

FACING THE ECONOMIC COMPETITIVENESS CHALLENGE IN ROMANIA: THE INNOVATION ISSUES

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Abstract:

This paper examines the main aspects influencing the innovative environment of Romania by analyzing the levels and composition of innovation indicators and comparing with levels obtained by other countries. The competitiveness of Romania is strongly linked to its position in innovation. The same indicators responsible for weak innovation are linked to the poor composite innovation performance indicators such as the Summary Innovation Index. That shows better the large gaps accumulated over time in all innovation dimensions, particularly in firms activities and innovation output when they are compared to the EU average values and as such having repercussions on the innovation performance index, implying economic mechanisms in mitigating the issues that Romania faces with.

Key words: innovation, research & development, competitiveness, performance, firm, Romania.

JEL classification: O31, O52.

1. INTRODUCTION

Numerous studies have emphasized the contribution of innovation towards improvements in productivity, competitiveness and economic growth. This is why innovation activity indicators are closely monitored and introduced in various indexes such as "Global Competitiveness Index" reported by The World Economic Forum, "The Knowledge Economy Index" measured by The World Bank, "the Summary Innovation Index" published by Eurostat etc., that can allow comparability among countries or their evolution can be analyzed for the same country and provide good information for policymakers. Without trying to analyze all indicators published or computed by various international bodies, this paper aims at highlighting the main aspects that are not favorable, but are persistent and characterize innovation activity in Romania, as well as their effect on aggregate indices, including their impact on other components composing aggregate indexes. In this regard, we consider an analysis of the main components of indicators impacting innovation activities in Romania, offering international comparison.

Our motivation for developing this work results from observing the persistence of factors that negatively impact innovation in Romania, that have not received adequate attention in the past by innovation policy, but continue increasingly to hamper the innovation performance, growth and economic competitiveness of Romania.

The rest of this papers is organized as follows. In section 2, we shape a comparative analysis of competitiveness of Romania in the global context, identifying and highlighting the significant gaps in comparison with other countries, mainly on innovation indicators. That shows that the competitiveness of Romania is strongly linked to its position in innovation. The same indicators responsible for weak innovation involved in shaping competitiveness are linked to the poor innovation performance indicators analyzed in section 3. That context, by comparing with the EU average, offers a better understanding of the large gaps accumulated over time in all innovation dimensions, particularly in firm activities and innovation output, and as we have expected, in the output indicators and as such having repercussions on the innovation performance index values. The last section concludes and discuss the economic mechanisms in mitigating the issues that Romania faces with.

2. HOW INNOVATION CAPABILITIES INFLUENCE COMPETITIVENESS

Competitiveness is defined in The Global Competitiveness Report as the set of institutions, policies, and factors that determine the level of productivity of a country (World Economic Forum, pp. 4). The level of productivity further determines the rates of return and therefore growth rates in an economy. Many factors drive productivity and competitiveness. The global competitiveness index (GCI) captures various components of competitiveness of an economy. The last Report provides an overview of the competitiveness performance of 144 economies, which contains detailed profile for each of the economies included in the study, as well as data tables with global rankings covering over 100 indicators grouped into 12 pillars of competitiveness. The GCI index is built by aggregating of weighted average scores of the 12 pillars.

The scores are highly interdependent. For instance, a strong capacity for innovation (pillar 12) is difficult to be achieved without well educated workforce (pillar 4 and 5) that can assimilate technologies (pillar 9), without sufficient funding (pillar 8), goods market efficiency (pillar 6), depending also on the quality of a country's overall business networks and the quality of individual firms' operations and strategies (pillar 11).

According to the GCI score, Romania is placed on a modest position (59 of 144 countries) and most innovation related indicators are low when they are compared with the maximum levels obtained in the study. Table no. 1 reflects the aggregate scores registered in the Romania case and the distance (in %) from the maximum level of each score. As it can be seen, Romania is the 66th in the world regarding the score of the pillar 12 (innovation), but its distance from the maximum score is the highest.

Table no. 1. Romania in the global competitiveness ranking according to the pillars in connection with innovation (year 2014)

Pillar	Sub-indicator	Score				Romania rank (out of 144 states)
		Max.	Min.	Romania		
				Score	% of max.	
Pillar 4	Health and primary education	6.89	2.72	5.58	80.98	88
Pillar 5	Higher education and training	6.22	1.94	4.63	74.43	58
Pillar 6	Goods market efficiency	5.64	2.92	4.18	74.11	89
Pillar 8	Financial market development	5.91	1.95	4.12	69.71	64
Pillar 9	Technological readiness	6.36	2.07	4.49	70.59	47
Pillar 11	Business sophistication	5.82	2.61	3.77	64.77	90
Pillar 12	Innovation	5.78	1.98	3.28	56.74	66
12.01	Capacity for innovation	5.88	2.49	3.70	63.92	68
12.02	Quality of scientific research institutions	6.35	1.72	4.0	62.99	55
12.03	Company spending on R&D	5.94	1.96	3.13	52.69	65
12.04	University-industry collaboration in R&D	5.96	1.95	3.58	60.06	71
12.05	Government procurement of advanced technology products	5.70	2.00	3.40	59.64	75
12.06	Availability of scientists and engineers	6.24	2.42	4.02	64.42	72
12.07	PCT patent applications	6.1	1.72	2.23	36.55	56
CGI	Aggregate index	5.70	2.79	4.30	75.54	59

Source: World Economic Forum - *The Global Competitiveness Report 2014–2015*

The weakest level of innovation sub-indicators obtained for Romania are associated with "company spending on R&D" (52.69% of maximum) and "PTC patent application" (36.55 % of maximum). Although the place that Romania holds concerning other indicators is not able to have a more favorable impact on the index of innovation, given the modest values of sun-indicators,

research and developing (R&D) spending and hence patent applications, which are crucial for innovation, remain extremely low.

The consideration of R&D as an inchoate stage in the process of innovation objectively results from the connection between R&D and economic growth. R&D has direct implications in firms or organizations developing (in-house) innovations, being generators of new/substantially improved products or processes as well as having indirect effects in supporting innovation by forming absorptive capacity, adapting of acquired technology and diffusing, and hence supporting technology exploitation. In fact, the R&D-based models of growth attest a close correlation between R&D activity and technological innovation. According to Solow's theory (1957), the technological change is the major source of long term productivity and economic growth. In this process, R&D is a key input in technological change (Romer, 1999), in acquiring knowledge and a major contributor to economic growth and competitiveness. This is why R&D intensity is closely monitored by various research and policy organizations.

Also, patents represent exclusive right to operate, use or sell an invention for a period of time in the space where the application is made. Patents encourage the production of new technologies in benefit of society, by allowing inventors appropriability of returns and recovering of capital investments. Theoretically, patenting of inventions can solve the problem of imperfect collection of revenues; exclusive rights granted by society increase inclination to invent by restricting the use of inventions. Those mechanisms lead to expectations on the acquisition of ex-post market power, being considered crucial in fostering innovation. As a result, from the point of view of an innovative firm, patents can be regarded as mechanisms for maintaining or increasing competitiveness. In terms of innovation policy, they are meant to spur innovation and economic development, but the effectiveness of those mechanisms is conditioned by their design.

In general, the number of patent applications is used mainly as an intermediate indicator of innovation and can be seen as a result of R&D activities performed by firms. However, the use of indicators based on patented inventions data is not free of drawbacks (Diaconu (2012a)). This is why turnover corresponding to new to the market and new to the firm innovations is used more often as an output of innovation process. In the same time, R&D expenses are used as input in many models of innovation and in new forms of composite indicators calculated by different organizations.

3. RESEARCH AND DEVELOPMENT - DRIVER OF INNOVATION

The aggregate R&D intensity in different states or regions is not only a matter of effort in the R&D field, but also expresses a combined result of strategies of enterprises, of their demography and that is a function of industrial structure and of macroeconomic dynamics.

The most used indicator in many innovation models is the R&D intensity, which is R&D expenditure as % of an output measure. At the enterprise level, it is usually relevant the R&D expenditure to turnover ratio. At the industrial or national level, R&D expenditure achieved in the business sector, BERD, as % of added value or total production is used. At the national level, total gross expenditure on research and development, GERD, as % of gross domestic product (GDP) can be useful, expressing R&D expenditure in all sectors (business enterprise, government, higher education and private non-profit sectors).

According to GERD/GDP and BERD/GDP, Romania is far behind the average of EU member states, the stability in time of this gap being noticed in the following figures.

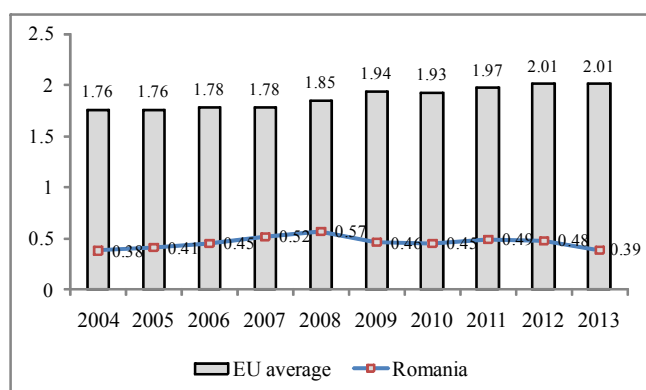


Figure no. 1 Total intramural R&D expenditure

GERD/GDP (%)

Source: Eurostat database - all sectors

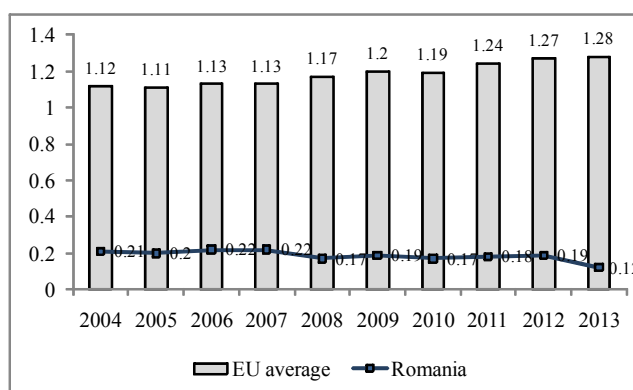


Figure no. 2 Intramural R&D

BERD/GDP (%)

Source: Eurostat database, business enterprises sector

Used in order to make comparisons, R&D intensity is of importance from two points of view. A significant dimension of GERD/GDP for a country reflects the technological progress and the commitments in the area of creating of new knowledge.

Likewise, although BERD/GDP (figure no. 2) holds the greatest percentage of GERD/GDP (figure no. 1), the significant and unfavorable gap in that dimension persists in Romania when we compare its value with the level of indicators for the EU 28 average and this emphasizes that firms adopt other innovation mode than based on R&D. The greatest proportion of BERD/GDP comes from firms (internal and external funding from financial markets) in the EU 28 average (82%) as well as in Romania (62%), and only a small proportion comes from government sector (7% and 2% respectively in 2013). Therefore this gap is due, to a great extent, to the R&D expenses made in the sector of enterprises. We also observe that, while most countries in the EU have raised their levels of R&D spending, the trend of R&D in Romania is descendant in both indicators under the impact of the economic crisis, which has become visible in decreasing of innovation performance compared to last years as well.

At the same time, the greatest BERD/GDP percentage comes from the manufacturing industry in Romania, even if its contributing part varies over time, together with the increasing of R&D expenditure percentage in the services sectors and the quasi-constant maintenance of R&D expenditure of the other sectors such as agriculture, extracting industry, constructions, production and distribution of electrical energy and water (Diaconu, 2012a). A low level of R&D expenditures has also impacted the performance obtained from innovation in Romania.

4. INNOVATION CAPACITY IN ROMANIA EVIDENCED IN COMPOSITE INDEX

The competitiveness of Romania is strongly linked to its position in innovation and R&D expenditure in one of the innovation inputs. In a larger context, the Innovation Union Scoreboard incorporates 3 main types of indicators and 8 innovation dimensions, capturing in total 25 different indicators in order to be analyzed the performance of the EU innovation system. As it is shown in European Commission (2015), The Summary Innovation Index (SII, annually calculated for each member state) takes into consideration 3 main types of indicators: "The enablers" capture the main drivers of innovation performance external to the firm and cover 3 innovation dimensions (human resources; open, excellent and attractive research systems; finance and support), "Firm activities" capture the innovation efforts at the level of the firm, grouped in 3 innovation dimensions (firm investments; linkages & entrepreneurship and intellectual assets) and "Outputs" that cover the effects of firms' innovation activities in 2 innovation dimensions (innovators and economic effects).

The values of the innovation dimensions corresponding to the types of indicators are shown in the table below for Romania and EU 28 average, alongside the gap (in %) between them.

Table no. 2. Average performance and variance in performance across the innovation dimensions for the EU 28 average and Romania (year 2014)

Sub-indicator	EU 28 average	Romania	Romania (% of EU 28 average)
<i>Innovation enablers</i>			
Human resources	0.598	0.471	78.76
Open, excellent research systems	0.542	0.113	20.84
Finance and support	0.556	0.147	26.43
<i>Firm activities</i>			
Firm investments	0.454	0.080	17.62
Linkages & entrepreneurship	0.473	0.043	9.51
Intellectual assets	0.624	0.171	27.40
<i>Outputs</i>			
Innovators	0.505	0.159	31.48
Economic effects	0.601	0.322	63.57
<i>SII</i>	0.555	0.204	36.75

Source: European Commission (2015)

Although the gap is obvious at all innovation indicators and dimensions, the most affected by large differences are "linkages & entrepreneurship" (9.51%), "firm investments" (17.62%), "open, excellent research systems" (20.84%), "finance and support" (26.43%), "intellectual assets" (27.40%) and "innovators" (31.48%).

"Innovators" include 3 indicators measuring the share of firms that have introduced innovations onto the market or within their organizations, covering both technological and non-technological innovations (European Commission, 2015). Obviously, increasing of economic competitiveness through innovation or transfer of scientific knowledge into practice decisively depends on the involvement of business sector, including entrepreneurs. However, as we show in figure no. 3, the proportion of innovative firms of the total firms was at the lowest level in Romania of the whole EU area.

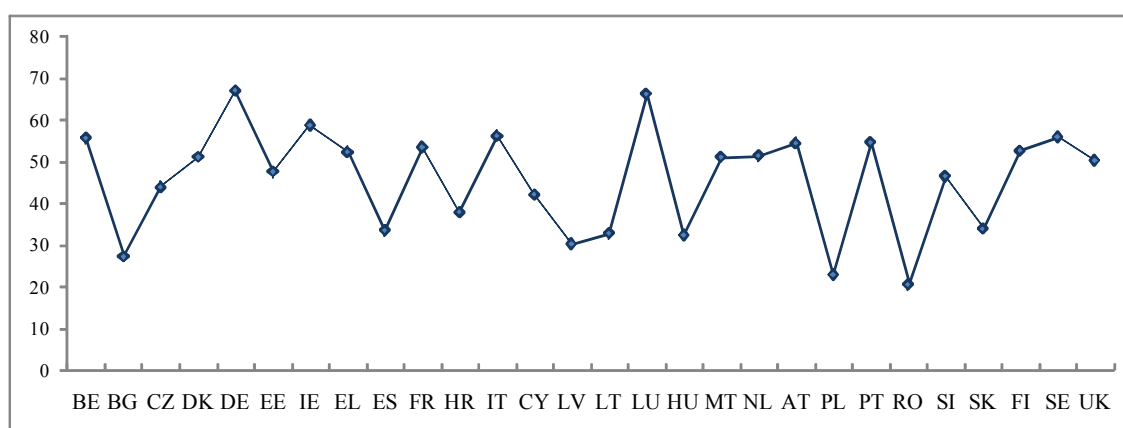


Figure no. 3. Innovators of the total number of enterprises in the EU

Source: Eurostat database - Commission Innovation Survey (CIS 2012), all NACE sectors

That is why, without large representation of innovative firms in the innovation system, including by R&D activities, economic performance cannot be achieved. Poor connecting of firms to R&D and innovation or, alternatively, a low innovativeness level negatively impacts other innovation indicators and dimensions such as "linkages & entrepreneurship", "firm investments",

"open, excellent research systems", "intellectual assets". Low innovativeness level can be determined by the lack of funds of Romanian firms. Multinational companies operating in Romania are mainly adopters by importing technologies, as the R&D related structures remain concentrate on the parent company. Conversely, "finance and support" and "firm investment" have determined innovativeness level.

In fact, "finance and support" comprises R&D expenditure in the public sector and venture capital investments. "Firm investments" include R&D expenditure in the business sector and non-R&D innovation expenditure. Those dimensions are linked to innovativeness expressed by the number of innovators and, on the other hand, to other dimensions shaped above.

The public R&D expenditure of GDP remains extremely low, but also the R&D expenditure achieved in the business sector is very modest as we have shown. The venture capital investment (the supply of funds), that is vital for firms in developing innovations, remains insignificant in Romania as well. Innovative enterprises in early stages or expansion generate the demand for venture capitals and that is a result of the research and development expenses carried out at their level, and of the culture formed in the research and development field which, in turn, is fostered by the government support (public R&D expenditures), including scientific research performed in institutions of higher education and research.

That is why there is a strong link between R&D intensity and venture capital investments. Statistic data of various countries show that the supply of venture capital increases to the increase of technological opportunities in the entrepreneurial environment reflected by the amount of R&D expenditures (Diaconu, 2012b). R&D intensity captures the activity of enterprises with R&D based innovation. Applied on the case of Romania for the period 2000 - 2014, the direct link between venture capital investments (in million euro) and R&D intensity expressed by GERD/GDP is shown in the following figure ($p < 0.05$ all items):

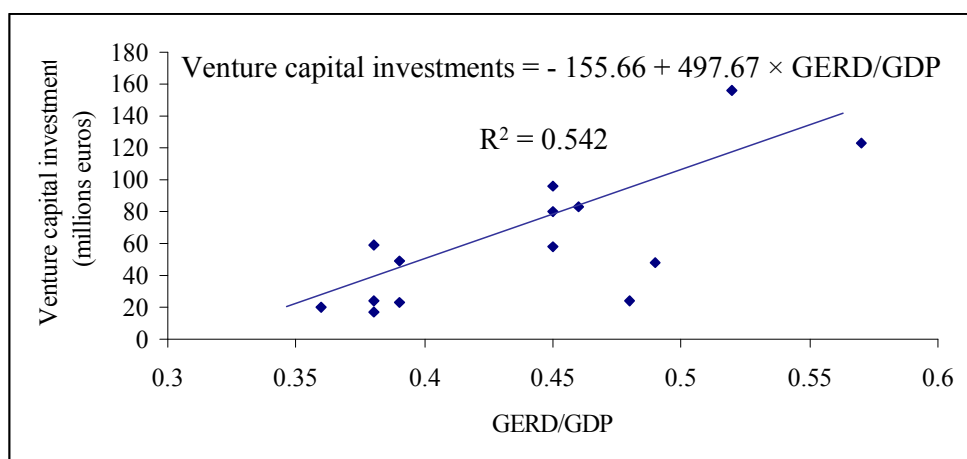


Figure no. 4. Venture capital investment - R&D intensity link in Romania

Source: Author's calculation based on the Eurostat data

There are many other factors influencing the venture capital investments in Romania (Diaconu, 2012b), but the R&D intensity is the strongest. The dependence showed in figure no. 4 indicates that as the total R&D intensity increases, the venture capital investments increase and highlights the importance of funding research and spurring of entrepreneurial culture. In fact, when the gross expenditure on R&D rises, that means that both the number of firms that perform R&D activities and the government support increase. Thus, increasing the efforts of the firms in research activities and the culture formed in the R&D field promoted by the government support, reflected in gross expenditure on R&D, has a positive incidence on venture capital investments, through the direct impact on both the demand and supply of venture capital funds.

The absence of individual investors (business angels) and the poor representation of venture capital supply coming from institutional investors to the early stages of innovative firms have been a major impediment to the development of R&D intensive industries. That is why both "innovators"

(referring to SMEs with product and process innovations, SMEs with marketing and organizational innovations and employment in fast-growing firms innovative sectors) and "economic effects" (that comprise especially medium and high-tech product exports, knowledge-intensive services exports and sales of new to market and new to firm innovations) are modest as well. The "innovators" dimension suffers of the very low percentage of SMEs with technological (product and process) innovations, many SMEs of the innovative firms engaging in marketing and organizational innovation. Therefore, the "economic effects" dimension cannot express mainly the medium-high tech product and knowledge-intensive services exports and sales of new to market innovations. This closest dimension to the European average is due to the new to firm innovations, which, we can suspect, that they are not of the highest novelty or resulted from R&D activity.

Romania's innovation performance has declined most of all countries in the period 2013 - 2014 due to a very strong decrease in sales of new innovative products. Romania alongside Bulgaria and Latvia belongs to the fourth group of modest innovators that includes member states that show an innovation performance level well below that of the EU average, i.e. less than 50% of the EU average. Among the modest innovators, the highest innovation progress is recorded in Latvia and Bulgaria whereas a strong performance decline occurred in Romania which is at the bottom of the performance scale in 2014 (European Commission, 2015). Romania shows also a decreasing innovation performance compared to last year (figure no. 5).

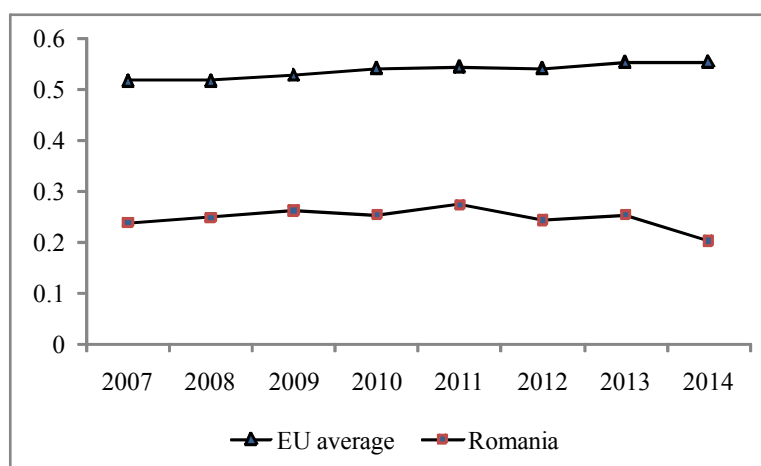


Figure no. 5. Trend of the innovation performance expressed by SII in the EU average and Romanian

Source: European Commission (2015)

At the same time, while the average innovation performance expressed by SII in the EU average register a slightly improvement, Romania shows a decreasing innovation performance. Overall, the EU average annual growth rate of innovation performance has reached 1.0% over the eight-year period 2007 - 2014 with most member states improving their innovation performance. For Romania, the average annual growth rates are negative (European Commission, 2015).

5. CONCLUSIONS

This study is focused on a comparative analysis of the situation in Romania, in the context of globalization and European integration, starting with highlighting the competitiveness gaps and their dependence of the innovation system. The same indicators responsible for weak innovation involved in shaping competitiveness are then linked to the poor innovation performance indicators.

From emphasizing the key dimensions of innovative processes over time and comparing their main measures with quantitative values at the EU average, we are able to appreciate many weaknesses that characterize also innovation in firms, and under the impact of various variables of the national innovation system in Romania. Opting for various mechanisms for boosting innovation

should be derived from the analysis of variables that characterize innovation activities, obstacles faced by firms, including those in the financing of projects.

Regarding the input indicators associated with linear view of innovation, our data reveal that both BERD/GDP and GERD/GDP, reflecting the commitments in term of creating new knowledge and technological progress, have been at a level less than 1/4 in Romania compared with the EU average, manifesting stability over time, but being affected by the impact of economic crises. That shows weaknesses in the innovation system and in the entire Romanian economy as well as its inability to manage key variables of economic competitiveness in times of crisis. BERD/GDP is still strong influenced by the industrial structure, being the consequence of sectoral composition influence that reflects structural effects and by the R&D intensity associated with each sector emphasizing an intrinsic effect (Diaconu, 2012a). Strong influences of R&D intensity is also due to the poor number of innovative firms, in particular the number of R&D innovative ones. The consequences of low commitments in R&D are reflected in the innovation performance indicators.

In relation to the SII composite index incorporating elements of the national innovation system, Romania ranks consistently in the group of modest innovators, summarizing the weaknesses in all innovation dimensions, particularly in firms activities and innovation output. Those are the consequence of a reduced number of innovative firms, low total R&D funding both in firms and by the government support and weak public-private collaborative partnership. As a result, a poor level of venture capital investments we have identified. The absence of individual investors (business angels) and weak supply of venture capital coming from institutional investors to the early stages of innovative firms have been major impediments to the development of the R&D intensive industries and innovation performance reflected in the output dimensions.

This result has important implications for the government policy, by boosting both the demand and supply side of venture capital. Strengthening the demand by stimulating firms to innovate and development of attractive investment projects needs mechanisms of direct and indirect support, a good access to the research results publicly funded, including the transfer of the research results to business sector to be valued and developed. An adequate means of entrepreneurial stimulation is needed. Besides the entrepreneurial culture, an attitude of risk taking must be cultivated and opportunities for small enterprises of getting outside the business on the secondary markets must exist on the capital market.

In the same context, supporting the supply for venture capital is necessary, in particular for seed and start-up stages that are uncovered by the intermediated market of venture capital. This measure is able to meet the demand of these stages, including by facilitating the development of networks for individual investors by providing of infrastructure support. Appropriate funding mechanisms are needed for each innovation stage (Diaconu, 2012b).

We are in favor of direct support to innovation through grants targeted mainly at the SMEs level, that would reduce their financing constraints, requiring cooperation with universities and research institutions, improving qualitatively and quantitatively the effectiveness of innovation processes and risk taking attitudes. In this manner, technological opportunities can come from the sphere of fundamental research, aiming at restructuring industries toward the sciento-intensive ones.

Orienting innovation in Romania by stimulating the enterprises to engage themselves more in research must be able to attenuate the considerable vulnerabilities that hinder the economic development based on knowledge: the concentration of economic and creative capacities in several sectors and, as a result, their dependence on the imports of technologies, on the external resources of knowledge and the insufficient funding from venture capital resources (Diaconu, 2012a). The institutional instruments conceived to support linkages with the technological frontiers or with various markets and users can have also effects of diminishing the disadvantages of Romania compared to the more advanced countries in innovation.

The financing of research has always been a big issue in Romania, although it's recognized among the priorities of every government. Without a national strategy in innovation in the long-run, which would effectively promote the national interests by addressing the increasing in demand for

innovation, Romania will depend forever of imported technologies, without being able of exploiting and benefiting of its native innovation capacity to increasing the living standard of its citizens.

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