Main Issues of R&D Financing in Romania

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Abstract. *Under current circumstances, the acute shortage of financial resources – particularly of budgetary resources – makes it very difficult to provide for the funding needed to carry on the activities of research, development and innovation (RDI), which are acknowledged, in all experts' opinions, to play a crucial role in overcoming crisis and economic recovery. It is, thus, more important than ever that the policy makers be aware of the severe consequences that might come forth due to the lack of governmental support for these activities. A strong commitment to responsibly setting priorities, designing policies and instruments for performance growth, and to mindfully saving and using the limited resources available to RDI is, therefore, critical.*

The purpose of this paper is to analyse and assess how challenges related to the provision of financial inputs for research activities are addressed by the national research system, especially in the new condition of economic crisis. Its actors have to ensure and justify that adequate financial and human resources are most appropriately mobilised for the operation of the system.

A central issue in this domain is to choose the appropriate modalities and instruments for transforming effects of the resource mobilisation in visible performance increasing of the R&D system and, also, for transferring the knowledge results into economy. The paper aims to analyse and assess specific barriers faced by the circulation of the financial flows that must be overcome by research and development actors.

Key words*: R&D financing, R&D financial flows, European Research Area*

JEL Classification*: O31, O33, O38*

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1. Policies of resources mobilization for research activities in Romania

The present internal and international environment, characterized by turbulence, insecurity and uncertainty, by economic and social crises threatening local, regional and, more and more, global communities, requires an efficient mobilization and use of all kind of resources, inclusive of the knowledge flow provided by research and development activity.

In Romania it is a dire need nowadays that the research, development and innovation activities at all levels be understood as instruments able to design solutions to economic and social challenges, the responsibility of scientific community to provide viable answers being more imperative than ever. Economic recovery and long-term growth, technological performance of Romanian economy imposed by strong competition at European and global level depends on the answers offered by researchers to actual problems.

The congruence between scientific activity's results and the ability of researchers to specifically address the needs of the society it serves depends on various factors concerning the scientific knowledge providers, potential users, infrastructure, political and economical environment.

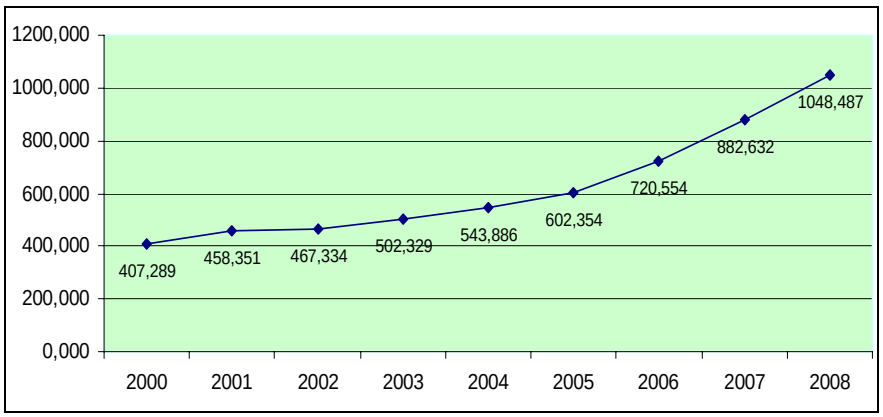
Starting in 2000, when Romania started negotiations for accession to the EU, the Romanian Government has given high priority to research and development, which were understood to be a main driver for competitiveness and sustainability. Since 2001, the policy objectives, including the issue of research resources provision, have been derived mostly from the Lisbon Strategy and the European Research Area targets. This new political direction has been reflected in policy documents as a justification for channelling resources into research. The National Development Plan 2005-2008, the National Reforms Programme (2007-2010), drawn up in the context of the European Strategy for Growth and Jobs, the National Strategic Reference Framework (2007-2013) and two of its Operational Programmes provide strong arguments for increasing allotted R&D resources, and contain objectives and special instruments to achieve them.

Coping with the requirements of closing the competitiveness gaps between Romania and developed EU member states, the government must seek the best ways for mobilizing research and development resources and valorizing them in order to increase the innovativeness and economic and social efficiency.

In accordance with the current orientations of European R&D and innovation policies, Romania's Government inserted the need of R&D funding and human

resources mobilization, as a priority, into the most of the programs and strategies, such as: the National Development Plan, the National Plans for Research, Development and Innovation, the National Programme of Reforms for achieving the Lisbon Strategy objectives, Export Strategy, Industrial Strategy, so on.

The expenditures on research and development increased considerably over the period 2005-2008 (Figure 1), in order to recover the significant underfinancing that marked the years 2001-2004. The government budget appropriations or outlays for research and development[1] in 2008 represented 1.06% of the total government expenditures, which is almost double the 2004 level (0.51 %).



Source: According to Eurostat Statistics Database[2].

Fig. 1 – The trend for GERD, Romania (2000-2008), PPS/2000

A specific impetus to initiate policy measures in favour of increasing R&D resources has been given by the CREST program, which took place in Romania in 2005, during the second cycle of the Open Method of Coordination of Policy Mix in European Countries. Foreign peers have reviewed the instruments of the Romanian Policy Mix for research and innovation, which are intended to raise the investment in R&D, and recommended an increase in resource mobilisation in the long-term, in accordance to the EU strategies and programmes[3].

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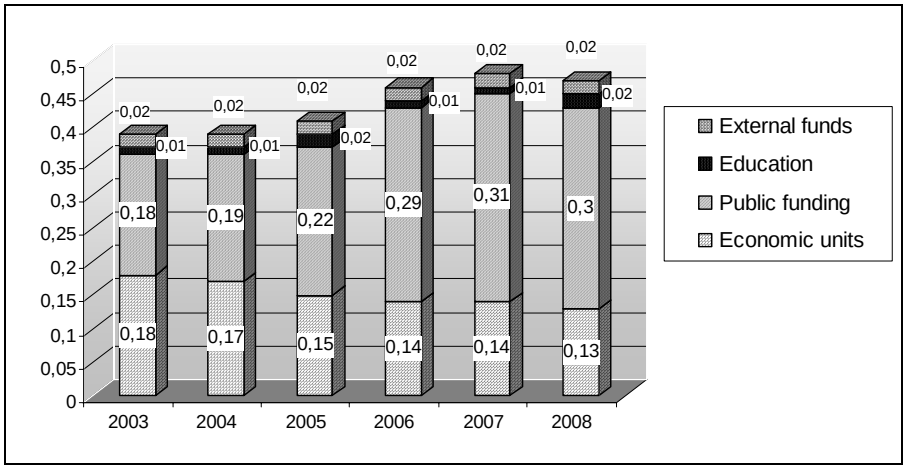
[1] *http://epp.eurostat.ec.europa.eu/portal/page/portal/science_technology_innovation/introduction*

[2] *http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_gerdtot&lang=en*

[3] *Steliana Sandu, Michael Dinges (2007): Monitoring and analysis of policies and public financing instruments conducive to higher level of R&D investments. The "Policy Mix" Project: Country Review Romania, United Nations University, UNU-MERIT, March.*

2. The contribution of public and private sectors to research and development financing

The ambitious goal of increasing the level of public expenditures for R&D to 1% of GDP until 2010, according to the Barcelona 2002 target, imposed considerable effort, especially between 2005-2008, for strengthening the budget capacity to invest in research-development and innovation field. Nevertheless, the efficiency of public spending on R&D, the quality and fairness in the assessment of the projects demanding public financial support within the National Plan for Research, Development and Innovation (NPRDI), the socio-economic relevance of some of the public funded research projects, the appropriateness of applied research projects for the specific needs of the Romanian industry are yet questionable. A higher performance and quality, in accordance with international requirements and standards for the research and development activity[1], asks for a strong commitment at present.



Source: According to the data from Romanian Statistical Yearbook. 2009, p. 617.

Figure 2. The share of total R&D expenditures in GDP by financing sources

While, during 2004-2008, the public contribution to the growth of the total expenditure on RDI (from 0.39% to 0.58% of GDP) was considerable, the share of the economic companies' investment in research and innovation dropped from

[1] *http://www.ad-astra.ro/library/?lang=ro#reviste.*

0.17% to 0.13% (see Figure 2). This sector, not yet fully market-oriented, is still dependent on public financing. In 2008, while 39.15% of the total business research and development expenditures came from public funds, the sectors' contribution to the total R&D expenditures (GERD) was of only 29.9%, on a decreasing trend, and significantly lower than the EU 27 average, of 54.5% GERD.

The lack of indirect incentives – tax credits – or financial services and instruments for risk management, coupled with the companies' reluctance or inability to take on financial and commercial risk arising from R&D, leads to a low level of the business in-house R&D. Joint venture capital is in an early stage in Romania, and has no visible contribution to the stimulation of R&D activity. The new Fiscal Code (Law 571/2003 revised), which came into force on the 1st of January 2007, introduced a package of fiscal measures for stimulating R&D activities performed by or for enterprises. Yet, until now, these indirect inducements haven't generated any significant favourable effect.

The considerable budgetary funds allotted to the business sector in contrast to the decreasing participation of this sector in GERD leads to the conclusion that the public funds brought about a "substitution effect", instead of the desired "complementary-like effect"[1]. Given the current contribution of the business sector to the GERD, it requires more than six-time raise in its share in GDP in order to reach the level of 2% of GDP by 2020.

The dependency of the business sector on public funding and its decreasing contribution to the total research and development funding attest that it is still not enough consolidated, in order to be able to truly contribute to increasing expenditures on research, development and innovation in the near future. The restructuring process of industrial branches, the limited financial resources, the lack of capital specifically addressing research joint ventures, start-up funding and spin-offs and the lack of adequate fiscal incentives for economic agents potentially interested in RD investment represent important barriers to improving the private business funding for research and innovation.

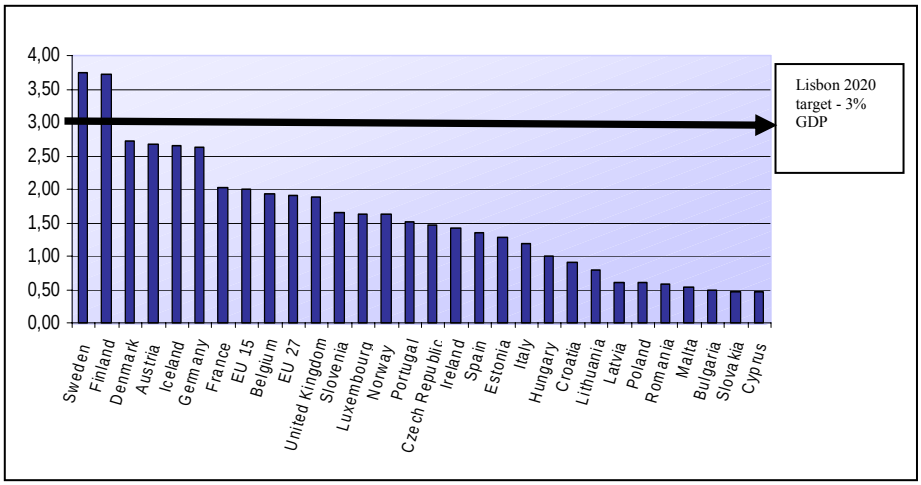
The National Strategy for Research, Development and Innovation (2007-2013) contains special provisions for raising the interest of the business sector in the field and its contribution to the increase of R&D investment. The financial support provided through the Cohesion and Structural Funds, which can be accessed

[1] *Sandu S., Paun C. (2009): "Evaluarea posibilităților de recuperare a decalajelor dintre România şi UE în domeniul CD&I" in* Studii economice *091001, National Institute of Economic Research.*

through the operational programmes, (mainly OP Increasing competitiveness and OP Development of Human Resources), as well as through special programmes targeting SMEs and start-ups, is likely to help improve this unfavourable situation.

In Romania, about 35% of the research units belonging to the business sector are SMEs. The biggest investors in research are the enterprises with more than 500 employees. Under these conditions, the latest attempts made by policy makers with a view to identify financial tools for supporting the SMEs involved in research activity are likely to underpin the business sector consolidation.

The economic crisis reversed the upward trend of the Romanian R&D expenditures. This will demand an even more strenuous effort for future resources mobilization in the research and innovation area, with a view to reach convergence with the developed European countries and to close the large economic and technologic gap between EU and Romania. Figure 3 clearly shows that, in 2008, despite consequent and significant positive growth rates for GERD, Romania still ranked among the last European countries, concerning the R&D intensity.



Source: Eurostat Data Base on line[1].

Figure 3 - Gross Domestic Expenditure on R&D (GERD) as a percentage of GDP, 2008

[1] *http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_gerdtot&lang=en.*

The pressure to reduce technology gaps, in an economic environment characterized by low productivity and still weak commitment in sustainable technological development, imposes the intensification of innovation in all economic sectors.

Yet, there still is a limited capacity for innovation, caused by the low interest and involvement in research and development activities, including cooperation with profile institutions. A poor understanding of the need for quality control and certification, leading to a low degree of conformity with advanced quality standards, a reduced interest in issues such as industrial and intellectual property and, also, a somehow blurred perception about the needs for, advantages and priorities of, sustainable development and environment protection led to limited progress in terms of the intensity and quality of services that applied research provides to industry[1].

The low level of innovation culture is also an important barrier to business R&D investment in the enterprise sector.

Despite being mentioned, together with Bulgaria as "the growth leaders also showing the overall fastest rate of improvement in innovation performance"[2], Romania ranks third to last among the EU-27 countries, according to the latest European Innovation Scoreboard [EIS], with an overall innovation performance score (SII) of 0.278, much lower than the average EU-27 score of 0.476.

Considering the current position as a 'catching-up' country (stable membership of this country group since 2005), it is estimated that a convergence time of at least 22 years is needed in order that Romania may reach the EU average level of performance[3].

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[1] *Sandu S.,Zaman Gh., Gheorghiu R. Modoran C. 2009): "ERAWATCH Country Report 2008.An Assesment of research system and policies. Romania" In: JRC European Commission, Institute for Prospective Technological Studies, EUR 23766 EN/2.*

[2] *European Commission (2009): "Enterprise and Industry", ProInno Europe, Paper nr.15, European Innovation Scoreboard, p.13.*

[3] *Sandu S., Paun C (2009): "Convergence between the Romanian and the EU RD&I systems", Working Papers of National Institute for Economic Research 09061, National Institute for Economic Research; European Commission (2009): PRO INNO Europe paper nr.10, European Innovation Scoreboard 2009.Comparative analysis of innovation performance, January 2010.*

3. Effects of the recent economic crisis in securing long term investment in research

In Romania, the present economic crisis brings the upward trend of the R&D investments to a standstill. Many decision-makers, both in the private and public sector, have been tempted to choose to substantially cut or delay forecasted investments in research, development, innovation and education. Such decisions would have negative impact on the country's growth and employment prospects, in the medium and long term.

However, there have been countries, both inside and outside Europe, which have decided on increasing the expenditure for research, development and education in spite of the economic difficulties, ensuring, therefore, not only a strong position in innovation[1] but, also, an easier road toward economic recovery and growth.

EU Science and Research Commissioner, Janez Potočnik, has thus called on governments and the private sector not to reduce the spending on research and innovation. He argues that sustained investment in innovation can help re-launch the overall economy, and major societal challenges such as security of energy supply, food safety and climate change will remain long after the end of the financial crisis.

According to a World Bank Report[2] the economic crisis is a powerful opportunity for Europe and Central Asian countries to redirect investment in R&D by restructuring government sponsored research and development institutes, in order to increase its rate of return. Shigeo Katsu, Vice President for the Europe and Central Asia Region of the World Bank, mentioned in this report that, in order "to ensure that countries will be able to promote post-crisis growth, the fundamental of knowledge generation must be preserved, and the investment into research and human capital must be continued through his difficult time. This would provide for an effective recovery as well as medium and long term growth".

In the context of the present economic crisis, governments in many countries have launched economic stimulus packages to address the economic downturn. Most of them have been intended not only to raise, in the short run, the

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[1] Commission of the European communities, Brussels, COM 800 final (2008):Communication from the Commission to the European Council, a European Economic Recovery Plan.

[2] The World Bank (2009): Innovation is vital to post-crisis growth in Europe and Central Asian Countries, in News Release, ECA, Paris, April.

aggregate demand, but also to boost aggregate supply and restore favorable conditions for growth. Therefore, they included measures designed to foster investment in research, development and innovation, to support small and medium-sized enterprises (SMEs), education, and the greening of the economy.

Yet, in Romania, despite the positive experiences of other European countries, despite previous legal provisions stipulating a gradual increase of public investment in R&D to 1% of GDP until 2010 – according to NASTI (National Agency for Science, Technology and Innovation) officials, the R&D budget for 2009 was dramatically reduced.

The positive trend of the public budget for research and development during 2009-2010 came to a sudden, unexpected halt, due to the financial crisis. Instead of the forecasted level of 0.86% of GDP for 2009 and 2010 – as it should have been, according to prior commitments – the expenditure on research and development represents only about half of the previous share in GDP.

This significant public budget shrinking brings about serious negative consequences for the research, development and innovation sector, as public funding provides for a large share of total RDI expenditure.

It is not only the investment plan that has been negatively affected (it has been halved), but also the human resources employed in the RDI activity. Because of diminished funds for wages, the number of researchers is supposed to decrease as well. Many research projects, previously contracted, cannot be continued due funds shortage. For example, a series of payments, which were due in 2008 for R&D contracts concluded within the NPRDI 2007-2013 framework, have been postponed or stopped financing in 2009 and 2010. The national competitions for new projects have been suspended. Some of the projects involving private partners will also have to be put on hold.

Young researchers will be particularly affected by the diminishing revenues from research and innovation activities, switching their interest to better-paid jobs in other economic activities.

4. Increasing efforts to promote and implement the research results into economy and society

Effective and prompt policy mechanisms for the R&D field, designed to increase the quality of the research results, to intensify the knowledge transfer through closer relations between academy and industry should continue to be an

important concern for all key actors, such as various government bodies, NGOs and research and development institutes.

The new instruments of financing, in force since 2005 and improved with the National Research, Development and Innovation Strategy 2007-2013 (NRDIS) and the second National R&D and Innovation Plan (2007-2013*)* (NPRDI), allow access of all R&D system actors to public funds, promote multi-annual funding and stimulate collaborative and multidisciplinary research and co-funding from a variety of funding sources.

The distribution of a big share of the R&D financial resources to programmes of industry and agriculture (according to the data from the National Institute of Statistics[1] in 2008) should have generated economic results in these sectors. Unfortunately, the actual impact is rather insignificant, due to various causes, such as: weak relationship between research and industry, low level of industrial in-house R&D, lack of needed incentives for conveying the research results toward industrial users – even though many R&D projects involves the partnership between research, university and industry sectors, in so named "consortia".

Moreover, it seems that some of the projects funded within the National Plan for Research Development and Innovation 2007-2013, reflect rather the area of interest and specialization of the various research teams than the real needs of the industrial sector addressed.

The CEEX programme, started up in 2005, was expected to be an incentive for the growth of private R&D expenditure, but this effect has yet to be observed.

Indirect incentives, such as tax credits or financial services and instruments to mitigate the financial and commercial risk arising from R&D activities were absent before 2005 and the joint venture capital is still in its early stage in Romania. Various attempts to improve this situation have had no visible contribution to the stimulation of R&D activity yet.

In 2007, the Government sustained various programmes financed from the state budget for SMEs, which are now in the initial phase of implementation; the results of these programmes cannot be adequately estimated or measured. All of these programmes might play an important role in stimulating and diversifying the types of knowledge circulation between SMEs and large companies from different sectors, directly or indirectly involved in R&D activities, contributing thus to the development of the knowledge market in Romania.

[1] *National Institute of Statistics (2010): Romanian Statistical Yearbook 2009, p. 624.*

The Sectoral Operational Programmes represent new funding sources for different activities in the research and development field. For example, The Sectoral Operational Programme for the Increase of Economic Competitiveness (SOP IEC) - Priority Axis II: "Increasing economic competitiveness through R&D and innovation" promotes the improvement of cooperation between universities, R&D institutes and enterprises. This can be achieved through joint RDI projects and other complementary forms of collaboration (ex: networks, practice exchange) in technological domains of common interest. The result of these partnerships could be the formation of poles of excellence at regional level, the direct access of firms to RDI activities, and support for micro-enterprises in high technology domains (spin-offs of institutes and universities, within S&T parks).

As part of the Human Resources Programme of NPRDI2, a new financing scheme for post-doctoral studies and mobility of Ph.D. students was launched in 2008. It supports a stage up to 3 month in a research laboratory and it covers the costs of mobility and with access to the research infrastructure.

Beginning with 2008, the structural funds have strongly encouraged large inter-sectoral collaborative projects, enabling also participation of foreign specialists, which was very difficult in the past. Structural funds also support networking in the form of clusters of excellence. The question is whether Romanian research units and companies have the capacity to elaborate consistent proposals to access structural funds, and thus benefit from knowledge circulation.

Encouraging R&D activities of start-ups and consolidated enterprises through structural funds will also increase their ability to collaborate with the R&D units and to absorb their results. In order to support the SMEs for accessing the structural fund for research and development, NASR (the National Agency for Scientific Research) signed partnerships with *EXIMBANK* and the *National Fund for SMEs Credit Warranties*.

Increasing the absorptive capacity of SMEs is a vital prerequisite for efficient knowledge circulation. The Innovation Programme plays an important role in knowledge circulation. The policy of knowledge circulation is conceived, structured, funded and monitored according to the four specific modules, which support technology transfer, the development of entities and structures for innovation support, services for innovation and R&D. If successful, this is likely to underpin the business sector consolidation.

A critical problem for Romania is the still weak cooperation between the different types of research institutes and the industry. Public instruments seem insufficient to enhance the collaboration between the research sector and industry.

Presently, the main cooperation framework between research and the productive sector consists of the national RDI programmes and direct orders (RDI procurement).

In order to increase the interest for innovation within the business sector, a friendly (legal, institutional, etc) environment for innovation should be ensured. Besides, there is a dire need for properly designed indirect instruments (fiscal, financial tools) that would foster innovation activities in enterprises and a more open attitude to clustering, networking and cooperation with external research units.

R&D projects realised within national programmes exhibit a serious weakness in the exploitability of results. This is partially due to the fact that the projects are not sufficiently market-oriented, but also to a lack of consistent ex-post evaluation and monitoring of research results, which proved to diminish the researchers' efforts to produce high quality, exploitable research outcomes. The intensity of patents, as one of the central indicators of the quality of knowledge production, is at a very low level in Romania, representing only about one percent of the EU average patents registered with both EPO and USPTO. Romania also ranks low among EU countries regarding the number of publications.

The technology-transfer and innovation (TTI) infrastructure, namely the organisations specialised in dissemination, transfer and capitalisation of R&D results is still in its early development stages. The future development and consolidation of TTI infrastructure by the new specialised programmes might ensure a favourable framework to strengthen the partnership between enterprises, universities and R&D institutions.

All the main policy measures taken within the last years were carefully aligned to European objectives and priorities. The decision-making process and policy design are strongly influenced by policy developments in the EU, as reflected in the Framework Programmes or key policy documents issued by the European Commission. Current policy documents such as the National Strategy of R&D and Innovation (2007-2013) and the National Plan for RDI (2007-2013) have an overall emphasis similar to many of the main strands of EU policy in the research field.

The R&D related objectives inserted in new strategic documents are intended to answer, more or less properly, to the requirements of the Lisbon 2020 Agenda. This can give a strong impetus to better mobilise needed resources with the view to reaching the goal of 3% of GDP.

Despite the current scarcity of resources, the performance of the R&D system might be improved provided that funds are allotted according to identified priorities.

The stimulation of the academy-industry relations through scientific cooperation and mobility is hoped to benefit knowledge production and circulation. The 2020 Lisbon Strategy and European Commission offer a set of benchmarks for the measurement of competitiveness, as well as best practices, which aim at avoiding risks for the R&D activity.

The main risks are mainly related to the implementation process. The overlapping of measures and programmes, and the overloading of the policy makers and of the implementing agencies should be avoided, lest the results be disappointing. The lack of coordination, monitoring and of clear responsibilities for each actor involved in the implementation process, the lack of transparency in structural funds management, as well as bureaucratic delays in respecting EU deadlines and procedures could compromise the attainment of strategic goals.

The need for Romania to converge towards EU norms and practices has had a strong influence on the development of the R&D system, which has undergone a positive development in terms of decision-making, management, diversity and flexibility of institutional funding. Recently (starting from 2005) the promotion of excellence was adopted as a permanent milestone of the R&D system. The impact in terms of resource mobilisation was visible.

The accession to the EU has been an important driver of knowledge demand. On the one hand, it implied a harmonisation of the European strategic priorities in the field of RDI with national ones. On the other hand, the need for rapid compliance with EU standards in several sectors (e.g. agriculture and food) has boosted the demand for new technologies and certifications. The efforts to correlate the national and European S&T priorities, domains and objectives specific to the European Research Area (ERA) and the EU Framework Programme for Research for 2007-2013 (FP7) were sustained through the Research of Excellence Programme (2005-2008) and later through other programs within the National Plan for R&D and Innovation 2007-2013. The effort to take on European best practices regarding identification, coordination and monitoring of knowledge demand has resulted in significant research policy improvements.

The European Research Area has played a consistent role in the architecture of the R&D policy mix in Romania, especially with reference to excellence and exploitability of knowledge production. The advantages associated with the

integration into ERA are directly related to the participation of Romanian research community in the single labour market for R&D, to easier access to a high quality R&D infrastructure, to the share of knowledge and optimisation of programmes and priorities.

Because of its relatively modest R&D potential, Romania takes advantage of adopting ERA benchmarks and standards, programming and monitoring procedures, as well as a system of indicators adequate for a knowledge-based society.

As a result of Romania's integration into the EU, new policies focusing on science-industry linkages have been promoted, in an attempt to strengthen the absorptive capacities of both public and private creators and users of knowledge. The main directions in which ERA is strengthening the knowledge production of research institutions in Romania are the following: fostering networking, co-ordination and integration at institutional level; providing long-term and institutional R&D funding and improving the co-ordination of national and regional research funding; linking scientific research funding to scientific performance; improving research careers and promoting inter- and trans-disciplinarity.

Further, the government needs to stimulate the absorption of funds and efficient management and to prioritise the distribution of the R&D funds. It should address the slow pace of restructuring, the mismatch between knowledge production and societal demand, the weak regional knowledge diffusion and the poor ex-post and impact evaluation of the different programmes and of the overall strategy implementation, which are negatively acting on the quality of research activity and the efficiency of public funding.

The contribution of foreign direct investments for R&D is a very important driver for the RDI system. Even if still at an incipient stage, the process of attracting FDIs in the R&D sector seems promising. The Romanian Agency for FDIs (ARISD) confirms that many Romanian researchers are currently employed in R&D departments of important MNCs present in Romania, mainly in the automotive and ICT fields.

The fragmentation of the R&D system seems to be one of the persistent weaknesses that threaten the achievement of the objectives of the national RDI Strategy and of the National R&D Plan. It facilitates the waste of public funds (including EU funds) and the inefficient allocation of R&D resources. In the National R&D Strategy for 2007-2013 the necessity of "a decreased fragmentation by fostering cooperation in a highly competitive environment" is

also mentioned. It is not possible to solve the problem of fragmentation by administrative decisions (such opinions have been expressed at times), but by a steadfast process of evaluation and monitoring of research organisations using scientific performance and socio-economic criteria, which have to be met by all institutions applying for public funding. This process of "self-selection" has already started in 2008 by the compulsory accreditation process (according to the Law 551/2007) using specific criteria of scientific performance (ISI publications) and economic relevance (project requested by economic and social actors).

This might be a first step towards strengthening certain centres of excellence providing high quality research, which would eventually be entitled to have priority in public funding, while other institutions with unsatisfactory research results will either entirely disappear, or will merge with better performing ones. The participation in international projects is also appreciated in the evaluation process.

In our opinion, the recent policy documents are an indicator for heading in the right direction. Unfortunately, they are, at times, too unspecific in terms of implementation, making it difficult to assess their future effectiveness. Their efficiency depends on the quality of implementation and on the availability of the needed financial sources.

6. Conclusions

The Romanian Research and Development system was marked by positive developments and increasing recovery after the strong decline characteristic to the transition years. The dramatic downslide of the GDP during 1996-1999 had a serious impact on the R&D system, which is largely dependent on public funding. New policy initiatives and the increase in the public funding for research and innovation activities during the years before the current economic crisis, contributed to the partial recovery of the system. A significant growth in public R&D expenditure was part of the government commitment to meet the objective of Lisbon Strategy and Barcelona target.

The efforts to comply with the 2007 EU accession requirements, to converge towards EU norms and practices and to ensure the necessary conditions to achieve the Lisbon tasks have triggered a positive impact on the design of the R&D and Innovation policy, on the evolution and current architecture of the Romanian research, development and innovation system.

The decentralization of the decision-making system, the externalisation of the RDI management, the gradual increase of competition-based funding of R&D at national level, the diversity and flexibility of institutional funding systems and beginning with 2005, the promotion of excellent R&D performers through the National R&D and Innovation Plan are the main positive trends in research and development resources mobilization.

The present norms and regulations allows access of all R&D system actors to public funds, promotes multi-annual funding and stimulates collaborative and multidisciplinary research and co-funding from a variety of funding sources.

The weaknesses that should be surpassed refer mainly to the inefficiency of the R&D financing; incipient stage of technology transfer, (innovation infrastructure and diffusion mechanisms); imperative to align to EU quality and standardization criteria; low visibility of Romanian research; weak correlation between RDI and industrial policy; little experience in R&D evaluation, lack of normative, stable and common framework for evaluation of R&D programs (ex ante and ex post) according to efficiency of public spending.

The R&D and Innovation system is confronted, also, with still inadequate research infrastructure for high performance, aging of R&D, and unbalanced distribution of researchers among branches, research fields and regions, defective collaboration and networking among R&D researchers from different R&D institutions and/or universities.

Another critical problem for Romania is the weak, undefined network of relations between different type of research institutes and industry and consequently the low level of applicability of the research results into economy. The legal framework, the financial instruments intended to stimulate the research activity and the application of research results in the economy (i.e. risk capital funds for high-tech start-ups, and spin-offs), as well as the current fiscal incentives to foster innovation activities in enterprises still need improvement.

The public policy instruments are not sufficient in order to enhance the collaboration between the research sector and industry. There is a strong need for a friendly environment (legal, institutional) with respect to innovation in the private sector and for a coherent and attractive package of incentives for clustering and networking.

The technology-transfer and innovation infrastructure, namely the organizations specialized in the dissemination, transfer and valorisation of R&D results is still poorly developed. The future development and consolidation of TTI infrastructure

via the national programmes might ensure a favourable framework to strengthen the partnership between enterprises, universities and R&D institutions.

The activity of research and development has a critical role in the dynamics of productivity and economic growth. According to specialized literature[1], research and development performed in the private sector in Romania carries significant externalities. Moreover, it increases the absorptive capacity of the business sector for technologies, be it brought by multinational corporations or developed in government or university research units. Therefore, the overall benefits (social benefits) associated with business R&D are larger that the private effects, which justify the public support, have R&D activities in the private sector.

At the same time, the government should support R&D activities in the public sector also, through appropriate funding, as these activities play a significant role in the long-term economic growth of the country. As the impact of R&D investment in public research units seems to be lower than expected, policy makers should consider the redesign of the principles and methods of financing research and development in public research units, of priorities setting, as well as of performance monitoring and evaluation. Of course, this policy orientation needs to be adjusted to each economic field, considering the spill-over effects generated by research and development as well as the specific relationship between public and private research.

The impact of research and development on productivity depends also on the intensity of private research activities. Very often, the private research develops technologies, which have previously been produced, tested and evaluated in public research units. Therefore, it is important that research and development policies encourage the interconnection between public and private research, which would facilitate the flow of knowledge between the two sectors.

Policy makers should ensure an open environment for imported technologies, through encouraging consistent inflows of goods with a high degree of technological complexity, of embedded human capital, valuable innovative ideas. But it is equally important to ensure that local firms dispose of the necessary technological capacity to exploit these new technologies. Empirical studies have shown that the level of R&D investment is a condition for an efficient utilization of foreign technology. Therefore, the alternative to keep a position of mere spectators, satisfied with imitating the technological progress achieved in other parts of the world shouldn't be an option. Therefore, Romanian policy makers

[1] *Sandu S., Modoran C. (2008): "The impact of R&D investment on productivity" in:* Annales Universitatis Apulensis*, Series* Oeconomica*, volume 2, Issues 10, p.18, IDEAS, RePEc.*

should stimulate the R&D investment and create a favourable environment for increasing their return.

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