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Romania's Creative and Innovation Potential

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Abstract

The article deals with the current state of the Romanian R & D and innovation system, evaluated by the European Commission through the aggregate indicator Innovation Union Scoreboard, as well as based on national statistics regarding different relevant indicators - the number of employees and specialists from the respective activities, the weight in GDP of expenditure allocated for their funding, the number of innovative enterprises by size, the final results of the activities. Based on this analysis, at the end of the article are proposed some major coordinates to concentrate efforts for future recovery and intensive qualitative development of R&DI activities

Keywords: *research, technological development, innovation, national R&DI system*

JEL Classification: *O3*

Introduction

An essential pillar of development and competitiveness growth of an economy is the research - development and innovation activities (RDI). The growing importance of this pillar in the contemporary world is convincingly illustrated by the fact that a good part of the world countries, firstly developed ones, have made of these activities intense stimulation a primary coordinate of their development strategy.

Synthetic assessment of current state of the Romanian R&D system

In Romania, the situation of these activities is deteriorating, which is the case of education as well, which means drastically reducing the chances of accelerated economic development, competitiveness increasing and reducing adverse gaps the performances of our country present compared to European averages. The evaluation is confirmed by the latest assessment made by the European Commission in March 2014, according to which the Innovation Union Scoreboard (IUS) aggregate indicator*, calculated for the EU27 and each of the member countries, indicates in Romania's case a decrease of performance in this field from 49, 8% of the EU average in 2009, when it peaked, at 42.8% in 2013; in the same reference years, innovation index, calculated according to the IUS methodology, was 0.26 in 2009 and almost 0. 24 in 2013, thus

registering a slight setback[1]. Detailing IUS parts and Romania's performances in each case in relation to the European Union represents a true diagnosis of the RDI system status, so these are reproduced in the following table.

Table 1. IUS 2013 determined for Romania

Innovation dimensions / indicators	Relative performance to EU (EU=100)	Indicator growth rate (%)
HUMAN RESOURCES		
New doctorate graduates	**100**	**11,4**
Population with completed tertiary education	**61**	**9,7**
Youth with upper secondary level education	**99**	**0,7**
OPEN, EXCELLENT, ATTRACTIVE RESEARCH SYSTEMS		
International scientific co-publications	**52**	**10,9**
Most cited scientific publications	**32**	**3,3**
Non-EU doctorate students	**9**	**-5,8**
FINANCE AND SUPPORT		
R&D expenditures in the public sector	40	6,0
Venture capital investments	50	-5,3
FIRM INVESTMENTS		
R&D expenditures in the business sector	9	-7,0
Non-R&D innovation expenditures	81	-14,0
LINKAGES & ENTREPRENEURSHIP		
SMEs innovating in-house	34	-5,7
Innovative SMEs collaborating with others	25	0,5
Public-private scientific co-publications	40	4,2
INTELLECTUAL ASSETS		
Patent Cooperation Treaty (PCT) patent applications	21	-0,9
PCT patent applications in societal challenges	22	4,0
Community trademarks	39	42,7
Community designs	12	44,6
INNOVATORS		
SMEs with product/process innovations	34	-4,2
SMEs with marketing/organisational innovations	63	-1,4
Fast-growing innovative firms	94	1,2
ECONOMIC EFFECTS		
Employment in knowledge-intensive activities	47	2,2
Contribution of medium/high exports to trade balance	99	1,1
Knowledge-intensive services exports	100	1,4
Sales share of new innovations	99	-2,2
License and patent revenues from abroad	49	7,8

Source: European Commission, Enterprise and Industry. Innovation Union Scoreboard 2014, Office Publications, 2014, p. 65

[1] European Commission, Enterprise and Industry. Innovation Union Scoreboard 2014, Publications Office, 2014, p. 65

IUS aggregate indicator integrates three main indicators (Facilitators, i.e. the driving forces of innovation, Firm activities - namely its investment effort, Results – i.e. outputs of firms R&D and Innovation) and eight dimensions of innovation (Human resources, Open, excellent research systems, Finance and support, Firms investments, Linkages & Entrepreneurship, Intellectual assets, Innovators, Economic effects), each expressed by different indicators, 25 in total (for those indicators, see Table no. 1)

According to the indicators level shown in the table, those to which Romania is well quoted are New doctorate graduates and Knowledge-intensive services exports (technical assistance, mainly), which lie at the EU average; the weakest performances are registered by Non-EU doctorate students and R&D expenditures in the business sector, in which case, in fact, high negative rates are recorded, along with other seven indicators showing decreasing levels.

Compared to the evolution of the innovation index registered at the European Union level, Romania's performance is modest and varied within narrow limits, according to the following figure, which shows the existence of a slow and fluctuating conversion process.

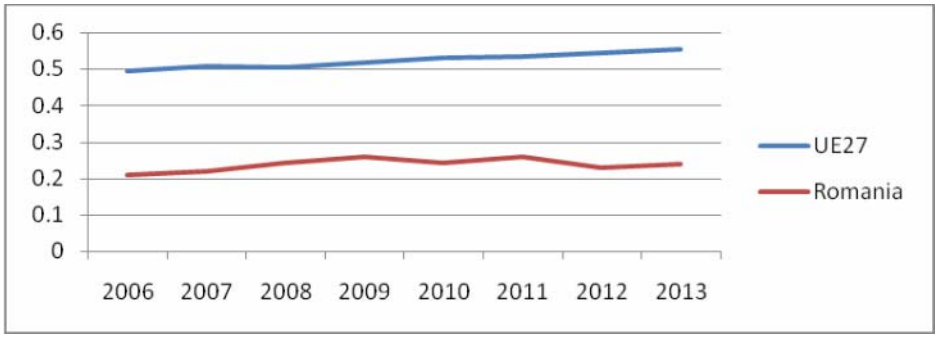

Fig. 1. Evolution of innovation index in the European Union and Romania, 2006-2013

Source: European Commission, Enterprise and Industry. Innovation Union Scoreboard 2014, Publications Office, 2014

For its performance, Romania was placed in Modest Innovators Group, together with Bulgaria and Latvia. Poor performance of R&DI activities in Romania is a direct consequence of their chronic underfunding, a situation opposite to that of most EU countries, where the financing of activities represent a significant share of GDP, as shown by the figures in the following table.

Table 2. Share of R&D expenditures in GDP in some of the EU Member States, 2001- 2011

	2001	**2005**	**2007**	**2011**
EU27	1,87 [e]	1,82	1,84	2,05 [e]
Austria	2,05	2,46	2,51	2,77
Bulgaria	0,46	0,46	0,45	0,57
Czech Republic	1,16	1,22	1,37	1,64
Danemark	2,39	2,46	2,58	2,98
Finland	3,32	3,48	3,47	3,80
France	2,20	2,11	2,08	2,25
Germany	2,47	2,51	2,53	2,89
Hungary	0,93	0,94	0,98	1,22
Italy	1,08	1,09	1,17	1,25
Netherland	1,93	1,90	1,81	2,03
Poland	0,62	0,57	0,57	0,76
Romania	0,39	0,41	0,52	0,50
Slovakia	0,63	0,51	0,46	0,68
Sweden	4,13	3,56	3,43	3,39
United Kingdom	1,77	1,70	1,75	1,78

Note: e – estimation

Source: EUROSTAT. R&D expenditure, by sector of performance, % of GDP (tsc00001)

Share of GDP allocated to R&D activities in Romania was the lowest in 2011, at the same level as Cyprus, compared to all other member states of the European Union, being over four times

lower than the EU average and representing 30.5% of that in the Czech Republic, 41.0% of that in Hungary, 65.8% of that in Poland and 87.7% of that in Bulgaria.

As a result, the R&D sector has contracted significantly after 2000, continuing the trend started in 1990, the number of employees and researchers, in full-time equivalent, reducing at the country level, in manufacturing industry and its component sectors, according to the figures in Figure 2 and Table 3.

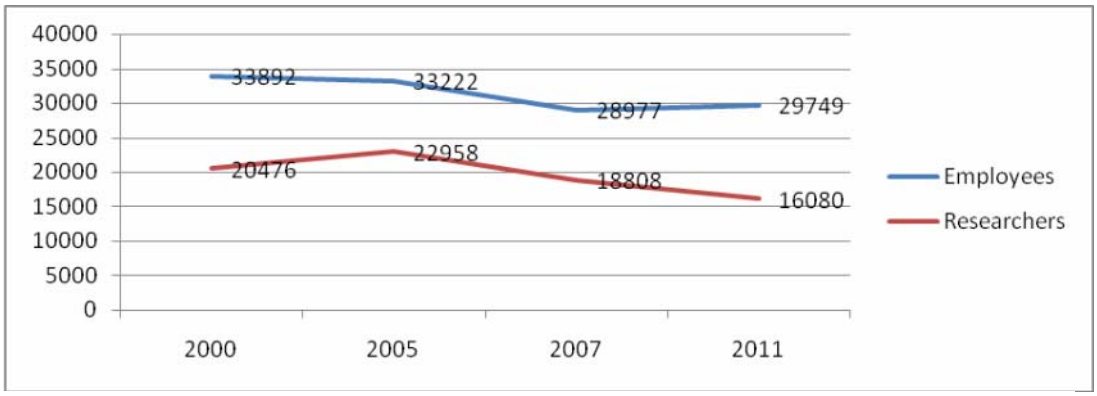

Fig. 2. Total number of employees and researchers in R & D activities in Romania, in full time equivalents, 2000-2011

Source: Romanian Statistical Yearbook issues 2001, 2008 and 2012, NIS, Bucharest, 2002, 2009 and 2013

In manufacturing industry, personnel cuts were more severe, in some areas leading to staff shortages in some areas, as figures prove in the following table.

Table 3. Employees in R & D activity in the business sector, by activities of the manufacturing industry, 2000-2011

(number of persons in full time equivalent)

	2000		2005		2007		2011 *	
	Emplo-yees	Of which: Resear-chers	Emplo-yees	Of which: Resear-chers	Emplo-yees	Of which: Resear-chers	Emplo-yees	Of which: Resear-chers
Manufacturing industry	14922	9033	9454	6727	6084	3879	2879	1168
Food, beverages, tobacco	27	22	203	124	77	70	128	51
Textile products, clothing articles, leather goods and footwear	584	209	223	93	126	31	66	14
Wood and wooden products manufacturing	74	21	77	51	66	30		
Pulp, paper and paper products	112	75						
Crude oil processing, coalcoking and nuclear fuel treatment	192	78	452	293	728	252	-	-
Chemical substances and products	1143	673	811	457	615	357	747	277
Rubber and plastic products	119	88	177	113	111	69	122	47

Table 3 (cont.)

Manufacturing of construction materials and other non-metallic minerals	555	256	108	41	21	3	27	3
Metalurgy	1285	789	520	388	413	295	41	2
Metallic construction, machinery and equipment	10548	6623	6696	5074	3914	2761	1687	742
Furniture and other industrial activities n.e.c.	283	199	187	93	13	11	6	6

Note: * From business sector
Source: Romanian Statistical Yearbook issues 2001, 2008 and 2012, NIS, Bucharest, 2002, 2009 and 2013, tables 16.1.6. şi 13.8.

Despite the contraction of R&D activities resources, the results of their carrying on are varied, showing, on the one hand, the achievement of certain qualitative improvements in their content, but on the other hand, the sensitive reduction of creative and innovation potential. Thus, the number of innovative companies in the manufacturing industry has continuously increased during the period 2000-2006, overall and in all size classes (less the large enterprises after 2004), the number drastically decreasing during the crisis 2004-2008, by 38, 4% in total, as well as in all size classes (see table below).

Table 4. Number of innovation enterprises, by size class, from manufacturing industry, 2000-2002, 2002-2004, 2004-2006, 2008-2010

	Total	**Product innovation only**	**Process innovation only**	**Product and process innovation**	**On-going and/or abandoned innovations**
2000-2002					
Manufacturing industry	2827	355	299	2173	...
Small	1406	202	142	1062	...
Medium	879	107	104	668	
Large	542	46	53	443	...
2002-2004					
Manufacturing industry	3378	313	741	2324	...
Small	1666	202	430	1082	...
Medium	1149	107	221	818	...
Large	563	46	90	424	...
2004-2006					
Manufacturing industry	3651	288	659	2704	...
Small	1902	156	362	1384	...
Medium	1275	113	223	939	...
Large	474	19	74	381	...
2008-2010					
Manufacturing industry	2248	398	535	1244	71
Small	1334	248	351	687	48
Medium	594	98	121	358	17
Large	320	52	63	199	6

Source: Romanian Statistical Yearbook issues 2008 and 2012, NIS, Bucharest, 2009 and 2013, tables 13.22. and, respectively, 13.15.

Gratifying is the fact that, at least in the first three periods shown in the table, there was a visible increase in the share of innovative enterprises with complex innovation, of product and process,

the most valuable and productive for value added growth, to the detriment of businesses focused solely on product or process innovation; most likely, if the crisis had not interfered, trends clearly outlined in the 2000-2006 period would have continued, perhaps with more force, namely increasing number of innovative enterprises in all size classes and the share of innovative firms achieving product and technology innovations.

The evolution of the two indicators of results of R & D activities - the number of patent applications and the number of patents granted and published - very relevant to the scientific and practical "productivity" of activities, highlights slow and continuous reduction, although fluctuating, in the latter case, illustrated in the following figure.

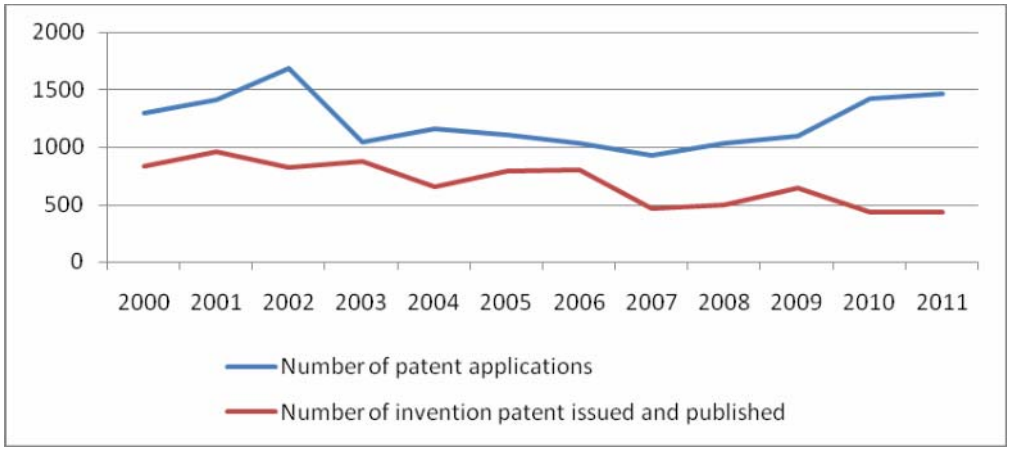

Fig. 3. Number of applications for invention patents and invention patent issued and published, 2000-2011

Source: Romanian Statistical Yearbook issues 2011 and 2012, NIS, Bucharest, 2012 and 2013, tables 13.29. and 13.30., respectively 13.24. and 13.25.

Besides, Romania's poor performance concerning the number of patents granted and published highlighted by the national statistics is also confirmed by EUROSTAT data that prove our country's results far lower than those recorded by even former socialist countries, according to figures in the following table.

Table 5. Number of patent applications and patents granted in some former socialist countries of the EU, 2005, 2006 and 2010

	Patent applications to the European Patent Office			**High-tech patent applications to the European Patent Office**			**Patents granted by the US Patent and Trademarks Office**		
	Number		**Per 1 million inhabi-tants**	**Number**		**Per 1 million inhabitants**	**Number**		**Per 1 million inhabitants**
	2005	**2010**	**2010**	**2004**	**2009**	**2009**	**2001**	**2006**	**2006**
EU27	56620	54414	108,6	10792	4765	9,5	32603	19520	39,6
Bulgaria	24	12	1,6	2	2	0,3	7	21	2,8
Czech Republic	109	268	25,5	15	8	0,7	53	58	5,7
Estonia	6	51	38,1	2	2	1,5	5	9	7,0
Hungary	135	203	20,2	29	8	0,7	73	39	3,9
Latvia	19	24	10,7	…	3	1,3	1	5	2,1
Lithuania	9	22	6,5	2	2	0,6	5	5	1,5
Poland	124	305	8,0	21	26	0,7	57	43	1,1
România	**29**	**40**	**1,9**	**3**	**6**	**0,3**	**11**	**17**	**0,8**

Table 5 (cont.)

Slovakia	31	33	6,0	3	1	0,1	5	8	1,4
Slovenia	109	167	81,7	3	8	3,7	21	10	5,0

Source: EUROSTAT (on line data codes : pat_ep_ntot.pat_ep_ntec and pat_us_ntot)

The figures in the table show that the best performing countries according to the two analyzed indicators are the Czech Republic, Estonia and Slovenia (included, according to IUS2014, into the "Innovation follower" group, the third level of the hierarchy), and the less successful are Bulgaria and Romania (in the fourth and last level -"Modest innovators", Romania with Innovation Index of 0.237 in 2013, and Bulgaria - 0.188, EU27 = 0.554).

Besides the reducing levels of the two indicators shown for Romania, other objects of industrial property have also undergone significant declines in recent years, as evidenced by the figures in the following table.

Table 6. Number of applications and certificates for other objects of industrial property, 2007 and 2011

	2007	**2011**
Demands of utility models	-	64
Certificates issued	-	49
Designs and models registration applications	684	356
Designs and models included in the design registration applications	2872	1246
Registration certificates of designs and models published	896	409

Source: Romanian Statistical Yearbook 2012, NIS, Bucharest, 2013, Table 13.26.

The results presented above, regarding the R&DI activities in Romania, in sharp decline in recent years, represent the natural effect of the disturbances shown in the allocation and use of resources, which significantly differ from the situation existing in most EU countries.

Conclusions

Romania's R&DI system potential is modest in all areas - resource allocation, activities organization and outputs completing these activities -, which is why, based on the detailed assessment undertaken, the European Commission has placed our country in the lowermost of the groups within which countries are framed, namely the "Modest Innovators", whose performance is below the European average. A key aspect to bear in mind concerning the presence of a country in a group or other is that as one climbs the ladder, performances on the eight dimensions of innovation tend to balance their growing.

In this respect, Romania has great achievements to New doctorate graduates, Youth with upper secondary level education, Knowledge-intensive services exports, Contribution of medium and high-technology exports to trade balance, Sales share of new innovations, Fast growing innovative firms, performance indicators which are at the EU27 average or very close to it. In contrast, the other 19 indicators shown in Table 1 present performances far beyond the average, the worst being the Non-EU doctorate students, R&D expenditure in the business sector, Community projects. Also, worrying is the negative growth rate recorded by a number of indicators, such as Non-EU doctorate students, Venture capital investments, C&D expenditure in the business sector, Non-R&D innovation expenditures, Innovating SMEs in-house, PCT patent applications, SMEs with product / process innovations, SMEs with marketing/ organizational innovations, Sales share of new innovations.

As stated above, high dispersion of the 25 indicators levels considered in the IUS calculation is a feature of countries framed in the Modest innovators group, which shows the existence of

imbalances of national R&DI system and the substantial reserves of creative potential which should be turned to better account.

Moreover, there are significant imbalances in terms of R&DI potential in the manufacturing sectors, in most of them the respective potential decreasing but to different degrees. For example, Metallurgy is one of the most affected sectors, primarily through the number of employees and expenditures in the R & D activities, despite the fact that the sector has a substantial contribution to export. On the other hand, the area of Food, beverages and tobacco has increased significantly its number of employees in R & D activities, but registered expenditures reductions in those activities.

The fact that over 70% of technological knowledge existing in Romania comes from direct and indirect import of technology (the technology transfer achieved by intra-industry trade) highlights the reduced contribution of own R&D, which coupled with the fact that over 80% foreign trade is covered by foreign companies, constitutes the proof of the low creative potential we have.

Strong restriction of the national R&DI system and a significant decrease of its performance occurred as a result of insufficient attention given by governmental authorities to Science and Technology, engendering numerous deficiencies, namely the underfunding of the system, poor infrastructure and decaying, the specialists' exodus, lack of venture capital and effective forms of stimulus, etc.

The current situation requires engaging through industrial policy in several priority areas to ensure the revitalization of R&DI activities and to turn innovation into a driver of national development and competitiveness, as occurs, for example, in most other former socialist countries, by:

- establishing a clear Science and Technology strategy, indicating the priority coordinates of concentrating efforts that should be followed consistently, regardless of electoral cycles;
- concentration of the attracted EU and national funds upon the financing of priority projects, with major effects on economic development;
- promoting and appropriate fostering development and multiplication of centers of excellence in R & D activities;
- development of modern organization forms of technological progress assimilation and dissemination - science and technology parks, technology networks, high tech clusters, clusters of knowledge services, technological poles etc. -, effective supporting their functioning, financing the development and modernization of related infrastructure;
- promoting "smart specialization" at regional, level through proper profiling these forms depending on regional competitive advantages;
- strengthening "university-industry" links between higher education and scientific research institutions and industry, to better link research with the real needs of productive activity, amplifying and accelerating technology transfer, increasing R & D and innovation activities private funding;
- promoting industrial R & D in areas of medium and high technology, uptake and commercialization of key enabling technologies;
- strengthening integration of universities, research institutions and laboratories into scientific and technological cross-border cooperation projects at the EU level.

References

1. European Commission. *Some Key Issues in Europe's Competitiveness – Towards an Integrated Approach.* COM(2003)704 final, Brussels, 2003.
2. European Commission. *An Integrated Industrial Policy for the Globalisation Era: Putting Competitiveness and Sustainability at Centre Stage*. COM(2010)614 final, Brussels, 2010.

3. European Commission. *A stroger European Industry for Growth and Economic Recovery. Industrial Policy Communication Update*. COM(2012)582 final, Brussels, 2012.
4. European Parliament, Committee on Industry, Research and Energy. *Draft Report on reindustrialising Europe to promote competitiveness and sustainability* (2013/2006(INI)).
5. McKenzie, R. B., *Industrial Policy.* In: David R. Henderson (ed.). Concise Encyclopedia of Economics (1st ed.), Library of Economics and Liberty, 2002.
6. Olteanu, D., *Technological Specialisation of Production and Export in Europe,*in:Economic Convergence, vol.I (A. Iancu coordinator), Romanian Academy, National Institute of Economic Research, The Publishing House of the Romanian Academy and C.H. Beck, Bucharest, 2008, pp. 178-204.
7. Olteanu, D., *Progres tehnologic, competitivitate şi specializare*, Editura Expert, Bucureşti, 2007.
8. Peculea, M., *Valorificarea cercetării ştiinţifice în industrie. Studiu de caz*, în : Dezvoltarea economică a României. Competitivitatea şi integrarea în Uniunea Europeană (Coordonator A. Iancu), Editura Academiei Române, 2003, pp. 399-406.
9. Rodrik, D., *Industrial Policy for the Twenty-First Century*, John F. Kennedy School of Government, Harvard University, September 2004. Paper prepared for UNIDO.
10. Rothwell, R., Zegveld. W., *Reindustrialization and Technology*, Longmans Group Limited, London, 1985.
11. Russu, C. *Economie industrială*, Editura Economică, Bucureşti, 2003.
12. Sandu, S., Păun, C., *Convergence between the Romanian and the EU in the R&DI Systems,* in: Economic Convergence, vol.I (A. Iancu coordinator), Romanian Academy, National Institute of Economic Research, The Publishing House of the Romanian Academy and C.H. Beck, Bucharest, 2008, pp. 156-177.
13. Slusarczyk, B., Horizontal Industrial Policy in Poland. In: *Annales Universitatis Apulensis Series Œconomica*, 11(2), 2009, pp. 910-917.
14. Smith, A., *An Inquiry into the Nature and Causes of the Wealth of Nations*. London: Methuen & Co.(1904) [1776].