



ERAWATCH Country Report 2008

An assessment of research system and policies

Romania

Steliana Sandu, Gheorghe Zaman, Radu Gheorghiu, Cristina Modoran



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ERAWATCH Network - Institute of National Economy,
Romanian Academy of Sciences

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Joint Research Centre
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Executive Summary

Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are at the heart of the Lisbon Strategy. The strategy reflects this in guideline No. 7 of the Integrated Guidelines for Growth and Jobs which aims to increase and improve investment in research and development, in particular in the private sector. The report aims at supporting the mutual learning process and the monitoring of Member States efforts. The main objective is to characterise and assess the performance of the national research system of Romania and related policies in a structured manner that is comparable across countries. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. This report is based on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

The current situation of the research and development (R&D) system in Romania is closely related to the country's economic performance, which has continued to improve in recent years. Romania is part of the European Union since January 1, 2007. The R&D system has undergone profound changes in terms of organisation, setting priorities, financing mechanisms and exploitability of research results. *Challenges and the corresponding strengths and weaknesses are summarised in the table below.*

The main weaknesses of the R&D system, especially up to 2006, are related to the low mobilisation of private funding for R&D activities, the weak accountability of public funding, the reduced exploitability of research results, the deficient monitoring and evaluation of research all along the project life cycle, and to the weak regional diffusion of knowledge. The governance structure of the R&D system is still very fragmented; therefore, there are many institutions - ministries and some academies of science – sharing responsibility for coordinating resource mobilization.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	Investment in R&D has been given high consideration at political level. Public debate was kindled and measures to improve public awareness of the importance of R&D activities are in place.
	Securing long term investment in research	The significant increase in the share of R&D public expenditures in GDP as well as the introduction of multi-annual commitments support long-term investment in research. The absorptive capacity of Structural Funds is low, Romania being so far a net contributor.
	Dealing with barriers to private R&D investment	Private R&D investment remains modest compared to EU standards and continue to decline. Business R&D is largely dependent on public funding.
	Providing qualified human resources	The performance of the higher education system has improved in recent years following reforms and restructuring. Research careers remain unattractive for talented young graduates.

Domain	Challenge	Assessment of strengths and weaknesses
Knowledge demand	Identifying the drivers of knowledge demand	The slow pace of industry restructuring and development has a negative influence on the demand for knowledge coming from the business sector. Despite the existence of mechanisms for identification of priorities and of the institutional framework responsible for the process, public demand for R&D still remains unspecific. Strategic decisions are based on a participatory approach.
	Co-ordination and channelling knowledge demands	The coordination of knowledge demand is realised through National RDI Plans. Channelling mechanisms are still weak.
	Monitoring of demand fulfilment	A rigorous ex-post evaluation of impact of the implementation of priorities is lacking.
Knowledge production	Ensuring quality and excellence of knowledge production	The scientific performance of knowledge production reflected in intensity of ISI publications and of patents remains low. There are however some research fields in which Romania has a long tradition of quality knowledge production. New R&D programmes, launched since 2005, provide competitive based funding and are important tools to ensure excellence of knowledge production.
	Ensuring exploitability of knowledge	Knowledge production does not match economic and societal demands, which leads to low exploitability of R&D results. Low exploitability was also a consequence of weak accountability of public funds. Exploitability of results was not given enough weight in the evaluation of projects under NPRDI 1.
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	A sound infrastructure to sustain knowledge circulation is in place. Several programmes extend support for joint R&D projects between university, public research units and the business sector.
	Profiting from international knowledge	Romania is involved in active partnerships in regional cooperation (SEE ERA NET; BSEC). Support for mobility of researchers has been extended. International knowledge was not fully capitalised due to weak links to the international research community.
	Enhancing absorptive capacity of knowledge users	SMEs have a low absorption capacity of knowledge. Regional knowledge diffusion remains weak in underdeveloped areas.

In each of the above mentioned domains, resource mobilisation, knowledge demand, production and circulation, there are recent policy responses to the challenges identified. Many of them are found in the [National Research Development and Innovation Strategy](#) (NRDIS) and the second National Plan for Research, Development and Innovation (NPRDI 2), both designed for the time horizon 2007-2013. The ex-ante evaluated effects of the measures proposed in the two policy documents are impressive, but risks still remain regarding the actual outcomes.

The following table outlines the main opportunities and risks related to recent policy dynamics. Most aspects of the research-related Integrated Guidelines of the Lisbon Strategy are addressed with the purpose of raising R&D intensity to the target of 3%. The main objectives of R&D and innovation policies in place after January 2007, when Romania became member of the EU, are directed toward obtaining a more visible impact on the economy and society. Strong partnership between industry - universities and research organizations are expected in order to effectively access both governmental funds and European funds for R&D. The general opinion of the role of R&D has been reconsidered and the vision is that R&D funding is a long-term

investment. This principle is reflected in all policies currently in place. All main political documents contain a special chapter on R&D and on its role in the different domains of economic and social activity. The main policy opportunities as well as the corresponding policy-related risks are summarised in the table below, which draws on sections 2.4-5.4 of the present report.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	A strategic vision of long-term investment is reflected in many policy documents, which complement each other. A support scheme to increase Romanian participation in FP7 has been launched. Measures and support schemes to increase attractiveness of research careers have been initiated. Financing instruments for the reintegration of Romanian researchers working abroad were introduced.	Detailed measures and actions to reach the objectives set are still to be decided and they will be crucial to determine the success of resource mobilisation. A delay in the implementation of assumed measures could jeopardize the attainment of the objectives set. Insufficient absorption capacity of national and international funds could have adverse effects on R&D activity.
Knowledge demand	National R&D priorities for 2007-2013 were based on a foresight exercise and further processes to identify the drivers of knowledge demand are planned (e.g. exploratory workshops, technology platforms, science shops). The policy measures adopted in 2007 represent sound premises for a better channelling of knowledge demand. An improvement of the monitoring and evaluation procedures is anchored in recent policy documents.	An inefficient management of the programmes within the NPRDI 2 or a delay in its implementation could prevent reaching the ambitious objectives set. An inefficient coordination between the different institutions with responsibilities related to the identification and channelling of knowledge demand could represent risks for the R&D system. Weak monitoring of knowledge demand could prevent an alignment of R&D supply and demand.
Knowledge production	Project evaluation is oriented towards excellence. This is supported by specific measures, such as compulsory output commitment for exploratory research projects and international evaluation for large projects (both starting 2008). An integrated monitoring system including measurable strategic targets and output indicators for different programmes is targeted by recent policy changes.	A slow pace of policy implementation may delay improvement of knowledge production. Although measures are in place in order to ensure the quality of scientific outcome, their translation into an increased number of patents and publications remains open for post-implementation evaluation. The risk therefore remains that a low exploitability of research results might continue, if chosen incentives prove to be inefficient or insufficient.
Knowledge circulation	It is expected that the accession of Structural Funds will support inter-sectoral and international scientific cooperation. The involvement of international experts in R&D projects will foster knowledge circulation. Project based mobility schemes for PhD students were launched in 2007 to support knowledge dissemination. Several financial schemes to support knowledge circulation for SMEs were launched.	The risk of a lack of coherence and coordination of implementation of R&D strategies and policies remains. Frequent changes and interference of political factors could be observed in the past in the process of implementation.

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. More specifically the European Research Area has

played a consistent role in determining the R&D policy mix in Romania with regard to excellence and exploitability of knowledge production. The advantages offered by the integration into ERA are directly related to the participation of Romania in the single labour market for researchers, benefiting from a high quality R&D infrastructure, sharing knowledge and optimising programmes and priorities.

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1 - Introduction and overview of analytical framework

1.1 *Scope and methodology of the report in the context of the renewed Lisbon Strategy and the European Research Area*

As highlighted by the Lisbon Strategy, knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the EU economy are at the heart of the Lisbon Strategy. The strategy reflects this in guideline No. 7 of the Integrated Guidelines for Growth and Jobs. This aims to increase and improve investment in research and development (R&D), with a particular focus on the private sector. One task within ERAWATCH is to produce analytical country reports to support the mutual learning process and the monitoring of Member States' efforts.

The main objective is to analyse the performance of national research systems and related policies in a comparable manner. The desired result is an evidence-based and horizontally comparable assessment of strength and weaknesses and policy-related opportunities and risks. A particular consideration in the analysis is given to elements of Europeanisation in the governance of national research systems in the framework of the European Research Area, relaunched with the ERA Green Paper of the Commission in April 2007.

To ensure comparability across countries, a dual level analytical framework has been developed. On the *first level*, the analysis focuses on key processes relevant to system performance in four policy-relevant domains of the research system:

1. Resource mobilisation: the actors and institutions of the research system have to ensure and justify that adequate public and private financial and human resources are most appropriately mobilised for the operation of the system.
2. Knowledge demand: needs for knowledge have to be identified and governance mechanisms have to determine how these requirements can be met, setting priorities for the use of resources.
3. Knowledge production: the creation and development of scientific and technological knowledge is clearly the fundamental role of a research system.
4. Knowledge circulation: ensuring appropriate flows and distribution of knowledge between actors is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production.

These four domains differ in terms of the scope they offer for governance and policy intervention. Governance issues are therefore treated not as a separate domain but as an integral part of each domain analysis.

Figure 1: Domains and generic challenges of research systems

Resource mobilisation	Knowledge demand	Knowledge production	Knowledge circulation
<ul style="list-style-type: none"> • Justifying resource provision • Long term research investment • Barriers to private R&D funding • Qualified human resources 	<ul style="list-style-type: none"> • Identification of knowledge demand drivers • Co-ordination of knowledge demands • Monitoring of demand fulfilment 	<ul style="list-style-type: none"> • Quality and excellence of knowledge production • Exploitability of knowledge production 	<ul style="list-style-type: none"> • Knowledge circulation between university, PRO and business sectors • International knowledge access • Absorptive capacity

On the *second* level, the analysis within each domain is guided by a set of generic "challenges" common to all research systems that reflect conceptions of possible bottlenecks, system failures and market failures (see figure 1). The way in which a specific research system responds to these generic challenges is an important guide for government action. The analytical focus on processes instead of structures is conducive to a dynamic perspective, helps to deal with the considerable institutional diversity observed, and eases the transition from analysis to assessment. Actors, institutions and the interplay between them enter the analysis in terms of how they contribute to system performance in the four domains.

Based on this framework, analysis in each domain proceeds in the following five steps. The first step is to analyse the current situation of the research system with regard to the challenges. The second step in the analysis aims at an evidence-based assessment of the strengths and weaknesses with regard to the challenges. The third step is to analyse recent changes in policy and governance in perspective of the results of the strengths and weaknesses part of the analysis. The fourth step focuses on an evidence-based assessment of policy-related risks and opportunities with respect to the analysis under 3) and in the light of Integrated Guideline 7; and finally the fifth step aims at a brief analysis of the role of the ERA dimension.

This report is based on a synthesis of information from the European Commission's ERAWATCH Research Inventory¹ and other important publicly available information sources. In order to enable a proper understanding of the research system, the approach taken is mainly qualitative. Quantitative information and indicators are used, where appropriate, to support the analysis.

After an introductory overview of the structure of the national research system and its governance, chapter 2 analyses resource mobilisation for R&D. Chapter 3 looks at knowledge demand. Chapter 4 focuses on knowledge production and chapter 5 deals with knowledge circulation. Each of these chapters contains five main subsections in correspondence with the five steps of the analysis. The report concludes in chapter 6 with an overall assessment of strengths and weaknesses of

¹ ERAWATCH is a cooperative undertaking between DG Research and DG Joint Research Centre and is implemented by the IPTS. The ERAWATCH Research Inventory is accessible at <http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.home>. Other sources are explicitly referenced.

the research system and governance and policy dynamics, opportunities and risks across all four domains in the light of the Lisbon Strategy's goals.

1.2 Overview of the structure of the national research system and its governance

Romania is the seventh largest EU Member State in terms of population. With a total GERD of €444m (2006), it accounts only for around 0.2% of total EU27 R&D expenditure. Reported per inhabitant, R&D expenditure was also at a very low level, €20.6, compared to €1292 in Sweden, the highest ranked among EU27. With 0.45% GERD as a percentage of GDP R&D intensity (2006) Romania is significantly behind the EU27 average of 1.84%. The share of GERD financed from abroad is also below the EU27 average, and has halved since 2001, from 8.2% to 4.1% in 2006.

In Romania, many institutions at different levels have specific responsibilities in the elaboration, monitoring, implementation and assessment of R&D policy. An overview of the structure of the Romanian R&D system is presented in Figure 1.

At the legislative level, there are two commissions: the [Senate Commission for Education, Science and Youth](#) and Sport and the [Chamber of Deputies Commission for Education, Science, Youth and Sport](#), which debate and approve draft laws and other legislative documents related to science, education, sport and youth.

The [National Council for Science and Technology Policy \(NCST\)](#) undertakes the role of a high-level policy coordination body. Its task is to set priorities and the required legislative framework for the implementation of the National Strategy for RDI, in line with the objectives and sectoral strategies of the Government Programme and in consultation with key stakeholders (local and central public administration bodies, the [Romanian Academy](#), higher education organisation, R&D institutes, economic agents, employers' federations and labour unions, etc). NCST is chaired by the Prime Minister and includes among its members: the Minister of Education, Research and Youth and the President of the National Authority for Scientific Research (NASR), the ministers of Economy and Finance, Agriculture and Rural Development, Communications and IT, and the President of the Romanian Academy. (ERAWATCH, 2008)

The [Ministry of Education, Research and Youth](#) (MERY) through the [National Authority for Scientific Research](#) (NASR) is the specialist body of the Romanian central public administration responsible for R&D policy. Its mission is to formulate R&D and innovation policies, monitor their implementation and assess the results and impact. MERY acts for the promotion of general strategies aimed at the development of the national R&D and innovation system and to integrate them into the European Research Area.

The consultative bodies to the MERY (INNO-Policy Trend Chart, 2007) play a role in setting sectoral priorities and decide on funds allocation for programmes under the framework of the National Plan for RDI. Professional representatives, private associations and representatives of the main trade unions are invited to join a number of consultative bodies, such as the Advisory Board for R&D and Innovation. MERY-NASR collaborates with 10 other ministries having R&D and innovation responsibilities in their specific fields such as agriculture, transport, environment etc. Each of them co-ordinates a network of national R&D institutes (see Figure 1).

Four National Agencies provide coordination mechanisms in strategic areas. The Romanian Standards Association (ASRO), in charge of developing national standardisation and quality certification and Romanian Association for Accreditation (RENAR), accountable for accreditation amount to The National Quality System. The other two agencies coordinate R&D activity in their respective fields: the [National Agency for Atomic Energy](#) - a government body which promotes development in the nuclear field and co-ordinates scientific research and co-operation with international organizations; and the [Romanian Space Agency](#) (ROSA) – which coordinates space activities and the National Space R&D programme.

At the national level there are four academies that coordinate research in a network of institutes. The [Romanian Academy](#) organised into 14 scientific divisions specialised in technical, basic and socio-human sciences and has its own national network of 60 research institutes and centres. In addition to the Romanian Academy there are two branch academies: the [Academy of Medical Sciences](#) (with 23 institutes and research centres, and 12 clinics affiliated to medical universities) and the [Academy of Agriculture and Forestry Sciences](#) (with a network of 25 institutes and research centres, 91 research and production units). The Romanian Academy of Technical Sciences is aimed to promote the development and innovation in technological education and research.

At the operational level, there were about 787 research units at the end of 2007 (INSSE, 2008), belonging to different institutional organizations. Most of them (559) are performing R&D in the business sector, either as specialized R&D units or as departments within firms themselves. The government sector is comprised of 44 National Research Institutes, coordinated by different ministries, the network of institutes of the Romanian Academy and other public R&D organizations.

The structure of GERD by performing sectors in 2006 revealed that almost half of the R&D expenditure goes to the business sector (55.31% in 2004 and 48.48% in 2006). Government intramural expenditure has slightly increased its share to 32.34% in 2006 compared to 34.14% in 2004. The higher education sector registered a visible increase in the GERD share between 2004 and 2006, from 10.12% to 17.72%.

Public funding is primarily channelled through MERY-NASR (81%), being further allocated to different R&D actors predominantly on a competition basis (95%) while the rest (5%) is used as institutional funding for subsidies (2.5% for scientific events organized in Romania or abroad, publications, information activities, etc. and 2.5% for overhead/management costs). Financed projects have to address the priority themes specified in the various programmes funded by [MERY-NASR](#) (ERAWATCH, 2008). The remaining part of the public funding is divided between the Romanian Academy (8.2%), other academies and the ministries involved in R&D activities.

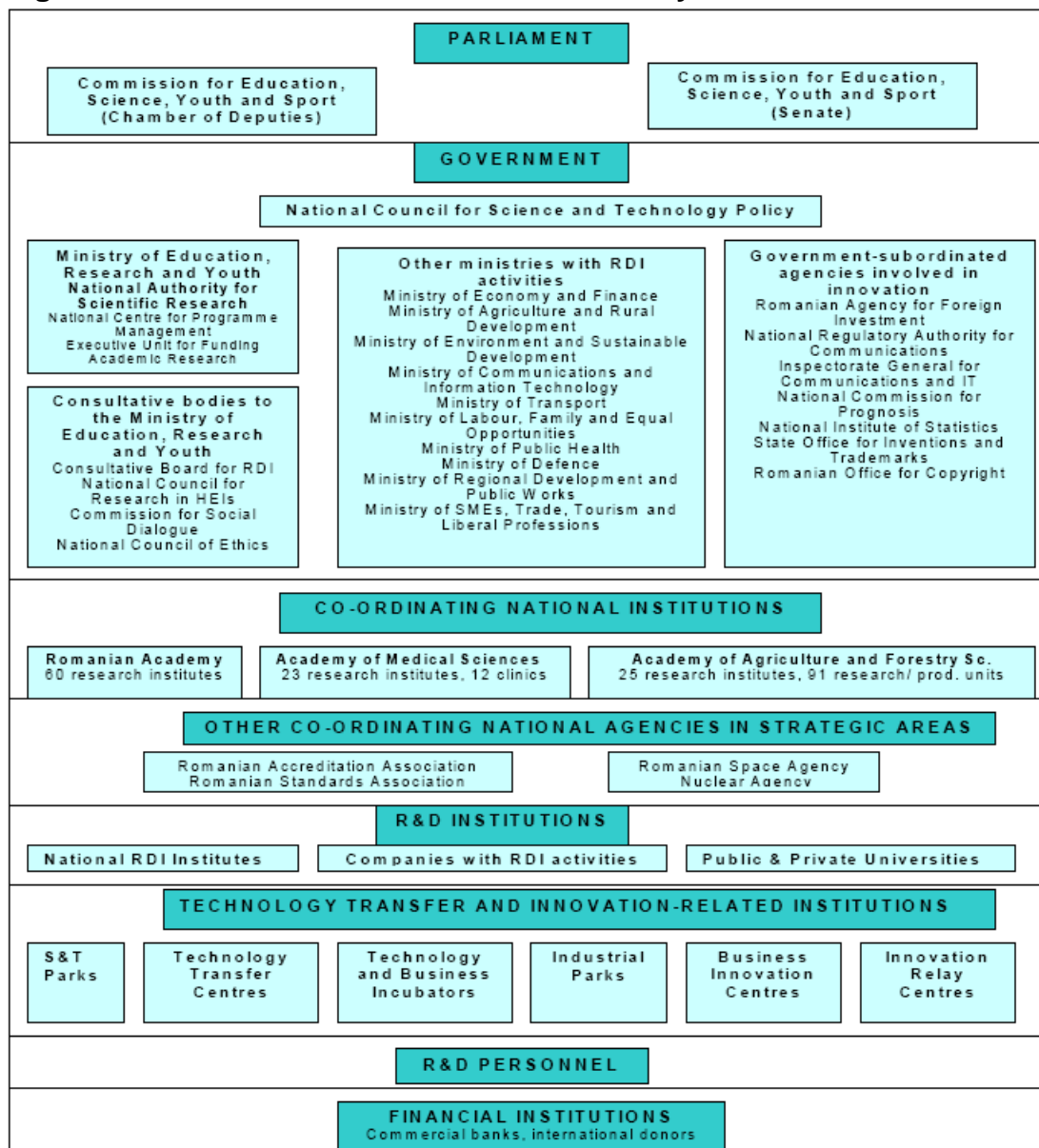
The following bodies operate at present, under the coordination of the [National Authority for Scientific Research](#), as agencies for the implementation and financing of national R&D and innovation programmes:

- The [National Centre for Programme Management](#) (NCPM) which ensures the management for a part of the R&D programmes coordinated by MERY-NASR and funded from national and international sources;
- The [Executive Unit for Financing Research in Universities](#) (EUFRU), which ensures the management of research, programmes mostly addressing the development of scientific careers and increasing the research capacity in

universities. EUFRU organises national competitions and monitors successful projects funded by MERY, through the [National University Research Council \(NURC\)](#) for the development of higher education research. It also participates in national and international tenders for attracting external funding for education and research and facilitates information dissemination in these areas.

The NURC as advisory body of the MERY, and its component EUFRU play an important role in university and post-university research funding.

Figure 2: The Structure of the Romanian RDI system



Source: INNO Policy TrendChart, Romania, 2007

In line with the vision of [National Research Development and Innovation Strategy 2007-2013](#), three new public institutions will be set up, namely the Research Council, the Technological Development Council and the Innovation Council.

2 - Resource mobilisation

The purpose of this chapter is to analyse and assess how challenges related to the provision of inputs for research activities are addressed by the national research system. 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 the long time horizon required until the effects of the mobilisation become visible. Increasing system performance in this domain is a focal point of the Lisbon Strategy, with the Barcelona EU overall objective of a R&D investment of 3% of GDP and an appropriate public/private split as orientation, but also highlighting the need for a sufficient supply of qualified researchers.

Four different challenges in the domain of resource mobilisation for research which need to be addressed appropriately by the research system can be distinguished:

- Justifying resource provision for research activities;
- Securing long term investment in research;
- Dealing with uncertain returns and other barriers to private R&D investment; and
- Providing qualified human resources.

2.1 Analysis of system characteristics

2.1.1 Justifying resource provision for research activities

The Romanian Government has given a high priority to R&D as a main driver for competitiveness and sustainability, beginning in 2000, when Romania started negotiations for accession to the EU. Since 2001, the R&D policy, including the issue of resources provision, has been derived mostly from the Lisbon Strategy and the European Research Area objectives. 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.

A specific impetus to initiate policy measures in favour of increasing R&D resources has been given by the [CREST exercise](#), 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 Policy Mix, which play a role in multiplication of R&D investments in Romania, and recommended an increase in resource mobilisation in the long-term, in accordance with EU strategies and programmes.

The importance conferred by the government on research activity in economic and social progress is reflected in the share of the total government budget allocated to public R&D expenditures. The share of GBOARD in total general government expenditure has gradually increased from 0.47 % in 2003 to 0.92% in 2006. Despite this favourable trend, it is still significantly far from the EU 25 average of 1.57% in 2005 (Eurostat, 2008).

The enhancement of public awareness regarding the role of science for economic growth is another way to improve the justification for resource provisions. Main instruments employed in Romania are the national and regional science exhibitions and events organized yearly by [NASR](#) since 2005 such as “Research Saloons”, “National Saloons of Inventions”, and the “Day of Researchers”, supported by public and sponsorship funds. The private sector, through the [Chamber of Commerce and Industry](#), has organised a number of seminars and workshops on the role of setting priorities in science and the allocation of resources to promising R&D fields. Public debates are also present on the agenda of mass media, of non-governmental organisations, professional associations and, more generally, of civil society, which is more and more actively involved in the discussion concerning R&D policies.

2.1.2 Securing long term investment in research

The key actor responsible for securing long-term investment in R&D is the Romanian Government, chiefly through the [Ministry of Education, Research and Youth](#) – the [National Authority for Scientific Research](#) as it manages the largest share of all R&D public funds. Other actors interacting in securing R&D investment are Ministries, such as the [Ministry of Economy and Finance](#), the [Ministry of Defence](#) and the [Ministry of Agriculture and Rural Development](#), which manage Sectoral Programmes, and the [Romanian Academy](#), which coordinates basic and advanced research programmes. All these institutions responsible for R&D funding have strategic medium and long-term investment plans and monitor the achievement of the established objectives and commitments. The financing commitments for the budgetary funds are undertaken on an annual basis with the adoption of the Law on the State Budget (Agachi, 2007).

The main instrument for achieving the national strategic R&D objectives of [MERY-NASR](#) is the National Plan for R&D and Innovation (NPRDI). The first [National Plan for R&D and Innovation](#) covering the period 1999-2006 (NPRDI 1), introduced multi-annual resource commitments into the policymaking process. Despite this, during the first operational years, the annual R&D budgets adopted by the Parliament were often reduced. Therefore, the planned objectives of the research projects could be only partially achieved. Starting with 2005, when the volume of GBAORD substantially increased, multi-annual resource commitments remained firm, with a positive impact on long-term investment.

The [Research of Excellence Programme \(CEEX\)](#), operational between 2005 and 2008, was established with the particular aim of efficiently integrating the Romanian R&D system into the European Research Area. It proved to be a policy tool able to provide appropriate funding for research projects. Compared to the [National Plan for R&D and Innovation 1999-2006](#), where due to the scarcity of R&D funds projects were financed at a minimum survival level, the funds available for each CEEX project increased more than tenfold. [The second National Plan for R&D and Innovation \(2007-2013\)](#) (NPRDI 2) contains strong provisions for investment in research, which are highly consistent with the FP7 priorities (see section 2.3).

A general revitalisation of university research activity has been observed since performing research activities became compulsory for university accreditation (Government Decision 1418 / 2006). New R&D centres have been set up in almost all universities. Together with the business sector and public national research institutes, they are involved in collaborative and partnership research projects.

Though still very low compared to the EU 27 average of 0.4%, the share of university research spending in GDP has doubled from 0.04% in 2004 to 0.08% in 2006.

The European Research Framework Programme, European Structural Funds, shared European R&D infrastructure and other facilities are new sources of long term R&D investment, accessible following Romania's accession to the European Union. Unfortunately, the success rate of Romanian R&D applications in European R&D Framework Programmes was low (10.3% of around 4,400 Romanian applications in FP6 and EURATOM were successful) (NASR, 2007a). Therefore, Romania has so far been a net contributor to EU R&D, in spite of its own relative low level of resources. This situation slightly improved in 2007, when both the number of FP7 applications and the success rate (772 applications within a year and a success rate of 12.7%) have increased (NASR, 2007b). Several national programs supported international cooperation, both in the [NPRDI 1](#) (the CORINT Programme, which provided co-financing to the participants at FP5, FP6 and EUREKA) and in the [NPRDI 2](#) (the CAPACITIES Programme, which provides co-financing for FP7). Lack of experience in the elaboration of applications and weak institutional collaborations are the main barriers to a larger participation in R&D EU Framework Programmes. Among other barriers the unsuitable infrastructure for applied research, as well as the low international visibility of Romanian researchers could be mentioned. From 2007, the participation of R&D units in FP7 will be further encouraged, by giving an advantage in the competition for accessing national funds.

Romania plays an active part in international research organizations. In 2002, the Romanian government signed the Memorandum of Agreement with CERN followed by the Government Decision 1242/2002, as a legal framework stimulating scientific cooperation through R&D projects. There are currently more than 70 researchers involved in seven experiments operating the CERN facilities. As a full member of the European Space Agency since February 2006, Romanian contribution in the same year consisted of the export of hi-tech products, equivalent of €15-25 million (MERY-NASR, 2006).

As a conclusion, it can be noted that the government provides the largest share of resources for long-term investment in research. The sharp increase of the share of government appropriations for R&D during 2004 – 2006 (from 0.17% of GDP in 2004 to 0.32% of GDP in 2006), as well as the figures for 2007 (the GBAORD in GDP was 0.56%) and forecasts for 2008 (0.7%; NASR, 2007a) are clear evidence that this positive trend is likely to continue.

2.1.3 Dealing with uncertain returns and other barriers to business R&D investment

Presently, the business sector covered at the end of 2007 around 64.3% of the research organizations in Romania and consisted of joint stock companies, commercial companies and limited liability companies, which prevalingly carry out research activity (INSSE, 2008). This sector is still largely dependent on public financing. In 2006, 47% of total BERD originated from the state budget (authors' calculations based on data provided by INSSE (2007), Romanian Statistical Yearbook 2007). In the same year, the contribution of the business sector to R&D financing continued to decrease from 50.2% in 1999 to only 30.4% of GERD, being thus significantly lower than the EU 27 average of 54.5%. If this tendency persists, the prospect of reaching the Barcelona target within the 2013-2015 time frame is at

risk. Comparing the considerable budgetary funds spent in the business sector with the decreasing participation of this sector to GERD leads to the conclusion that the public funds brought about a “substitution effect” instead of the desired “complementary-like effect” (Sandu and Paun, 2008). At the end of 2006, the [NASR](#) stated that “a tenfold increase in the business sector contribution to GERD is required in order to reach the level of 2% of GDP by 2013-2015” (MERY-NASR, 2006).

A short presentation on the factors which have led to this situation seems necessary to understand the unfavourable evolution of the business R&D sector. Lacking financial resources during the period of transition to becoming a market economy in the first years after 1990, numerous industrial research institutes depended on a market that was just emerging at that moment. Against a backdrop of the huge economic difficulties facing industrial enterprises, which had to be restructured and downsized, the demand for research was almost completely absent. Under these conditions, the Government created a financing instrument to ensure their survival, namely the Special Fund for Research (1994-1995), which was supported by 1% of the turnover of all economic units. Starting with the “Horizon 2000” national programme (1995-2000) project-based funding through competitions was launched. Nevertheless, most expert evaluators of competitive calls came from organisations in the private business sector; therefore, the bulk of public funding through this programme was directed to this sector, irrespective of performance and efficiency criteria.

The first NPRDI (1999-2006), structured by 15 programmes with diverse, prevalingly applicative and industry-related topics, was also an important competition-based financing tool for sustaining R&D business sector. According to the data supplied by the [National Institute for Statistics](#), out of the total programme-based expenditures for R&D, 60% in 2001 and 42% in 2006 were allotted for the fields in which mainly business sector research units operate, such as industrial and agricultural output, and power supply technology and distribution.

An important barrier to business R&D investment is, in a wider context, the low level of innovation culture in the enterprise sector. “The enterprise innovation level has not been consistently supported by an operational technology transfer system, and the risk capital may be considered absent” ([NRDIS](#), 2007).

The [CEEX](#) programme started 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 risk financial and commercial risk arising from R&D activities were absent before 2005. Joint venture capital, still in its early stage in Romania, has had no visible contribution to the stimulation of R&D activity yet.

In Romania, about 35% of the research units in the business sector are SMEs. The majority of the investors in research are the enterprises with more than 500 employees. Under these conditions, the policy makers have recently attempted to identify and implement financial tools intended to support SMEs involved in research activity (see chapter 5.3). If successful, this is likely to underpin the business sector consolidation.

The heavy dependence of the business sector on public funding, together with its continuously decreasing contribution to the total R&D funding attest that it is still not

sufficiently consolidated in order to effectively contribute to R&D expenditures. The restructuring process of industrial branches, the limited financial resources, the lack of capital specifically addressing business research (joint ventures, start-up funding and spin offs) together with the lack of adequate fiscal incentives for economic agents potentially interested in R&D investment have been until 2007 significant barriers to the improvement of R&D financing for the enterprises sector.

2.1.4 Providing qualified human resources

The higher education system, as the main provider of qualified human resources for R&D has significantly improved since 2000, but still lags behind the European level. The number of students has increased from 582,221 enrolled students in 2001-2002 to 785,506 in 2006-2007 (INSSE, 2007, Romanian Statistical Yearbook). Many universities have improved their curricula and have been increasingly oriented towards research activities, in accordance with the Bologna and European Higher Education Area provisions.

The share of tertiary graduates in science and engineering per 1,000 of population aged 20-29 years in 2005 was of 10.3% in Romania compared to the EU27 average of 12.9%. The figure for PhD students in science and technology, measured, as percentage of the population aged 20-29, was 0.23% in 2005, ranking 17th among the EU27 countries ([European Innovation Scoreboard, 2007](#)). Romania registered a high average growth rate of graduates from tertiary education in science and technology between 1994 and 2004. This is due to major reforms initiated in the higher education sector. New curricula as well as new universities have been set up under the reform programme and the number of students enrolled in various study programmes available in Romania has been steadily rising (EUROSTAT, 2008).

The structure of the education market was profoundly distorted by the industry restructuring which affected the Romanian economy during the transition period. The educational offer has not correlated with the labour market demand for medium and long term. For instance, the number of candidates in the field of business studies and economics, law and journalism was about ten times higher than the available offer, while the demand for positive or technical sciences was negligible. Nevertheless, during the last few years, the interest in and competition for some technical specialisations (like automatics, electronics, telecommunications, constructions, and energy) has significantly increased (Agachi, 2006).

The important developments after 2005, relating to the Bologna Process, contributed to the improvement of the capacity of universities to provide higher qualifications relevant to the requirements of the labour market. [The National Agency for Qualifications in Higher Education and Partnership between Universities and the Socio-Economic Environment](#) is a specific body whose mission it is to promote the partnership between universities and the labour market ([Sturza and Salomia, 2007](#)).

The relationship between higher education and research organizations has improved since 2005. The [CEEX](#) Programme supported the development of postdoctoral programmes in universities and research institutes, research projects for young researchers (PhD students and masters students aged under 35 years), projects for postdoctoral programmes, the return to Romania of PhDs with doctoral or postdoctoral studies abroad and transversal mobility projects for young PhD students ([Sturza and Salomia, 2007](#)).

The attractiveness of a career in research is still at a low level in Romania compared to other possible employment options, due to low salaries, especially for young researchers, and sometimes due to inadequate working conditions (lack of adequate equipment, scientific reviews, and books). The annual average growth rate of total researchers in full time equivalent was of 2.3% in Romania between 2000 and 2005, especially in the higher education sector. In the business sector this share has decreased by 4.1% in comparison with the positive growth rate of 3.8% for EU 27. At present, the number of researchers per 1000 people in Romania is only a third of the EU 25 average.

The brain drain phenomenon continues to have a negative impact on the highly qualified labour force in R&D. Unfortunately, even if policy measures aimed at retaining young talented researchers in Romania were recently adopted, their results are not yet visible.

2.2 Assessment of strengths and weaknesses

The adherence of Romania to the objectives of the Lisbon Strategy has contributed to a better resource mobilisation for R&D. The motivations of a higher investment in R&D activities have been supported through measures of public awareness creation (exhibitions, saloons, etc) initiated by the authorities with responsibilities in the field of research, but also by the civil society and the media. At an operational level, the introduction of firm multi-annual commitments with the launch of the CEEEX Programme has contributed to a long-term development of the R&D sector. In terms of human resources, an increase in the number of students, especially the rebound of technical specialisations positively contributes to the supply of human resources for research activities.

Despite these positive developments, significant weaknesses remain, such as the low absorptive capacity of Structural Funds (Vass, 2008), the negative trends in the business R&D sector, and difficulties in attracting young researchers in the field of research due to insufficient payment and difficult research conditions.

Main strengths	Main weaknesses
<ul style="list-style-type: none"> • Share of the R&D public expenditures in GDP doubled between 2005 and 2006; • Presence of debate and policy measures to improve public awareness to support resource mobilization for R&D; • Support for future improvement of medium and long-term investment security through multi-annual commitments; • Increase in the number of students and in the quality of the higher education system. 	<ul style="list-style-type: none"> • Low absorption capacity of Structural Funds • High dependency of the business R&D sector on public funding; • Low contribution of the private sector to R&D investment (decreasing share in GDP) • Low attractiveness of scientific careers • Brain-drain of young and talented researchers

2.3 Analysis of recent policy changes

Starting with 2007, the Government of Romania “gives the highest importance to the commitments formulated at the 2006 Spring EU Council, to progressively increase public spending for R&D in order to reach the level of 1% in 2010” ([National Reform Programme - Implementation Report, 2007](#)).

The [National Research, Development and Innovation Strategy \(NRDIS\) 2007-2013](#) is the main policy document that stipulates important improvements in resource mobilization. In this document major challenges are identified and specific actions are set. Other strategic documents complement the R&D Strategy, such as the [Sectoral Operational Programme "Increase Of Economic Competitiveness" \(SOP- IEC\)](#) Axis 2, the [Sectoral Operational Programme, Human Resources Development \(SOP HRD\)](#) - Axis 1 (Ministry of Economy and Finance, 2008), the [National Export Strategy](#), [National Reform Programme](#) etc. All these programmes emphasise the necessity of long-term investments in R&D, but are very prudent in predicting the horizon by which the Barcelona target will be met.

The NRDIS contains special provisions related to the revival of the business sector and to the increase of its contribution to the R&D investment. The financial support given through the Cohesion and Structural Funds, which can be accessed through the two operational programmes mentioned above, as well as through special programmes targeting SMEs and start-ups, is likely to contribute to the reversal of the unfavourable trend of BERD. On the other hand, some of these measures and programmes are too general, with no specific support mechanism to encourage and stimulate enterprises (IER, 2006).

The new Fiscal Code (Law 571/ 2003 revised), which came into force on the 1st January 2007, introduced a package of fiscal measures for stimulating R&D activities performed by or for enterprises. This law stipulated a tax-deduction for all R&D expenditure, as well as for 20% of the R&D investment. Other fiscal incentives include non-taxation of the incomes obtained by patent owners (natural persons) from the application, or from the transfer of patents; special regimes for depreciation expenses of technological equipment and intangible assets. Investments up to €50m under the regime of scientific and technological parks are granted special fiscal facilities.

The co-financing of pre-competitive research projects launched by companies, in particular of those projects involving cooperation with the universities and research institutes, is considered the core of the activities supporting private R&D investments. In 2007, the [Romanian Committee for Research Infrastructure \(RCRI\)](#) was established for long-term planning of investments in infrastructures. Its role is to support the [National Authority for Scientific Research](#) in justifying and updating investment-related priorities. RCRI will finalize a unitary strategy for the R&D infrastructure development, resulting in the so-called national road map. The goal is to integrate the national road map for long-term research infrastructure into the European area of research.

As far as R&D human resources are concerned, the NRDIS mentions that "for the period 2007-2013, the goal will be to increase the interest in research careers, in particular through scholarships and access to research grants during the initial training of the researchers through doctoral and postdoctoral programmes, mainly in the interdisciplinary areas" (NRDIS, 2007). The number of researchers is stipulated to increase threefold by 2013. The interconnection between higher education and research organisations are supposed to allow the selection, motivation and support of talented young people towards a research career, both in the public and private sectors. Special R&D policy measures have recently been undertaken to stimulate young researchers from Romania and the Diaspora, such as strengthening the R&D

collaboration and communication with the Diaspora in the framework of exploratory workshops. This is an instrument designed to reverse the brain drain.

Since 2008, budgetary allocations are conditioned by bringing complementary sources for R&D projects and by the possibility of accessing new regional, national and international partnerships. The [IMPACT programme](#) was established in 2007 in order to enhance the absorptive capacity of European Structural Funds. It provides funding for developing feasibility studies and offers consultative support for applications submitted under SOP IEC.

Romania promotes a sustainable R&D policy of bilateral and multilateral cooperation with other countries involved in multinational programmes such as COST, NATO, EUREKA, Framework Programmes 6 and 7 etc. Projects are supported both by national and Structural Funds, the latter addressing larger partnerships between universities - research institutes and enterprises, and projects involving foreign specialists.

A summary of the main challenges in the field of resource mobilisation and the responses provided by recent policy changes is provided in the table below:

Challenges	Main policy changes
Justifying resource provision for research activities	<ul style="list-style-type: none"> Arguments for resource provision for research activities have been reinforced through the National Strategy for RDI (NRDIS) and the second National Plan for RDI (NPRDI 2).
Securing long term investments in research	<ul style="list-style-type: none"> The IMPACT Programme was launched under NPRDI 2 in order to support the absorption of Structural Funds.
Dealing with uncertain returns and other barriers to business R&D investments	<ul style="list-style-type: none"> The NRDIS contains provisions for the revival of the business, such as support measures for SMEs and start-ups. Co-financing requirements under the NPRDI 2 are expected to stimulate the increase of the share of private funds.
Providing qualified human resources	<ul style="list-style-type: none"> The NRDIS has set ambitious goals in terms of human resources. It is hoped that the measures designed will increase the attractiveness of research careers, especially for young, talented graduates from Romania and from abroad and reverse brain drain.

2.4 Assessment of policy opportunities and risks

Main policy opportunities	Main policy-related risks
<ul style="list-style-type: none"> Strategic vision of long term investment reflected in many policy documents which complement each other; A support scheme to stimulate the FP7 applications has been launched; Measures and support schemes to increase attractiveness of research careers; Financing instruments for the reintegration of Romanian researchers working abroad (starting 2007). 	<ul style="list-style-type: none"> Even though broad lines of action are clearly anchored in recent policy documents, detailed measures and actions to reach the objectives set (e.g. to increase the attractiveness of research career) are still to be determined. Delay or lack of consistency in the implementation of assumed measures (e.g.: fiscal incentives package, incentives for young researchers etc); Possible insufficient absorption capacity of national and international funds.

Two important recent policy documents (NRDIS and NPRDI 2) have addressed the weaknesses of the R&D sector in terms of resource mobilisation and have introduced development opportunities for the sector: the justification of resource provision for R&D activities has been reinforced; a strategic vision of long-term investment in research has been adopted; with the launching of the IMPACT programme, support has been provided for SOP IEC applications; and measures to increase the attractiveness of research careers have been designed.

But there are several risks related to the development of R&D resource mobilisation. Several measures are rather vague in terms of appropriateness of budgetary support to achieve desired objectives and it is yet unclear whether the measures will bring solutions to the challenges identified. Another risk is the delay in implementation or the lack of answer to the incentives designed from R&D actors.

2.5 Summary of the role of the ERA dimension

The integration process of the Romanian Research Area into the European Research Area (MERY-NASR, 2006) and the need to satisfy highly specific entry demands has had a tremendous influence on the shape and pace of R&D developments in Romania, also regarding resource mobilisation. The political commitment of 1% of the GDP for public R&D expenditures, as an answer to Lisbon Strategy requirements, gave a strong impetus to resource mobilisation.

The policy instruments adopted in Romania regarding resource mobilisation have been influenced by the European experience in the field of resource mobilisation: priorities set are similar to those of FP7; the national road-map regarding long-term investment in research infrastructure is to be aligned to European best practices.

Even if the rate of success in European Framework programmes is still low, measures have been taken to stimulate the attraction of resources from this source.

3 - Knowledge demand

The purpose of this chapter is to analyse and assess how research related knowledge demand contributes to the performance of the national research system. It is concerned with the mechanisms to determine the most appropriate use of and targets for resource inputs.

The setting and implementation of priorities can lead to co-ordination problems. Monitoring processes identifying the extent to which demand requirements are met are necessary but difficult to effectively implement due to the characteristics of knowledge outputs. Main challenges in this domain are therefore:

- Identifying the drivers of knowledge demand;
- Co-ordinating and channelling knowledge demands; and
- Monitoring demand fulfilment

Responses to these challenges are of key importance for the more effective and efficient public expenditure on R&D targeted in IG7 of the Lisbon Strategy.

3.1 Analysis of system characteristics

3.1.1 Identifying the drivers of knowledge demand

Structure of knowledge demand

Given its relative importance as a determinant of industrial output, but also due to its higher knowledge intensity, the manufacturing sector plays a significant role in knowledge demand generation. Its structure and technology levels have a strong influence on both quantity and quality of knowledge. The more important the high-tech sector is in a country, the higher and more sophisticated the knowledge demand generated.

The structure of Romanian industry reflects the prevalence of traditional industrial sectors, which use relatively low technologies and show a weak demand for knowledge. In terms of the manufacturing production in 2005, the first sectors with the largest share were from the medium-low and low tech segment: food products, beverages and tobacco, coke, refined petroleum products and nuclear fuel, and the manufacture of basic metals and fabricated metal products. Together they represented 45.3% of the total manufacturing production.

Data regarding technological and scientific specialisation is rather scarce for Romania (ERAWATCH, Country Specialisation Report – Romania, 2006). RDI investment in manufacturing, even if it does account for the largest share of total private RDI investment (62% of BERD in 2004), still remains less important than in other European countries. The EU27 average share of manufacturing BERD was 82% for the same year. In Romania, other sectors of activity, mainly agriculture, but also mining and quarrying have significantly higher shares compared to the EU27 averages (12% and 8%, respectively, compared to 0.7% and 0.4% at European level). The share of BERD allocated to services is with 10% below EU27 average.

Romanian manufacturing BERD in 2003, with €73m in absolute terms ranked among the lowest in a group of 18 European countries, most EU 15 countries and some new Member States. The sectors with the largest shares were the motor vehicles (16.2%), machinery (11.8%), electrical machinery (10.6%), and petroleum (10.6%) (ERAWATCH, Country Specialisation Report – Romania, 2006). When analysed by the criterion of technological intensity, almost a third of manufacturing BERD was performed in low-tech or medium-tech manufacturing, Romania ranking thus among the first in the same group of European countries. The share of high tech in the same year was only 7%, Romania being in this respect the second lowest in the sample ([Eurostat, 2008b](#)).

Foreign direct investment has also oriented knowledge demand. According to the data of the Romanian Association for Electronic and Software Industry (Mihail, 2007) more than 5,000 Romanian employees work in R&D or IT development and the high-tech field within MNC branches located in Romania. Over the last few years, the number of Romanian companies becoming involved in R&D projects has increased in some industrial fields such as ICT, automotive industry. The presence of foreign private funds in the ITC sector could explain why the NPRDI 2 is not very generous to this sector, compared to the European FP7 budget (*Information and Communication Technologies* have received only 10% of the programme budget, compared to 28% in FP7 Cooperation Programme), despite recognising it a priority field for research. The ICT industry is, in fact, one of the most dynamic branches in

Romania, measured in terms of added value, employment and success stories. ICT also accounts for 25% of the Romanian applications to FP7 ([NASR, 2007b](#)).

Society and its concerns can also be drivers of knowledge demand. Although little evidence exists to the extent to which societal demands directly resonate in research projects in Romania, a few examples suggest that this does happen, as is the case with certain environmental (e.g. Rosia Montana), social assistance and integration (e.g. unemployment, Roma minority) issues. An important role in voicing out the concerns of the society is played by the civil society.

In a wider sense, public authorities also address societal concerns in their strategic documents. Therefore, ministries involved in R&D, through their own R&D Structural Programs, government agencies (such as the [Agency for Regional Development](#), the [National Agency for Employment](#), the [Romanian Energy Regulatory Authority](#), the [Romanian Agency for Foreign Investment](#), the [National Agency for Mineral Resources](#) etc) and local public authorities are acting as demand drivers in the R&D field.

The Romanian Academy and the two branch academies (the [Academy of Medical Sciences](#) and the [Academy of Agriculture and Forestry Sciences](#)) are important intrinsic drivers of knowledge demand, strongly involved in basic research. Within the [NPRDI 2](#), the IDEAS programme supports basic research.

Process for identifying the drivers of knowledge demand

It should be mentioned that only recently, starting with the elaboration of NRDIS, the identification of priorities has been based on instruments such as foresight. It is encouraging though, that the first steps have been taken to a more consistent approach to identify also the drivers of knowledge demand. Since these developments are very recent, more details will be provided in section 3.3.

Advisory mechanisms are in place at different levels and their input is required in formulating strategic directions for research. At the executive level, both the presidential institution, as well as the cabinet of the prime minister, have special advisors for science and technology. The Inter-Ministerial Council for Science, Technology and Innovation provides an inter-ministerial dialogue forum on R&D and ensures the correlation of RDI policies and programmes at government level. Consultative bodies of the Ministry of Education, Research and Youth (MERY) include the Advisory Board for RDI, the [National University Research Council](#) (NURC) and the Strategic Orientation Councils at programme level within the NPRDI 2. Representatives from the science, technology and industrial communities take active part in these bodies.

Another initiative to support the relationship between demand and supply has been the setting up and consolidation of technology platforms at national level, based on public-private partnership, in relation to joint development of strategic agendas for research, for the medium and long term. They were developed with the purpose of subsequently integrating them into existing technology platforms at European level. Romania has so far established working groups with the purpose of formulating common agendas for research (so-called "mirror groups") for 25 of the 33 European Technology Platforms. Six representatives have been officially nominated within equivalent European Technology Platforms. Within two of these platforms (new materials; hydrogen and fuel cells), the collaboration of different stakeholders involved has materialised through ERA NET projects.

An overall appraisal of policy making and evaluation ranked the performance of the Romanian system as above average compared to other EU countries with respect to the openness of the process of designing innovation policy measures. The report characterised policy development as being undertaken through a partnership-based approach involving consultation with key stakeholders at all stages. However, the appraisal of the impact on innovation of developments and regulations in other policy fields was assessed as unsatisfactory until 2006. (European Trend Chart on Innovation, 2006)

3.1.2 Co-ordinating and channelling knowledge demands

A consistent attempt to coordinate and channel knowledge demand started with the [National Plan for R&D and Innovation \(1999-2006\)](#). This plan was initiated in 1999 and began with four programmes. It was updated in 2001 and 2005. If the first four programmes had a rather broad coverage (economic restructuring, quality and standardisation, infrastructure and cooperation, and international partnerships), the following ones were more specific (agriculture and food, environment, energy and resources, civil planning and transportation, life and health, biotechnologies, new materials, micro- and nanotechnologies, aeronautics and space technologies etc.). But despite these efforts to channel resources to priority areas, in 2005, 41% of GBAORD was spent on non-oriented research ([EUROSTAT, 2008](#)). This is largely due to the fact that with so many priorities, almost every project could find a place within one of the programmes of the first NPRDI. This is expected to decrease with the more rigorous current mechanisms of priorities setting and implementation, but it will probably take some time for it to be reflected in the data. More than a third of GBAORD (34%) was allotted to basic research, followed by 18.5% for industrial technologies. 12% of government financing addressed environmental protection and health, while around 9% was allocated to agriculture production and technologies.

In terms of the coordination of knowledge demand, the key actors involved are the [Ministry of Education, Research and Youth](#) through the [National Authority for Scientific Research](#) (MERY-NASR), the [National Council for S&T Policy](#) and the Inter-Ministerial Council for Science, Technology and, Innovation. While the last two have more of a role in strategic coordination, the first is mainly involved in operational coordination. Overall policy coordination in the field of innovation was assessed as “satisfactory” (European TrendChart on Innovation, 2006).

The [National Council for Science and Technology Policy](#) ensures high-level coordination of setting and implementing priorities, also involving other consultative bodies such as the Advisory Board for Research, Development and Innovation, the [National University Research Council](#) (NURC), the Strategic Orientation Council related to the programmes of the National Plan for RDI, the Trilateral Commission for Social Dialog and the Council for Research Grants of the [Romanian Academy](#). The Inter-Ministerial Council for Science, Technology and Innovation is the cooperation platform for all other ministries involved in R&D activities (see section 1.2).

[The National Authority for Scientific Research \(NASR\)](#) coordinates the process at a sectoral level, focusing on a better correlation of RDI policies with other sectoral development policies, such as: ICTs, industry, agriculture, health, energy, environment, transports, and regional development. The coordination activity of NASR refers to the bulk of the budgetary funds, but also to funds from foreign

sources (structural funds and co-financing from private sources for research projects under the National Plan for RDI).

3.1.3 Monitoring demand fulfilment

Monitoring and evaluation of national research policy measures and programmes is a relatively new exercise in Romanian R&D management and is still in its incipient stages. A recent overall appraisal of the evaluation practice related to innovation policy in Romania, pointed to an unsatisfactory evaluation culture (European Trend Chart on Innovation, 2006).

The evaluation of the demand fulfilment in the first National Plan for R&D and Innovation (1999-2006) consisted of the technical reports prepared by programme managers. They were aggregated into annual programme reports prepared by the MERY-NASR. The annual ex-post evaluation reports provided a large volume of information about the composition of programmes in terms of input and output: the types of actors and projects involved in programmes; number of the contracts; personnel involved; total public budget; co-financing funds; articles and books published in the national and international scientific review and printing houses; papers presented to national and international conferences; patents and so on. These reports, in their essence, had only monitoring character without a consistent impact analysis (Sandu S, Dinges M, 2007).

A positive aspect of the evaluation of R&D programmes carried out by MERY-NASR is the transparency and publication of the results. Annual reports are published on the ministry's website, thus available for all stakeholders and the public at large. Specialists assessed as satisfactory the regularity and transparency of policy monitoring and reviewing processes. (European Trend Chart on Innovation, 2006).

3.2 Assessment of strengths and weaknesses

Due to its specialisation in relatively low technology industries and the slow restructuring process of the Romanian economy towards high technology sectors, the knowledge demand coming from the business sector is weak. During the 1990s, public funding was not targeted, but allotted on an institutional basis. With the introduction of project-based funding, an important step has taken place towards research channelling, but experience has shown that the priorities of NPRDI [1](#) were too broad to focus research on desired topics. This weakness has been addressed by the recent policy changes and it is hoped that the existence of strategic directions for research, developed through a participatory approach, will eventually correct this weakness.

Main strengths	Main weaknesses
<ul style="list-style-type: none"> • Strategic directions for research are set through cooperation between RDI actors; • Coordination of knowledge demand through National RDI Plans. 	<ul style="list-style-type: none"> • Slow pace of industry restructuring and development with negative influence on the demand for knowledge coming from the business sector; • Weak channelling mechanisms of knowledge demand, with the result that public demand remains rather unspecific; • Lack of rigorous ex-post evaluation of impact of the implementation of priorities.

3.3 Analysis of recent policy changes

Starting from 2005 - 2006, the identification process of knowledge demand drivers has been substantially improved in the elaboration process of [the National Research, Development and Innovation Strategy, 2007-2013](#) and of the (NPRDI 2). The nine general priorities and their subsequent themes included in the Plan are the result of the exploratory exercise, the first Romanian foresight in science and technology, with a broad national participation. Specialized systems and instruments for public consultation and for developing medium and long term prognoses (including tools for forecast, foresight) have been used in order to set R&D priorities and objectives. The nine priority fields which channel applied research projects are implemented through the programme "Partnerships in priority S&T domains" (similar to the Cooperation Programme in FP7), which represents 36% of NPRDI 2 budget. The great interest the foresight exercise has attracted in the whole R&D community proves the importance of collaborative prospective approaches for the identification of areas with high scientific relevance and/or expected impact. The national R&D exercise contributed to the popularisation of the foresight techniques, and it is hoped that they will continue to be used. During the national consultations on R&D priorities, managers of large companies involved in R&D activities, representatives of producers' associations, researchers from different enterprises, and spokespersons from trade unions have represented the business sector. However, the "voice" of the business sector is still relatively weak due to considerable mistrust between the private and the public sector, which hinders efficient cooperation.

Regarding basic research, R&D opportunities were identified. To support this process, exploratory workshops have been launched.

Science shops are important platforms for communication between science and society, which might prove useful for demand identification. Supported by the Dutch Ministry of Foreign Affairs, a network of eight science shops has been set up in Romania in Iasi, Bacau, Galati, Brasov, Ploiesti, Oradea and Bucharest using EU funds ([InterMEDIU Net](#)). The NPRDI 2 through the CAPACITIES Programme plans to expand this pilot project to further improve the relationship between knowledge supply and economic and societal demand.

The main cooperation framework between research and the business sector consists of the programmes of the NPRDI 2 and the Research of Excellence Programme (2005-2008). The implementation instruments of the programmes are collaborative research projects achieved by research-industry consortia (covering around 80% of the total number of projects).

A more effective monitoring is expected based on stricter evaluation norms and standards. Quality control during project life cycle (evaluation, contracting, intermediary reports, final reception and post-implementation monitoring) has improved in the NPRDI 2. According to the Plan, outputs have to be clear with a strong push for ISI publications and patenting. The dynamics of the R&D community towards topics relevant to the society and the business sector is to be encouraged. Across all stages of running the Plan, indicators for emphasising both the direct effects (indicators of results) and the indicators of impact are used for each of the objectives.

An overview of how recent policy changes relate to identified challenges is presented in the following table:

Challenges	Main policy changes
Identifying the drivers of knowledge demand	<ul style="list-style-type: none"> • Nine priority fields were identified for applied research and exploratory workshops were launched for basic research through the NPRDI 2.
Co-ordinating and channelling knowledge demands	<ul style="list-style-type: none"> • Coordination of knowledge demand has improved with NRDIS and NPRDI 2. • NPRDI 2 through its nine priority areas aims at improving the channelling process of knowledge demand.
Monitoring demand fulfilment	<ul style="list-style-type: none"> • In the NPRDI 2 monitoring and evaluation norms have significantly improved.

3.4 Assessment of policy opportunities and risks

The number of priority domains in the NPRDI 2 has been reduced and these were formulated more specifically, with the purpose of better channelling research efforts towards business and societal demands. The fact that these priorities were selected based on an ample foresight exercise with the participation of all R&D stakeholders gives them additional legitimisation. Further knowledge demand identification measures are planned, while at the same time a better channelling of research based on identified priorities is anchored in the NPRDI 2. The same policy document includes significant improvements in terms of monitoring of knowledge demand fulfilment. Considerable risks remain in the process of implementation of announced measures.

Main policy opportunities	Main policy-related risks
<ul style="list-style-type: none"> • National R&D priorities for 2007-2013 based on foresight exercise; • Further processes for identifying the drivers of knowledge demand are planned (e.g. exploratory workshops starting 2008, technology platforms, science shops); • A better channelling of knowledge demands sustained by measures adopted in 2007; • Improvement in evaluation procedures using new quantitative and qualitative indicators. 	<ul style="list-style-type: none"> • Inefficient management of the programmes within second NRDI Plan could jeopardize reaching the priorities set; • Delay in implementing R&D measures proposed; • Lack of coordination between responsible bodies; • Although, improved monitoring and evaluation norms are provided in NPRDI, failure in successfully implementing them can put at risk the targeted objectives.

3.5 Summary of the role of the ERA dimension

An important driver of knowledge demand was the accession to the European Union. The harmonization of national strategic priorities in the field of RDI (Lisbon strategy, Barcelona target etc.) with the European ones became an operational tool for improving the quality of R&D priority setting taking into consideration certain specific conditions for our country. 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 to European R&D policy, priorities and objectives are sustained through the Research of Excellence Programme (2005-2008) and later through other programs within the NPRDI 2.

The priorities set and included in the second National Plan for R&D and Innovation are almost the same as those of FP7, but the financial allocation between the nine priority areas different. This reflects the bearing of the national interest within the European framework. The largest budget share is allocated to innovative materials, processes and products (15%), followed by *environment* (14% in Romania, 7% in FP7) and *health* (14% in Romania, 19% in FP7). *Information and Communication Technologies* have received only 10% of the programme budget, compared to 28% in FP7 Cooperation Programme.

An effort to adopt European best practices regarding identification, coordination and monitoring of knowledge demand has resulted in significant research policy improvements.

4 - Knowledge production

The purpose of this chapter is to analyse and assess how the research system fulfils its fundamental role to create and develop excellent and useful scientific and technological knowledge. A response to knowledge demand has to balance two main generic challenges:

- On the one hand, ensuring knowledge quality and excellence is the basis for scientific and technological advance. It requires considerable prior knowledge accumulation and specialisation as well as openness to new scientific opportunities, which often emerge at the frontiers of scientific disciplines. Quality assurance processes are here mainly the task of scientific actors due to the expertise required, but subject to corresponding institutional rigidities.
- On the other hand there is a high interest in producing new knowledge, which is useful for economic and other problem solving purposes. Spillovers, which are non-appropriable for economic knowledge producers as well as the lack of possibilities and incentives for scientific actors to link to societal demands, lead to a corresponding weak exploitability challenge.

Both challenges are addressed in the research-related Integrated Guideline and in the ERA green paper.

4.1 Analysis of system characteristics

4.1.1 Improving quality and excellence of knowledge production

Although there are signals of better coordination of R&D, especially after EU accession, in Romania, knowledge production is achieved within in a very fragmented R&D system (Agachi, 2006) with many institutions belonging to different coordinating bodies producing basic and applied research (see chapter 1.2.). The R&D system, unlike other European R&D systems, is concentrated, to a greater extent, in different of R&D organizations and units other than universities. Public R&D organisations are the most active R&D actors, while higher education institutions have been until recently only marginally involved in R&D activities. The fragmentation, low funding and isolation of the R&D system, as a legacy of the past, has had a negative impact on the quality of knowledge production, especially in the first years of transition to the market economy. During the 1990s the R&D system

went through a long restructuring and reconfiguration period. It was a time when emphasis was laid more on “survival” than on excellence. This approach has seriously affected the quality of knowledge production, expressed both in publications and patents.

Romania still has good researchers and tradition in several areas of science and technology such as mathematics, physics, chemistry, material sciences and engineering (ERAWATCH, Country Specialisation Report – Romania, 2006). Engineering and natural sciences accounted for 58.7% of the total researchers in 2006 as compared to 75.3% in 2001. In the same year, agricultural and social sciences employed about a quarter of researchers.

Romania ranks low among EU countries regarding the number of publications. Its contribution to the overall world scientific productivity between 1995 and 2005 was 0.07% for citations and 0.2% for publications (AdAstra, 2006). Romania had an average number of citations of only 3.46, almost three times below the world average citations per paper (9.43) during this period. Taking into account the number of ISI indexed publications, Romania ranked 48th among 146 countries in terms of citations and 43 in terms of publications. A fourfold increase in Romania’s scientific productivity is required in order to reach the level of other new Member States, while an eightfold increase is needed to reach EU27 average level (ERAWATCH, 2006). However, when looking at the knowledge productivity (i.e. output / resources), the performance of the Romanian R&D system is less dramatic, suggesting that the main reason for the low performance has been the low investment in R&D (Agachi, 2006).

During the preparation of Romania for EU membership, complex comparative analyses of the R&D systems have revealed significant gaps between Romania and the European countries in terms of configuration, performance and financing mechanisms. To address the problems mentioned above, as well as to promote the integration of the Romanian R&D system into the European Research Area, the “Research of Excellence” Programme (CEEX) was initiated. The experience in its implementation over the last two years has already brought about changes in the structure of R&D. High tech projects in nanotechnologies, biotechnologies, ecotechnologies and ICT have been prioritised in the allocation of funding. The CEEX Programme was basically designed as a “training” instrument to enhance the Romanian participation in EU programmes and the quality of knowledge production. The experience accumulated during the CEEX Programme has been used in the new funding schemes started in 2007 (described in chapter 4.3).

The most important mechanism to warrant excellence in science is the correlation of financing resources allotted to each R&D organization with scientific excellence and with the economic and social usefulness of its scientific results. The Romanian Academy and the other branch academies of sciences, the National University Research Council and different ministries, each of them for their R&D subordinated organisations, gradually adopted the competitive system of funding for programmes or through research grants.

An important driver for excellence fostering within all R&D units, yet to be fully exploited has been the cooperation and scientific networking with partners from ERA. Even though Romania did not manage to recuperate its contribution to FP6 (MERY-NASR, 2006 and 2007b), seen from a long-term perspective, the experience acquired by Romanian researchers involved in international research programmes is

expected to have a positive impact on the quality of R&D knowledge production (MERY-NASR, 2007b).

Scientific excellence in the higher education system is stimulated by a regular performance evaluation. A tendency towards aligning evaluation to international standards could be observed in recent years. Best performers were stimulated by preferential treatment with regard to funding and by other types of support. The practice of giving awards and bonuses for ISI quoted papers has been extended.

4.1.2 Improving exploitability of knowledge production

Weak exploitability of knowledge production has been a characteristic of the Romanian R&D system during the transition period and still continues to remain a serious challenge. One essential shortcoming of R&D planning procedures consists in the lack of strategic guidance during the last decades. This has led to serious overlapping, effort dissipation and lack of consistency, compatibility and coordination in the process of knowledge production, thus hampering proper integration of societal and economic needs into R&D priorities.

The intensity of patents, 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. The number of national patents is also low and was decreasing continuously during 2004-2007. For the period 1999-2006, more than 51% of the new national patents registered with the Romanian State Office for Inventions and Trademarks were owned by individuals, 27% by companies, 19% by research institutes and only 3% by universities (SOIT data, 2008).

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 reduces the incentives for researchers to produce high quality, exploitable research outcomes. Private R&D institutes proved more interested in obtaining domestic or international grants, than in competing for contracts from the business sector. These funds, not being strongly monitored by the institutions in charge, did not produce expected results. The low accountability of publicly funded projects was one of the main factors leading to modest exploitability of R&D results.

Economic exploitability was not a quality criterion for support of public R&D and pre-competitive programmes. Although in the NPRDI [1](#), more than 5,200 new products were reported, out of which 55% were claimed to have been put into production, the reduced number of patents and the small number of innovative firms make questionable the credibility or usefulness of the R&D results. The experience accumulated during the NPRDI 1 has emphasised the importance of continuous monitoring and of establishing consistent benchmarks in order to correlate research input with the output and economic and societal demand.

Effective mechanisms to appropriate knowledge returns are still in the early stage of development. The State Office for Inventions and Trademarks and the Romanian Copyright Office are the main institutions in charge with the protection of industrial property, copyright and related rights. The patent law and intellectual property rights (IPR) as mechanisms to appropriate knowledge returns have been harmonised with

European legislation and international principles. A special Strategy of Intellectual Property Rights in Romania for 2003-2007 has been elaborated, but its impact is not yet visible. Setting up the legal and institutional framework, although an important first step, it is not sufficient to ensure an effective exploitability of knowledge. There are other challenges, such as law enforcement, competition in the science market, relevance of scientific output, which are still to be tackled.

Reforms and policy changes within the last years have sought to mitigate these adverse effects (for a more comprehensive discussion of the recent policy changes see section 4.3). An area in which an improvement could be observed in the last years is the increasing cooperation between private enterprises and the higher education R&D sector. An important number of employees in private enterprises have benefited from grants and scholarships with the purpose of further education at MBA and PhD level. On the other hand, teaching staff and students have benefited from hands-on experiences gained in the labs and R&D centres of private enterprises. Research departments in universities, especially in technical universities, have received increasing support from industry to better match the specialization of scientific knowledge production to that of the economy.

Some of these universities have, recently, decided to adopt programmes containing specific incentives for entrepreneurship and innovative behaviour (e.g. the Bucharest Polytechnic University). Others have set up their own patent innovation and implementation centres (e.g. Timisoara and Cluj Napoca Technical Universities). High-tech industrial platforms were established within technical universities (Bucharest Polytechnic University, Transylvania University in Brasov), while other universities became part of technological parks (Gheorghe Asachi University in Iasi). All these new structures aim to stimulate and support collaborative academia-industry research programs, the development of clusters of excellence and foreign direct investments in high tech.

Strengthening science-industry linkages is a major challenge, considering the country has a low level of innovation and lags significantly behind other EU countries, particularly in the business sector. Public-private partnerships are becoming a more and more effective tool in S&T development. They take the form of competence centres, technological platforms, and S&T parks. The access of innovative firms to RDI co-funding schemes has been simplified, and their collaboration with academic research and public R&D units has been supported.

4.2 Assessment of strengths and weaknesses

Even though, Romania has a long tradition of excellence in knowledge production in certain research fields, at an overall assessment the number of ISI publications and of patents is very low. In addition to this, the exploitability level is modest, a situation which could be explained by the fact that within framework of NPRD 1 and previously, exploitability of results was not given sufficient consideration in the decisions regarding the allocation of funds. Weak monitoring of results of projects funded from public funds has been correlated with low accountability of R&D performers. On the positive side, the CEEX programme was launched in 2005 to stimulate excellence and the adoption of EU good practices in the R&D sector is an important first step towards better results.

Main strengths	Main weaknesses
<ul style="list-style-type: none"> • Long tradition of knowledge production in some research fields; • Programmes encouraging scientific excellence since 2005; • Integration of EU good practices into Romanian financing schemes, such as allocation of funding based on competition, is an important prerequisite for quality knowledge production. 	<ul style="list-style-type: none"> • A modest number of ISI publications and a reduced number of patents, mainly generated by the low R&D funding in the past years; • Knowledge production does not match to a necessary extent economic and societal demands, which leads to low exploitability of R&D results; • Exploitability was not given sufficient weight in the funding allocation process and the evaluation of results; • Weak accountability of public funded projects.

4.3 Analysis of recent policy changes

Recent policy changes were adopted in 2007, with significant expected results for the RDI sector in terms of quality and exploitability. The National Research Development and Innovation Strategy, 2007-2013 sets objectives aimed at improving the quality of knowledge production, such as obtaining high quality scientific and technological results, and being competitive in the global arena. Internationally recognized schools of excellence, supported by special programmes, are supposed to ensure the critical mass and the required facilities for high performance research. Poles of excellence are planned to be established by concentration of R&D funds on projects proposed by highly recognised researchers at an international level. The training of young researchers in doctoral or postgraduate schools of excellence is to be specifically emphasized, thus preparing them to participate in advanced research. For that purpose, postgraduate schools will have to attract researchers with high performance track records, experienced in coordination young doctoral students, of any nationality.

The NPRDI 2 has notably drawn upon the shortcomings of the previous plan, thus improving incentive mechanisms, in order to ensure research quality and exploitability. A diversification of project financing instruments conducive to excellence has also been included. Several programmes within the NPRDI 2, which have addressed the knowledge production challenges mentioned in section 4.1, are presented below. All of them are competition-based programmes, with more rigorous criteria compared to the programmes of the first NPRDI 1.

The "[Exploratory Research Projects](#)" Programme (**PN-II-ID-PCE-2007-2**) has as main goal "the development of the knowledge in all the research domains, both by fundamental and advanced research" and is aimed at small research teams. The "[Complex Exploratory Research Projects](#)" Programme (**PNCII-ID-PCCE-2008-1**) encourages the "development of knowledge through fundamental research with advanced inter and trans-disciplinary character". Through this programme, much higher budgets are allotted per funded project, requiring large research teams and institutional collaboration. Having distinct evaluation procedures (the first has a single stage, while the second has a two stages evaluation procedure), in both sub-programmes a proportion of 75% from the total maximum number of points which can be obtained in the evaluation process, is devoted to criteria concerning the scientific quality of the proposal and the scientific authority of the research team. Evaluation and approval of project proposals is carried out by Romanian and foreign expert panels.

Complex research responding to clearly identified problems priorities is already supported through the [Partnerships programme](#). Involving demand-side representatives in RDI projects encourages the focusing of research efforts towards clearly identified problems. The exploitability of research results is to be also improved through the [Innovation programme](#), which finances projects initiated and developed by enterprises.

An aspect significantly changed in the new policies designed to improve quality and exploitability of knowledge production is the evaluation process. Experience in the past has shown that poor monitoring and evaluation have led to inefficiencies; therefore the process of evaluation has been completely redesigned, from the evaluation of project proposals to the evaluation of implementation, results and impact. The evaluation of the proposals within the framework of NPRDI 2 is mainly focused on the criteria of scientific and technological quality, project management, economic and environmental impact, taking into account results dissemination and utilisation. The quality control of project financing has been improved in several aspects, namely: pervasive online evaluation combined with panel mediation; feedback of the peer reviewers available to the applicants; contractual output commitment (e.g. an international article per senior researcher in exploratory research projects); intermediary and final project reception based on evaluation; and transparency regarding projects and outputs through creation of public online databases.

However, the monitoring system is still in the process of being designed. Efforts are made to create unitary databases and thus to increase the credibility of reported results and avoid double reporting. Additional steps are to be taken to define clear indicators, to provide procedures regarding the collection and aggregation of the monitoring data, and to establish an institutional framework for the monitoring.

A new change in R&D policy was introduced by the Government Decision nr 551 / 2007, which stipulates that, starting from 2008, access to public funding is restricted to R&D units with attestation and accreditation certificates. At the same time, rigorous performance criteria (ISI publications, demand oriented projects) regarding the evaluation of researchers and institutes have been introduced. Each R&D unit has to accomplish a minimum necessary level of performance in order to be accredited or attested.

Recent policy measures taken by the Government ensure the financing of the free access of researchers to outstanding reviews and publications worldwide (MERY-NASR, 2007). Together with awards for ISI publications (see section 4.1.1), this measure is a new incentive to enhance the quality of the knowledge production. The Sectoral Operational Programmes Human Resources Development, Increasing of Economic Competitiveness, Environment Infrastructure and Regional Operational Programme (ROP) also represent important R&D funding tools focused on quality knowledge production and improved exploitability.

Main challenges in the field of knowledge production and the corresponding main policy changes are summarised in the following table:

Challenges	Main policy changes
Ensuring quality and excellence of knowledge production	<ul style="list-style-type: none"> • Programmes of NPRDI 2 geared towards excellence: IDEAS, Partnerships, and Innovation programmes; • Promotion of poles of excellence through the NRDIS and NPRDI 2; • The NPRDI 2, SOP HRD, IEC, EI and ROP programmes ensure funding for quality and excellence of knowledge production.
Ensuring exploitability of knowledge production	<ul style="list-style-type: none"> • Both ex-ante and ex-post evaluation processes have been improved with a focus on quality and exploitability.

4.4 Assessment of policy opportunities and risks

Recent policy documents have drawn upon the experience of the previous R&D financing tools and they have incorporate incentives for quality and excellence in knowledge production, such as compulsory output commitments for exploratory research projects. The evaluation process has been improved throughout the project life cycle. But the opportunities arising from the recent policy changes could be put at risk by a slow implementation. Moreover, it is not clear whether the measures will achieve their intended results.

Main opportunities	Main risks
<ul style="list-style-type: none"> • Excellence orientation of project evaluation criteria supported by specific measures, such as output commitments, international evaluation for large projects (starting 2008); • Integrated monitoring system including measurable strategic targets and output indicators for different programmes. 	<ul style="list-style-type: none"> • A slow pace of policy implementation may delay improvement of knowledge production; • It is not clear how the proposed measures would be translated into better R&D performance (increasing number of patents, ISI articles, brands, trademarks, know-how) • Low exploitability of research results might continue, if chosen incentives prove to be inefficient or insufficiently related to ERA programmes. • The monitoring system is still in the process of being designed in its details, the intended outcomes depending on the success of its implementation.

4.5 Summary of the role of the ERA dimension

The European Research Area has played a consistent role in determining the R&D policy mix in Romania with regard to excellence and exploitability of knowledge production. The advantages offered by the integration into ERA are directly related to the participation of Romania in the single labour market for researchers, benefiting from a high quality R&D infrastructure, sharing knowledge and optimising programmes and priorities.

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 were promoted, in an attempt to strengthen absorptive capacities of both public and private creators and users of knowledge. ERA helped initiate and

strengthen links between actors of knowledge production, with the result of an improved knowledge diffusion and exploitation. The main directions in which ERA is strengthening the knowledge production of research institutions are: 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, promoting inter- and trans-disciplinarity and labour force mobility. Romanian researchers have had many opportunities for cooperation and mobility within the European Research Area, to learn more and to understand what performance in science means and the factors influencing a successful R&D career.

5 - Knowledge circulation

The purpose of this chapter is to analyse and assess how the research system ensures appropriate flows and sharing of the knowledge produced. This is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production. Knowledge circulation is expected to happen naturally to some extent, due to the mobility of knowledge holders, e.g. university graduates who continue working in industry, and the comparatively low cost of the reproduction of knowledge once it is codified. However, there remain three challenges related to specific barriers to this circulation, which need to be addressed by the research system in this domain:

- Facilitating knowledge circulation between university, PRO and business sectors to overcome institutional barriers;
- Profiting from access to international knowledge by reducing barriers and increasing openness; and
- Enhancing absorptive capacity of knowledge users to mediate limited firm expertise and learning capabilities.

Effective knowledge sharing is one of the main axes of the ERA green paper and significant elements of IGL 7 relate to knowledge circulation. To be effectively addressed, these require a good knowledge of the system responses to these challenges.

5.1 Analysis of system characteristics

5.1.1 Facilitating knowledge circulation between university, PRO and business sectors

The first actors of knowledge circulation in Romania are its producers: R&D public institutions, universities, enterprises and, to a certain extent, private research departments or centres. Beside research entities directly or indirectly involved in knowledge circulation, a particular role in this domain pertains to co-ordinating public entities (ministries and agencies involved in R&D activities, as well as other intermediaries, such as Programme Management Units, e.g. the Managerial Agency for Scientific Research, Innovation and Technology Transfer), together with NGOs,

the Chambers of Commerce, science shops networks and scientific, industrial and technological parks and platforms, knowledge incubators and brokerage centres.

Knowledge circulation between knowledge producers and users is supported, at national and regional levels, by several institutions, policies, programmes and a special legal framework compatible with EU and international regulations. Functional autonomy of R&D entities is one of the important premises, which enhances knowledge circulation through various channels.

Many business and technological parks and incubators deploy significant effort in the direction of knowledge transfer, by offering a large variety of R&D services, such as access to communication infrastructure and databases, assistance for innovation and technology transfer, technological audit, studies, consultancy on industrial property rights. These are important steps, which gradually enhance the role of the private sector in knowledge circulation.

The National Authority for Scientific Research (NASR) has, among other responsibilities that of the dissemination of information in the R&D domain, publication, diffusion and stimulation of technology transfer as well as of innovation results to economic agents and society at large. The Direction of Technology Transfer and Infrastructure, within NASR, is directly involved in supporting knowledge transfer between different sectors of economy. Each research project devotes a certain proportion of funds for dissemination of research results to different categories of beneficiaries free of charge or with co-financing contribution.

The NPRDI 1 had several programmes encouraging not only technology circulation as such, but also researcher mobility and knowledge diffusion in various ways (workshops, conferences, symposia, researcher exchange programs, academic spin-offs etc.).

The National Network for Innovation and Technology Transfer (ReNITT) supports the setting up and development of technology transfer centres, industry liaison offices, scientific and technological parks and technological and business incubators (NASR, 2007). ReNITT includes at present 42 temporarily authorised entities, of which 15 incubators, 12 centres of technology transfer, and 15 centres of technology information. These entities are functioning in Arad, Bucharest, Cluj Napoca, Craiova, Deva, Iasi, Ramnicu Valcea, Timisoara, and Tulcea. They are accredited according to the HG 406/2003. NASR authorised also the functioning of four scientific technological parks (Law nr.50/2003) situated in Bucharest, Iasi, Timisoara and Galati.

Infrastructure units, such as technology transfer centres, science parks and incubators, developed until 2007 are becoming active factors of knowledge circulation, ensuring an exchange interface for different users at national and international levels. The increase in the recent years of available funds and of the relative weight of targeted research has mostly boosted horizontal collaboration (i.e. PROs and R&D units of the business sector) and to a lesser extent the vertical one (i.e. between knowledge producers and beneficiaries). This situation is expected to change over the coming years.

The national education system plays an important role in producing and disseminating systematic, coherent, credible and publicly accessible knowledge in accordance with the new quality requirements for accreditation of secondary and higher education units and programmes. Within universities a network of centres for

innovation and technology transfer has recently been set up, ensuring the transfer of knowledge produced to potential users (R&D entities or private companies) on a commercial basis. Joint R&D projects between universities or research institutes and enterprises generate and develop new channels of knowledge diffusion and transfer. The cooperation between universities and industry can either take the form of a mutually beneficial exchange (e.g. of high skilled personnel) or of contracting of one side by the other (e.g. consultancy offered by academic staff as a first step towards a future research consortia, legal arrangements for short term employment contracts, special courses for industrial employees etc.). Despite these efforts, the connection between industry, universities and research units remains weak, a situation which could be explained through the relatively autarchic development of R&D during the last two decades and to the weak demand for R&D of the business sector.

Science shops (see section 3.3) can have a positive influence on knowledge circulation, as they have the stimulation of knowledge dissemination as one of their main objectives. The extension of the pilot project financed by the Dutch Ministry of Foreign Affairs is planned to be realised within the framework of the NPRDI [2](#).

5.1.2 Profiting from access to international knowledge

As a new member of the EU, Romania is closing up the gap at present, thus benefiting from a multitude of international knowledge circulation channels; however these have not been yet effectively exploited to their full potential, due to insufficient links to the international research community.

For Romanian researchers, involvement in COST actions and EUREKA projects can pave the way toward forging sustainable European partnerships, which can in turn give rise to future projects under the EU Framework Programs for Research and Technological Development. Based on intergovernmental agreements, Romania jointly manages scientific and technical programs along with countries all over the world at a rate of about 440 projects per year. Over 40% of them are carried out in Europe and are aimed at developing a sufficient number of projects to uphold the country's future participation in the EU Framework Programmes. At the same time, Romania has taken an active part in regional cooperation:

- *In South-Eastern Europe and the Western Balkans*, NASR helped draft along with fellow project members the first regional call under the South East European ERA NET (SEE ERA NET).
- *In the Black Sea region*, Romania, which is an active member of the Black Sea Economic Cooperation (BSEC) initiative, took over the presidency of the BSEC Working Group for Science and Technology (WGST) last June.

The international mobility of human capital has been supported under a range of financial schemes. Also, mobility costs were eligible for deduction in the NPRDI research projects, and participation with presentations to international conferences has been financially supported. Yet, most research programmes within the first NPRDI were closed to direct foreign participation.

Romanian Mobility Centres have been set up in Bucharest, Cluj, Timisoara, Craiova, Constanta and Brasov, with the purpose of facilitating researchers' mobility within and outside the borders of Romania. The Romanian Researchers' Mobility Portal provides valuable information on the organisation of R&D institutes, on fellowships and grants, research careers and vacancies. The inter-sectoral mobility of

researchers remains reduced, mainly due to the considerable gap between the wages of highly skilled employees in the business and public research sectors.

5.1.3 Absorptive capacity of knowledge users

The absorptive capacity of knowledge users is rather limited. According to the Community Innovation Survey 2004, the share of innovative enterprises expressed as a percentage of all enterprises in Romania was of 19.5%, which places it third to last. This represents only a very modest improvement compared to 2002, when the share was 17%. Only 27.9% of the innovative enterprises have introduced new or improved products to the market, compared with an average of 35.9% at EU27 level. According to the [INNO-Policy TrendChart Country Report for Romania](#) (2007), SMEs accounted for the largest part of innovative companies (86%), of which 55% were small- and 31% medium-sized enterprises. An analysis by economic activity of innovators shows that the majority represent industry (67.5%), with manufacturing accounting for almost two thirds of this, while services had a share of 32.5% (Statistics in Focus, 2007 and INNO-Policy TrendChart, 2007).

The degree to which Romanian SMEs are involved in innovation cooperation is very low; Romania ranks the very last among EU Member States. Complex innovation in high tech fields depends on the ability to draw on diverse sources of information and knowledge, or to collaborate on the development of research projects or an innovation.

Technological transfer of R&D results is quite low because in fact there is little transferable knowledge. As “transferable products” have a rather unclear definition, in the period 1999-2006 their reported number was considerably larger than the implemented ones. However, resulting from the INVENT programme of the National Plan for R&D and Innovation (1999-2006) a catalogue of such products put into production is available.

Regional distribution of knowledge circulation in Romania is still suffering from significant discrepancies and gaps. In fact, the highest level of knowledge transfer is taking place in relatively developed regions and cities, the less developed ones lagging behind and underperforming as far as knowledge circulation is concerned. This is a challenge for achieving social, economic and scientific cohesion.

The European Innovation Scoreboard (EIS) 2006 ranked Romanian performance in terms of innovation significantly below average. Both in terms of SMEs collaboration on innovation and in-house innovations, Romania is well behind EU25 average. The first indicator needs to increase fourfold, while the second should double in order to catch up with average European performance. The degree to which Romanian SMEs are involved in innovation cooperation is particularly worrying; Romania ranks the very last among EU Member States in this respect. Complex innovation in high tech fields depends on the ability to draw upon diverse sources of information and knowledge, or to collaborate on the development of research projects and innovation.

5.2 Assessment of strengths and weaknesses

The infrastructure needed to support knowledge circulation is in place and the mobility of researchers is supported through existing initiatives. Romania is also an active member in regional cooperation projects. But weaknesses persist, thus

impairing knowledge circulation: regional knowledge diffusion is weak, international know-how is not fully exploited and the absorptive capacity of SMEs remains limited.

Main strengths	Main weaknesses
<ul style="list-style-type: none"> • Infrastructure to sustain knowledge circulation. NASR offers logistic support for technological platforms, incubators and industrial parks; • Active partnership in regional cooperation (SEE ERA NET; BSEC). • Support for mobility of researchers; 	<ul style="list-style-type: none"> • International know-how not fully exploited due to unsatisfactory links to the international research community; • Low absorption capacity of knowledge by SMEs; • Weak regional knowledge diffusion in underdeveloped areas.

5.3 Analysis of recent policy changes

Recent policy decisions attach a high importance to the objectives of improving knowledge circulation, as a support for science-industry links at national and regional levels.

The [Sectoral Operational Programme - Increasing of Economic Competitiveness](#) (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 ways 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 by institutes and universities, within S&T parks).

In order to improve knowledge circulation between the research and business sectors the government has reinforced with the NPRDI 2 the policy of stimulation of R&D public private partnerships, through mandatory co-financing from the private sector, as well as through the **Partnerships programme**, and of research infrastructures for technology transfer, through the **INFRATECH programme**. The **INFRATECH programme**, (within the framework of the NPRDI 2) aims to stimulate the founding of technology and business incubators, technology transfer centres, technology information points, S&T parks, as well as offices matching industry demand with technological research supply. This multi-annual programme will continue up to 2009.

The **Innovation Programme** plays also an important role in knowledge circulation. The policy of knowledge circulation is conceived, structured, funded and monitored based on four modules, which support technology transfer, the development of entities and structures for innovation support and services for innovation in R&D institutes assisting SMEs innovating activities.

As part of the **Human Resources programme** of NPRDI 2, a new financing scheme for mobility of PhD students was launched in 2008. It supports up to 3 months in a research laboratory and it covers the mobility and cost of access to the research infrastructure. It should be also mentioned that, starting in 2008, through NPRDI 2, foreign researchers are actively encouraged to participate within national programmes.

Since 2008, Structural Funds strongly encourage large inter-sectoral collaborative projects, enabling the 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 remains whether Romanian R&D units and companies have the capacity to elaborate consistent proposals to access these funds, and thus benefit from knowledge circulation.

Encouraging the R&D activities of start-ups and consolidated enterprises in different forms through structural funds will also increase their ability of collaborate with the R&D units. In order to support SMEs to access the structural fund for R&D, NASR 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.

In 2007, the Government sustained various programmes financed from the state budget for SMEs, which are now in the initial phase of their implementation; therefore, the outcomes of these programmes cannot yet be adequately estimated or measured. All of these programmes have 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.

Main challenges in the field of knowledge circulation and main corresponding policy changes are summarised in the table below:

Challenges	Main policy changes
Facilitating knowledge circulation between university, PRO and business sectors	<ul style="list-style-type: none"> • Knowledge circulation between university, PRO and the business sector is supported through several programmes of the NPRDI 2, such as Partnerships and Infratech.
Profiting from access to international knowledge	<ul style="list-style-type: none"> • The Human Resource programme of the NPRDI 2 supports international mobility of researchers; • International collaboration is stimulated through Structural Funds.
Absorptive capacity of knowledge users	<ul style="list-style-type: none"> • Various programmes to support the absorptive capacity of knowledge users, especially SMEs (e.g., Innovation programme of the NPRDI 2) have been adopted.

5.4 Assessment of policy opportunities and risks

Important opportunities have been created with the recent policies regarding knowledge circulation. Several of the NPRDI 2 programmes (e.g. Partnerships, Infratech, Innovation, Human Resources), as well as the SOP-IEC contain important measures designed to improve knowledge transfer between universities, PROs, and industry, to support the linkage of Romanian researchers to international research networks and to enhance the absorptive capacity of knowledge users, especially SMEs. But the success of all these proposed measures can be put at risk by a lack of coherence, coordination and by the interference of political factors in the knowledge flow.

Main policy opportunities	Main policy-related risks
<ul style="list-style-type: none"> • Structural Funds (starting 2008) support inter-sectoral and international scientific cooperation; • Involvement of international experts in R&D projects (starting 2008), which aims at improving and fostering knowledge circulation channels at national and international levels; • Mobility schemes for PhD students enabling a closer national and international cooperation, visibility and complementarity; • Financial schemes supporting knowledge circulation for SMEs. 	<ul style="list-style-type: none"> • Lack of coherence of R&D strategies and policy implementation; • Frequent changes and interference of political factors; • Weak coordination of funds allocated to knowledge circulation programmes at national and regional levels.

5.5 Summary of the role of the ERA dimension

In the ERA context, Romania has better access to scientific knowledge and information available at EU level and can more easily adopt good practices in the area of knowledge circulation. The process of identifying weak knots in knowledge channels and flows, as well as the identification of the weakest link in systems of knowledge circulation is enhanced through the participation in ERA. These are issues of primary importance, which need to be addressed; otherwise they have the potential to negatively affect the R&D domain as a whole.

The [Centres for mobility of researchers in Romania](#) (Romob), part of the ERA MORE initiative (The European Network of Mobility Centres), facilitate the mobility of researchers. ERA is a sustainable factor for setting up partnerships with EU countries to improve knowledge sharing and decision making at national and local level concerning human resources circulation problems: brain drain, brain gain and brain loss.

6 - Overall assessment and conclusions

6.1 Strengths and weaknesses of research system and governance

The focus on R&D mechanisms to stimulate an increase in the quality of human resources and of the research results, on intensification of knowledge transfer through closer relations between academy and industry are an important concern for different government bodies, NGOs and R&D institutes. The new instruments of financing, put in place since 2005 and improved with the new [National Research, Development and Innovation Strategy 2007-2013](#) and the second National R&D and Innovation Plan (2007-2013), 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.

Despite these good developments, the R&D system is still confronted with serious weaknesses regarding its performance and the governance of research activity. While the public financing system is gradually being transformed into a competitive one, the dynamics of business R&D funding are not positive. The contribution of the

business sector to R&D financing has decreased starting in 2004 from 0.18 % of GDP to 0.14% in 2006, which is far from reaching the Barcelona target till 2015. The recent R&D and Innovation strategies and policy instruments aim to correct this situation. They include measures focused on stimulating the role of the business sector in R&D by means of fiscal incentives and venture capital for the development of innovative industries.

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. At present, the main cooperation framework between research and the productive sector consists of the national RDI programmes and direct orders (RDI procurement). The legal framework and the financial instruments to stimulate research activity and the application of research results in the economy (i.e. risk capital funds for high-tech start-ups, and spin-offs) are weak, as are tax incentives to foster innovation activities in enterprises. 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.

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 reduces the incentives for researchers 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 innovation and technology transfer (ITT) infrastructure, namely the organisations specialised in the dissemination, transfer and valorisation 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.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	Investment in R&D has been given high consideration at political level. Public debate was kindled and measures to improve public awareness of the importance of R&D activities are in place.
	Securing long term investment in research	The significant increase in the share of R&D public expenditures in GDP as well as the introduction of multi-annual commitments support long-term investment in research. The absorptive capacity of Structural Funds is low, Romania being so far a net contributor.
	Dealing with barriers to private R&D investment	Private R&D investment remains modest compared to EU standards and continue to decline. Business R&D is largely dependent on public funding.
	Providing qualified human resources	The performance of the higher education system has improved in recent years following reforms and restructuring. Research careers remain unattractive for talented young graduates.

Domain	Challenge	Assessment of strengths and weaknesses
Knowledge demand	Identifying the drivers of knowledge demand	The slow pace of industry restructuring and development has a negative influence on the demand for knowledge coming from the business sector. Despite the existence of mechanisms for identification of priorities and of the institutional framework responsible for the process, public demand for R&D still remains unspecific. Strategic decisions are based on a participatory approach.
	Co-ordination and channelling knowledge demands	The coordination of knowledge demand is realised through National RDI Plans. Channelling mechanisms are still weak.
	Monitoring of demand fulfilment	A rigorous ex-post evaluation of impact of the implementation of priorities is lacking.
Knowledge production	Ensuring quality and excellence of knowledge production	The scientific performance of knowledge production reflected in intensity of ISI publications and of patents remains low. There are however some research fields in which Romania has a long tradition of quality knowledge production. New R&D programmes, launched since 2005, provide competitive based funding and are important tools to ensure excellence of knowledge production.
	Ensuring exploitability of knowledge	Knowledge production does not match economic and societal demands, which leads to low exploitability of R&D results. Low exploitability was also a consequence of weak accountability of public funds. Exploitability of results was not given enough weight in the evaluation of projects under NPRDI 1.
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	A sound infrastructure to sustain knowledge circulation is in place. Several programmes extend support for joint R&D projects between university, public research units and the business sector.
	Profiting from international knowledge	Romania is involved in active partnerships in regional cooperation (SEE ERA NET; BSEC). Support for mobility of researchers has been extended. International knowledge was not fully capitalised due to weak links to the international research community.
	Enhancing absorptive capacity of knowledge users	SMEs have a low absorption capacity of knowledge. Regional knowledge diffusion remains weak in underdeveloped areas.

6.2 Policy dynamics, opportunities and risks from the perspective of the Lisbon agenda

All the main policy measures taken within the last couple of 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 Development Plan (NDP), 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 different strategies offer answers, more or less suitable, to the requirements of the Lisbon Agenda. This has given a strong impetus to resource mobilisation with the goal of reaching 1% of R&D expenditures in GDP. The increase in available resources is expected to improve the performance of

the R&D system, if coupled with a more appropriate allocation of funds according to priorities. The stimulation of the academy-industry relations through scientific cooperation and mobility is hoped to benefit knowledge production and circulation. The Lisbon Strategy has offered a set of benchmarks for the measurement of competitiveness, as well as best practices, which aim at avoiding risks for the R&D activity.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	A strategic vision of long-term investment is reflected in many policy documents, which complement each other. A support scheme to increase Romanian participation in FP7 has been launched. Measures and support schemes to increase attractiveness of research careers have been initiated. Financing instruments for the reintegration of Romanian researchers working abroad were introduced.	Detailed measures and actions to reach the objectives set are still to be decided and they will be crucial to determine the success of resource mobilisation. A delay in the implementation of assumed measures could jeopardize the attainment of the objectives set. Insufficient absorption capacity of national and international funds could have adverse effects on R&D activity.
Knowledge demand	National R&D priorities for 2007-2013 were based on a foresight exercise and further processes to identify the drivers of knowledge demand are planned (e.g. exploratory workshops, technology platforms, science shops). The policy measures adopted in 2007 represent sound premises for a better channelling of knowledge demand. An improvement of the monitoring and evaluation procedures is anchored in recent policy documents.	An inefficient management of the programmes within the NPRDI 2 or a delay in its implementation could prevent reaching the ambitious objectives set. An inefficient coordination between the different institutions with responsibilities related to the identification and channelling of knowledge demand could represent risks for the R&D system. Weak monitoring of knowledge demand could prevent an alignment of R&D supply and demand.
Knowledge production	Project evaluation is oriented towards excellence. This is supported by specific measures, such as compulsory output commitment for exploratory research projects and international evaluation for large projects (both starting 2008). An integrated monitoring system including measurable strategic targets and output indicators for different programmes is targeted by recent policy changes.	A slow pace of policy implementation may delay improvement of knowledge production. Although measures are in place in order to ensure the quality of scientific outcome, their translation into an increased number of patents and publications remains open for post-implementation evaluation. The risk therefore remains that a low exploitability of research results might continue, if chosen incentives prove to be inefficient or insufficient.
Knowledge circulation	It is expected that the accession of Structural Funds will support inter-sectoral and international scientific cooperation. The involvement of international experts in R&D projects will foster knowledge circulation. Project based mobility schemes for PhD students were launched in 2007 to support knowledge dissemination. Several financial schemes to support knowledge circulation for SMEs were launched.	The risk of a lack of coherence and coordination of implementation of R&D strategies and policies remains. Frequent changes and interference of political factors could be observed in the past in the process of implementation.

Policy 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.

6.3 System and policy dynamics from the perspective of the ERA

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. A significant growth in public R&D expenditure to 0.22% of the GDP was achieved in 2005, followed by a further increase to 0.29% in 2006 and to an estimated 0.56% in 2007. Other increases up to 1% are expected by 2010, as part of the government commitment to meet the 3% objective of the Lisbon Strategy.

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 of correlation of 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. An effort to adopt 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 determining the R&D policy mix in Romania with regard to excellence and exploitability of knowledge production. The advantages offered by the integration into ERA are directly related to the participation of Romania in the single labour market for researchers, benefiting from a high quality R&D infrastructure, sharing knowledge and optimising 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 were 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.

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List of Abbreviations

ARIES	Romanian Association for Electronic and Software Industry
BERD	Expenditure on R&D in the business enterprise sector
BSEC	Black Sea Economic Cooperation
CEEX	"Research of Excellence" Programme
CERN	European Organization for Nuclear Research
COST	European Cooperation in the field of Scientific and Technical Research
CREST	Committee for Research in Science and Technology
EPO	European Patent Office
ERA MORE	The European Network of Mobility Centres
ERA	European Research Area
EU	European Union
EUFRU	Executive Unit for Financing Research in Universities
FDI	Foreign direct investment
FP	Framework Programme
GBOARD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
ICT	Information and Communication Technology
INSEE	National Institute of Statistics
IPR	Intellectual Property Rights
ITT	Innovation and Technology Transfer
MBA	Master in Business and Administration
MERY	Ministry for Education, Research and Youth
MNC	Multinational corporations
NASR	National Authority for Scientific Research
NCM	National Centre for Programme Management
NCST	National Council for Science and Technology
NDP	National Development Plan
NGO	Non-governmental Organisation
NPRDI 1	National Plan for Research, Development and Innovation, 1999-2006
NPRDI 2	National Plan for Research, Development and Innovation, 2007-2013
NRDIS	National Research, Development and Innovation Strategy
NURC	National University Research Centre
R&D	Research and Development
RCRI	Romanian Committee for Research Infrastructure
RDI	Research, Development and Innovation
ReNITT	The National Network for Innovation and Technology Transfer
Romob	Centres for mobility of researchers in Romania
ROSA	Romanian Space Agency
S&T	Science and Technology

SEE ERA NET	South East European ERA NET
SME	Small and Medium Size Enterprise
SOIT	Romanian State Office for Inventions and Trademarks
SOP HRD	Sectoral Operational Programme Human Resources Development
SOP ROP	Sectoral Operational Programme Regional Operational Programme
SOP IEC	Sectoral Operational Programme: Increase of Economic Competitiveness
WGST	Working Group for Science and Technology

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Abstract

The main objective of ERAWATCH country reports 2008 is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. The reports are produced for each EU Member State to support the mutual learning process and the monitoring of Member States' efforts by DG Research in the context of the Lisbon Strategy and the European Research Area. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The reports are based on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources. This report encompasses an analysis of the research system and policies in Romania.

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