exploitable research results (Žižalová, 2010). In Hungary, undergoing transformation and the process of privatization did not make companies hungry for innovation; as a result, a very limited number of companies regard universities as crucial partners in innovation (Inzelt, 2004). In Romania, as confirmed by the analyses that backed the Regional Innovation Strategies (RIS), universities and industry experience significant gaps in their cooperation that are mainly sourced by the lack of resources for R&D, an unclear or inappropriate offer of R&D providers, poor managerial skills of researchers, a lack of awareness regarding the benefits of research and innovation and, more important, the lack of an innovation culture among SMSs (Serbanica, 2011). Regarding Slovenia, while there is intense co-operation between Slovenian research institutes and companies, the level of co-operation between university institutes and industrial firms remains below the average and the innovation system is still fragmented (Koschatzky, 2002). In this respect, it should be noted that most of CEE countries still have *a low technology profile* (Bulgaria, Romania), *a low proportion of research in high technology intensive sectors* (the Czech Republic, Estonia), *weakly developed sector of industrial production* (Latvia), *no clearly focused entrepreneurship policies* (Estonia), *belated recognition of potential for service innovation* (Lithuania) and *lack of an innovation culture in the economy*, especially at the SMEs level. None the less, the macroeconomic pressures exacerbated by the global economic crisis in 2008, together with the cut of government expenditures in view of the budget deficit have brought additional risks and threats to CEE countries' RDI profiles (Erawatch country reports, 2011). The survey that backed the *Global Competitiveness Report 2011-2012* (Schwab, 2011) provides information on the potential for the research base to co-operate with industry. As shown in *Annex no. 1*, there are significant disparities between CEE countries in respect to *university – industry collaboration in R&D,* with the Czech Republic and Lithuania on the top of the list and Romania and Bulgaria at the end on the ranking.

The main argument of this paper is that CEE countries should not be approached as a homogenous group in policy-making, despite some significant similarities in their common communist past. Consequently, our research goal is to classify CEE countries into homogenous groups, while evidencing the factors that contribute significantly to fostering university – industry cooperation. To this end, we have used the data that backed the Global Competitiveness Report

2011 and conducted a discriminant analysis, due to its advantages in both synthesizing a set of variables and expressing the relationships between them.

RESEARCH FRAMEWORK

The data for computation of the Global Competitiveness Index (GCI) was drawn from two sources: international organizations and national sources and the Executive Opinion Survey, with a total of 13,395 respondents from 142 countries in 2011. The GCI includes a weighted average of many different components that were grouped into 12 pillars of competitiveness: institutions, infrastructure, macroeconomic environment, health and primary education, higher education and training, goods market efficiency, labour market efficency, technological readiness, financial market development, market size, business sophistication and innovation. Whitin each pillar, performaces of the 142 participating countries are ranked separately for each component.

The dependent variable in our analysis - "**University – industry collaboration for R&D**" - was included in the *Innovation* pillar, together with other determinants such as the capacity for innovation, quality of scientific research institutions, company spending on R&D, government procurement of advanced technologies, availability of scientists and engineers and utility patents granted per million population. In line with the literature that investigates the determinants of university – industry collaboration (Polt et al., 2001; Holi, Wickramasinghe and van Leeuwen, 2008; Mathieu, 2011) and considering the fact that *a strong innovation capacity would be very difficult to achieve without a healthy, well-educated and trained workforce that is adept at absorbing new technologies and without sufficient financing for R&D or an efficient goods market that makes it possible to take new innovations to market* (Schwab, 2011, p. 8), we decided on a set of **independent variables** describing the knowledge production and knowledge absorption capacities, but also the presence of an enabling environment (*Table 1*). Within each category, we have looked for above 0.80 correlations and deleted two variables that were initially selected, namely *business sophistication* and *capacity for innovation* (that were highly correlated with *company spending on R&D*). The remaining variables are presented below.

Table 1 – Study variables

Category	Name	ABBREV.	GCI description
DEPENDENT VARIABLE			
University-industry collaboration in R&D		UI_links	To what extent do business and universities collaborate on research and development (R&D) in your country? [1 = do not collaborate at all; 7 = collaborate extensively]
INDEPENDENT VARIABLES			
KNOWLEDGE PRODUCTION CAPACITY	**Higher education and training**	HE	Quantity of education + Quality of education + On-the-job training
	Quality of scientific research institutions	Science_qual	How would you assess the quality of scientific research institutions in your country? [1 = very poor; 7 = the best in their field internationally]
KNOWLEDGE ABSORPTION CAPACITY	**Availability of scientists and engineers**	Scientists	To what extent are scientists and engineers available in your country? [1 = not at all; 7 = widely available]
	Company spending on R&D	R&D_spending	To what extent do companies in your country spend on R&D? [1 = do not spend on R&D; 7 = spend heavily on R&D]
ENABLING ENVIRONMENT	**Government procure-ment of advanced technology products**	Gov_procure-ment	Do government procurement decisions foster technological innovation in your country? [1 = no, not at all; 7 = yes, extremely effectively]
	Intellectual property protection	IP_protection	How would you rate intellectual property protection, including anti-counterfeiting measures, in your country? [1 = very weak; 7 = very strong]
	Venture capital availability	Vent_capital	In your country, how easy is it for entrepreneurs with innovative but risky projects to find venture capital? [1 = very difficult; 7 = very easy]

A discriminant analysis was further carried out to classify the performances of world's 142 countries for university – industry collaboration in R&D and to identify those variables contributing most to groups' separation. Given our research purpose, only CEE countries' performances were then subjected to in-depth analysis.

According to Burns and Burns (2008), the discriminant analysis involves the determination of a linear equation like regression that will predict which group the case belongs to. The use of the discriminant analysis implies checking up hypotheses regarding the normality of multivariate distributions in the predictor variables, the absence of multi-collinearity and the homogeneity of variances within each group. At the same time, group sizes of the dependent variable should not be grossly different. Consequently, as collinearity and homogeneity diagnostics are automatically computed in the SPSS discriminant analysis output, we only assessed the normality of the individual metric variables and eliminated one multivariate outlier case (Mozambique).

Simultaneously, we have plotted each independent variable against all other independent variables in a scatterplot matrix and observed multiple linear relationships between the variables.

The discriminant variable (G3) by which we divided the countries in three equal groups was *university – industry collaboration in R&D.* To meet the main precondition in discriminant analysis - the presence of a non-metric dependent variable -, we treated the discriminant variable G3 as categorical and named the three groups according to their performances: *leaders (Group 1), followers (Group 2) and non-performers (Group 3)* in university – industry collaboration.

Since the purpose of this analysis is to identify the variables that significantly differentiate between the three groups, the stepwise method based on Mahalanobis distance (D^2) method was appropriate. The F test for Wilks's Lambda was significant for all independent variables (sig. smaller than 0.05), with *quality of scientific institutions* and *R&D spending* producing very high values of F's (*Table 2*). These ANOVA results indicate significant group differences on each of the independent variables and justify further analysis.

Table 2 - Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
HE	,412	98,305	2	138	,000
Science_qual	,224	238,927	2	138	,000
Scientists	,590	47,966	2	138	,000
RD_spending	,351	127,407	2	138	,000
Gov_procurement	,583	49,317	2	138	,000
IP_protection	,476	75,873	2	138	,000
Vent_capital	,682	32,234	2	138	,000

As resulted from our SPSS 17 computation, the highest eigenvalue corresponds to the first discriminant function (3,888) that accounts in a ratio of 97,3% for the dispersion of the group means, as compared to the second function that accounts for only 2,7% of dispersion. At the same time, since the probabilities of the chi-square statistic for Wilks' lambda tests are significant (,000 and ,003), we can conclude that there is at least one discriminant function to separate the groups of the dependent variable (*Table 3).*

Table 3 – Eigenvalues and Wilks' Lambda

Func-tion	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	3,888[a]	97,3	97,3	,892
2	,107[a]	2,7	100,0	,311

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a. First 2 canonical discriminant functions were used in the analysis.

Test of Function(s)	Wilks' Lambda	Chi-square	Df	Sig.
1 through 2	,185	230,519	8	,000
2	,903	13,915	3	,003

The appropriateness of using the covariance matrix in computing classifications is evaluated by the Box's M statistic. Since Box’s M significance is above the alpha level, we can conclude that the analysis meets the assumption of homogenity of variances (*Table 4*).

Table 4 - Test Results

Box's M	15,218
Approx.	2,483
df1	6
df2	474635,077
Sig.	,021

Tests null hypothesis of equal population covariance matrices of canonical discriminant functions.

The Pearson coefficients (determinant loadings) are presented in the Structure matrix in *Table no 5* and they should be interpreted like factor loadings in factor analysis. By identifying the largest loadings for each discriminate function the researcher gains insight into how to name each function (Burns and Burns, 2008). The *quality of scientific institutions* has the highest discriminaning loading in the first discriminant function, while *higher education and training* and the *availability of scientists and engineers* are correlated with the second one.

Table 5 - Structure Matrix

	Function	
	1	2
Science_qual	,944*	-,097
RD_spending	,689*	-,092
IP_protection[a]	,543*	,083
Gov_procurement[a]	,349*	-,033

Vent_capital[a]	,346*	,172
HE	,593	,740*
Scientists	,413	,549*

*. Largest absolute correlation between each variable and any discriminant function
a. This variable not used in the analysis.

The summary table of variables entering and leaving the discriminant functions is shown in *Table 6*. Four out of our seven predictor variables, namely *quality of scientific institutions* (science_qual), *availability of scientists and engineers* (scientistis), *company spending on R&D* (RD_spending) and *higher education and training* (HE) – are useful in differentiating between performances in university – industry collaboration in R&D.

Table 6 - Variables Entered/Removed[a,b,c,d]

		Min. D Squared					
				Exact F			
Step	Entered	Statistic	Between Groups	Statistic	df1	df2	Sig.
	Science_qual	4,190	2 and 3	98,459	1	138,000	7,582E-18
	Scientists	4,524	2 and 3	52,766	2	137,000	1,020E-17
	RD_spending	4,902	2 and 3	37,845	3	136,000	7,576E-18
	HE	4,903	2 and 3	28,177	4	135,000	5,105E-17

At each step, the variable that maximizes the Mahalanobis distance between the two closest groups is entered.

a. Maximum number of steps is 14.

b. Maximum significance of F to enter is .05.

c. Minimum significance of F to remove is .10.

d. F level, tolerance, or VIN insufficient for further computation.

The classification output indicates that 81,6% of the original grouped cases were correctly classified (*Table 7*) that means they were included in the group to which they actually belongs. Consequently, the model can be generalized.

Table 7 - Classification Results[a]

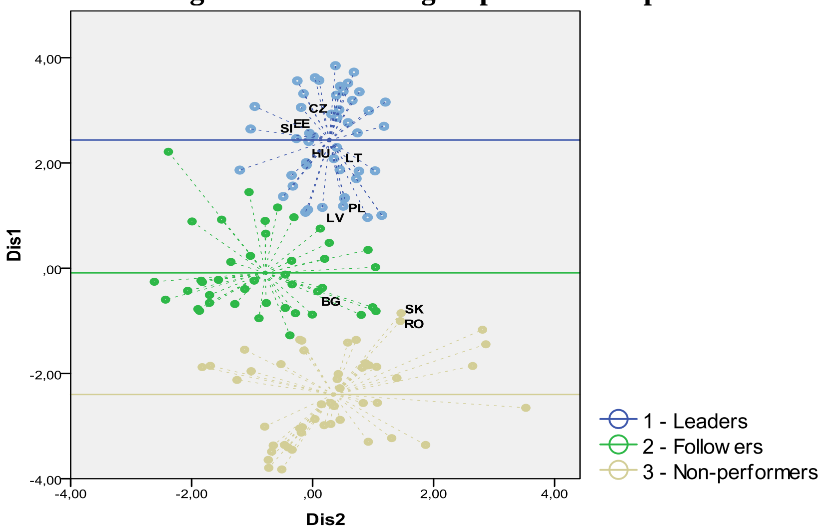
			Predicted Group Membership			
		Groups	1	2	3	Total
Original	Count	1	43	4	0	47
		2	7	32	8	47
		3	0	7	40	47
		Ungrouped cases	0	0	1	1
		‘1	91.5	8.5	.0	100.0

	2	14.9	68.1	17.0	100.0
	3	.0	14.9	85.1	100.0
	Ungrouped cases	.0	.0	100.0	100.0

a. 81.6% of original grouped cases correctly classified.

Figure 3 synthesizes the countries' positions in relation to the two discriminant functions, while introducing the predicted group membership for the CEE countries. As separate group covariances were used in the discriminant analysis, countries' results should be interpreted in relation to their group's centroid. Given their position above the mean in the Leaders' group, the Czech Republic, Estonia and Slovenia were classified as *Top leaders*, while Hungary and Lithuania have kept their *Leaders'* status. Poland and Lithuania are very close to each other in the space between the centroids of the first and the second group so that both of them can be classified as *Top followers*. Finally, even if Bulgaria distances itself from Romania and Slovakia due to a better position for the quality of scientific institutions, its overall performance justifies its inclusion in the *Non-performant followers'* group (together with Romania and Slovakia). *Annex no. 1* can help to interpret the final results: as compared to the initial classification, Slovenia has reinforced its position within the Leaders' group and joined the *Top leaders'* category for its high performances in the quality of scientific institutions, company spending for R&D and higher education and training. At the same time, despite a modest score for university – industry cooperation for R&D, Poland has been classified as a *Top follower* due to its relatively high performances in the quality of higher education and scientific research. Not at least, it should be noted that Slovakia and Romania are quite far (up) from the third group centroid so they can also be included in the *Followers'* group.

Figure 3 - Predicted group membership



SI, EE, CZ – *Top leaders*, HU, LT – *Leaders*, PL, LV – *Top followers*, BG, RO, SK – *Non-performant followers*

CONCLUSIONS AND DISCUSSIONS

This study was aimed at classifying world's countries for their performance in university – industry cooperation in R&D and at mapping the position of the CEE region in this respect. The results have confirmed our hypothesis regarding the heterogeneity of the CEE countries' performances and have identified the factors that explain the variations, namely *the quality of scientific institutions*, *company spending on R&D*, *the quality of higher education and training* and *the availability of scientists and engineers*. Consequently, policies that address knowledge transfer issues are expected to be more efficient if they consider the characteristics of predicted groups for the above-mentioned variables.

CEE's *top leaders* - the Czech Republic, Estonia and Slovenia - have high scores for both the quality of scientific institutions and company spending on R&D. In this respect, their relatively high R&D intensity support performances in knowledge transfer: Slovenia leads the CEE group for the total gross expenditures for R&D (GERD) as % of GDP (2,11 in 2010) and makes important steps towards the EU 3% target, while Estonia (1,62 % of GDP) and the Czech Republic (1,56 % GDP) get closer to the EU27 average of 2% of GDP (Eurostat 2012). According to Erawatch report (Bučar, 2011), over the years, Slovenia has built relatively extensive R&D, innovation and entrepreneurship support network and has introduced a new system of financing public research, requiring the public research organizations to increase the share of business funding. The measure which proved to be very effective in stimulating cooperation between the public R&D and the business sector was the financing of young researchers, as they proved to be a communication link that often resulted in more intensive cooperation. In its turn, the Czech Republic have utilised the structural funds for building innovation infrastructure and environment stimulating knowledge circulation and have created a simple methodology for the knowledge and technology transfer offices, with a special emphasis to patent and license application, IP, spin offs, etc. (Hebakova and Valenta, 2011). As regards to Estonia, since early 2000, there are a considerable number of policy measures aimed at increasing extramural R&D and support the commercialization of research by higher education institution; of these, the Competence Centres programme proved to be the most efficient, as the centres have tackled efficiently intra-university barriers to industry cooperation and have improved technology absorption on the industrial side (Rannala and Männik, 2011).

Despite their clear progress in knowledge transfer, all the three countries in the *Top leaders'* group still face a number of constraints: if for Slovenia the main challenges are related to monitoring closely the human resources in science and technology (HRST) stocks and finding the best coordination matrix for its extensive support network, the Czech Republic and Estonia should still consider the insufficient supply of mediation services to innovative companies and the sustainability of the new R&D infrastructure, given their dependence of public and structural funds.

Hungary and Lithuania enter the *Leaders'* category, but they stay below the group's centroid. Despite its 20th position in the GCI for the quality of scientific institutions, Hungary has one of the worst scores in the CEE group for company spending on R&D (81st) (*Annex 1*). Even though, firms fund research activities both at universities and PROs to a noteworthy extent: 15,7% of Higher Education R&D (HERD) comes from business funding, more than double of the EU27 average of 6,8% in 2008. Among the extensive science and technology policy measures aimed at fostering academia – industry cooperation, the most important development has been the financing of 38 joint research centers, each located at a university (Havas, 2011). Regarding Lithuania, it should be noted that it is among the EU27 leaders in producing tertiary education graduates, with the 26th position in the GCI for Higher education and training (*Annex 1*). Nevertheless, the country lags substantially with regard to the capacity to produce and commercialize knowledge, but there in a very strong commitment to fostering R&D collaboration and knowledge transfer in the Lithuanian Innovation Strategy for 2010-2020 (Paliokaitė, 2011). For the future, both Hungary and Lithuania should address the fragmented technology transfer offices' system and the creation of a critical mass of competence in university knowledge transfer.

Poland and Latvia were included in the *Top followers'* category as they have a relatively high score for the quality of scientific institutions. For both countries, on a national policy level, there has been a significant push for knowledge circulation and a considerable contribution from the EU structural funds. Through the opportunities created by "Building upon knowledge" and "Partnerships for knowledge" programs, Poland is expected to stimulate private R&D (Jerzyniak, 2011), as is currently stays on the 80th position in the GCI (*Annex 1*). In its turn, Latvia has efficiently implemented policy measures aimed at knowledge transfer via competence centers and clusters (Kristapsons, Adamsone-Fiskovica and Draveniece, 2011), but there are still numerous problems to be solved, especially in terms of developing technological capabilities in industry and ensuring the optimal stocks of scientists and engineers, as the country currently stays on the 96th position at the global level (*Annex 1*).

Finally, Bulgaria, Romania and Slovakia were included in the *Non-performant followers'* category, with Bulgaria staying slightly higher due to its better position for the quality of scientific institutions (78th for Bulgaria, as compared to 91st for Romania and 97th for Slovakia). The countries have very low business expenditure R&D (BERD) intensities, ranging from 0,18% of GDP in 2010 for Romania (eight times lower than the EU27 average of 1,23% GDP) to 0,27 for Slovakia and 0,3 for Bulgaria. Regarding Bulgaria, the most compelling factors behind the limited flow of knowledge between businesses, universities and public research institutions are the outdated legal and institutional frameworks related to innovation and research and the predominance of state sector in R&D financing and performance (Damianova et al., 2011). Similarly, the most important trend in the Slovak research system is the decrease in industry and applied research and the increased concentration of GERD in public research institutions (Baláž, 2011). Finally, in Romania, there are many gaps in the public – private cooperation legislation and universities' third mission is in its very incipient stage, with only few universities consolidating their technology transfer and commercial infrastructure and personnel (Ranga, 2011).

According to Radosevic (2011), the main problem is that current policies for science-industry linkages in CEE countries are still based on the logic of linear innovation model, while the reality of these countries is based on the logic of interactive innovation model. Despite its peculiarities, science – push models can be acceptable, to a certain respect, to those countries with a high quality of scientific institutions and technological capabilities. On the contrary, in countries such as Bulgaria, Romania or Slovakia, where the knowledge production sector is ineffective and businesses do not fully understand the utility of R&D, creating an environment that is conductive to innovation for both universities and industry is the imperative precondition of knowledge transfer.

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Annex no. 1 Discriminats of university – industry collaboration in R&D in CEE countries

CEE Countries (EU27)	**Quality of scientific research institutions**	**Company R&D spending**	**Higher education and training**	**Availability of scientists and engineers**	**University-industry collaboration in R&D**
	Rank/ 142				
Bulgaria	78	98	70	92	116
Czech Republic	26	28	30	42	30
Estonia	27	40	23	62	34
Hungary	20	81	45	38	33
Latvia	56	67	34	96	57
Lithuania	37	57	26	57	31
Poland	44	80	31	67	65
Romania	91	87	55	59	115
Slovakia	97	89	53	74	104
Slovenia	33	39	21	89	46

Source: *Schwab K. (2011), World Economic Forum: Global Competitiveness Report 2011-2012, Geneva, Switzerland.*