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An assessment of research system and policies

Belgium

Nelly Bruno, Alasdair Reid, Jon van Til and Geert van der Veen

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ERAWATCH COUNTRY REPORT 2008

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ERAWATCH Network -
Technopolis Group

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The report is only published in electronic format and available on the ERAWATCH website: http://cordis.europa.eu/erawatch. Comments on this report are welcome and should be addressed to Mark Boden (Mark.Boden@ec.europa.eu).

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 Belgium 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.

It is barely relevant to talk about a 'Belgian research' system since the country is increasingly regionalised and as a result: research structures, funding and outputs differ with significant regional variations. However, the broad trends suggest that in terms of resource mobilisation, and despite the commitment of the public authorities at Federal and regional level to meet the 3% GERD/GDP target, that research intensity in the economy is actually declining or stable. In particular, the importance of business expenditure on R&D in Belgian GERD and the fact that a large part of the BERD activity is undertaken by enterprises under foreign control, raises the threat of a decline in R&D intensity if enterprises are not encouraged to maintain their operations in Belgium (despite the documented uncompetitive salary conditions of scientific and technological staff compared to main competitors).

The governance system in Belgium is complex reflecting the constitutional devolution of powers to the regions and linguistic community governments. The most likely future trend is a further regionalisation of the remaining science policy competencies of the Federal authorities towards the regional level. Higher education research funding is channelled through the two main language communities (Flemish and French-speaking) allied to funding for more applied research and investment in research infrastructure that is mobilised by the three regional government (Flanders, Wallonia and Brussels-Capital). The risk of some over-fragmentation of the research system has been pointed to in recent reports, but the structure is unlikely to change and hence the real issue is to find mechanisms to ensure that synergies and co-operation can be maintained between research funding instruments at regional level.

As noted above, the Federal and regional (and related language community) governments have all committed to raising expenditure. Additional appropriations for research funding have been made by all authorities in one form or another since 2005: essentially through fiscal instruments at Federal level and through new specific funding allocations to research programmes or infrastructures at regional level. Nevertheless, the level of government budget appropriations is not sufficient to obtain the targets set in the National Lisbon Reform programme. Equally, at least in the case of Wallonia, without the support of EU Structural Fund programmes it is doubtful the current levels of funding or structuring of research potential into competitiveness

poles would have been attained. This raises the question of the budgetary consequences that will arise in the post 2013 period. On the other hand, the Belgian research organisations (public and private) do seem to have been able to obtain and mobilise more effectively in recent years funding from the EU's Framework Programme for research.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	A large consensus exists on the need to increase public expenditure for research and all the Belgian authorities have committed more funds (including via fiscal measures)
	Securing long term investment in research	Importance of publicly funded research is significantly below EU27 average despite commitments to increase funding and inflows of EU Structural Funds and Research Framework Programmes.
	Dealing with barriers to private R&D investment	Belgium is generally well-placed in terms of the share of Government Expenditures for R&D (GERD) funded and performed by the private sector. However, Business Expenditures on R&D (BERD) is concentrated in a few large, foreign owned firms; and the trends are negative
	Providing qualified human resources	Belgium human resources in science and technology (HSRT) rates are good; but a high share do not work in science and the salary conditions in Belgium increase the risk of a brain drain despite measures taken.
Knowledge demand	Identifying the drivers of knowledge demand	Knowledge demand in Belgium is largely driven by business interests (foreign owned) and there are few formal mechanisms such as foresight exercises, or technology assessment, etc. which help to structure a broader societal demand.
	Co-ordination and channelling knowledge demands	The main methods used to channel knowledge demand are R&D programmes and funding for strategic research centres and 'competitiveness poles'. The use of more novel instruments such as pre-competitive public procurement is only beginning to be examined (in Flanders). A main element of the co-ordination of knowledge demand is Belgian involvement in the European Space Agency. The Belgian authorities are also relatively active in ERA-NET and Open Method of Coordination (OMC) type activities
	Monitoring of demand fulfilment	Evaluation of the quality and relevance of scientific research and research funding policies could be improved further.
Knowledge production	Ensuring quality and excellence of knowledge production	A strong share of competitive as opposed to baseline funding at universities would improve the quality of Belgian research
	Ensuring exploitability of knowledge	Lack of absorptive capacities in SMEs allied to low (high-tech) entrepreneurial propensity are a major weakness Disconnection between technological specialisation and economic tissue.
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	Relatively wide-ranging and extensive set of measures already in place to promote knowledge transfer.
	Profiting from international knowledge	Belgian participation rates in EU or international programmes are improving, including for SMEs A range of measures exist to encourage research mobility, etc.
	Enhancing absorptive capacity of knowledge users	Collective research centres and other transfer mechanisms in existence for many decades. Rates of participation and investment in life-long learning remain a key weakness of Belgium.

Human resources for research are a crucial issue in Belgium despite a relatively strong performance in terms of human resources for science and technology in the workforce, however, the rate of new graduates in these fields is well below the EU25 average. An effort is being made by the regional authorities to put in place grant for researchers returning from abroad schemes, while the Federal authorities are using reduction in social security charges to improve salary related cost competitiveness.

Structured efforts to chart and monitor demand for knowledge are still largely insufficient in Belgium. Mostly, policy making is done through a bottom-up process where interest groups lobby for increased support for one or more area related to scientific research and its commercial exploitation. In Flanders, the structuring of knowledge demand is done largely through four large strategic research centres, while in Brussels and Wallonia, the approach is structured around clusters or competitiveness poles (bringing together higher education and industrial research). The Flemish authorities have made the most investment in technology assessment on a continuous basis; while in Wallonia a regional foresight was carried out at the turn of the century but has not been repeated or updated.

Even if Belgium, on average, performs well in terms of knowledge production, there are still shortcomings in the exploitation of the rather strong science base. The research carried out in higher education tends to be rather distant from the 'real' economy and there is a disconnection between scientific and technological specialisations.

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	Strong and coordinated effort to increase funding with explicit and public commitments to raise funds.	End of significant Structural Fund support from 2013 onwards (notably for Walloon research effort) Risk of relocation of R&D activities of the key foreign investors
Knowledge demand	Initial steps to explore pre-competitive procurement (Flanders)	Lack of structured foresight or long-term planning Little emphasis on knowledge intensive services related R&D Little focus on society driven research
Knowledge production	Structuring of research effort in strategic research centres (Flanders) and competitiveness poles (Wallonia)	Non-attractive salaries for researchers and fragmentation of system
Knowledge circulation	Additional measures supporting Intellectual Property rights (IPR) Increased support to attract and retain researchers	On-going under-investment in training and technology diffusion

To sum up, the structure of this report in some ways is a reflection of the conceptual weaknesses underlying the Belgian 'research system(s)'. Most stakeholders have spent the last 8-10 years calling for increased public funds (resource mobilisation) without a clear understanding in doing so about the knowledge demand needs (why, in what fields, for who and to what end is one seeking to increase knowledge production); the assessment of the outputs and results of research programmes is weak and the effort to create a range of structures and incentives to support knowledge circulation has not dramatically improved the situation, since a major impediment lies in the industrial specialisation versus the scientific specialisation, allied to the low internal capabilities of most SMEs to absorb knowledge. When one adds to this context, the fragmented nature of the research system (effectively two

higher education systems and basic research funding systems); and three industrial research funding systems, then it becomes clear that there are a range of bottlenecks in Belgium to effective investment in research. The main policy-related opportunities and risks are summarised in the table above.

The ERA dimension while debated is mostly tackled in an opportunistic manner when a specific element of the ERA debate is relevant (e.g. researchers' mobility, Space research). It would be an exaggeration to say that there is an internationalisation/globalisation strategy (at either federal or regional levels) covering elements such as mobility, joint programming, the opening up of national programmes and joint European research infrastructures. Most effort has been put into encouraging the mobility of researchers, with a relatively wide range of programmes, both for EU researchers to join Belgian teams and for returning researchers, etc.

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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
• Justifying resource provision • Long term research investment • Barriers to private R&D funding • Qualified human resources	• Identification of knowledge demand drivers • Co-ordination of knowledge demands • Monitoring of demand fulfilment	• Quality and excellence of knowledge production • Exploitability of knowledge production	• 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 four 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 Inventory[1] 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 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] 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.

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

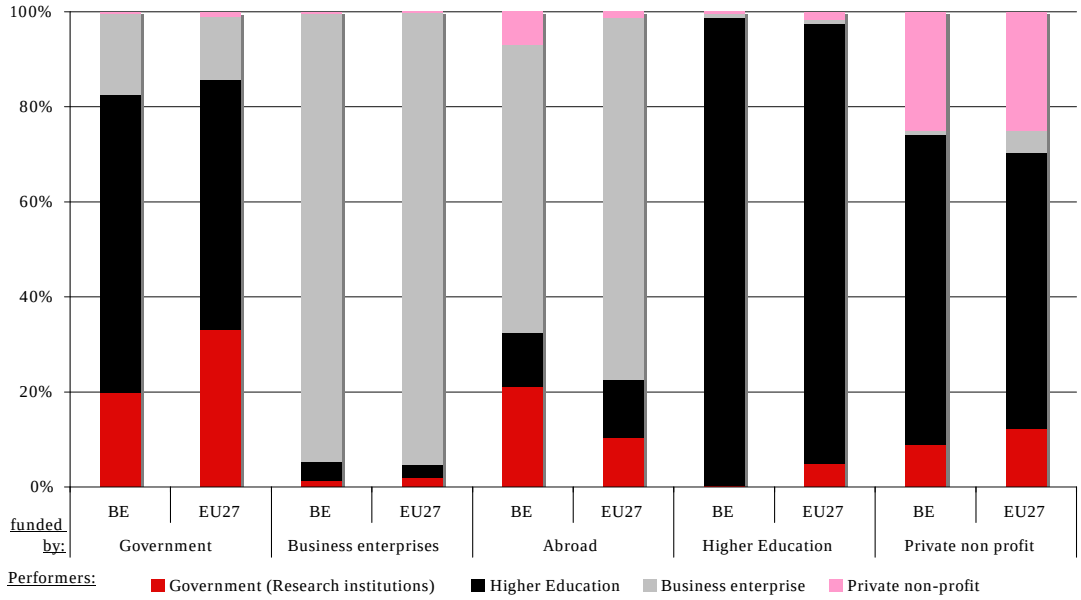
This section provides a brief descriptive overview of main structural characteristics of the research system and its governance:

The Belgian research system in a nutshell

Belgium is a densely populated Federal State (10.5m inhabitants in 2007 or 2.1% of the population of the EU27. The country is divided into three regions: Flanders (6.1m inhabitants), Wallonia (3.4m) and Brussels-Capital (1m); and three language communities: the Flemish (7.1m speakers), the French (4.3m) and the German (74,000). Its gross domestic product (GDP) stood at €311b (in PPS) in 2007, or 2.4% of the EU27; while GDP/capita was 1.18 times higher than the EU27 average in 2007 (in PPS). However, there are significant regional differences in GDP/capita with Wallonia lying well below the EU15 average (77,6% in 2005), Flanders slightly above (106.6%) and the region of Brussels-Capital is an outlier (213.4%)[2].

Belgian gross expenditure on R&D (GERD) as a share of GDP was 1.83% in 2006[3], slightly below EU27 average (1.84%). However, the ratio has declined from a peak of 2.08% in 2001, after a steady increase since 1995. While the share is slowly decreasing, in 2006, approximately two-thirds of research was performed in the business sector (EU27: 62.7%); and 22.3% in the higher education sector (EU27: 21.8%). The share of research performed in the government sector (8.6%), while increasing, remains below the EU27 average (13.4%); while the share performed by the private non-profit sector is low (1.2%) but above the EU27 average.

Figure 2: Research funding and performance by sector (2005)



Source: Eurostat

[2] Data from Eurostat and Federal Planning Bureau

[3] All data provided in this report is sourced from Eurostat for the latest available year at the time of writing this report, unless explicitly stated otherwise.

In terms of research performers, there are two separate university systems. Flanders has six universities (of which two in Brussels), four large research centres (IBBT, IMEC, VIB, VITO) and a number of smaller competence poles for knowledge development. Recently due to the Bologna reform process, the nine French-speaking universities (including two in Brussels) and higher education institutes ('*hautes écoles'*) have been structured into three academies (Louvain, Wallonie-Bruxelles and Wallonie-Europe). Similarly in Flanders, the universities and '*Hogeschool'* have been grouped in five associations. One aim of these changes is to facilitate students shifting between different types of courses at various levels of higher education and to create more critical mass and sharing of resources.

Equally, the formerly Federal network of public-private sectoral research centres have now been regionalised in terms of their funding, while continuing to serve firms of their industrial sector irrespective of location. In Wallonia, although a number of research centres have been funded through the Structural Funds, there is nothing comparable in scale to the Flemish strategic research centres; however the recently established competitiveness poles have a role in structuring public/academic and enterprise research efforts.

Business R&D is highly concentrated and largely under foreign control: 10 enterprises accounted for 31% of the intramural R&D expenditure in 2005 (36% in 2000), of which eight are under foreign control. In total, foreign owned companies account for 70% of the total business R&D expenditures in Belgium.

Multi-level governance of the research system

The governance of research policy in Belgium reflects the complex multi-level system of this (con)federal[4] State: with a federal government, three regional governments and three language community governments all having competence for certain matters relevant to science. The Federal Government retains responsibility for a limited number of matters related to science policy still in its competencies[5]; the communities are competent for matters related to persons including education and scientific research; whilst the regions are competent for applied and industrial research. The regional governments oversee applied and industrial research with economic development purposes as well as they support technology guidance and funding for interfaces between research organisations, industry and universities.

At Ministerial level, each of the authorities has a Minister responsible for science, however, generally only as one element of a broader portfolio. In the Federal Government, the Minister for SMEs, Agriculture and Science Policy; in Brussels-Capital, the Minister of Economy, Employment and Science Policy; Flanders has a Minister for Economy, Enterprise, Science, Innovation and Foreign Trade. Although, the French-speaking Community and the Walloon Region remain separate entities, the same person is Minister for Higher Education, scientific research and international relations for the community and Minister for Research, new technologies and foreign affairs at regional level.

[4] La Belgique est (...) incontestablement, une fédération (...) Cela étant, la fédération belge possède d'ores et déjà des traits confédéraux qui en font un pays atypique, et qui encouragent apparemment certains responsables à réfléchir à des accommodements supplémentaires dans un cadre qui resterait, vaille que vaille, national", V. de Coorebyter "La Belgique (con)fédérale" in Le Soir 24/06/08.

[5] The federal science institutes (essentially national libraries, scientific collections and museums), defence and space research, intellectual property law, corporate taxation, employment legislation and social security measures for research.

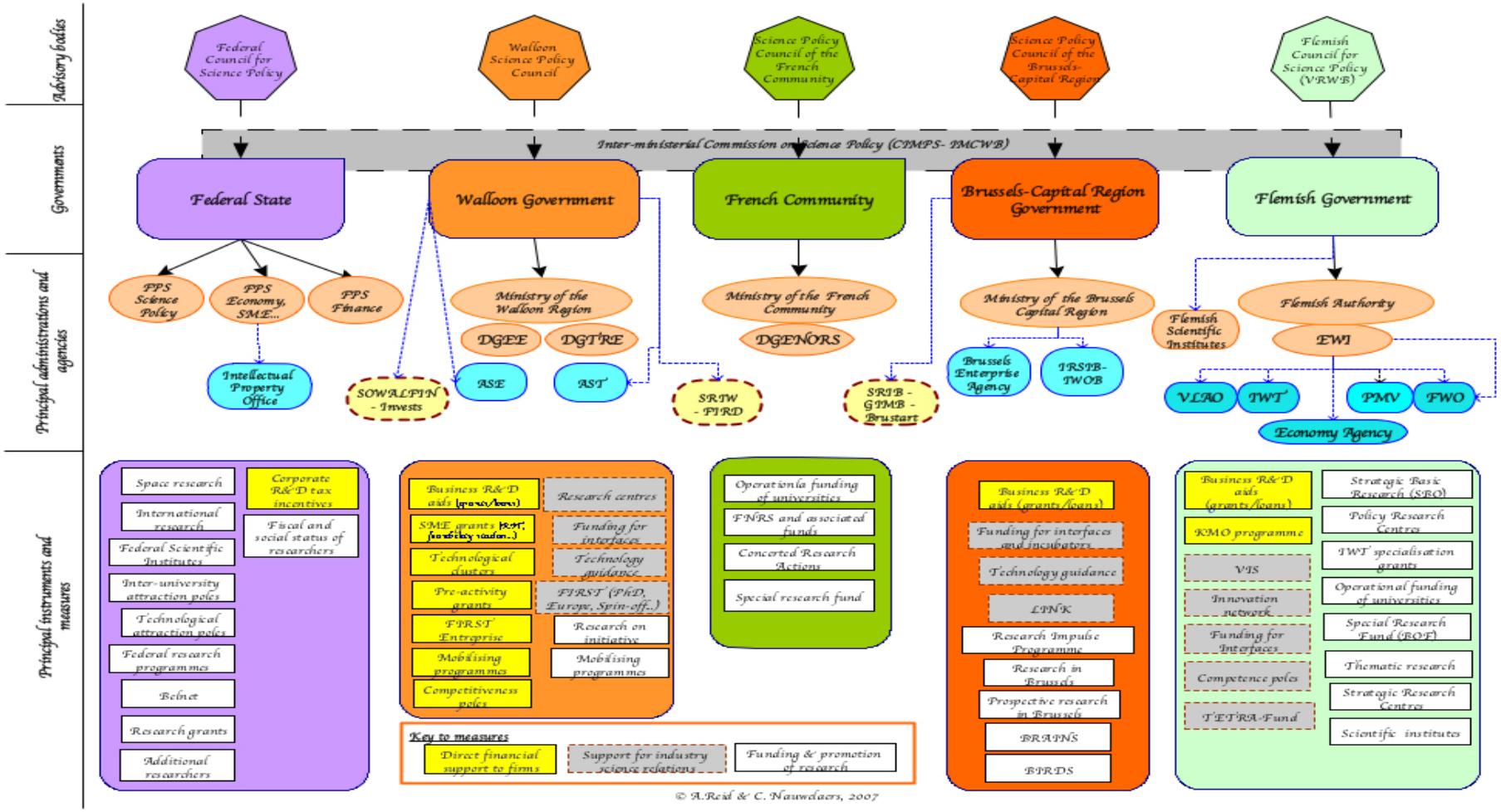
In the Belgian political system, policy development tends to be done by the Ministerial cabinets, more or less in consultation with the administrations. This tends to be more the case in Flanders where the Department for Economy, Science and Innovation (EWI) deals more with policy leaving implementation to specialised funds or agencies, than in other entities where the policy making role and capacity in the administrations tends to be weak. Some counter-weight to the influence of the cabinets is provided by science policy councils that exist at Federal level (FRWB-CFPS: Federal Science Policy Council) and in all three regions (the Science Policy Council of the Brussels-Capital Region, Flemish Council for Science Policy (VRWB), Walloon Council of Science Policy (CWPS). These bodies advise their respective governments on science policy issues, strategies and on specific funding mechanisms (design and evaluation).

At administrative level, the role of departments of ministries versus agencies differs between entities. The Federal Science Policy Office is responsible for coordinating science policy at federal level, the design and implementation of research programmes and networks; the management of Belgium's participation in European and international organisations (European Space Agency (ESA), European Standards Organisation (ESO), European Synchrotron Radiation Facility (ESRF), etc.) and the supervision of ten federal scientific establishments. In the region of Brussels-Capital, the IRSIB/IWOIB (Institute for the support of Scientific Research and Innovation of Brussels) manages the implementation of research funding. In Flanders, the EWI is principally focused on policy design and management, while two agencies are responsible for implementation (although with some input to policy design), namely: the Research Funding Council (FWO), and the Institute for the promotion of Innovation by Science and Technology (IWT). The Ministry of the French-speaking Community governs fundamental research aspects providing funding through the National Scientific Research Fund (FNRS). Industrial research funding and some funding for academic, public or not-for-profit research centres is managed by the Directorate General for Technologies, Research and Energy (DGTRE) of the Ministry of the Walloon Region.

The co-operation mechanism between the various governments is the Inter-Ministerial Conference for Science Policy (CIMPS/IMCWB) that has established two permanent sub-committees CIS (International Co-operation) and CFS (Federal co-operation). However, the co-ordination tends to focus on practical issues such as carrying out harmonised statistical surveys (R&D, Community Innovation Survey (CIS), etc.) and submission to the European Commission, Eurostat, OECD, etc. of statistics or policy surveys.

To sum up, it makes no sense to write about a Belgian research system. The Federal Government does not decide on a national policy framework implemented by regions; on the contrary, the regions/communities have full autonomy in managing their ‘regional research systems’. Indeed, under on-going constitutional reforms, the likelihood of a further regionalisation of science policy (e.g. space research) is strong.

Figure 3: Overview of the governance structure of the Belgian research system



Source: ERAWATCH Research Inventory 2008, Structure of the Research System

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

This section analyses how the challenge to justify increased resource mobilisation for research (instead of other often competing resource uses) is addressed in political processes. There is a wide consensus in Belgium on the importance of (raising) R&D investments, originating from both the influence of EU strategic goals (Lisbon strategy and Barcelona objective) and a generally acceptance that the future competitiveness and social well-being of the country depends on a greater investment in knowledge.

In Flanders, the 2001 Vilvoorde pact between government and social partners (employers organisations and unions) was a first contribution to meeting the Lisbon goals; followed by the 2003 Innovation Pact to meet the 3% Barcelona target. Although no further justification is given as to why this 3% target is good for Flanders, it is a standard in science policy discourse. The implementation of the Innovation Pacts is laid down in the policy note on Science and Innovation 2004-2009 and the Flemish Innovation Policy Plan 2005. The 2006 Flanders in Action socio-economic action plan to stimulate attainment of Lisbon Goals was revived in 2007-8 with debates on innovation and entrepreneurship. Also in the 'Policy Letters' of the Minister of Economy, Science, Innovation and Foreign Trade of 2008 and 2009, increasing the resources for research activities is a main theme; justification is given by referring to the Lisbon goals.

The government of the French speaking Community has placed scientific research at the heart of its political project in 2004[6], noting that scientific research is "a permanent source of progress and well-being for everyone, of innovation and employment, it supports social cohesion". Furthermore, referring to the 3% target, the declaration states: "the government do everything possible to reach this ambitious objective. In the field of scientific research, cooperation between the different levels of power in charge of research will be enhanced and new synergies will emerge with the regions. The government will provide a specific support to research teams that integrate European networks. It will reinforce the attractiveness of the Community and of the regions of Wallonia and Brussels-Capital thanks to the quality of their scientific and technological poles".

In the Walloon region, the 2005 overall 'Marshall Plan' to revive the Walloon economy has set a major emphasis on research and innovation. The Brussels-Capital region started somewhat later to take up its role in the Lisbon process, but the 2007-2013 Innovation Plan (approved by the social partners) stresses the importance of research as a means of fostering regional economic progress.

The Federal level coordinates reporting on the Lisbon Strategy progress. In the whole of Belgium it is not so much the importance of research that is a matter of debate, but the way to stimulate it. The chapter on promoting productive economic growth in the 2007 Lisbon Reform Plan Progress Report for Belgium starts by mentioning the 3% R&D Forum in which the various levels of governance and representatives of the private sector are organised with a view of boosting Belgium's R&D effort to 3% of GDP in 2010, in line with the targets adopted by the federal government and the three Regions. The forum was tasked with pinpointing Belgium's R&D weaknesses, while making recommendations for stopping the decline in R&D spending in recent years. This group has, however, not led to a spur of new activities in this field in Belgium: the policies as laid down in the 2005-2008 National Reform Plan (NRP) were continued at the same pace as before.

At Federal level, the Belgian Employers Federation[7] has been keeping an active eye since 2002 on progress towards Lisbon targets publishing an annual "Focus Lisbon" analysis of progress made by Belgium compared to the other EU Member States. A synthetic "Lisbon index" score places Belgium at 46.7% (i.e. 15th out of 27 Member States) for all Lisbon indicators monitored, well behind most of the former EU15 Member States and just in front of several new Member States.

The low level of public funding of research is an important point of concern in the country raised in many recent publications[8]. In the French-speaking Community, a Commission of the Parliament has published in September 2007 a study on the state of play of scientific research in the Community (based on interviews and fieldwork) in order to raise awareness amongst policy-makers. One month later, an open letter to the negotiators of the Federal Government has been issued by Belgian stakeholders of research policies, out of which the president and directors of the Federal Science Policy. In this letter, a call for a strong, coherent and integrated federal science policy as well as a substantial refinancing of the scientific policy was made.

[6] Gouvernement de la Communauté française, Déclaration de politique communautaire, p.36, juillet 2004
[7] Fédération des entreprises de Belgique, "Focus Lisbonne", March 2007
[8] OMC peer review, Policy-Mix project, Federal Planning Office, 2007; TrendChart, CWPS or Belspo, 2008

The consensus nonetheless does not mean that the 3% target is within reach. Government budget appropriations for R&D (GBAORD) have been more or less stagnating since the beginning of the century, represented 0.61% of GDP in 2006; far below the EU27 average of 0.76%. The distribution between the different authorities is: Federal level: 26.3%; French-speaking Community: 12.63%; Flanders: 49.74%; Walloon Region: 10.28%; Brussels-Capital: 1.07%. However, the Federal Government has recently boosted fiscal incentives for R&D, which are not included in the 3% calculations. Furthermore, a further increase of public funding occurred: in Flanders with €60m in 2007, €75m in 2008 and €100m in 2009, to reach €742m in 2009); the Walloon region increased the research budget by €85m in 2007 to reach €259m (after an increase of €38m in 2006), for a total increase of 39% in the period 2006-2009 (thanks mainly to the Marshall Plan). In Brussels-Capital region the research budget increased by €11.5m in 2008 (+€23.5m in comparison to 2004) to reach €48.5m in 2008.

2.1.2 Securing long term investment in research

The challenge to mobilise and secure investments in research which only pay-off in the long term, such as fundamental research and generic research infrastructures, is usually a task of government or not-for profit actors. In Belgium, a standard government period is five years and funding flows to universities and public research institutes do not fluctuate very much when a new government takes office. In 2005, 0.45% of GDP was spent as publicly funded GERD, as a proxy for long-term investments in R&D; this is significantly lower than EU27 average (0.65%). The latest Eurostat figures indicate that the percentage of GERD financed by government has increased slightly since 2001 (22%) to reach 24.7% of GERD in 2005 (EU27: 34.2%); while the public sector as a performer is particularly weak[9].

According to the Federal Office for Science Policy, institutional support for universities represented 24% of the total public funding for R&D (€1,960m) in 2006, funding for scientific institutions 14% and project based funding 12%; allocated to universities by way of the research funding agencies. Apart from these mechanisms, 17% of funding is in the form of research action programmes, which are open to public research and/or private research agencies and include individual grants for researchers and 15% is meant for industrial research. 14% of government budget is dedicated to the participation in international research programmes, mainly space research. According to Eurostat data, in 2006, R&D intensity of the higher education sector lies around EU 27 average (0.4% of GDP) whereas the government sector is below EU27 average (0.16% against 0.25% in 2006).

The mechanisms for funding fundamental research, which fall under the responsibility of the Belgian communities, adhere to the principle of researcher's initiative and consequently do not incorporate any priorities in terms of sectors or disciplines.

The French-speaking Community funds academic research mainly through its basic allocation to universities; financial means stood at €118.5m in 2008, that is, an

[9] A report from the Walloon Scientific Council highlights in particular the low importance of the public sector in performing R&D in Wallonia: 1% in 2005, whereas it represents 10% in Flanders and 16% in EU15. Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008

increase of 7% compared to 2007. Additional funding for researchers and research teams, based on competition, is channelled through the 'national' research funds (FWO-Flanders and FNRS in the French-speaking community). The budget of the FNRS is currently increased in order to be redeveloped (budget of €81.3m in 2008, €86.65m in 2009). The number of researchers and PhD students supported by the Fund has been increased (100 PhD students per year as of 2009), as well as new programmes have been launched.

In February 2008 the Flemish Government decided to base institutional university financing largely on the number of new students and the number of university graduates. The research part of basic funding is, in the new system, in total 35% of total university institutional funding. The distribution of this 35% over the universities will be (for 50%) based on output figures (mainly relating to scientific output). Discussions on the financing of the university system are ongoing because the numbers of students has increased faster than academic staff. In addition to regular funding of universities, Flanders has two programmes for non-specific research and knowledge development[10]. Both the programmes received increased attention, an extra €9m was dedicated to the Special Research Fund (BOF) in 2008, and the FWO was updated with a new decree and work plan. Approximately 50% of the FWO budget (€174m in 2007) is spent on projects and 44% on mandates for researchers. In addition, IWT has a specific programme for individual scholarships for PhD students (200 researchers for a budget of €20m per year). Furthermore, the Flemish Minister for Economy, Science, Innovation and Foreign Trade announced the intention to increase the number of strategic research centres. Feasibility studies have started in 2008 with respect to a strategic initiative in materials and a centre for translational medicine research.

In the Walloon region, science policy has been boosted with the adoption of the Marshall Plan in 2005 allowing an increase of public funds dedicated to R&D of 39% over the period 2006-2009. The Walloon programmes of excellence targeted towards universities focus important financial means during five years on activities of the academic labs recognised for their scientific excellence and their capacity to valorise research results. The most recent programme has been launched in the area of bio refinery (TECHNOSE) and will last till 2012.

The ERDF (European Regional Development Fund) and ESF (European Social Fund) co-financed programmes for the period 2007-2013 is another source of funds. Given the institutional context of Belgium, there is no coordination between the three Regions for the design and the implementation of their respective Structural Funds programmes and the national government has no responsibility with regard to their programming or management. This is reflected in separate processes for programmes design, implementation and management in the three regions. From the total Structural Funds for Belgium (€2.258b) as mentioned in the National Strategic Reference Programme for 2007-2013 (i.e. excluding 'territorial cooperation' objective), Wallonia receives 61%, Flanders 32% and Brussels-Capital 4%.

ERDF means will be spent on sustaining regional competitiveness and strengthening territorial cohesion (Brussels); promoting the science and innovation economy, stimulating entrepreneurship, improving the attraction for foreign companies and on

[10] I.e. the Special Research Fund (BOF), aiming at intrauniversital research and knowledge development; and the Fund for Scientific Research (FWO), aiming at interuniversital research.

urban development (Flanders); and creation of companies and employment, development of human capital, sciences and research, and sustainable development of the region (Wallonia). In Wallonia, the total amount dedicated to research activities from the European Structural Funds for the period 2007-2013 represents €250m (ERDF plus contribution from the Walloon Region), which is an increase of 30% in comparison to the previous period (25% of these funds are dedicated to SMEs). One issue clearly for Wallonia, more than the two other regions, will be the impact of a reduction in total Structural Funds resources post-2013 on public research funding.

Financing from the Framework Programme is also an important source of research financing in Belgium. Based on the 2007 analysis of the EWI, Belgium did very well in the 6th Framework Programme (FP6) (2nd place for grants/GDP; 3rd on subsidy per 1,000 inhabitants; 4th on number of participations/GNP and number of participations/million inhabitants). By the end FP6, financing acquired by Belgian organisations stood at €700m (figures from the NCP Wallonie FP6), out which 50% went to Flanders (share of GDP, 57%), 26% to Wallonia (GDP 23%) and 24% to Brussels-Capital (GDP 19%). To put these figures in context, the €123m gained by Walloon organisations in four year is equivalent to the additional research appropriation allocated under the regional economic strategy ("Marshall Plan" for the period 2006-2010). The total number of participations (at 55% budget allocation within FP6) of Belgium is 1632 (3.90% of total participations). Belgium partners took part to 19.4% of all projects with a share of coordinators of 15.7% (against 12.9% for the EU27). The financial return has been 4.17%, against an expected return of 3.78%. Approximately 55% of the FP6 subsidies went to universities and research institutes, and approximately 20% to companies.

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

Markets alone often fail to provide sufficient incentives for business investment in R&D from a social welfare perspective due to risk (limited appropriability of results, etc) and long time horizon of R&D investments. In Belgium, a wide range of measures exist (fiscal at Federal level, and direct State Aid at regional level) aimed at boosting business expenditure rates. Yet, business expenditure on R&D (BERD), which has traditionally accounted for a significant share of Government Expenditures on R&D (GERD), has been shrinking from 1.51% of GDP in 2001 to 1.24% in 2007[11]. While still above the EU27 average, the share of the business enterprise sector has decreased continuously since 1995 to 68.01% of GERD in 2005 (47.75% in Brussels-Capital, 69.72% in Flanders, 73.5% in Wallonia) and 67.9% in 2006. The reduction in the share of BERD is partly explained by a (slight) increase in public investment (from a low level).

However, it is also a reflection of structural factors: the economy is dominated by intermediate goods and medium-tech sectors, and highly dependent and sensitive to the decisions of a handful of large (foreign-owned) enterprises[12]. More than three quarters of BERD is performed in the manufacturing sector, out of which a quarter by the pharmaceutical sector, 13% for chemicals and 11% for radio, TV and

[11] More analysis of support measures in favour of enterprise level R&D can be found in the Inno-Policy TrendChart reports on Belgium.
[12] In 2005, 42.86% of BERD was performed by companies with more than 1000 employees.

communication. Half of research activities are therefore performed in three sectors, although the share of ICT technologies is decreasing rapidly (while the service sector accounts for around 17%[13]). Wallonia faces particular difficulties to shift from an industrial fabric oriented to low- to medium-tech activities to excellence in key technological areas (Nauwelaers, 2007).

A second issue is that R&D activity is highly concentrated and under foreign control: the top-10 R&D spender companies[14] represent 31% of internal expenses (36% in 2000) and eight of them are under foreign control. Therefore, 59% of R&D spending by businesses in Belgium is by foreign-owned subsidiaries (of which, 45.9% by companies from the United States and 49% by companies from the EU15). In addition, 11% of BERD was financed by capital from abroad (as high as 19.8% in Brussels-Capital compared to 10.68% in EU27)[15]. During recent years, a number of these R&D intensive foreign firms have reduced their activity or sold units in Belgium with an impact in both economic (jobs, etc.) and research intensity terms. The introduction of additional tax measures and in particular, the concept of notional interests is clearly designed to arrest this outflow.

The largest part of the R&D financed by Belgian enterprises is performed in-house: companies are responsible for 68% of research execution and 60% of research financing in Belgium (2005), not taking into account foreign companies. As regards the types of business R&D financing, in 2005, 80% of the R&D expenses by companies come from their own funds and public financing represents only 6.2% (EU27: 7.17%) with nonetheless strong regional disparities (10.34% in Wallonia, 5.76% in Brussels-Capital, 4.66% in Flanders).

Several recent reports on Belgium have highlighted that policies in support of business R&D tend to be driven from the bottom-up process by the main industrial actors (OMC peer review, Policy-mix, 2007). Indeed, a study carried out in 2006 on Walloon R&D support schemes has shown that R&D schemes are mainly oriented towards already key players and that incentives for firms to engage in R&D activities for the first time are insufficient. In general, there is a suspicion that the various incentives have little more than a marginal effect on influencing decisions of firms to invest or increase investments in R&D, or on (re-)locating their R&D activities to Belgium. In this respect, the corporate tax incentives were over-hauled in 2006-2007 given that the previously existing measures were recognised as ineffective and costly and bureaucratic to manage. The impact of such changes will clearly take some time to filter through into increased BERD assuming the measures are enough to offset the structural characteristics of the Belgian economy and poor cost-competitiveness.

A second policy issue here is that propensity to entrepreneurship (high-tech or otherwise) in Belgium is a perennial problem. The efforts of the Federal and regional authorities to improve the business environment (reducing red tape, tax advantages for young innovative firms) and specific support measures (the usual panoply of incubators, business innovation centres and direct support) have not led to significant improvements. Venture capital investment represented 0.17% of GDP at market

[13] Source : CFS/STAT, Federal Science Policy Office

[14] Agfa-Gevaert, Alcatel Bell, Glaxosmithkline Beecham Biologicals, Janssen Pharmaceutica, Philips Innovative Applications, Procter & Gamble Eurocor, Society For Worldwide Interbank Financial Telecommunication (SWIFT), Techspace Aero, Total Petrochemicals Research Feluy, UCB

[15] 12.4% of total R&D spending in Belgium was funded by capital from abroad, which is well above the EU27 average of 8.9%.

price in 2006 (EU15: 0.19%), which is a multiplication by a factor 4 since 2005 and which puts Belgium in third position after Sweden and UK. Nonetheless, venture capital used as seed and start-up capital[16] in Belgium was well below EU15 average in 2006 (7.1% of the total venture capital investment against 28.49%), placing the country in last position[17]. Recent efforts by the authorities to introduce additional support (young innovative company tax status at Federal level), regional venture funding (Arkimedes in Flanders) etc. may begin to pay off in the near future.

2.1.4 Providing qualified human resources

With respect to human resources, Belgium shows a strong relative performance with a high level of education of the population and investments in higher education superior to the EU average. In 2006, 52.5% of the employed population had a tertiary education level (EU-27: 39.5%) which puts Belgium in third position after Cyprus and Spain. Belgium is first in EU27 for the share of tertiary educated people employed in high-tech-sectors in 2006 (38%). The potential Human Resources in Science and Technology (HRST) lies at 38% of the working population in 2006, which is well above the EU27 average of 32% but below the Nordic countries and the Netherlands (42-45%)[18]. Nevertheless, especially in Flanders an increasing number of firms report problems in finding and hiring qualified workers; in particular ICT personnel is scarce[19]. Indeed, the number of vacancies in Flanders has risen by 2,500 per month in the first half of 2008.[20]

In terms of the future potential, the performance of 15 year olds in science is above OECD average, with nonetheless strong regional disparities, with a particularly high score in Flanders[21]. Nevertheless, even if the number of science and technology workers is also relatively high and growing (46.6% in 2006 of the labour force against 42% in 2002 (EU27 average of 38.6%), new graduates in these areas are less numerous accounting for 17.74% of new tertiary education graduates in 2005 (EU25 average: 22.79%)[22] against 18.8% in 2002[23]. In terms of doctorates, 1.1 per 1000

[16] Seed capital is provided for research and to assess and develop an initial concept. Start-up is financing for product development and initial marketing.

[17] Other interesting results come from a study carried out in 2006 by the Walloon Federation of Enterprises (Union Wallonne des Entreprises, Rapport sur la situation de l'entreprise en Wallonie, 2006). It showed that Walloon high-growth companies, which account for almost two jobs out of three created finance themselves more through loans than venture capital, increasing their financial risk. The majority of companies experiencing a strong growth were active in the sector of utilities, health or in traditional sectors, or were companies oriented towards the internal market. Only a minority were active in sectors with high growth potential (ICT, medical, biotech).

[18] HRST consists of all employees with higher education and those working in a 'science and technology profession. Knowledge workers (HRSTC), those belonging to both categories represent 16% of the working population in Belgium in 2006 (EU27: 13%). Figures from NOWT (2008) Wetenschaps- en Technologie-indicatoren 2008 (A publication for OCW), The Hague, March 2008.

[19] De Standaard, Bijna 15.000 vacatures voor informatici, 22 May, 2008

[20] De Standaard, Niemand te vinden voor 50.000 jobs, 14 May, 2008

[21] PISA, The Programme for International Student Assessment, OECD, 2007

[22] In terms of graduate output across OECD countries, the performance of Belgium is lower than the OECD average in science, where the number of people with a higher education degree per 100,000 employed 25-to-34-year-olds was 816 compared with 1,295 on average across OECD countries in 2007. Only Austria, Hungary and Turkey ranked lower than Belgium.

[23] Tableau de bord de l'innovation, http://indicators.plan.be

persons between 25-34 years obtain a doctorate, which is below the OECD average; the number of S&T doctorates (0.6 per 1000) is however the average OECD level.[24]

Nonetheless, as recently argued by the Minister of Research for Wallonia and the French-speaking Community[25], it would be ineffective to increase the number of doctorates only for them not to find a job given that the number of posts in the academic sector cannot be easily increased (400 researchers of the FNRS in addition to academic posts in universities) as it depends on the retirement rate. Indeed, in 2006, around 31% of the HRST were not working in a S&T occupation, which is well above the EU27 average of 22%. A main tool of action of the public authorities is to support their hiring within industry (e.g. through the FIRST enterprise scheme). It is argued in many recent reports that the incentive to become a researcher in Belgium are low due to poor career perspectives, the low levels of salaries of researchers and engineers; and the complexity of the financing system and the low level of public financing[26]. As emphasised by the Minister of Research in Wallonia and in the French speaking Community, in the context of increased mobility, these could be incentives for researchers to move to other countries.

The OMC peer-review of Belgium (2007) highlights that universities in Belgium would lack of “rejuvenation” most notably, because of the language regulations (limited use of English allowed in HEI), impeding moves of students and researchers from and to the country. Furthermore, the existence of too many universities could be a factor hindering the achievement of the required critical mass to conduct research. Nonetheless, there is currently a move in the system thanks to the Bologna process, with the merger of several universities and other higher education institutions into academies in the French-speaking Community and into associations in Flanders.

In order to attract foreign researchers within the country, several measures have been launched, most notably at the federal level (Return mandates), in the region of Brussels-Capital ("Brains Back to Brussels", “Research in Brussels”) and in Flanders where the Odysseus programme was set up in 2006, to attract Flemish or foreign top researchers to Flemish universities. In the same year, the Methusalem programme was set up to allow researchers and their research groups to become leaders in their fields, by giving them a 5-year allowance. Both programmes intend to strengthen the Flemish research base.

It is also noteworthy that the European directive related to the scientific visa has been transposed to the Belgian law in 2007. As a consequence the procedure to obtain a visa and a residence permit for any researcher from a third country hosted by a chartered organisation in Belgium is simplified.

[24] NOWT (2008) Wetenschaps- en Technologie-indicatoren 2008 (A publication for OCW), The Hague, March 2008.

[25] Parlement de la Communauté Française, Etat des lieux de la recherché scientifique, rapport de commission présenté au nom de la Commission de l’enseignement supérieur et de la recherché scientifique par Mesdames Françoise Fassiaux-Looten et Caroline Persoons, Session 2007-2008, 26 Septembre 2007

[26] For a broader overview see the demands of the research actors in Parlement de la Communauté Française, 2007.

2.2 Assessment of strengths and weaknesses

The main strengths and weaknesses of the Belgian research system in terms of resource mobilisation can be summarised as follows:

Main strengths	Main weaknesses
• High share of business expenditure on R&D • Good quality of education	• Low government expenditure on R&D • Low base financing for universities • BERD decreasing and concentrated in a small number of foreign-owned firms • Relatively low HRST and relative decrease expected • Existence of two, almost separate research systems in the country • Low job security for researchers • Complexity of the funding system

Although there is a broad consensus on the need to invest more in R&D, current rates of growth of R&D investment remain insufficient to attain political objectives. Belgium's research performance is characterised by relatively high but decreasing share of activity by the business sector off-setting a growing but still relatively small public sector investment. Due to the dominance of a few large and foreign firms in the total business expenditures, this investment is precarious.

One important weakness of the Belgian innovation system is the institutional fragmentation impeding reaching critical masses and leading to a dispersion of the means. The financing base for universities is small, and the existence of two separate university systems may not be optimal, without measures to ensure synergies in the field of academic research.

In terms of human resources, the educational system is of good quality, but the number of students is low in perspective of internationally leading countries. Belgium has a relatively well-educated population but is losing ground in the area of new science and technology graduates; a situation worsened by the uncompetitive net wages paid to researchers and engineers and poor career perspectives (lack of significant research excellence poles).

2.3 Analysis of recent policy changes

There is a shared view that investment in fundamental research needs to be increased in order for Belgium to benefit from developments in a knowledge-based society. The NRP indicates that "all Belgian authorities have programmed an increase of public budgets for the coming years" and goes on to list the foreseen budgetary increases: €270m in Wallonia (Marshall Plan, with most notably the launch of competitiveness poles); €525m in Flanders (Innovation pact); a doubling of public credits in Brussels-Capital (Innovation Plan); and the creation of a €150m fund at the federal level. At the federal level, the government has reinforced its role in the area of fiscal incentives (however, money spent under this instrument does not appear in the 3% calculations). The Progress Report of the NRP (October 2007) indicates an increase in government budget appropriations for R&D by 8% in 2006, so that public spending on R&D increased from 0.60% of the GDP in 2005 to 0.62% in 2006. Each region budgeted for an increase in the funding earmarked for science policy in 2007.

In order to attract foreign researchers within the country, several measures have been launched recently, most notably at the federal level ('Return mandates'), in the region of Brussels-Capital ('Brains Back to Brussels', 'Research in Brussels') and in Flanders ('Odysseus' and 'Methusalem' programmes).

In line with the Bologna process, several universities and other higher education institutions have merged into academies in the French-speaking Community and into associations in Flanders. Finally, the European directive related to the scientific visa has been transposed to the Belgian law in 2007. As a consequence the procedure to obtain a visa and a residence permit for any researcher from a third country hosted by a chartered organisation in Belgium is simplified.

Challenges	Main policy changes
Justifying resource provision for research activities	• Marshall Plan in Wallonia • Innovation Plan in Brussels-Capital • New Structural Funds programming period • Decree for research in Wallonia • Innovation pact: ongoing increase of public R&D funds in Flanders
Securing long term investments in research	• More at federal level, e.g. space research • New tax incentives • New strategic research centres (in Flanders) • New DGTRE programmes for mainly 3-years long
Dealing with uncertain returns and other barriers to business R&D investments	• Competitiveness poles • Cluster policy • Enhancement of the venture capital provision
Providing qualified human resources	• Measures to attract foreign researchers: Brains back to Brussels, Research in Brussels, Federal Return mandates, Flemish Odysseus programme, Methusalem • Bologna process: merger of higher education institutions into larger groupings (academies or associations)

2.4 Assessment of policy opportunities and risks

Main policy opportunities	Main policy-related risks
• Political consensus on need to maintain effort to boost public (and indirectly business) R&D funding	• Budgetary restrictions due to global financial crisis and effects on public expenditure priorities cannot be discounted • Investment target alone is insufficient and needs to be matched by efforts with respect to human resources • Risk of delocalisation of foreign-owned R&D • Political instability at Federal level • Post 2013 withdrawal of Structural Fund support (Wallonia)

If reaching the 3%GERD/GDP Barcelona objectives agreed to by all the Belgian authorities is to be reached, there is a need for a significant further increase in public expenditure R&D; allied to a maintenance of current levels or better an increase in BERD. Nonetheless, the country has a strong level of public debt, which has a strong impact on the capacity of action in terms of public deficit. The Structural Funds offer good opportunities to increase the budget allocated to R&D activities. Nonetheless,

there is a clear need to think about the sustainability and the self-financing capabilities of the supported areas once funding is phased out post 2013.

Moreover, boosting funding requires a consequent increase in the number of researchers and consequently improved conditions (salary, career perspectives, financing)[27]. This would imply an increase in the number of candidates (e.g. awareness and image campaigns), a better success rate in the S&T domains and easier access to the labour market for an increased number of foreign graduates.

An increase in BERD also, seems increasingly unlikely to occur as strategic ownership of the last of the large 'Belgian' firms is increasingly frittered away (the latest example being the loss of national ownership over FORTIS, the banking giant) and the economic structure of the country becomes increasingly service sector dominated. Indeed, an important risk for the Belgian research system comes from its reliance on a few big players, with decisions centres often abroad. Further closures and downsizing of the activities of these companies would have strong negative impacts on the Belgian research performance. More top-down initiatives focusing on promising domains and increased support of smaller players could be decisive for a sustainable R&D policy.

Finally, the political instability in the country can also represent a risk in terms of financing and management of research activities. An enhanced co-operation, if not coordination, between the regional/community strategies supporting research is needed. The fragmentation of the research efforts in many universities can lead to sub-optimal levels of research but the recent enforcement of the Bologna Process is adding some more consistency to the system (merger of several HEI).

2.5 Summary of the role of the ERA dimension

Belgium, as a founding member of the EU, has always been oriented towards, supportive of and influenced by EU developments. All Belgian authorities have National Contact Points promoting and informing on possibilities for participation in EU research programmes. Furthermore, all three regions view creating excellence centres as a way to become an important player within the ERA and Belgium has done much better under FP6 than previous round of Framework Programmes (including participation of SMEs thanks to an active role of NCP and some financial support instruments for project preparation).

In terms of Structural Funds, the European Commission has calculated that, in the course of the period 2000–2006, Belgium devoted 53% of the Structural Funds to projects that were in line with the Lisbon objectives. However, none of the programmes allocated funding towards supporting large-scale European research infrastructures.

With respect to human resources the high Belgian personnel costs create less attractive research conditions for European researchers in Belgium. Various tax measures at federal level have however decreased the relative disadvantages of hiring researcher and of net salaries (reduction of social security chargers, etc.) in recent years.

[27] In order to enhance the attractiveness of the career of researcher, the Walloon Council for Science Policy recommends a rigorous implementation of the principles of the European charter of the researcher (2008)

The focus on the use of the Belgian languages in the research grant systems for PhDs also hamper European mobility as means of sourcing qualified human resources.

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. Thus it is about the drivers for knowledge demand as well as the processes to identify and respond to this demand. The demand for research is determined by private sector needs (hence influenced by economic structures and R&D specialisation patterns), by societal needs and by the demand from the research sector itself (e.g. influenced by requirements such as achieving research excellence or adapting to EU Framework programmes).

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

Three drivers of knowledge demand can be identified:

- drivers of business knowledge demand, including the role of the sectoral structure of the economy and their dynamics as well as foreign demand
- drivers of societal knowledge demand
- drivers of knowledge "demand" that is ‘intrinsic’ from the research sector itself.

According to the ERAWATCH specialisation study (2006), during the 2001-2003 period, Belgium exhibits a specialisation profile in terms of BERD in the basic metals, pharmaceuticals, chemicals, petroleum and food industries. On the side of the services sectors, community services, other business activities and telecommunications are specialised in terms of BERD for the same period.[28]

Business is the main driver of knowledge demand in Belgium. As argued in the OMC Policy mix review for Belgium (2007), policies in the country are often reactive instead of proactive, and mainly bottom-up driven with the risk of lacking some focus

[28] Erawatch, specialisation report for Belgium, 2006

on strategic research. The most supported sectors tend to be the best-developed ones (e.g. pharmaceuticals, chemicals). The lobby from the pharmaceutical sector is particularly strong[29]. This can notably been seen in the strong influence it had on the development of a new tax measure at the federal level on patent incomes.

Table 1: Main indicators, Belgium

	1997	1998	1999	2000	2001	2002	2003	2004	2005	Comments
GERD % of GDP	1,83	1,86	1,94	1,97	2,08	1,94	1,88	1,87	1,84	Decrease since 2001
BERD % of GDP	1,31	1,32	1,39	1,43	1,51	1,37	1,31	1,29	1,25	Decrease since 2001
HERD % of GDP	0,40	0,40	0,41	0,40	0,41	0,41	0,42	0,41	0,41	Constant
GOVERD % of GDP	0,10	0,11	0,12	0,12	0,13	0,14	0,13	0,14	0,15	Slight increase

Source: Regional Key Figures database, DG Research

During 2001, medical sciences and natural sciences each received almost a quarter of HERD. In terms of GOVERD by scientific field, what is striking is the dominance of engineering for all years of reference (1999, 2000, 2001) that accounted for almost two thirds of research expenditure in PRO's, followed by agricultural and natural sciences. These figures point to a very strong specialisation of PRO's to industrial needs. Within the services sector, the specialisation of Belgium presents a dynamic picture, with many sectors loosing or gaining in specialisation, as is the case of IT services, telecommunications, hotels and financial intermediation. With respect to the manufacturing sector, the specialisation profile of Belgium is more consistent within the 1993-2003 period, since the industries in which Belgium was specialised are almost identical for both periods. These sectors are namely electronic equipment, fabricated and basic metals, the food and textiles industry and the medium to high R&D intensive industries of plastics, chemicals and pharmaceuticals.[30]

In 2005, 9.7% of the business expenditures in R&D were dedicated to basic research, 31.9% to applied research and 58.7% to experimental development. The manufacturing sector represented 80.65% of these expenditures (24.4% only for the pharmaceutical sector, 12.8 % for chemicals and 10.71% for radio, TV and communication and 10.85% for low-tech activities) and the sector of services 16.91%[31].

The mechanisms for funding fundamental research, which fall under the responsibility of the Belgian communities, adhere to the principle of researcher's initiative and consequently do not incorporate any priorities in terms of sectors or disciplines. In terms of public credits for research, a total of €465.43m has been awarded to non-oriented research by the Belgian authorities in 2006, which represents 23.9% of total GBAORD. This is an increase in comparison to 2004 (21.1%) but a decrease from the previous year 2005 (24.2%). However, basic research is under financed in comparison to applied research.[32] Public financing

[29] See l'Echo, 18.07.2007
[30] Erawatch, specialisation report for Belgium, 2006
[31] Source: Commission de coopération fédérale, groupe de concertation CFS/STAT, calculs Politique scientifique Fédérale
[32] Parlement de la Communauté Française, Etat des lieux de la recherché scientifique, rapport de commission présenté au nom de la Commission de l'enseignement supérieur et de la recherché

represents 75% of the resources in the higher education in the French-speaking Community, which is above Belgian average but lower than EU15 average (82%).[33]

As highlighted in the ERAWATCH research inventory for Belgium (2008), a number of funds and public funding appropriations from Belgian authorities are dedicated to thematic priorities. At the Federal level there are thematic programmes in areas that fall within the competences of the federal level, namely space research and other federal research programmes in areas such as information society, national cohesion and normalisation. However, funding levels are relatively marginal even for the well-appreciated Inter-university attraction poles. The main focus of the Federal funding is clearly in the area of space research, alongside the important, if financially smaller, polar research programme.

The thematic focus of Flanders is primarily shaped through the four large strategic research centres (IBBT, IMEC, VIB, VITO) along with a number of smaller competence poles (or excellence centres). Main focus in Flanders is on the 'upcoming' technology fields; there is thematic focus on ICT, nanotechnology, biotechnology and sustainability. This does not necessarily align with the Flemish industry. IMEC for instance has built up a strong reputation in micro-electronics, even though there was (and is) no clear-cut industrial knowledge demand in this field in Flanders. Currently, feasibility studies for new strategic research centres in the area of materials, technology and translational biomedical research have started. Furthermore, there are smaller programmes for specific (mainly sectoral) knowledge development and/or knowledge transfer.

Wallonia has a series of mobilising programmes, short-term research programmes open either to universities and research centres or to companies, and sometimes to combinations of the public and private sectors. These programmes have, over the last 10 years, notably covered ICT applications, human medicine, engineering and new materials, digital sound and imaging technologies, biotechnology and nanotechnology. The areas of research for these mobilisation programmes are chosen from amongst the "40 key technologies" in which Wallonia has scientific and industrial expertise[34]. In addition, in the Framework of the Marshall Plan for the Walloon region, Marshall programmes of excellence are targeting annually specific areas of research for public institutions. Successive themes have been angiogenesis for cancer treatment in 2006 (NEOANGIO) and nanotechnology, information technology and biomedical applications in 2007 (NANOTIC). Themes have been decided by the Walloon Government based on a mapping of the excellence areas of the Walloon Region done by the National Fund for Scientific Research cross-checked with regional industrial policies. For each thematic programme, annual funding represents €5m over five years, out of which half is coming from the Walloon Region and half is financed by universities.

Since the adoption of its Regional Innovation Plan in 2006, the Brussels-Capital region is targeting its interventions on three priority sectors promising for the Brussels economy through annual impulse programmes: environment is the main funding focus in 2008 after the area of life sciences in 2007 and ICT in 2006.

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scientifique par Mesdames Françoise Fassiaux-Looten et Caroline Persoons, Session 2007-2008, 26 Septembre 2007

[33] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008

[34] Under the Marshall Plan for Wallonia, €25m are earmarked each year for mobilising programmes.

There are relatively few structured technology assessment, foresight or road-mapping activities carried out in Belgium. Wallonia did undertake a wide-ranging key technologies exercise in the late nineties which informed its subsequent support for a number of actions (technology clusters, etc.), however since then technology foresight and future studies have not driven research policy decision making. As noted elsewhere, it is rather a bottom-up process with some strategic guidance to create 'portfolios' of projects (e.g. under the latest round of Structural Fund projects) linked to the competitiveness poles. In Flanders, viWTA (Flemish Institute for Science and Technology Assessment[35]) has carried out a series of studies in support of Flemish parliamentary decision-making as well as that of other stakeholders. Moreover, two sectoral foresights on the Flemish food and chemicals sectors have also been carried out leading to a series of policy recommendations[36].

Equally, drivers of societal knowledge demand are rather weak with few not-for profit foundations or structures contributing to a debate on research funding priorities. Some exceptions include, for instance, in the field of cancer research, the Télévie operation with the importance of research in this area diffusing into other areas (report from French-speaking Community Parliament, 2007), or the TBM programme in Flanders for orphan drugs.

3.1.2 Co-ordinating and channelling knowledge demands

Not surprisingly given the high importance of the business knowledge demand in the country, the technological objectives[37] of the GBAORD are the ones that saw the biggest increase in Belgium since 1997 (from 37.9% to 45.9% in 2006), in such a manner that this share is more important in Belgium than in any other OECD country (CICW/CCPS, 2008). A consideration of the distribution of GBAORD between socio-economic objectives (NABS) at the Belgian level shows a steady decrease in the share of public credits for the NABS "production, distribution and rational use of energy" since 1987, an increase in "production and industrial technologies" which was already the biggest sector supported (33.3% of GBAORD in 2006) and a slow decrease of research financed by the general funds of universities (17.1% in 2006). The Federal Science Policy in a recent public points to the latter as a particular peculiarity compared to neighbouring countries.

According to the ERAWATCH specialisation report, by looking at the GBAORD priorities, Belgium during 2003 was specialised in the socioeconomic objectives of civil research, social issues, industrial research and exploitation of space. In addition, over the 1993-2003 period, Belgium became under-specialised in the objectives of agriculture, exploitation of earth and energy. [38]

As highlighted in the policy mix review for Belgium (2007), public procurement was a missing element in the R&D policy-mix, when space research is not taken into account, because of its orientation towards stable and tested equipments. Recently however ten projects for sector specific knowledge investments were started in Flanders. This Public Technology Procurement (PTP) is a follow-up of the Flemish

[35] http://www.viwta.be/
[36] Summaries available at: http://www.efmn.eu/Belgium
[37] Technological objectives are the following: NABS 1: 'exploration and exploration of the Earth', 5: 'production, distribution and rational use of energy', 7: 'production and industrial technologies', 9: 'exploration and exploitation of space'
[38] Erawatch, specialisation report for Belgium, 2006

participation as project leader in this area in an EU funded OMC project.

Moreover, due to very specific governance structure of the country, internal policy coordination could be regarded as sub-optimal in terms of aligning or ensuring synergies or complementarities between the different priorities of the different governments. The OMC peer review of Belgium argues in this context for an overarching structure coordinating the research efforts in the different regions. However, this seems illusory in the context of further regionalisation of science powers and not necessarily logical in all fields. Similarly to the "investment target", the issue is not whether to spend more money or whether to coordinate more, the issue is why and on what priorities should more money be spent, or where are there good and rational reasons for combining resources and initiatives to achieve scale versus areas where each of the regions wishes to focus on research specialisation in line with its industrial tissue or higher education research strengths.

The Walloon region fosters and finances the participation of labs and research centres to several international programmes, as the framework programme for R&D of the EU, the EUREKA (5 projects between 2006 and 2007: €1.7m) and COST programmes (70 Walloon research teams and takes part as well to the ERA-NET programme. As of May 2008 (CPS, 2008), the Walloon region was taking part to 6 ERA-NET projects. Flanders is also participating in various ERA-NET projects. These projects are a different development stages but globally enter the third level of cooperation and coordination (elaboration of joint activities). Projects are financed on the basis of calls for proposals open to universities, chartered research centres and companies.

3.1.3 Monitoring demand fulfilment

The research policy in the country is notably monitored by the Federal Cooperation Commission of the inter-ministerial conference of science policy, which has published two reports in March 2008 on the 1997-2007 period, one on the public R&D credits, the other on the business R&D. The federal authority orders external evaluations of some of its programmes: the inter-university attraction poles programme has been subject to an in-depth external evaluation, the results of which have been incorporated in further calls for proposal under this programme. An independent analysis of the R&D tax incentives system has also been carried out at the instigation of national authorities.

Evaluations of R&D policy instruments and structures are becoming more frequent throughout Belgium, however systemic evaluations are not yet implemented. The influence of EU Structural Funds requirements has certainly been an incentive in particular in Wallonia. A Walloon association for evaluation and foresight was created as early as 2000[39]. In Flanders however more and more programmes and initiatives are evaluated as well, starting from the external evaluations every five years of the management contracts with the Strategic Research Centres and smaller initiatives that are financed on this base (e.g. VLIZ (Flanders' Marine Institute)) by EWI. These evaluations are, though often performed by external experts, and are often not made public. Evaluations of the various strands of activities of the main implementing agency, IWT, were done in the past on an incidental basis, but have been addressed in a structural approach starting in 2007. IWT has established a "Monitoring and

[39] http://www.la-swep.be/index.php

Analysis" department, following the previous IWT Observatory, in order to prepare analyses of the Flemish innovation system and its various aspects. Such studies, which are made available to the public, nurture policy-thinking and influence the design of new measures. The research council FWO has being evaluated recently.

The Walloon Council for Science Policy, created in 1990 with notably the task to evaluate the science policy of the region on an annual basis, has taken an active role over the last decade in fostering a debate on R&D and innovation policy. Nonetheless, the first evaluation report has been published only in 2006, since it was lacking of detailed information on the Walloon system and the implemented actions. The decision has then been taken to produce such a report comprising as well policy in the French-speaking Community every two years: the second report has been published in May 2008.

In the French-speaking Community, a Commission of the Parliament has published in September 2007 a study on the state of play of scientific research in the Community (based on interviews and fieldwork) in order to raise awareness amongst policy-makers.

In May 2007, the Walloon Government has decided to implement a system of ex-post evaluation of research results financed by the Region, anticipating on the new decree covering research, development and innovation in Wallonia adopted in June 2008, which foresees the setting up of such a procedure. A first study (by ADE) has been carried out in the framework of the PROMETHEE II programme of innovative actions with the aim of establishing a methodology to assess the impact of research programmes of research units from higher education institutions. Two other studies are planned relative to the evaluation of R&D projects financed in companies on one side and in chartered research centres on the other side. The results of the three exercises will be eventually integrated into a global mechanism of evaluation of regional research policy, fitting with the requirements of the new decree.

Evaluation practices should become more widespread as soon as the enforcement decrees of the new decree covering R&D activities in the region will be voted. The decree does not provide many details on the way the evaluation will be conducted, except the creation of an interdepartmental steering committee in charge of supervising the whole set of measures relative to strategic management and evaluation, and the realisation, every 5 years, of an evaluation report of the research and innovation policy by an external body.

Finally, it has to be highlighted that evaluation practices of R&D programmes in the region of Brussels-Capital are non-existent.

3.2 Assessment of strengths and weaknesses

The slow relative growth in knowledge-based services can be regarded as a particular drag on the economy, in sharp contrast to trends in the EU15 and the US. This slower growth is essentially due to slower growth across all sectors, however, in knowledge based services this is made worse by a specialisation in sub-sectors which have shown slower growth in all industrialised countries[40]. This raises

[40] See for instance: E. de Bethune, Waar concurreren we ? (June 2006), and De Backer K. and L. Sleuwaegen (July 2006), De creatieve processen ondernemerschap, internationalisatie en innovatie; published by the Central Council for the Economy available at www.ccecrb.fgov.be/txt/fr/compet.htm

questions about Belgium's ability to compete in the future given competition from lower cost countries in less knowledge intensive sectors. In Flanders, there is an effort to widen the scope with initiatives in fields such as: micro/nanotech, biotech, ICT, sustainability, and in future translational medicine and materials. Furthermore the competence poles (Flanders), clusters (Brussels-Capital) and competitiveness poles are beginning to foster a co-ordinated approach to defining knowledge demand (and development) needs in a range of sectors or technological fields.

Main strengths	Main weaknesses
• High level of business investment in R&D driving demand • The main methods used to channel knowledge demand are R&D programmes and funding for strategic research centres and 'competitiveness poles'. • Culture of evaluation although evaluation of the quality and relevance of scientific research and research funding policies could be improved further	• Low level of interaction between basic and applied research • Few formal mechanisms such as foresight exercises, or technology assessment to structure a broader societal demand • The use of more novel instruments such as pre-competitive public procurement is only beginning to be examined (in Flanders). • A main element of the inter-governmental co-ordination of knowledge demand is Belgium's commitment to the European Space Agency

However, in general, strategic intelligence techniques are not widely used or available in the country and foresight and forward planning exercises are not common. So while, industrially oriented demand for research is being structured, the broader needs of society as defined by other stakeholders (public sector, non-governmental or not-for-profit sectors, etc.) are less well articulated.

3.3 Analysis of recent policy changes

Challenges	Main policy changes
Identifying the drivers of knowledge demand	• There is little effort made to undertake foresight or other activities that could structure understanding of existing or future knowledge demand. The Flemish strategic research centres and Walloon competitiveness poles are the main instruments used to identify drivers of knowledge demand
Co-ordinating and channelling knowledge demands	• No significant change beyond an increased emphasis on ESA activities; allied to some initial work on using public procurement as a lever for research and innovation in Flanders
Monitoring demand fulfilment	• This remains a weakly resourced element of the research system. Especially a systematic approach is missing

As noted above, there is little to report in the Belgian case in terms of an assessment of the demand for knowledge and how it affects research funding priorities. Clearly there is much more that could be done by all Belgian authorities to invest in a more structured set of policy studies, foresight activities, etc.

3.4 Assessment of policy opportunities and risks

Main policy opportunities	Main policy-related risks
• Development of an evaluation culture • Extension of limited activities in field of foresight, or technology road-mapping around competitiveness clusters, etc. • Use of pre-commercial public procurement to drive R&D priorities	• Still a focus on process and less on outcomes of programmes when evaluated. Not all evaluation reports are made public (e.g. of strategic research centres) • No real demand from public sector decision makers for foresight beyond an enlightened few • Fragmented markets make scale of any potential Belgian public-procurement for R&D initiative likely to be less effective

Again it is difficult to make much of a case for the policy risks and opportunities in this context. Clearly, there are a number of opportunities to invest more in this field but the demand from 'policy-makers' and therefore awareness needs to be raised further.

3.5 Summary of the role of the ERA dimension

Aside from involvement of individual stakeholders in specific programmes or actions (such as ERANETS) there is little evidence of a significant impact of the ERA dimension in the area of knowledge demand. Joint programming with other Member States is weak. The Flemish government has cooperation in science policy with the Netherlands (Holst, Simon Stevin initiatives), furthermore IWT participated in the joint call of ERANet/Susprise. The main European level influence on Belgian research funding priorities is clearly the European Space Agency (ESA) and the strong role that Belgium authorities take in this pan-European structure. This is designed to facilitate the access of Belgian enterprises (from all three regions) to funding and R&D in the space field and in this sense certainly represents one important 'demand stimulus).

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 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

Leaving aside the business sector, the main knowledge producers in Belgium tend to be the universities or associated strategic inter-university research centres (e.g. VIB). The research output of the Belgian universities is good (14.57 publications per 10.000 inhabitants, SCI expanded database, 2005), and the share of Belgian publications in the world increased from 0.88% in 1992 to 1.32% in 2005 (Vlaams Indicatorenboek 2007). There is however a large quality difference between well performing professors and non-performing professors, and few rewards and punishments to stimulate top-performance. In various university rankings a number of Belgian Universities are considered to be among the top-100 in Europe, but not in the top 10. Rankings however, vary very much, mentioned are (in alphabetical order), Antwerp, Ghent, Leuven, Liege, Louvain-la-Neuve, ULB, VUB.

According to the ERAWATCH specialisation report (2006), in terms of publications (2003- compared to EU15), Belgium was specialised in 2003 in the following areas: law, pharmaceuticals, plants and animals, microbiology, immunology, environment, engineering, economics, clinical medicine, biology and biochemistry. The main shares of publications by scientific fields could be found in the clinical domain (approx. 25%), chemistry and physics (approx. 10% each).

In general, the quality of Flemish university education is assured by the NVAO (Accreditation Organisation of The Netherlands and Flanders), visiting and assessing all university faculties regularly. In the French-speaking Community, a system of evaluation of the quality of the education system is currently being developed and an agency has been established in early 2008[41]. However, in general, there are few external evaluation processes of Belgian research, beyond traditional peer review of publications and the periodic evaluations carried out of the Flemish strategic research centres.

According to an analysis carried out by the FNRS[42], the publications coming from institutions of the French-speaking Community have increased by 5.11% on average annually between 1992-2005, against 7.8% for the Flemish Community. According to the FNRS, the growth differential between both communities has to be linked to the differences of financial means of the university research in the North and South of the country (+148.4% and +36.7% between 1995-2005). The French-speaking community rate is nonetheless higher than that observed in many Member States (Germany, Denmark, France, the Netherlands and the UK). Scientific production compared to the population also places the French-speaking Community in a good position: 9.86 publications for 10,000 inhabitants per year between 1992-2005

[41] Agence pour l'Evaluation de la Qualité de l'Enseignement Supérieur. http://www.aeqes.be. Furthermore, in line with the Bologna process a new decree adopted on 12 February 2008 by the Parliament of the French-speaking Community conditions the funding of higher education institutes to their enrolment in a quality evaluation process

[42] based on SCI -ISI-Thomson, concerns solely publications in exact sciences

against 9.66 in the Flemish Community and 8.84 in EU15[43]. Almost half of the Belgian French-speaking publications (48.5% over the period 1992-2005) are the result of an international collaboration (46.4% in the Flemish Community).[44]

However, in many recent reports (Policy-mix, OMC peer review, Federal Planning Office, 2007) the lack of competitive funding for universities is regarded as a possible impediment to reach a level of excellence in knowledge production. The allocation of funds has tended to done on the basis of the number of students and full-time equivalents researchers.

One example of a programme approach aimed at fostering excellence in universities is the Walloon programmes of excellence directed towards universities in order to focus important financial means during five years on the activities of academic labs that are recognised for their scientific excellence and their capacity to valorise research results. This initiative is co-financed equally by the Walloon region and the universities (€8.3m in 2007)[45]. In Flanders the amount of funding to universities by means of BOF and IOF is increasing over generic funding. The distribution of funds from these sources is partially based on output indicators such as the number of publications.

4.1.2 Improving exploitability of knowledge production

Even if Belgium performs well in knowledge production (e.g. in terms of publications) and has a strong knowledge base, this is not turned into a reinforced technological specialisation, notably as measured by patents. In particular there appears to be a significant problem in turning the considerable investment in research into commercially viable innovations. Finally, the low propensity to become an entrepreneur in Belgium (the lowest in EU15 together with France according to the Global entrepreneurship Monitor), and particularly to develop knowledge intensive firms, is a continuing cause for concern. As highlighted in the OMC peer review for Belgium (2007), there seems indeed to be a lack of absorptive capacity in industry, composed by a small share of high tech industries and a large share of SMEs, which are per se not always capable of applying state-of-the-art knowledge from universities. Science-industry linkages are regarded as particularly weak in the country: enterprises funded 11.7% of research performed by higher education institutions (2003).

According to the ERAWATCH specialisation profile for Belgium (2006), the country exhibits a coherent specialisation profile, particularly in the manufacturing sector. Thus, during the 2001-2003 period Belgium was specialised in terms of value added, employment, exports, BERD and patents in the basic metals, pharmaceuticals, chemicals, petroleum and food industries. A similar picture is presented by the services sectors of community services, other business activities and telecommunications that are specialised in terms of BERD, VA and employment for the same period.

[43] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008
[44] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008
[45] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008

However, there are no significant correlations between technological specialisation and economic specialisation. The number of EPO patents per million inhabitants was of 138.55 in Belgium in 2004, which is above the EU27 average of 108.4 but well below the German or Dutch performance. Moreover, the Belgian results demonstrate strong regional disparities (in 2002: 109 in Wallonia against 161 in Flanders). In terms of high-tech patents, the result of Wallonia is particularly worrying (8.7 in 2002 against 18.1 for EU27), with a steep decline between from 1999 to 2002. Particularly noteworthy is the low number of patents which could have an economic impact on the region even if there are strong high-tech industries (pharmaceuticals, ICT). This may reflect the low level of high and medium-tech employment in total employment in Wallonia (8.6%).

As has been stated in ProInno InnoPolicy TrendChart report for Belgium (2008), most of the Belgian patent activity is situated within industries where no comparative economic advantage is to be observed, while most of the sectors where Belgium does hold a comparative advantage in economic terms (exports) are not characterised by strong technological advantages, as measured by patents. This tends to suggest that Belgium's economic competitive position is not fully built on its comparative technological strength. Indeed, the pharmaceutical sector is particularly strong in Belgium and accounted for approximately 25% of the total intramural R&D expenditure in 2006, yet when specialisation indices are considered, Belgium is not specialised in this sector. The chemicals sector is another important sector in Belgium accounting for approximately 12% of the intramural expenditure from industry; here Belgium does have a specialisation in technological terms. As claimed by the CWPS (2008), the traditionally strong sectors in Wallonia, out of which some present an important innovation potential, are not performing R&D (except basic metal products" 4.7% of R&D expenses).

Concerning spin-offs, as highlighted by the CWPS (2008), a recent study has shown that most spin-offs originating from the French-speaking Community universities were not aiming at rapid growth and were creating relatively few jobs. In order to enhance the transfer of knowledge form academia to industry, interfaces have been put in place to make scientific knowledge production match with economic specialisation and public support is granted to many academia-industry collaborations (e.g. clusters and competitiveness poles) and public-private partnerships are gaining importance (cf new Walloon START programme). Concerning the public-private partnerships in Wallonia, they aim at federating financial means from universities, enterprises and of the region to tackle the requirements of a technological breakthrough in a specific sector of activity. The private partner has privileged access to research results according to the agreed convention-private partnerships.

In Flanders, the 'Pact of Vilvoorde' (2001) set a target to double the number of start up companies from the Flemish knowledge institutes (including strategic research centres and universities) and realise 25% of turnover by Flemish companies from new products and services by 2010. In order to achieve these goals a broad policy mix is used addressing the various stakeholders: entrepreneurs, universities, financing bodies, etc.. The main agency involved is IWT focusing on universities and entrepreneurs from universities. The IWT funded Flemish Innovation Co-operation (VIS) network activities have relations with start-ups as well as established firms.

Attention for spin-offs has been around for 10-15 years, while a focus on improving the availability of capital has been a topic for the last three-four years[46].

4.2 Assessment of strengths and weaknesses

Main strengths	Main weaknesses
• Good quality of knowledge production	• Fragmentation of the research system • Shortcoming in the exploitation of the rather strong science base and research capacity • Low economic impact of high-tech activities

Even if Belgium performs well in knowledge production, there are still shortcomings in the exploitation of the rather strong science base and research capacity. Belgium's economic competitive position seems to be not fully built on its comparative technological strength. In particular there appears to be a significant problem in turning the considerable investment in research into commercially viable innovations.

4.3 Analysis of recent policy changes

Challenges	Main policy changes
Improving quality and excellence of knowledge production	• Implementation of the Bologna process (merger of several HEI)
Ensuring exploitability of knowledge production	• Tax measures at the federal level (patent income) and to some extent at regional level (Brussels, Wallonia) for patent registration and maintenance of projects developed thanks to regional support • Development of public-private partnerships (cf. START programme)

In terms of the exploitation of the strong knowledge production, some important steps have already been taken. Most notably, some recent measures taken at the federal level could boost IPR efforts in Belgium like a tax deduction on patent incomes, which has been highly welcome in the country, notably by the pharmaceutical sector. As a result of this deduction, patent income is subject as of 2008 tax year to an effective tax rate of 6.8%, which is substantially lower than the rates available for patent income in most other European jurisdictions. The London Protocol allowing the reduction of the costs of a European patent by reducing the translation costs has come into force in 2008, but has not been ratified by Belgium[47]. This should nonetheless allow Belgian companies to reduce their patenting costs by 4%[48].

Since 2008, the federal level has as well taken some measures to foster patents applications by SMEs. Up to 2008, companies wishing to register a Belgian patent, had to ask for a search report delivered by the EPO on behalf of the Belgian State but which offered no guarantee. In order to improve preliminary searches each patent application is now accompanied by a written opinion by the EPO on the patentability of the invention, offering an additional protection to the applicant. Furthermore, the costs of the initial procedures have been substantially decreased ("search tax" going

[46] See the 2008 Innopolicy TrendChart Country Report for more details on start-up and entrepreneurship policies
[47] See L'Echo, 03/11/2007, Brevets: le grand chambardement, p.13
[48] European Patent Office calculations, reported in ibidem

from €887 to €300), even if annual fees increase as soon as the patent links to commercial activities.

Other important measures taken to improve the exploitation of research results in the country include:

In the French-speaking Community:

- the launch of the competitiveness poles in Wallonia, oriented towards the development of innovative projects
- thematic mobilising programmes associating research organisations and enterprises
- the reinforcement of the FIRST spin-off scheme,
- the reorganisation of the science & technology intermediaries network;
- the possibility introduced by the new decree covering R&D activities in Wallonia to award a lump-sum subsidy to young innovative companies
- the support to patent registration of universities, research centres and SMEs.

In Flanders:

- the launch of competitiveness poles oriented towards application of new technology,
- the development of technology transfer offices at universities,
- the focus of the strategic research centres on industrial needs.

4.4 Assessment of policy opportunities and risks

The need to improve the protection and exploitation of the innovation output of companies has been strongly recognised in many reports published recently, most notably in the report prepared by the Central Council for Economy, which provides recommendations for specific policy initiatives in the area[49]. For instance, the report proposes to follow the French model of proposing an IPR audit for free or at marginal cost for SMEs, a measure that has worked well in France, or to train researchers in universities on IPR issues.

Main policy opportunities	Main policy-related risks
• Modernisation of management of universities (academies, evaluation) in favour of excellence • More competition between universities • Continued progress in terms of patenting support and technology transfer • Increased support to fast-growing knowledge intensive small businesses • transform research and innovation efforts at the regional level into economic growth, notably in terms of employment in high-tech sectors	• lack of interregional cooperation leading to a fragment Belgian “research area” • political risk • complicated framework conditions for companies (+ high cost of labour)

In Flanders, the 2007 Soete report on the Innovation Policy Mix (for enterprise

[49] Van Pottelsberghe B., Vandecandelaere S., De Béthune E., Recommendations pour la politique belge en matière de brevets, Conseil Central de l’Economie, 2007

support) argued that the present Flemish set of instruments for innovation policy is complete but too complex, and therefore not transparent and not very user-friendly. The instruments are too oriented towards technological innovation, with a predominance of certain sectors. They are also not very well adapted to the needs of SMEs, especially start-ups, high-tech spin-offs, and suppliers. Moreover, the Flemish innovation system is too sub-regionally oriented.

On the French-speaking Community side, the CWPS (2008) recommends to complete the existing schemes by financing mechanisms for the downstream phase of R&D projects, facilitating the industrialisation and the first steps of the commercialisation. It argued as well for more systematic relays between the different types of support and in particular R&D aids and aids for economic expansion as well as the measures aiming at facilitating the access to risk capital. [50]

4.5 Summary of the role of the ERA dimension

As noted above, the ERA dimension is mainly important as a source of additional funding for Belgian research efforts. So far, few specific action has been taken to secure large-scale (European level) research infrastructure. However, Flanders has a reasonable (€20m/annum) programme for research infrastructures: the Hercules fund. In Flanders, the competence poles are mainly operating regionally, and are generally not related to ERA; however, the Walloon competitiveness poles programme is clearly designed to increase co-operation between a structured research capacity regionally and European partners. Similarly, the larger Strategic Research Centres in Flanders are often participating in EU and other international projects and are significant actors in the ERA (e.g. IMEC, VIB, VITO), as is the Walloon Space research pole (Liège) or the bio-medical pole (Brussels-Charleroi).

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.

[50] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008

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 gap between scientific knowledge production and commercialisation suggests insufficient collaboration between the non-profit (public and higher education) research activity and the enterprise sector. The CIS4 results show that, in 2004, 35.7% of enterprises with innovative activities were engaged in some form of cooperation for innovation (EU27 average: 25.5%). Nevertheless, they cooperate mainly with customers, suppliers and internal staff within the enterprise group. Links with universities or other higher education institutions (13.2% of co-operation), or with government or public research institutes (9.2%) are less frequent. Moreover, institutional sources are less frequently consulted than internal or market sources; and innovative enterprises find cooperation partners more easily among suppliers or customers than in universities or public research institutes.

According to Eurostat data, 10.86% of HERD was funded by the business sector in 2005 in Belgium, in comparison to 6.27% in the EU27. GOVERD was financed for 9.19% by the business sector, which is as well above EU27 average of 8.26%. Nonetheless GOVERD as % of GDP is in general lower in Belgium than in the EU27 (0.16% against 0.25%). In general it is felt that barriers to entrepreneurship are still relatively high in the country (see Policy-mix, 2007). This can be seen notably in the low number of industrial spin-offs in the country.

The specific industrial structure of the country has favoured the emergence of ‘islands’” of innovation, which are not necessarily linked to the external world (see Policy-mix, 2007), which impedes the diffusion of know-how in the economic tissue mainly composed by SMEs. The diffusion power of the Belgian innovation system is in general considered as low.

In order to facilitate knowledge circulation between the R&D stakeholders, the Walloon region has implemented a whole set of measures under the FIRST label, directed towards researchers in universities creating a company (FIRST spin-off), or researchers working in a company (FIRST Enterprise). A similar scheme for spin-off exists in the Brussels-Capital region, called “Spin-off in Brussels”. In all three regions of Belgium here is a diverse set of measures promoting science-industry linkages. The measures include funding for interface services at universities; funding for incubators; research centres with links to universities and the business sector; competence poles (with various different modes of public-private interaction) and various network support programmes.

As highlighted by the CWPS (2008), extramural expenditures for R&D by the business sector (research financed by the business but performed outside their labs) are increasing (+12.7% on average between 2000-2004). This could reflect an increased propensity of companies to develop international partnerships, given notably the current internationalisation of research.

Following an evaluation of the networks of intermediaries and in order to tight up the links within and between the three families of scientific and technical intermediaries that exist in Wallonia, the Walloon region has set up the AST in 2006 (Technological Stimulation Agency), in charge of improving the coherence of the system by exploiting fully the complementarities between the different actors. The three families of intermediaries are the following[51]:

- the valorisators, located within university interfaces. Their mission consists in supporting enterprises-university partnerships and the economic exploitation of academic research results. It is directed mainly towards firms developing new technologies
- the technological advisers (technology guidance), tied to chartered collective research centres. Their activities develop around three axes: technology watch, awareness-raising on new technological developments, technical interventions in companies, support in the innovation process. The main targets are the companies adopting existing technologies.
- the advisers for technological innovation which have to detect innovation potential in non-innovative companies, to raise their awareness and to support them in their pace.

The LIEU network gathers the university interfaces, the ADISIF the interfaces of high-level industrial institutes and the ACCORD-Wallonie is constituted by the chartered research centres.

In Flanders in recent years much attention has been paid to valorisation from research at the Flemish universities as well. KU Leuven has been a successful pioneer in Europe in this respect (Leuven R&D), and, partially based on the Leuven experiences Technology Transfer Offices have become more professional at other Flemish Universities as well. There is a specific programme for the support of TTO-offices run by IWT ('universitaire interface diensten') . Furthermore part of the funding of universities has become depending on the industrial relevant output of universities as well by way of the IOOF (Industrial Research Fund).

5.1.2 Profiting from access to international knowledge

It has to be highlighted that most programmes in the Belgian regions focus primarily on regional actors. Nonetheless, there is an important participation of Belgian entities in European Framework Programmes as well as some measures do exist at the federal level and in the Brussels-Capital region directed towards international researchers. Foreign direct investments in Belgium are particularly high because notably of the strong presence of big foreign subsidiaries in the country and the international role of the capital: FDI intensity in Belgium increased from 5.7% in 2002 to 14.6% in 2006, which is considerably above EU27 average (1.8% in 2006)

Nonetheless, as argued in the OMC peer review report, the languages regulations in university could represent a barrier to international knowledge, impeding too many courses to be given in English.

[51] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008

The Walloon government has agreed in April 2008 upon a participation of the Walloon Region in the EUROSTARS research programme up to €1.5m (DGTRE budget). This is exclusively directed towards Walloon SMEs. Flanders is also participating in EUROSTARS: project subsidies in Flanders for participating in the EUROSTARS programme can be obtained from IWT.

EUROSTARS is a joint programme gathering the EU and the intergovernmental initiative EUREKA. Dedicated to SMEs carrying out research and innovation activities, it will start its financing activities in 2008 with a total budget of €800m over the six first years. Thanks to this programme, the participating countries can put in common their national programmes and investments dedicated to SMEs research activities. The creation of solid links between public and private financing should support SMEs in their research activities. This should as well allow collaborating with the best research teams in Europe and turn their innovative ideas into commercial successes.

In Belgium, in 2006, 7.9% of the HRST was non-national. When looking at the share of active HRST in countries' active populations, in Belgium, the share of HRST is higher amongst the national citizens in the country than amongst the foreign population (41.4% for EU citizens, 33.8% for non-EU citizen). Looking at the share of foreign students among the total student population at tertiary level, Belgium stands above EU27 average with 9.6% (Eurostat).

A national contact point in Wallonia within the Walloon Federation for Enterprises (UWE) has been created in 2002 following the low participation rate of Walloon companies in the Fifth European Research Framework Programme (FP5). A new convention has been signed for 5 years in 2008 for a total budget of €3.7m. Since its creation, the NCP has achieved results in steady growth that still can be seen for the FP7 (2007-2013). For the first year of the programme, the Walloon enterprises have already achieved more than the quarter of their results in FP6: more than 70 projects have already been selected involving 39 Walloon companies, i.e. more than the whole FP5. In Flanders FP participation is coordinated by the Flemish Contact Point European Framework Programmes, a cooperation of IWT and EWI.

5.1.3 Absorptive capacity of knowledge users

Knowledge circulation can only be effective if knowledge users have sufficient absorptive capacity. In particular for small firms and in low tech sectors it is a challenge to ensure sufficient expertise and learning capabilities.

In terms of the absorptive capacity of the knowledge users, Belgium in general can draw on a well-educated labour force on a par with most industrialised nations, when measured notably in terms of the population aged 25-64 having a tertiary education (32.1% with however significant regional differences ranging from 34% in Flanders to 24% in Wallonia) in 2007. This rate is constantly increasing since 1995. The share of R&D personnel in companies in comparison to the active population (0.69% in 2005) is lower in Wallonia than in Flanders (0.9%) but similar to the share at the EU15 level (0.68%) and higher than the one in many other former industrial regions.

In the French-speaking Community (CWPS, 2008), there is a decreasing trend in the share of human resources dedicated to R&D in full-time equivalent in 2004 and 2005. Nonetheless, the number of physical persons having R&D activities is increasing and their share in the active population is stable, their share in the R&D personnel

increasing these last years to reach 78% in 2005. It seems therefore that there was no decrease in the number of workers dedicated to R&D but a decrease in the time they dedicate to the activities. The research potential would therefore remain the same even if it is not sufficiently exploited. It would be therefore at the level of technicians and R&D managing personnel that a deterioration of the situation in the higher education would happen. A short majority of the R&D personnel in the Walloon companies are indeed researchers (the rest being technicians and supporting personnel). This places Wallonia in a similar situation than in many Member States but better than in many RETI.

An important weakness in terms of knowledge absorption capacities is the level of participation in life-long learning, which is even worse in 2007 (7.2% of the 25-64 years age class %) than in 2006. This score is well below EU25 average of 10.3%. Strong regional disparities can be noticed with scores ranking from 5.12% in Wallonia to 10.43% in the region of Brussels-Capital. Belgium is still scoring well below average for the number of companies that implement training. Indeed, the total expenditure of Belgian companies is much lower than in other OECD countries. In 2006, 1.12% of the wage mass was allocated to training, confirming the stagnation of training efforts, the gap with the neighbouring countries having remained the same since 1993 (CVTS II).

5.2 Assessment of strengths and weaknesses

Main strengths	Main weaknesses
• Emergence of networks of intermediaries • High level of education • High participation in EU programmes	• skills mismatch • low level of life-long learning • low diffusion of knowledge in the economy

In terms of the availability of a sufficient knowledge absorption capacity, the Belgian situation is mitigated. On one side, the population has a high level of qualification but the level of participation of adults to life-long learning is very low. Although a research of quality is developing, its economic fabric faces difficulties in developing innovative activities creating jobs. Difficulties would therefore emerge during the phase of transposing industrially and commercially the R&D results and more generally the new acquired knowledge.

This could be explained by several factors in the past: partnerships between university/research centres/enterprises that are insufficiently developed, a scientific and technical system of intermediation that is too complex and dispersed, public support schemes not focused on SMEs that are already undertaking R&D (as opposed to potential innovators).

5.3 Analysis of recent policy changes

Several measures have been taken to attract researchers settled abroad: return mandates form the federal level, scientific impulse mandates - ULYSSE from the French-speaking Community (FNRS) and Odysseus in Flanders as well as measures in the Brussels-Capital region. In the Flemish community, foreign partners are rewarded up to 20% of the budget within the Strategic Basic Research programme. The fund for financing of non-oriented research in universities (BOF) can be used for participation in international research projects. Furthermore, a declaration of intention

for a strategic alliance between Flanders and the Netherlands in RTD activities was signed in May 2004. The new Odysseus programme attracts foreign researchers to work in the universities of the Flemish Community. In 2008 a study was performed by the Flemish universities on the 'quality of living' of foreign researchers in Flanders. Opportunities to improve the quality of living will be proposed in the European partnership for researchers in 2009 in which Belgium will participate.

Challenges	Main policy changes
Facilitating knowledge circulation between university, PRO and business sectors	• Restructuring of networks of intermediaries • Additional spin-off schemes (Brussels-Capital) • Competitiveness poles and clusters in Wallonia and Flanders • New decree on R&D in Wallonia
Profiting from access to international knowledge	• Return mandates from the federal level, scientific impulse mandates - ULYSSE from the French-speaking Community (FNRS) and Odysseus in Flanders, measures in Brussels
Absorptive capacity of knowledge users	• Measures directed towards SMEs • Skill centres (Wallonia)

In Flanders, the number of initiatives for knowledge circulation is limited since it is viewed as a less severe problem, although financial support to encourage foreign researchers to locate in Flanders is given. Moreover the VIS scheme is a major initiative to foster knowledge circulation. The VIS-scheme is rather comprehensive; it consists of several sub programmes that together build up a package of instruments. The most important sub-programmes are:

- Collective research. Aimed at the translation of research to successful innovations, this programme applies to situations where large groups of companies can profit from certain knowledge or technology.
- Regional innovation stimulation (RIS) is aimed at stimulation of groups of companies that have a technological problem in common. This programme stimulates networking between the companies and knowledge institutes by funding the labour costs of cooperative projects.
- Thematic innovation stimulation (TIS); primarily aimed at groups of SME's that need innovation support in a certain area of technology. This can be combined by exploration projects of 1 year, in these projects a certain domain will be scanned for state of the art, best practices and etc.
- Technological Services (TD) are offered via accredited knowledge institutes. Companies can obtain specialised technological advice that is either produced in special technological settings (projects of maximum €7500) or in other public financed research.

The new decree covering R&D activities in Wallonia fosters in particular partnerships between enterprises and between them and the other research actors by applying an increased rate of intervention to the projects carried out in collaboration (competitiveness poles or other schemes) and by offering in this case the possibility to chose between a subsidy or a reimbursable advance for the activities of experimental development. The new decree nonetheless does not take over the European framework clause related to the preferential treatment of project submitted by a company in collaboration with a research organisation.

Several steps have been recently taken to improve the participation of SMEs and traditional companies to innovation activities in Wallonia, either in the framework of the Marshall Plan for Wallonia or the decree covering R&D activities adopted in June 2008[52]:

- the creation of the AST aiming at reinforcing the cohesion of the scientific and technological intermediation system and to improve the support to SMEs in their innovative actions.
- the financing of technological guidance activities and of advices to technological innovation in the framework of the ERDF and ESF (2007-2013)
- the creation in the framework of the operational programmes ERDF (2007-2013) of technological service vouchers aiming at bringing companies to an innovation process
- the grouping of aids specific to SMEs in a sole scheme with compartments more readable and flexible (foresee in the new decree)
- the transposition of the new EU framework related to the support to innovation in SMEs (support to organisational innovation and process innovation in services, support to advices services in innovation or support to innovation).

The third call for projects of the competitiveness poles in Wallonia is in particular targeted towards SMEs, which have to define their training strategy and human resources needs downstream.

5.4 Assessment of policy opportunities and risks

Main policy opportunities	Main policy-related risks
• creation of new researchers posts • awareness campaigns for young people to engage in S&T studies • develop soft skills of researchers	• lack of technical personnel

In Wallonia, only 16% of R&D activities (BERD) is carried out by companies with less than 50 employees. This can be a source of fragility of the Walloon R&D system. Nonetheless the share of R&D performed in middle-size companies has increased in the last years (50-249 employees) against the number of firms with 250-499 employees[53]. The concentration of R&D expenses in Flanders is even higher than in Wallonia (6.9% by companies with less than 50 employees; 19.5% by companies with 50-249 employees; 73.5% companies >250 employees)[54]

To reach the Barcelona objective, it would be necessary to create new researchers posts and to hire persons to fill them in as well as to replace retired researchers. On this point, some results are worrying. The share of S&T graduates in new graduates from higher education is decreasing in 2004 and 2005 and lies clearly below other Member-states (except the Netherlands). Another source of worry is the number of doctorates awarded annually by the universities of the French-speaking Community

[52] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008
[53] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008
[54] Figures for 20054; Vlaams Indicatorenboek 2007, Steunpunt O&O indicatoren, 2007

that is stagnating since ten years, in particular in sciences.

There is therefore a risk of lacking of qualified personnel to implement new technologies stemming out researches from enterprises and other actors of the economic life, notably in a context of an increased specialisation of equipment. Another risk is to see the research potential decreasing over the time.[55]

According to the report from the CPS, this deficit of researchers and technical personnel could be made good under three conditions: 1) the number of young people wishing to engage into third-level education should increase, 2) the success rate in these disciplines should get better; 3) a higher share of graduates should be attracted by research. It appears in particular necessary to offer researchers the equipment and the support in terms of personnel allowing them to develop a research of quality. It is as well needed to solve the excessive insecurity of the researchers posts. The CPS is in favour of the implementation of the European researcher charter in the research organisations. [56]

Moreover, there is a need to develop in parallel the soft skills of the researchers in order for them to be able to find a job in the industrial sector.

5.5 Summary of the role of the ERA dimension

The Belgian involvement in initiatives such as EUREKA and Eurostars can facilitate knowledge circulation. The three regions have set up various schemes to stimulate the participation of academic or private research teams to European programmes. This includes, for example in Wallonia, allocation of an additional subsidy of 25% to research projects developed by SMEs or chartered research centres and in line with a European programme; allocation of a premium (Horizon-Europe), covering the expenses of SMEs, research centres or higher-education research units in order to prepare and register a project to take part to an EU R&D programme in order to obtain the EUREKA label[57].

In terms of the openness of the research activities on the European level, the various Belgian authorities have introduced changes recently. This orientation is mainly visible at the federal level since the international dimension of research is one of its key responsibilities. As highlighted in the ERAWATCH country report, in addition to the main federal programme in space research and a few other programmes, which are international in nature and together account for more than half of federal R&D budgetary spending, all federal research programmes have been opened for participation of research teams of other Member States (with a limit of 50% funding). The new measure of withholding taxes for private researchers active in cooperative research projects with public research institutions has also been granted in the case of partnerships with universities established in the European Research Area.

[55] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008
[56] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008
[57] Conseil de la Politique Scientifique, Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008

The three regions provide subsidies for research projects carried out in international teams, either to support preparation of such projects through lump-sum grants, or in the form of an augmented subsidy rate for projects with international participation.

In the Flemish community, foreign partners are rewarded up to 20% of the budget within the Strategic Basic Research programme. The fund for financing of non-oriented research in universities (BOF) can be used for participation in international research projects.

The French community takes part in international scientific cooperation agreements. In Wallonia, two existing subsidy schemes – RIT-Europe for companies and FIRST-Europe for universities – have been broadened in order to incorporate the possibility for researchers in the companies to work on projects in cooperation with EU partners. The region has also launched a "mobilising programme" devoted specifically to the support of scientific promoters involved in EU Networks of Excellence.

6 - Overall assessment and conclusions

6.1 Strengths and weaknesses of research system and governance

The table below summarises the findings of the previous sections.

Domain	Challenge	Assessment of strengths and weaknesses
Resource mobilisation	Justifying resource provision for research activities	A large consensus exists on the need to increase public expenditure for research and all the Belgian authorities have committed more funds (including via fiscal measures)
	Securing long term investment in research	Importance of publicly funded research is significantly below EU27 average despite commitments to increase funding and inflows of Structural Funds and RTD FP.
	Dealing with barriers to private R&D investment	Belgium is generally well-placed in terms of the share of GERD funded and performed by the private sector. However, BERD is concentrated in a few large, foreign owned firms; and the trends are negative
	Providing qualified human resources	Belgium HSRT rates are good; but a high share do not work in science and the salary conditions in Belgium increase the risk of a brain drain despite measures taken.
Knowledge demand	Identifying the drivers of knowledge demand	Knowledge demand in Belgium is largely driven by business interests (foreign owned) and there are few formal mechanisms such as foresight exercises, or technology assessment, etc. which help to structure a broader societal demand.
	Co-ordination and channelling knowledge demands	The main methods used to channel knowledge demand are R&D programmes and funding for strategic research centres and 'competitiveness poles The of more novel instruments such as pre-competitive public procurement is only beginning to be examined (in Flanders). A main element of the co-ordination of knowledge demand is Belgian involvement in the ESA. The Belgian authorities are also relatively active in ERA-NET and OMC type activities
	Monitoring of demand fulfilment	Evaluation of the quality and relevance of scientific research and research funding policies could be improved further.

Domain	Challenge	Assessment of strengths and weaknesses
Knowledge production	Ensuring quality and excellence of knowledge production	A strong share of competitive as opposed to baseline funding at universities would improve the quality of Belgian research
	Ensuring exploitability of knowledge	Lack of absorptive capacities in SME sector allied to low (high-tech) entrepreneurial propensity are a major weakness Disconnection between technological specialisation and economic tissue.
Knowledge circulation	Facilitating circulation between university, PRO and business sectors	Relatively wide-ranging and extensive set of measures already in place to promote knowledge transfer.
	Profiting from international knowledge	Belgian participation rates in EU or international programmes are improving, including for SMEs A range of measures exist to encourage research mobility, etc.
	Enhancing absorptive capacity of knowledge users	Collective research centres and other transfer mechanisms in existence for many decades. Rates of participation and investment in life-long learning remain a key weakness of Belgium.

The structure of this report in some ways is a reflection of the conceptual weaknesses underlying the Belgian 'research system(s)'. Most stakeholders have spent the last 8-10 years calling for increased public funds (resource mobilisation) without a clear understanding in doing so about the knowledge demand needs (why, in what fields, for who and to what end is one seeking to increase knowledge production); the assessment of the outputs and results of research programmes is weak and the effort to create a range of structures and incentives to support knowledge circulation has not dramatically improved the situation, since a major impediment lies in the industrial specialisation versus the scientific specialisation, allied the low internal capabilities of most SMEs to absorb knowledge. When one adds to this context, the fragmented nature of the research system (effectively two higher education systems and basic research funding systems; and three industrial research funding systems, then it becomes clear that there are a range of bottlenecks in Belgium to effective investment in research.

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

The main opportunities and risks related to recent policies in the perspective of the Lisbon agenda are summarised in the following table:

Domain	Main policy opportunities	Main policy-related risks
Resource mobilisation	Strong and coordinated effort to increase funding with explicit and public commitments to raise funds.	End of significant Structural Fund support from 2013 onwards (notably for Walloon research effort) Risk of relocation of R&D activities of the key foreign investors
Knowledge demand	Initial steps to explore pre-competitive procurement (Flanders	Lack of structured foresight or long-term planning Little emphasis on knowledge intensive services related R&D Little focus on society driven research
Knowledge production	Structuring of research effort in strategic research centres (Flanders) and competitiveness poles (Wallonia)	Non-attractive salaries for researchers and fragmentation of system
Knowledge circulation	Additional measures supporting IPR Increased support to attract and retain researchers	On-going under-investment in training and technology diffusion

6.3 System and policy dynamics from the perspective of the ERA

The ERA dimension is debated in a relatively unstructured way and tackled in an opportunistic manner when a specific element of the ERA debate is relevant (e.g. researchers' mobility, Space research). It would be an exaggeration to say that there is an internationalisation/globalisation strategy (at either federal or regional levels) covering elements such as mobility, joint programming, the opening up of national programmes and joint European research infrastructures.

Most effort has been put into encouraging the mobility of researchers, with a relatively wide range of programmes, both for EU researchers to join Belgian teams and for returning researchers, etc.

References

Bureau Fédéral du Plan (2007) : Le système d'innovation en Wallonie, Novembre 2007

Conseil de la Politique Scientifique (2008): Evaluation de la politique scientifique de la Région Wallonne et de la Communauté Française en 2006 et 2007, Mai 2008

Capron H., Hadjit A. (2007) : Les dispositifs d'aide à l'innovation en région de Bruxelles-Capitale: une mise en perspective aux niveaux belge et européen, Rapport final au Ministère de la Recherche Scientifique de la Région de Bruxelles-Capitale, Septembre 2007

Commissie federale samenwerking van de Interministeriële Conferentie voor Wetenschapsbeleid / Commission coopération fédérale de la Conférence interministérielle de la Politique Scientifique, Budgettaire kredieten voor O&O van de overheden in Belgie in de periode 1997-2007, Maart 2008/ Mars 2008

Commissie federale samenwerking van de Interministeriële Conferentie voor Wetenschapsbeleid / Commission coopération fédérale de la Conférence interministérielle de la Politique Scientifique, O&O van de sector van de ondernemingen in Belgie in de periode 1995-2006, R&D du secteur des entreprises en Belgique au cours de la période 1995-2006, April 2008/ Avril 2008

DG Research (2008): Regional Key Figures Database, extraction date: March 2008

ERAWATCH (2006): Country specialisation report: Belgium, June 2006

ERAWATCH research inventory, Belgium, http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.content&countryCode=BE&topicID=4

Eurostat, Statistics in Focus 61/2007; 72/2007; 81/2007

Eurostat Science and Technology indicators

Federal Planning Office (2008): Tableau de bord de l'innovation en Wallonie, last update in June 2008, http://indicators.plan.be

http://planmarshall.wallonie.be/spip/

http://www.sdrb.irisnet.be/en/ser_in.asp

Vlaams Indicatorenboek 2007, O&O indicatoren, Steunpunt beleidsrelevant onderzoek 2007-2011.

INNO-Policy TrendChart, policy measure database and annual country reports, 2007 and 2008

http://www.proinno-europe.eu/index.cfm?fuseaction=country.showCountry&topicID=263&parentID=52&ID=2

IRES (2006) : La fuite des cerveaux entrave-t-elle la croissance européenne, September 2006, Catholic University of Louvain (UCL).

L'Echo (2008): 26 April 2008

L'Echo (2007): 4 April 2007, p.8

National Bank of Belgium (2008): Annual report 2007, January 2008

National Bank of Belgium (2008): Belgian Prime News no.40, June 2008

National Bank of Belgium (2008): Indicateurs économiques pour la Belgique, n°2008-30, 25th July 2008

Nauwelaers C. (2006): "Strategic Evaluation on Innovation and the knowledge based economy in the Structural Funds, July 2006, Cohesion Funds, for the programming period 2007-2013: Country Report for Belgium", 2006, http://ec.europa.eu/regional_policy/sources/docgener/evaluation/pdf/evalstrat_innov/belgium.pdf

Nauwelaers C. (2007): Monitoring and analysis of policies and public financing instruments conductive to higher levels of R&D investments: the "POLICY-MIX" project, Country review Belgium, March 2007

OECD (2007): « Economic survey of Belgium, 2007 », OECD Policy Brief, February 2007

OMC Policy Mix Review report (2007): Country Report Belgium, July 2007

Parlement de la Communauté Française (2007): Etat des lieux de la recherche scientifique, rapport de commission présenté au nom de la Commission de l'enseignement supérieur et de la recherche scientifique par Mesdames Françoise Fassiaux-Looten et Caroline Persoons, Session 2007-2008, 26 Septembre 2007

PISA (2007): The Programme for International Student Assessment, OECD, 2007

De Standaard (2008): Bijna 15.000 vacatures voor informatici, 22 May, 2008

De Standaard (2008): Niemand te vinden voor 50.000 jobs, 14 May, 2008

Union Wallonne des Entreprises (2006): Rapport sur la situation de l'entreprise en Wallonie, 2006

Van Pottelsberghe B., Vandecandelaere S.,, De Béthune E., Recommendations pour la politique belge en matière de brevets, Conseil Central de l'Economie, 2007

List of Abbreviations

ASE	Walloon Economic Stimulation Agency
AST	Walloon Technological Stimulation Agency
BERD	Business Expenditures on Research and Development
CIMPS/IMCWB	Inter-Ministerial Conference for Science Policy
CIP	Competitiveness and Innovation framework Programme 2007-2013
CIS	Community Innovation Survey
CWPS	Walloon Council of Science Policy
DGTRE	Walloon Directorate General for Technologies, Research and Energy
EPO	European Patent Office
ERA	European Research Area
ERDF	European Regional Development Fund
ESA	European Space Agency
ESF	European Social Fund
ESO	European Standards Organisation
ESRF	European Synchrotron Radiation Facility
EU	European Union
EWI	Flemish Department for Economy, Science and Innovation
FDI	Foreign direct investments

FNRS-FWO	National Scientific Research Funds
FP	Research Framework programme
FP7	Seventh Research Framework Programme 2007-2013
FRWB-CFPS	Federal Science Policy Council
FWO	Flemish Research Funding Council
GBAORD	Government budget appropriations for R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditures on Research and Development
GNP	Gross National Product
GOVERD	Government expenditures on Research and Development
HEI	Higher Education Institution
HRST	Human Resources in Science and Technology
ICT	Information and Communication Technologies
IPR	Intellectual Property Rights
IRSIB-IWOIB	Institute for the support of Scientific Research and Innovation of Brussels
IWT	Flemish Institute for the promotion of Innovation by Science and Technology
JRC	Joint research Centre
NABS	Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets
NCP	National Contact Point
NVAO	Accreditation Organisation of The Netherlands and Flanders
OECD	Organisation for Economic Cooperation and Development
OMC	Open Method of Coordination
PRO	Public Research Organisation
R&D	Research & Development
RTD	Research, Technology and Development
RTDI	Research, Technology, Development and Innovation
SCI	Science Citation Index
SF	Structural Funds
SME	Small- and Medium-sized Enterprises
VA	Value-added
VRWB	Flemish Council for Science Policy

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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 Belgium.

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