Royal Belgian Academy Council of Applied Science

Belgian Research in the European Context

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The Belgian Academy Council of Applied Science (BACAS) consists of CAWET (a committee of the Koninklijke Vlaamse Academie van België voor Wetenschappen en Kunsten, recently converted to a separate class of technical sciences – KTW -) and CAPAS (a committee of the Académie royale des Sciences, des Lettres & des Beaux-Arts de Belgique). Its members come from academia and from industry.

Belgian Research in the European Context

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EXECUTIVE SUMMARY

This report on the state of Belgian research in the European context is the result of an initiative of BACAS, the Belgian Royal Academy Council for Applied Science. It is aimed at providing elements of reflection in the area of science and research policy for the 2010 Belgian Presidency of the European Union.

The report is based on both a quantitative assessment of Belgian research from international statistics and a qualitative evaluation obtained from responses to a questionnaire sent to individuals and organisations, public and private, involved in the planning, management and/or execution of research in Belgium.

As shown by various performance indicators, the Belgian R&D system occupies an honourable place in the European context, in terms of expenditures per unit GDP, number of researchers and doctoral graduates per 1000 employees, scientific publications, number of applications for patents and overall innovation performance, as well as participation in European programmes. On the negative side is the slowdown in growth of research funding, even before the current economic crisis. The Lisbon/Barcelona target of 3% of GNP for 2010 will be missed by a wide margin, as it was only 1.83% in 2006.

The main strengths of the R&D system, as seen through the replies to the questionnaire, are considered to be, first, the internationally recognised high quality of university education and research, and of other public and private research, second, the various initiatives at federal and regional levels to support fundamental and applied research, third, the fiscal measures to stimulate employment of researchers.

Weaknesses are the under-funding of public research and higher education, the “atomisation” resulting from the complexity of structures and decision making at the various political levels, the dearth of permanent research positions, the insufficient mobility of researchers, the fact that much of private research is done in foreign-owned companies, the unsatisfactory state of large scientific infrastructures.

The assessment leads to recommendations concerning public and private research funding, improved coordination between the different levels of government, increasing the attractiveness of research careers, as well as reducing the administrative load in the EU programmes and the reinforcement of the European Research Area.

RÉSUMÉ

Ce rapport sur l’état de la recherche belge dans le contexte européen est le produit d’une initiative du BACAS, le comité des Académies royales pour les applications de la science. Il a pour but de fournir des éléments de réflexion dans le domaine de la science et de la politique de recherche dans la perspective de la Présidence belge de l’Union européenne en 2010.

Il est basé, d’une part, sur une évaluation quantitative de la recherche belge telle que vue au travers de statistiques internationales et, d’autre part, sur une appréciation qualitative établie à partir des réponses à un questionnaire envoyé à des personnes et organismes publics et privés impliqués dans la programmation, la gestion et/ou l’exécution de la recherche en Belgique.

Comme le montrent divers indicateurs de performance, le système belge de R&D occupe une place honorable dans le contexte européen, que ce soit en termes de dépenses par unité de PNB, nombre de chercheurs et de docteurs par 1000 travailleurs, publications scientifiques, demandes de brevets, performance globale en matière d’innovation ou participation aux programmes européens. Un aspect négatif est le ralentissement dans la croissance du financement de la recherche, même avant le début de la crise économique actuelle. L’objectif de Lisbonne/Barcelone de 3% du PNB pour la R&D en 2010 sera loin d’être atteint: le pourcentage correspondant n’étant que de 1,86 en 2006.

Les forces principales du système de R&D, telles que perçues à travers les réponses au questionnaire, sont considérées être, en premier lieu, la haute qualité, reconnue internationalement, de l’enseignement et de la recherche universitaires ainsi que de la recherche exécutée par d’autres organismes publics et privés, en second lieu, les diverses initiatives aux niveaux fédéral et régional/communautaire en appui de la recherche fondamentale et appliquée, et en troisième lieu, les mesures fiscales pour stimuler l’emploi des chercheurs.

Les faiblesses sont le sous-financement de la recherche publique et de l'enseignement supérieur, l' « atomisation » due à la complexité des structures et du processus de décision aux différents niveaux politiques, la pénurie de postes permanents de chercheurs, la mobilité trop faible des chercheurs, le fait qu'une grande partie de la recherche privée est exécutée dans des firmes étrangères, l'état insatisfaisant des grandes infrastructures scientifiques.

Cette analyse conduit à des recommandations concernant le financement de la recherche publique et privée, l'amélioration de la coordination entre les divers niveaux de gouvernement, l'augmentation de l'attrait de la carrière de chercheur, ainsi que la réduction de la charge administrative dans les programmes de l'Union européenne et le renforcement de la collaboration entre pays et régions au sein de l'Espace Européen de la Recherche.

SYNTHESE

Dit rapport betreffende de toestand van de Belgische onderzoekswereld in de Europese context, is ontstaan op initiatief van BACAS, de *Belgian Royal Academy Council for Applied Science*. De bedoeling ervan is ideeën aan te reiken met betrekking tot het beleid inzake wetenschap en onderzoek naar aanleiding van het Belgisch voorzitterschap van de Europese Unie in 2010.

Het rapport is tegelijk gebaseerd op een kwantitatieve evaluatie van het onderzoek in België vanuit internationale statistische gegevens, en op een kwalitatieve analyse van de antwoorden op een vragenlijst die werd rondgestuurd naar zowel openbare als privé personen en instellingen betrokken bij de planning, het management en/of de uitvoering van onderzoek in België.

Verschillende prestatie-indicatoren tonen aan dat het Belgische R&D-systeem binnen de Europese context een eerbare plaats inneemt, zowel in termen van uitgaven in procent van het BBP, als van aantal onderzoekers en doctors per 1.000 werknemers, wetenschappelijke publicaties, patentaanvragen, innovaties in de brede zin en deelname aan Europese onderzoeksprogramma's. Negatief is de afnemende groei van de financiering van het onderzoek, een evolutie die reeds van voor de huidige economische crisis wordt vastgesteld. De Lissabon/Barcelona-doelstelling om tegen 2010 3% van het BBP aan onderzoek te besteden zal op verre na niet gehaald worden, daar in 2006 nog maar 1,83% werd bereikt.

Uit de antwoorden op de vragenlijst kan men afleiden dat als voornaamste sterke punten van het Belgische R&D-beleid worden beschouwd, in de eerste plaats de internationaal erkende hoge kwaliteit van het universitaire onderwijs en onderzoek, en van het overige openbare en privé onderzoek, vervolgens de diverse federale en regionale initiatieven ter ondersteuning van fundamenteel en toegepast onderzoek, en, tenslotte, de fiscale maatregelen gericht op het stimuleren van de tewerkstelling van onderzoekers.

Zwakke punten zijn de onvoldoende financiering van openbaar onderzoek en hoger onderwijs, de versnippering als gevolg van de ingewikkelde structuren en besluitvorming op de diverse politieke niveaus, het tekort aan vaste banen in de onderzoekswereld, de te geringe mobiliteit van de onderzoekers, het feit dat een te groot aandeel van de privéresearch plaatsvindt in bedrijven die in handen zijn van buitenlandse eigenaars en de ondermaatse infrastructuur van grote wetenschappelijke instellingen.

Deze analyse is aanleiding voor een aantal aanbevelingen inzake financiering van openbare en privéresearch, betere coördinatie tussen de verschillende bestuursniveaus, het aantrekkelijker maken van carrières in het onderzoek, het reduceren van de administratieve rompslomp van de Europese programma's en een versterking van de samenwerking tussen de Europese landen en regio's op vlak van onderzoek (European Research Area).

Chapter 1

INTRODUCTION

From 1 July to 31 December 2010, Belgium will hold the Presidency of the European Union. In order to establish this forthcoming Belgian Presidency in the field of science and research policy on firm ground, BACAS has taken the initiative to prepare a short report on Belgian research in the European context.

The objective is to assess the state of research and research policy in Belgium, on the basis of an as accurate and comprehensive as possible picture of its strengths and weaknesses in this field, the activities carried out in Belgian universities, research centres and enterprises, as well as relevant past and current initiatives taken by federal and regional authorities.

One of the key concerns was to situate Belgian research in its European context, by comparing its level of performance to that of other European countries, but also by trying to assess the Belgian involvement in European initiatives, starting with the EU Research Framework Programmes, and determining to what extent research policies in Belgium are implemented in relation with the major European objectives in this field.

One of these major European objectives, adopted at the Lisbon European Council of March 2000 at the initiative of the Belgian Commissioner for research, Philippe Busquin, is the realisation of a true European Research Area. The project has three components: an "internal market" for research, scientific knowledge and technology; a space for the coordination of research activities, programmes and policies in Europe; and research initiatives directly designed to be implemented at the European level, such as the new European Research Council for the funding of "frontier research".

Since March 2000, the European Research Area project, to which the EU currently tries to give a new impetus, serves as a reference framework for research policy issues in Europe. It influences thinking and debate on such issues, the way national research policies are conceived and implemented and, to a certain extent, the way research is carried out in Europe.

In order to gather as quickly as possible reliable and detailed information on the state of research and research policies in Belgium, while mobilising the Belgian research community, BACAS decided to launch a survey. A short questionnaire was addressed to the major actors in the field: universities, enterprises, research funding organisations, public bodies, etc. The response was high and, on average, of very good quality, with many interesting analyses and stimulating views and reflections.

The present report consists of three parts:
– A quantitative assessment of Belgian research on the basis of a range of figures, statistics and classical performance indicators (public and private funding, number of researchers, publications, patents), situating Belgium in the European and international context;
– A synthesis of the answers to the questionnaire, which summarizes the main messages coming from individuals and organisations involved in the survey, and helps in establishing a qualitative assessment of research activities and policies in Belgium;
– Defined on this double basis, a set of recommendations to federal, regional and European public authorities, in particular in the context of the Belgian Presidency of the EU, but also to the Belgian research community, Belgian universities, research organisations and industry.

From Etienne Davignon to Philippe Busquin, Belgian personalities played a significant and highly praised role in the development of the European research policy. In research as well as in many other areas, Belgian presidencies have often been extremely productive. BACAS hopes that, by helping to clarify domestic issues in the light of their European context, the present report will help the forthcoming Belgian Presidency to be a success in the research area.

Chapter 2

STRENGTHS AND WEAKNESSES OF THE BELGIAN SCIENCE & TECHNOLOGY SYSTEM AS SEEN THROUGH INTERNATIONAL KNOWLEDGE INDICATORS

Recently published international scoreboards using a range of knowledge indicators underline some of the key features of the Belgian S&T system including upstream (higher education) and downstream (innovation) components.
Three important sources of information have been used for this analysis:

- A. Science, Technology and Competitiveness, Key Figures, Report 2008/2009,
  DG Research, European Commission EUR 23608 EN, 2008.

- B. Main Science and Technology Indicators,
  OECD, Volume 2008/2, October 2008

- C. European Innovation Scoreboard 2008. Comparative Analysis of Innovation Performance,
  Pro-Inno Europe, Innometrics, January 2009

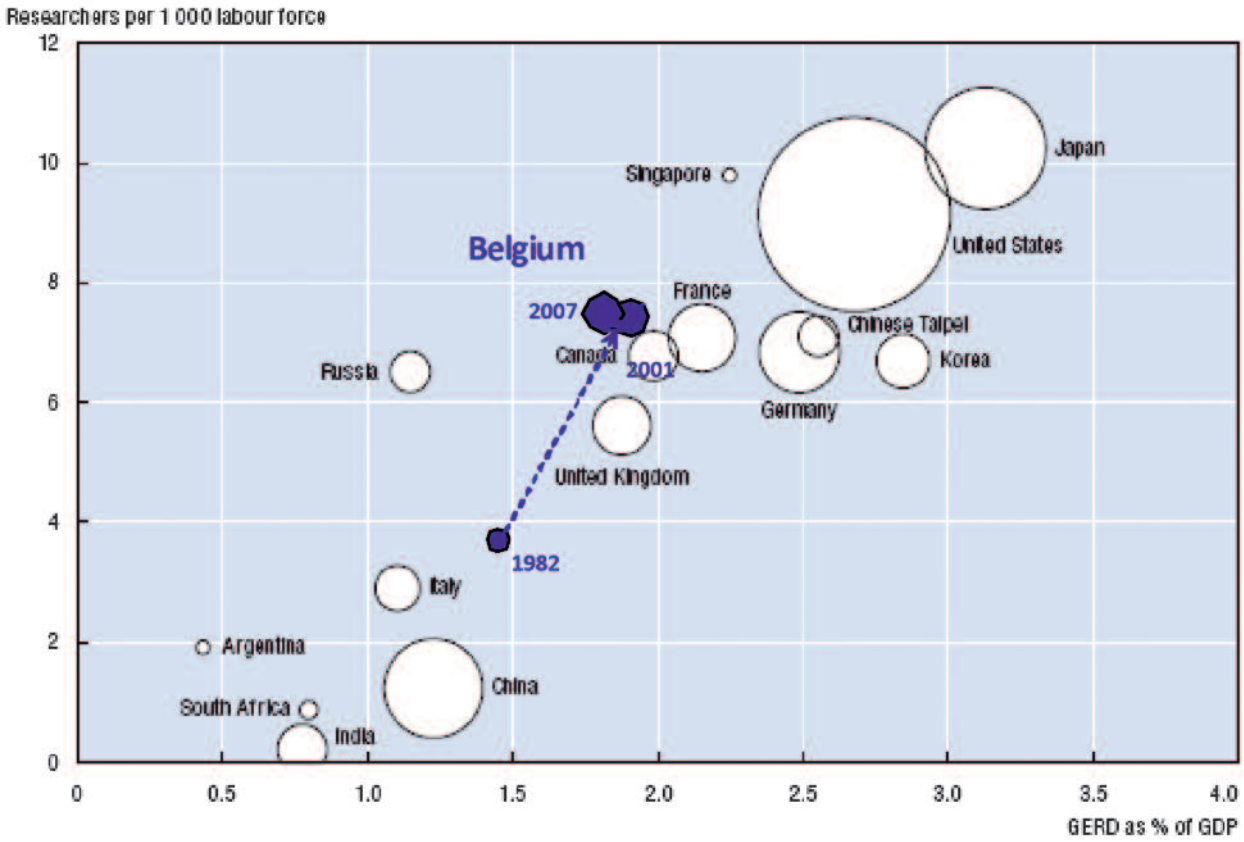
This benchmarking exercise reveals that, from an overall point of view, Belgium is not badly placed in the concert of European nations, the most worrisome aspect being the deceleration of its past dynamism, well before the appearance of the current economic crisis. See Table 1 below and Figure 1 next page.

The general picture of the Belgian position on the world scene is given by figure 1, describing its strength in terms of Research Intensity, the Gross Domestic Expenditure on R&D (GERD) as % of Gross Domestic Product (GDP), and number of researchers per 1.000 labour force. The size of the circles for each country is proportional to the absolute volume of R&D expenditure. For Belgium, the trajectory of the evolution between 1982 and 2007 with an intermediary point in 2005 is also indicated. Belgium occupies quite an honourable place amongst developed nations.

With reference to specific indicators linked to R&D performance, Belgium occupies the 11th place in terms of Gross Expenditure on R&D (GERD) in the EU 27 (2.7% of total EU 27 GERD) and is very close to the EU 27 average in terms of R&D intensity (GERD as a % of Gross National Product), as Figures 1 and 2 indicate.

Table 1. (source B) **GERD in various countries of the world**

	GERD million euro 2006 [1]	GERD EU-27 shares (%) 2006 [2]
US [3]	*273772*	-
EU-27	*213805*	100.0
Japan	118295	-
Germany	*58848*	*27.5*
France	*37844*	*17.7*
UK	34037	15.9
China	30002	-
Italy	15599	7.7
Spain	*11815*	*5.5*
Sweden	11691	5.5
Netherlands	*8910*	*4.2*
Switzerland	8486	-
Austria	*6946*	*3.0*
Finland	*6016*	*2.7*
Belgium	*5798*	*2.7*
Denmark	*5349*	*2.5*



1. Or latest available year.
2. The size of the circles is proportional to the absolute volume of R&D expenditure.
Source: OECD, Main Science and Technology Indicators, June 2006.

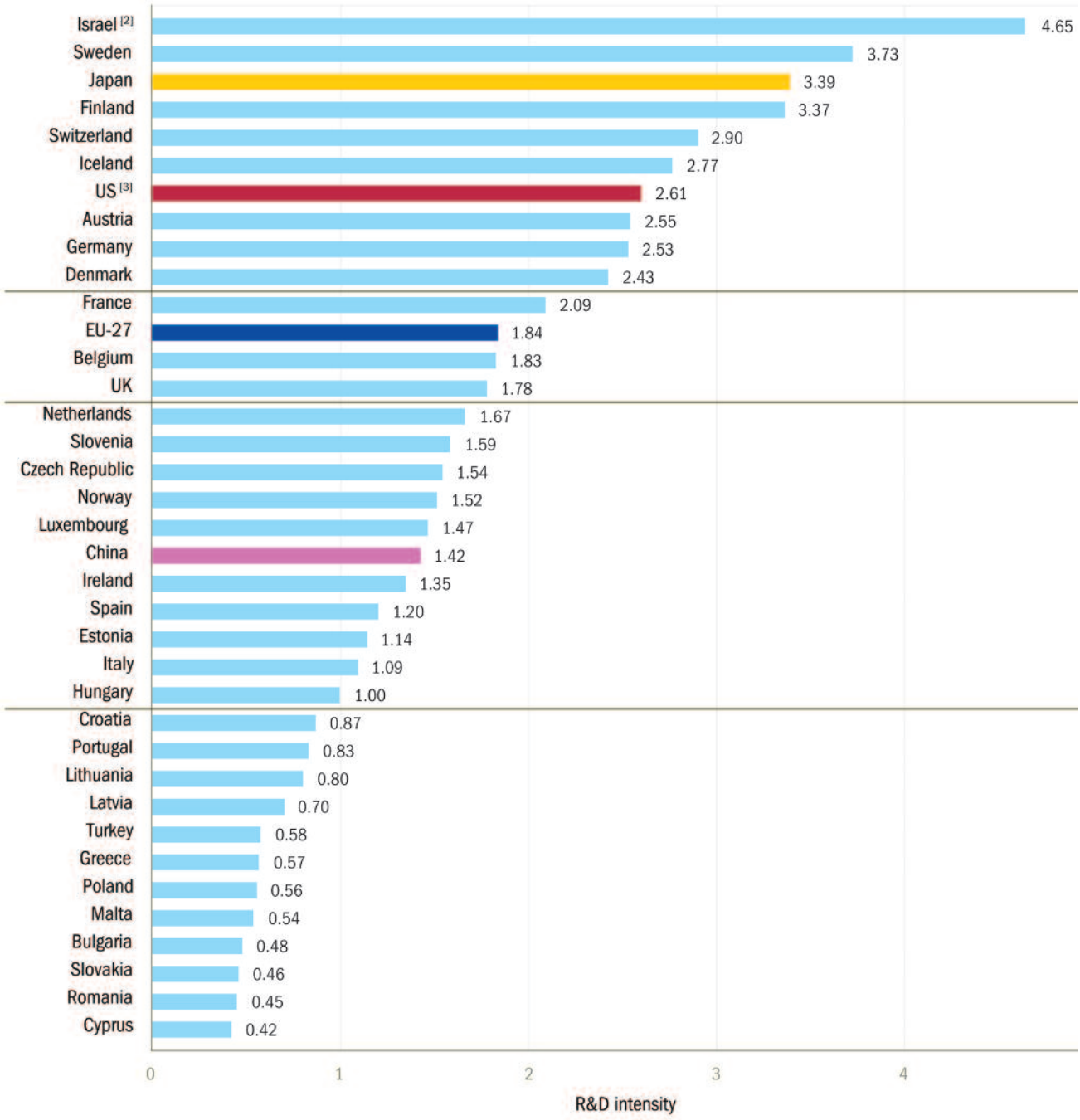
Figure 1. — (source B). Correlation between Research Intensity and Number of Researchers.

Growth in recent years constitutes a problem. GERD had a fairly modest growth, well below EU 27 average, and Research Intensity experienced a negative growth between 2000 and 2006. This implies that a great effort must still be expended to reach in 2010 the national R&D intensity target. In 2005, each Member State of the European Union has set such a national target which may differ from the Lisbon 3% target for the EU as a whole, depending on the specific situation of each country. If all member States were to reach their respective national targets, the Research Intensity of the EU 27 would become 2.5% in 2010, below the 3% assigned in Lisbon but still an improvement compared to the current situation. As shown in figure 3 Belgium is within the group of countries lagging behind in terms of progress towards the 2010 targets (3% for Belgium).

In terms of main sources of R&D funds, Belgium ranks 5th after Sweden, Finland, Germany and Luxemburg, among the EU 27 countries in terms of prominence of business enterprise funding, 59.7% in 2006 (above the EU 27 average of 54.6%), while 24.7% come from government, and 12.4% from abroad.

In terms of performers of R&D, the business enterprise sector accounts for 67.9% of the total in 2006, again a high figure only surpassed by the four countries mentioned; 22.3% are performed by higher education institutions and 8.6% by government institutions.

As shown in figure 4 in terms of business enterprise R&D expenditures, a very large fraction, about 60%, comes from foreign affiliates, reflecting the current situation of dependence from abroad of the Belgian industry.



Source: DG Research

Figure 2. — (source A). R&D intensity in the EU countries.

Another factor which creates some cause for worry is the negative growth of the share of the Research Intensity of Belgium financed by business enterprise between 2000 and 2006 while that financed by government remained stable. This evolution is represented in figure 5. In view of the weight of business enterprise in the overall R&D panorama, this was the main cause of the poor performance of Belgium in terms of R&D growth

The strength of the R&D workforce is another important indicator. R&D personnel in Belgium in terms of percentage of the population is above the EU 27 level as shown in figure 6 This may be linked to the very high share of population with tertiary education, one of the highest in Europe as depicted by figure 7, even if figure 8 indicates that in terms of doctoral degrees, Belgium lags behind many other European countries.

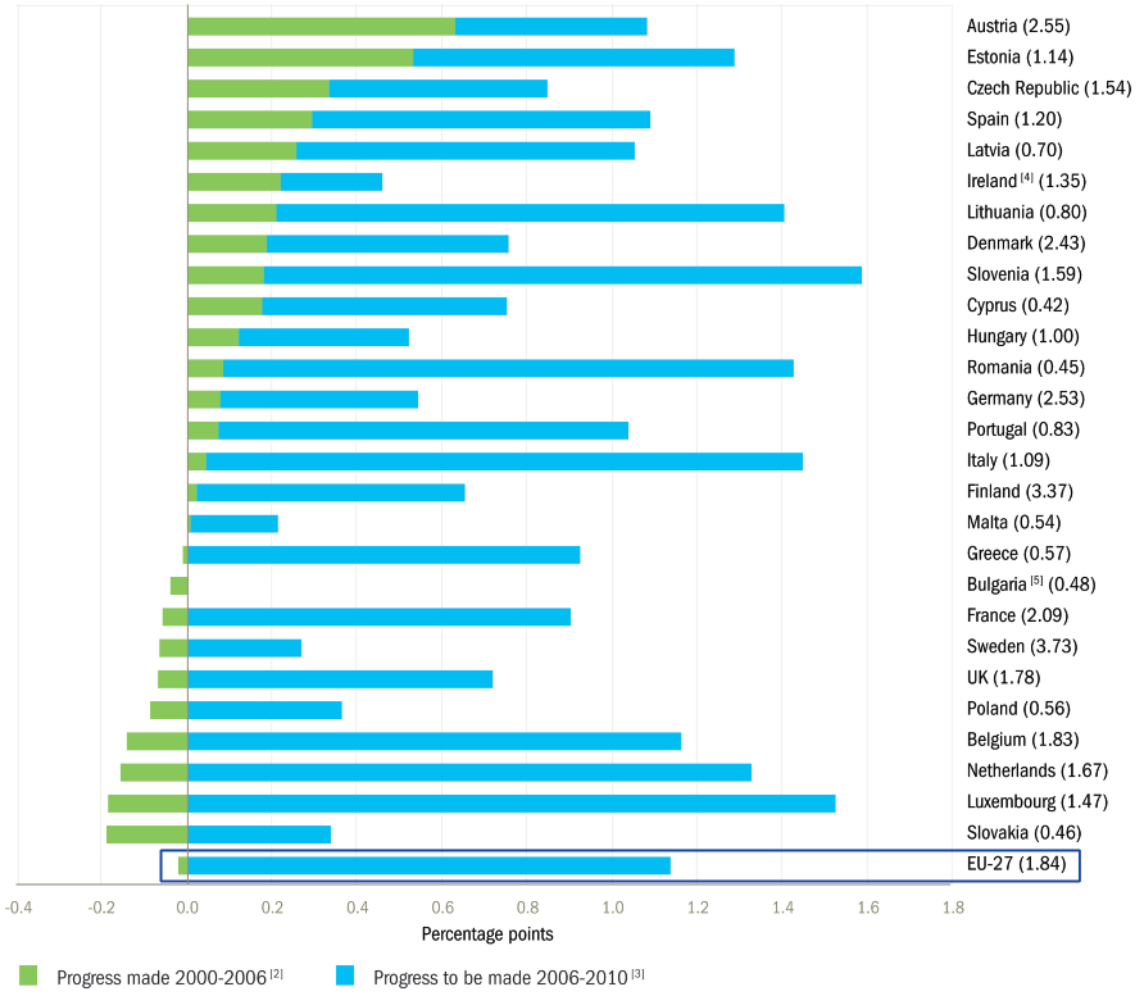


Figure 3. — (source A). R&D intensity progress toward the 2010 target.

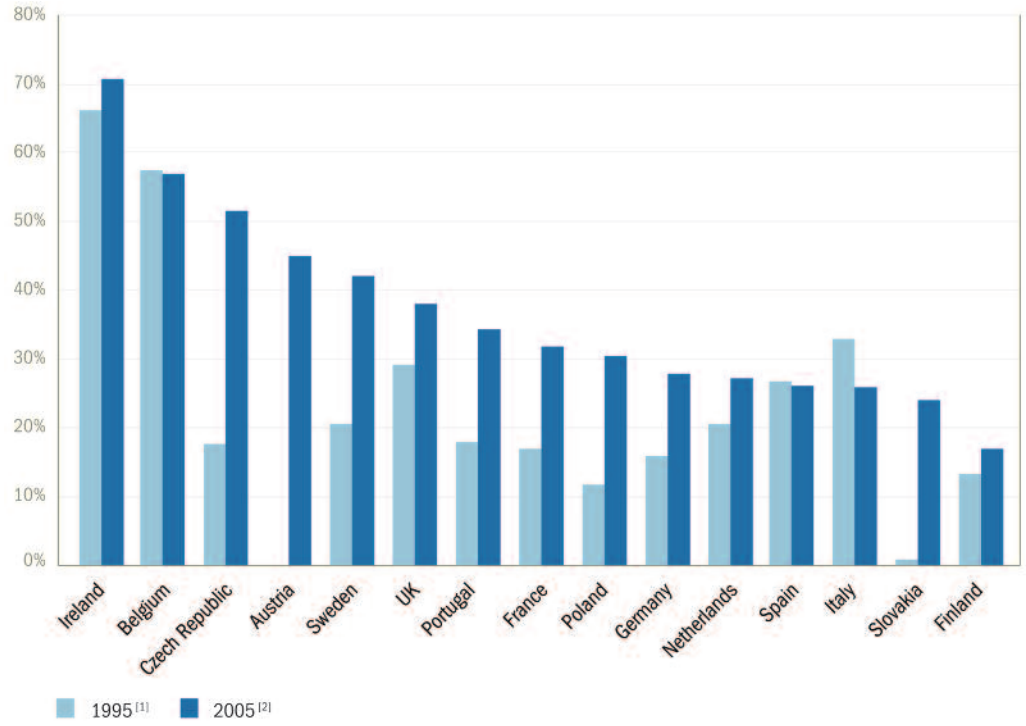


Figure 4. — (source A). R&D expenditure by foreign affiliates.

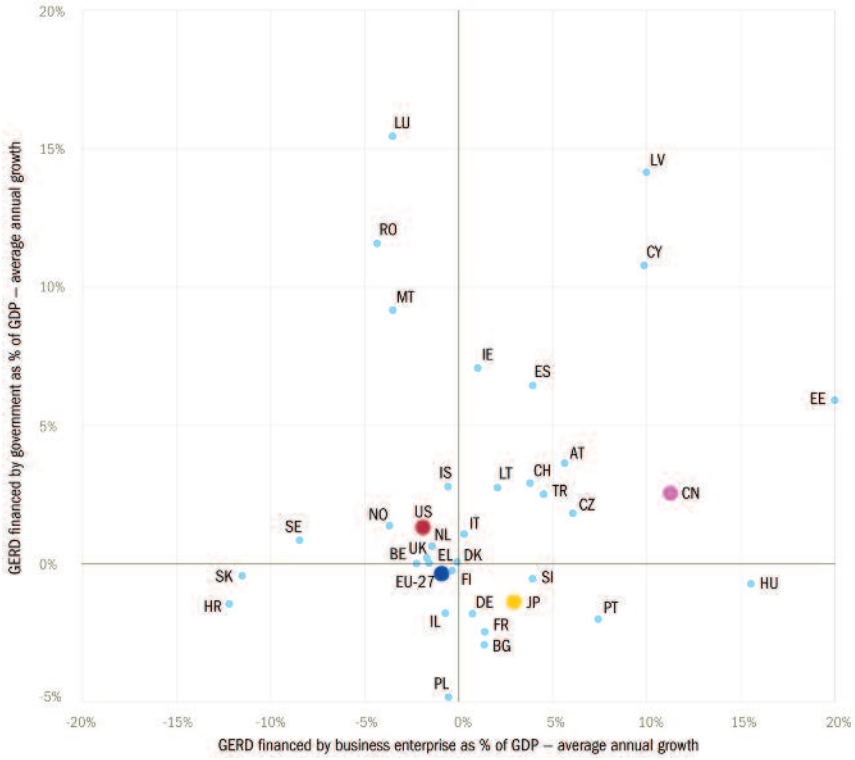


Figure 5. — (source A). Annual growth of GERD financed by government and business enterprise.

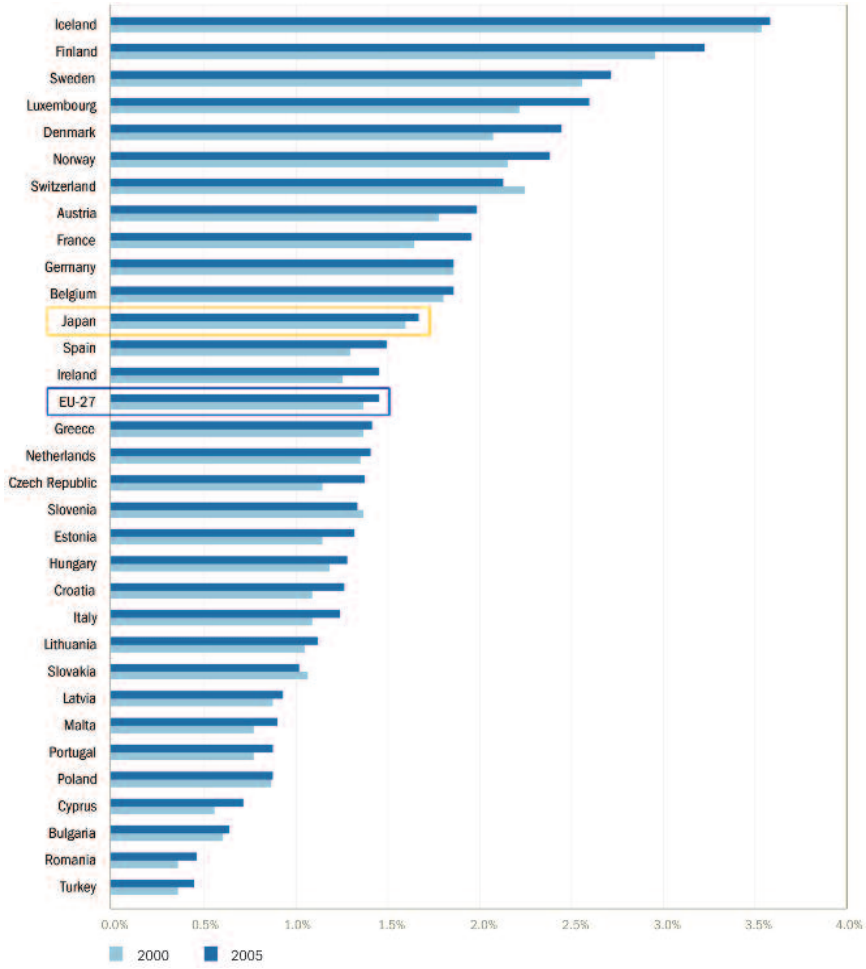


Figure 6. — (source A). R&D personnel as % of total employment.

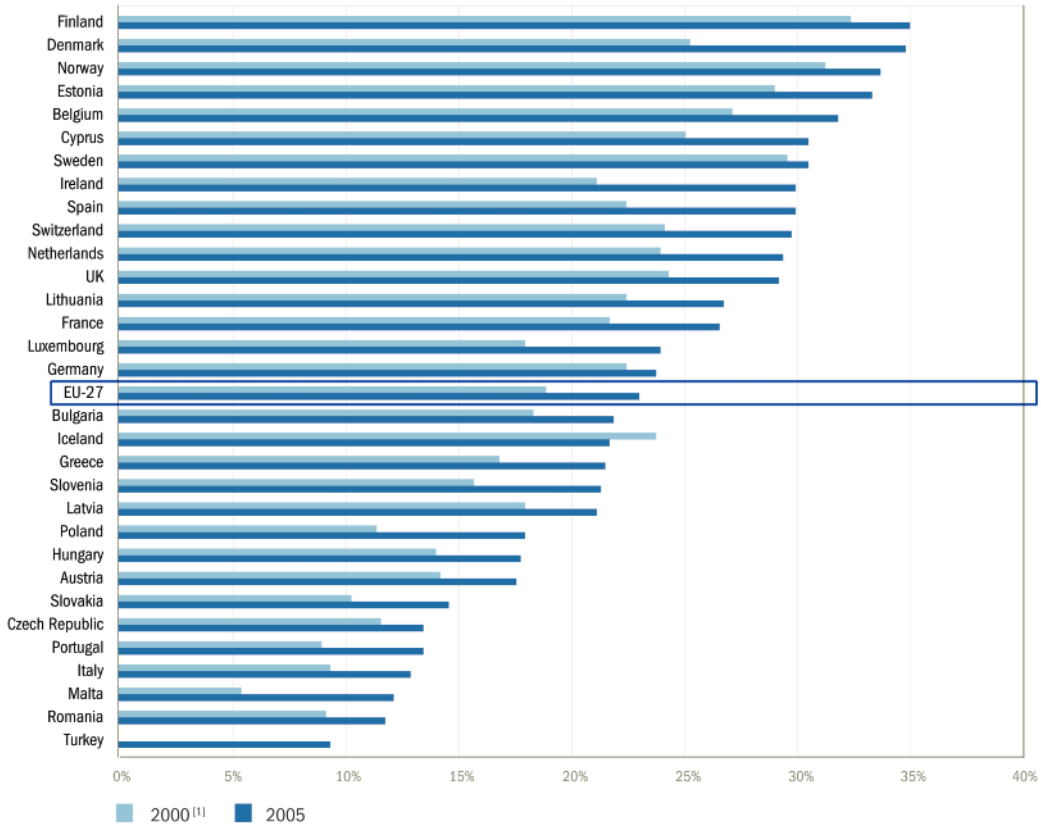


Figure 7. — (source A). Share of population aged 25-64 with tertiary education.

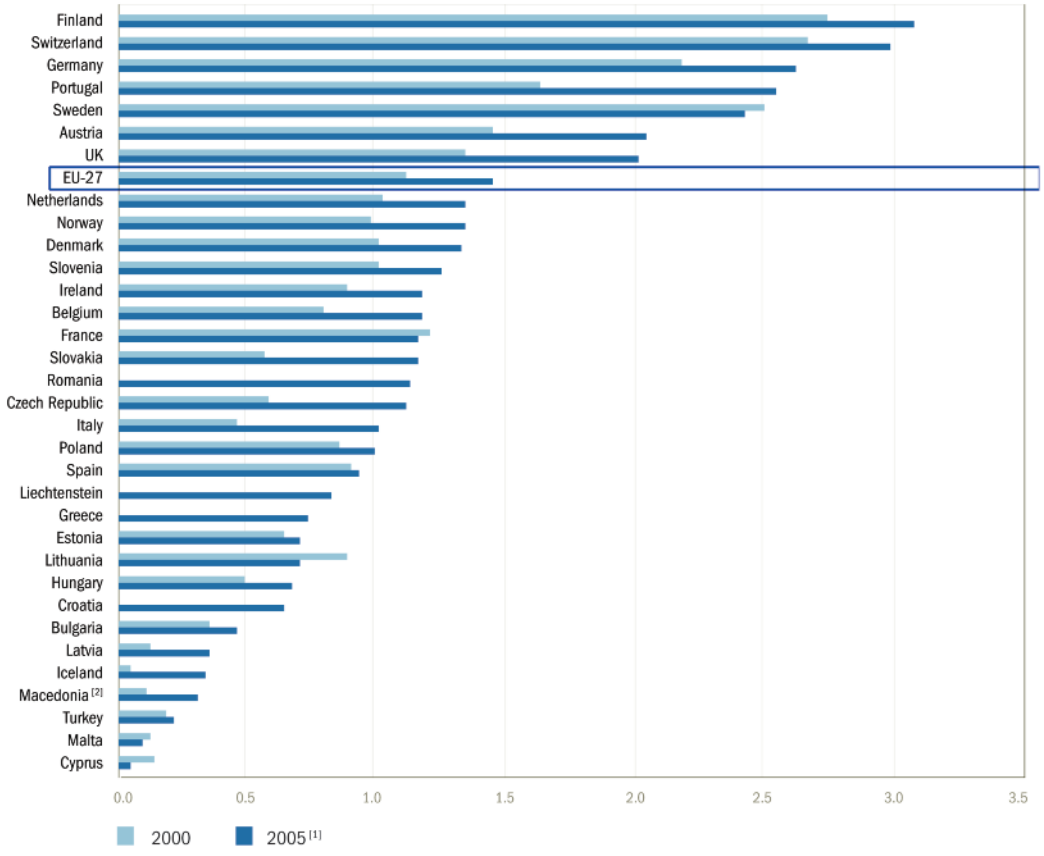


Figure 8. — (source A). Doctoral graduates per thousand aged 24-65.

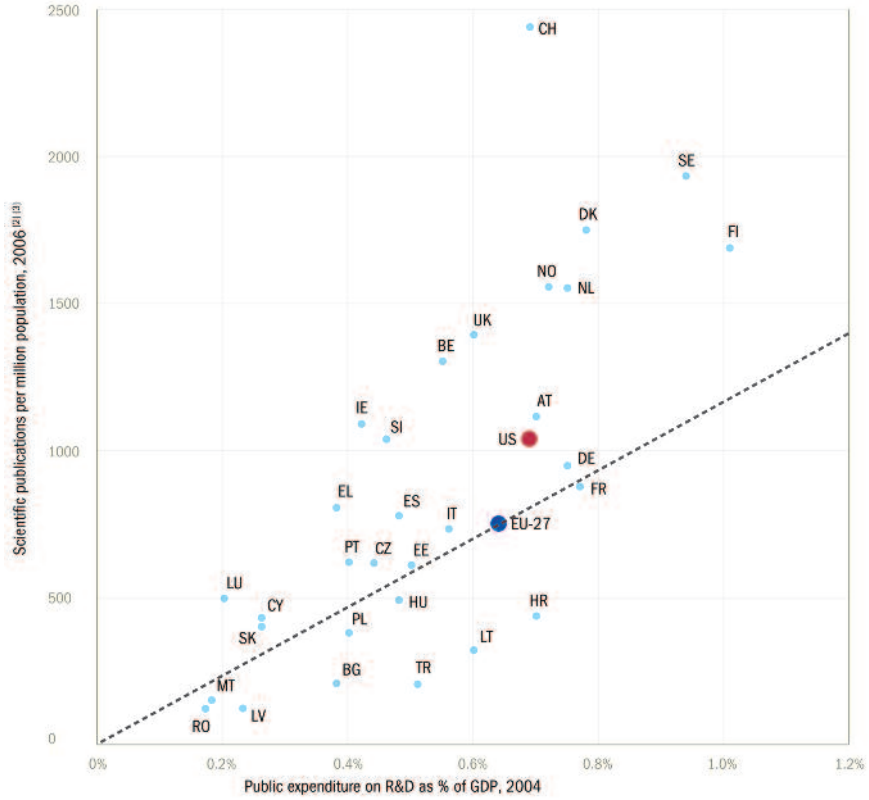


Figure 9. — (source A). Scientific publications in relation to public expenditure.

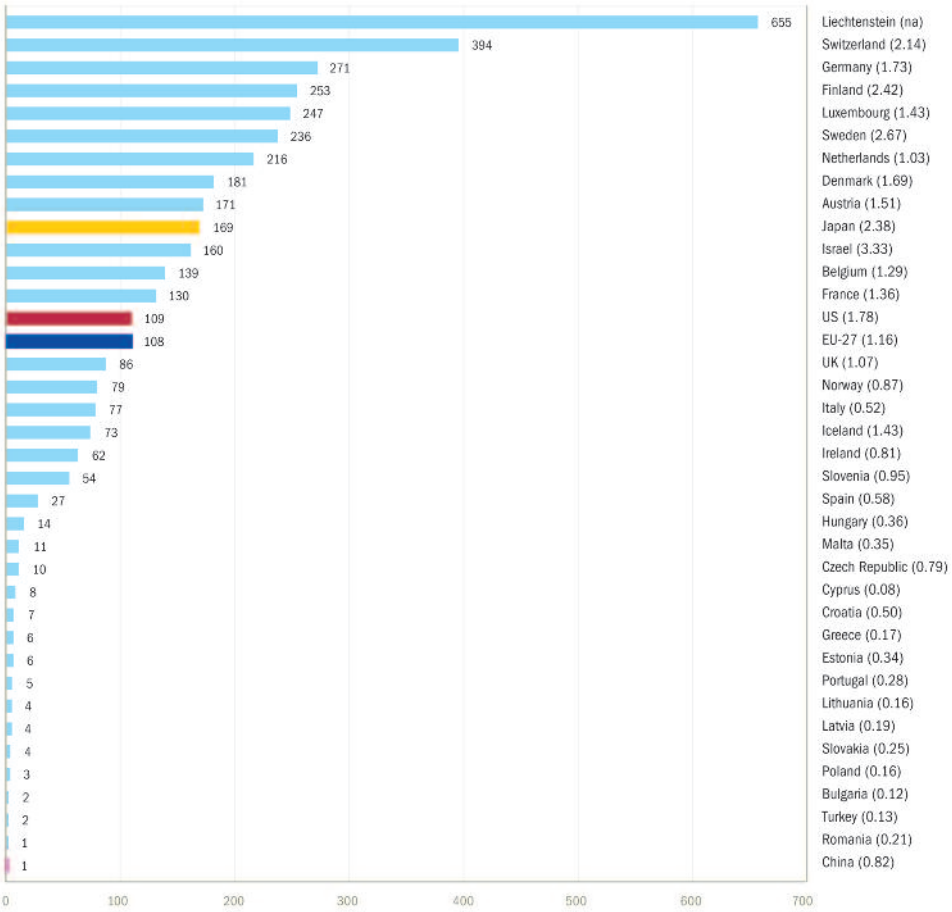


Figure 10. — (source A). EPO patent applications per million population.

If upstream of R&D, i.e. in tertiary education, the picture is positive, the situation downstream of R&D is equally favourable. It is particularly remarkable in terms of scientific publications as shown by figure 9 which correlates the number of scientific publications per million inhabitants to public expenditure in R&D as % of GDP. Belgium is well above the correlation curve calculated from the performance of all European countries. If Belgium would follow such curve it should produce around 600 publications per million inhabitants while in reality this number reaches about 1300, more than double the "norm".

Patents constitute another indication of the strength of the output of the R&D system.

Figure 10 shows the number of applications for patents submitted to the European Patent Office (EPO) per million inhabitants in 2004. Belgium with 139 applications is before France with 130, the United States with 109 and the EU average of 108. To put this performance in perspective, it is still well below those of Switzerland and Germany with 394 and 271 respectively. One should note that a large fraction of the domestic EPO patent applications are owned by foreign residents: the percentage is 47% for Belgium, only surpassed by Hungary (58.8%) and Luxemburg (58%).

The European Innovation Scoreboard 2008, mentioned at the beginning of this chapter, has conducted a very detailed analysis of the overall innovation performance of the EU countries, calculated as a composite of no less than 29 indicators.

The results of this analysis as shown in figure 11 and table 2, are encouraging for Belgium which ranks 9th in the group of "Innovation Followers" which includes Austria, Spain, Luxemburg, Belgium, France and the Netherlands, just behind the group of "Innovation Leaders" composed of Sweden, Finland, Germany, Denmark and the United Kingdom. Table 2 presents a matrix where the 27 EU countries are ranked according to their innovation performance and the rate of growth of their performance over 5 years. Belgium is described as a "moderate grower" when considering the evolution of this performance over a five-year period.

Finally, one should look at the European dimension of Belgian R&D.

Figure 12 allows delineating this dimension by considering the number of participations in European programmes per thousand researchers. Belgium, together with Netherlands, displays a very high rate of participation in these programmes, twice the participation of Finland or France. This figure confirms the generally adopted view that Belgian R&D is well inserted in the European context

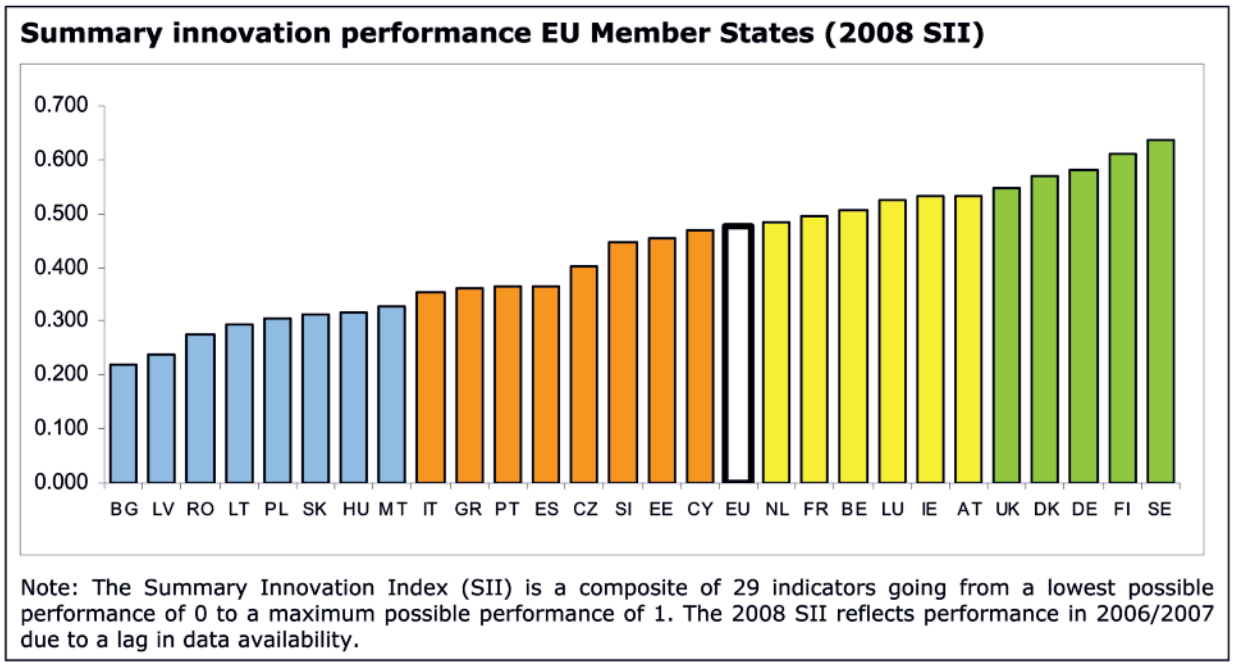


Figure 11. — (source C). Summary innovation index of EU Member States.

Table 2. (source C) **The matrix of innovators in the European Union**

Group	Growth rate	Growth leaders	Moderate growers	Slow growers
Innovation leaders	1.6 %	Switzerland (CH)	Germany (DE), Finland (F)	Denmark (DK), Sweden (SE) United Kingdom (UK)
Innovation followers	2.0 %	Ireland (IE) Austria (AT)	Belgium (BE)	France (FR), Luxembourg (LU)
Moderate Innovators	3.6 %	Cyprus (CY) Portugal (PT)	Czech Republic (CZ) Estonia (EE), Greece (GR) Iceland (IS, Slovenia (SI)	Italy (IT), Norway (NO) Spain (ES)
Catching-up Countries	4.1 %	Bulgaria (BG) Romania (RO)	Latvia (LV), Hungary (HU) Malta (MT), Poland (PL) Slovakia (SK), Turkey (TR)	Croatia (HR), Lithuania (LT)

Average annual growth rates are calculated over a five-year period.

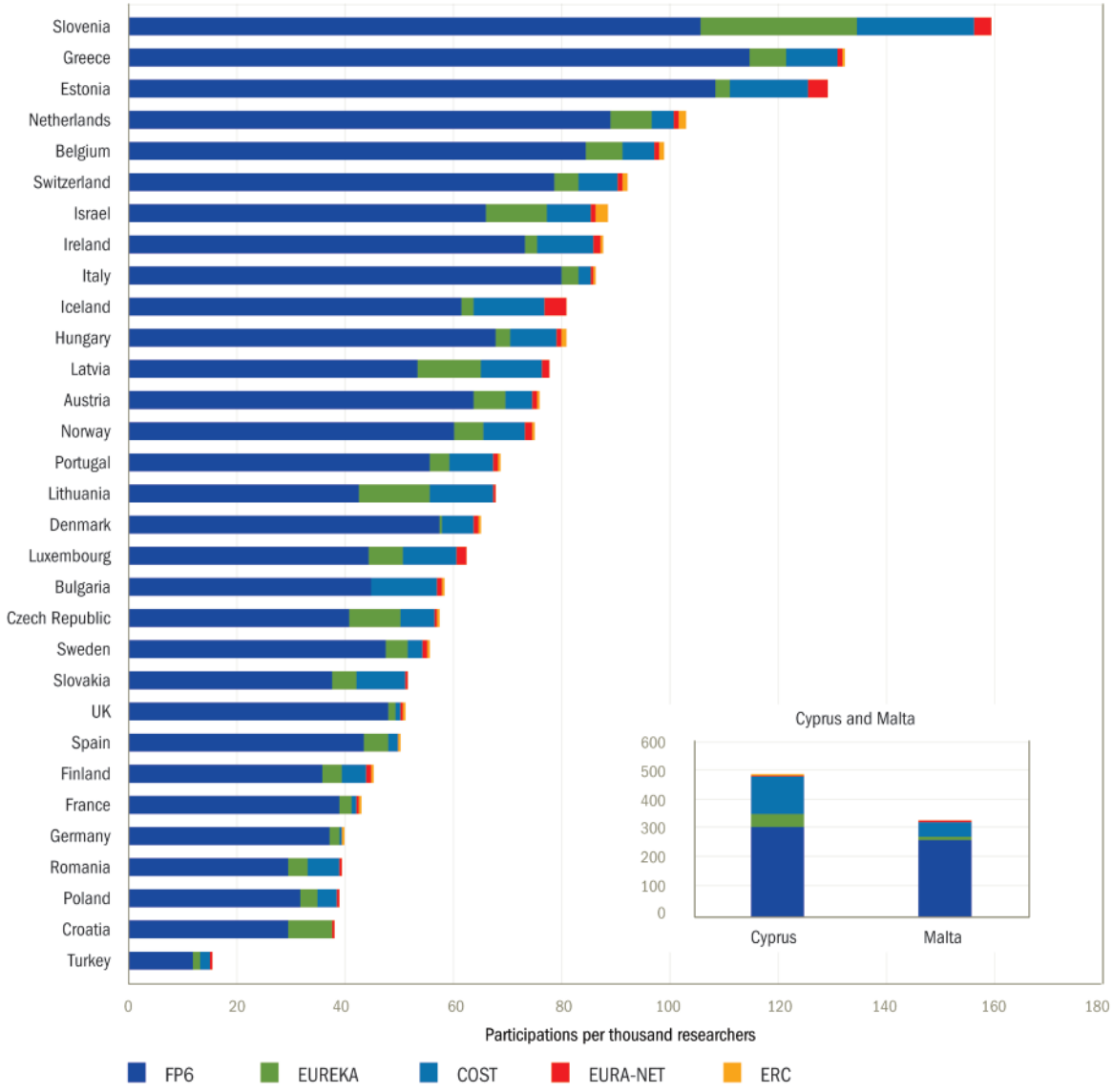


Figure 12. — (source C). Summary innovation index of EU Member States.

As a conclusion of this chapter, one may note that the Belgian R&D system, as shown through indicators, displays a healthy position in the European context. Less positive is the slowdown of its growth during the last years. This began before the current economic crisis appeared, and it can be feared that the crisis will aggravate this trend. The strong presence of foreign ownership in business enterprise is reflected by the large part of R&D expenditure coming from foreign affiliates and by the significant foreign ownership of patents. Belgium remains an attractive partner for other European countries and it should benefit fully from the existence of the European Research Area.

In February 2009, the European-American Business Council and the Information Technology & Innovation Foundation have published a report entitled "The Atlantic Century. Benchmarking EU & U.S. Innovation and Competitiveness" which gives the overall score in terms of innovation-based competitiveness for 36 countries in the world, including all countries of the European Union except Bulgaria and Romania. Belgium occupies the 14th position which is above EU average. The detailed analysis of this score confirms the analysis given in this chapter: Belgium achieves a higher score than its aggregate score in higher education, number of researchers, corporate R&D, scientific publications and productivity while it gets poor marks for government R&D, venture capital, new firms, e-government, business climate and trade balance. The upstream part of the innovation process displays its strength.

Chapter 3

REPLIES TO THE QUESTIONNAIRE

A questionnaire was sent to individuals and organisations (universities, enterprises, large research centres, federal, regional and community administrations, etc) actively engaged in the planning, management and/or execution of basic and applied scientific research and development.

Twenty-six substantial replies were received. The respondents, whose cooperation is most gratefully acknowledged, are listed at the end of this chapter.
Following is an attempt to synthesize the opinions expressed, based on a detailed examination of the replies.

Question 1
Identify the strengths and weaknesses of the current R&D management in Belgium.

Strengths

The excellence in university education and the high quality of its public and private research are internationally recognised. The very good scientific output production, the top research in key fields, and the international mobility trend ascertain these facts. Recent initiatives, e.g. Flanders' Odysseus, Methusalem and Hercules programmes, have been implemented to respectively attract or support top level researchers. In summary, a strong performance can be observed for Belgium with respect to human resources: the population is generally well educated, investments in higher education are superior to the EU average, and the number of researchers is relatively high and growing.

On the Federal and Regional levels new initiatives are taken to support fundamental and applied research activities. Besides the ten Federal Scientific Institutions, the Belgian Federal Science Policy Office (BELSPO) coordinates and supports a broad area of research activities (e.g. Space, Antarctic, North Sea, Biodiversity, and Interuniversity Attraction Poles IAP). On the Regional level, numerous initiatives are taken. Based on how well the technical and economic strengths of Flanders match up with the technical and economic trends identified in a recent European foresight study, the Flemish Science Policy Council selected six strategic clusters (see VRWB Study Series 18 "Technology and Innovation in Flanders: Priorities"). This study succeeded in getting all of the stakeholders significantly involved in innovation-related activities with a well defined critical mass. Research centres, such as IMEC, VIB, VITO, or IBBT in Flanders have the important mission to disseminate technology within the wider industrial fabric and to achieve a level of excellence and a critical mass in well defined domains. In Wallonia and the French speaking Community, the "Marshall Plan" and other initiatives (e.g. the "Actions de recherche concertée", the Nanowal Network, the START program, competitivity poles, spin-off spin-out program) have resulted recently in a marked increase in funding for basic and applied research (see the report of the "Assises de la Recherche" held on 5 March 2009 by the "Communauté Française de Belgique").

With regard to the objective of raising domestic R&D, the Belgian government set up some fiscal measures in favour of the private sector, to try out the innovation premiums system. As to the fiscal measures in favour of researchers, the government has been taking a series of measures since 2002 with a view to stimulate R&D for researchers working essentially in the public sector (accredited universities, higher education institutions and scientific institutions), by granting a 50% exemption from the advance tax payment on wages. This measure has subsequently been gradually extended to a growing number of researchers from companies taking part in R&D activities. This is a radical way of influencing the cost of research personnel in Belgium.
(See "Innovation Belgium. Fiscal measures and innovation premiums for companies", BELSPO brochure, http://www.belspo.be/belspo/fisc/public/Polit_Scien_en.pdf).

Weaknesses

Current investment in the government and higher education research infrastructure in Belgium compared to the amount of money spent by the private sector in business research and development reveals a clear, but striking pattern. Despite some recent, localised increase in funding, Belgium is currently near the bottom in Europe in the relative amounts of money (% of total GERD) it invests in government and higher education research. Furthermore, the trend of Belgian R&D investments in the higher education sector declined over the last twenty years: this contrasts with other European countries which have made the public strengthening of university research infrastructure an absolute priority (Research Series 07, BELSPO, 2005 "R&D and Innovation in Belgium".

Research funding

As agreed in Barcelona, research and technological development (R&D) investment in the EU will have to be increased to amount to 3% of GDP by 2010, up from the 1.9% of GDP in 2000. Public investment in

R&D should amount to 1% of GDP by 2010. The share of R&D expenditures in Belgium reached 1.83% of GDP in 2006 (See Table 12 of JPC), substantially below the 3% Barcelona objective. This figure for 2006 shows an erosion on Belgium's competitive edge in terms of R&D investment (2.11% in 2001), in particular with respect to private sector investments. Econometric projections show that, if current trends are maintained, it will be practically impossible for the country to reach a figure of 3% by 2010.

Nevertheless, the scientific output production in Belgium is very good, but is increasingly threatened by low public R&D expenditures. There is a significant under-funding of university and public research resulting in a lack of career perspectives and of the low net wages in Belgium in public research institutions. Especially basic financing of the universities is too low and may become in Flanders even more problematic with the "Academisering"[1] process of the High Schools. Moreover, structural funding of research (25% of the basic financing) is in some universities lower than 20% of project financing. A challenge for research institutes in the near future is the unbalanced proportionality between structural (government) finances and the total research budget. Some research institutes (e.g. IMEC) have a structural financing of less than 20%, which is much lower than the internationally accepted 30 to 50%. It should be noted that, especially on the regional level, some funding initiatives have counterproductive objectives in terms of rapid industrial applications because of their low quality or potential.

Research structures

Belgium shows a unique feature amongst all EU Member States, namely that it is the only country where Science, Technology and Innovation policies are completely decentralized across several governments enjoying full autonomy of decision power in such matters. Overall, it can be argued that the Belgian R&D is characterized by 'atomization' due to the complexity of structures at the Federal and Regional levels; at least five science ministries, a large number of funding agencies which do not collaborate, and too many initiatives in parallel. The apparent (too) important influence of the universities in Science Policy Councils and Research Foundations is also felt as a problem in the elaboration of a joint (universities, research centres, industry) and innovative R&D program. Overall, the need for more inter-university and inter-institution collaboration (e.g. IAP – Networks) is strongly supported by the research community.

Research careers

The research community must engage the interests of new science students. That means becoming more deeply involved in improving science education at all levels, including working with pre-university students and their teachers and exposing many more students to real science and scientists. Such intentions can raise the career aspirations of young people.

Indeed, human capital is the primary asset in the knowledge based economy. Shifting the current brain drain into a brain gain trend is the major policy challenge. However, the number of science and engineering graduates has significantly dropped over the last ten years. It also appears that Belgium has too low a female participation rate. Apparently research and research careers appear ill-perceived, a viewpoint which is to be considered in relation with the often proclaimed loss of interest for sciences among the young students. Moreover, there are increasingly insufficient positions for young academic researchers to pursue a career in Belgium given the relatively low levels of public research funding. The scarcity of permanent positions enabling groups to reach a "critical mass" is quite detrimental as well. Research careers need to become more attractive and lead to more permanent research positions if Belgium wants to meet its challenge of becoming a well-functioning knowledge-based economy. As far as the 3% objective is concerned, estimations are that Belgium needs to bring more than 11,000 researchers to the R&D sector between 2002 and 2010. It should be noted that the mobility of Belgian researchers is rather low on the international scene and even on the local level. Especially the temporary mobility between research and valorisation activities, between academic institutions and industry, between the public and private sector should be encouraged.

Question 2
Which strategy should be implemented to improve the situation? What are the important objectives on the level of research management?

There is a need for a major public funding injection in Belgium's public research infrastructure. Reinforcing government's appropriations for R&D should be a priority. In essence, the Barcelona target conveys the message that governments should invest at least 1% of their domestic resources in R&D in order to realize the optimal knowledge creation and attraction. It is also important to achieve a better match between

[1] As a consequence of the Bologna "BaMa" (bachelor/master) reform, high schools and universities are in the process of reinforcing their co-operation through so-called "associations" (five such associations have been established in Flanders). Within this framework, high schools will extend their research activities: the limited governmental budget for financing university research will thus have to be shared with the high schools, which is likely to aggravate the deficiency of public financing of universities.

research executed in the public and in the private sectors. In view of the limited funding, optimization of the resources and of their use is essential.

Improvement is necessary of the coordination mechanisms between the various governmental bodies, ministries and agencies, dealing with various aspects of the Belgian Research Area. Possibilities related to inter-regional linkages and exchanges (cfr. IAP- program and informal exchange group Wallonia-Flanders on cluster policy) should be evaluated; the contacts between universities and research institutes across regional borders should be fostered. In order to allow the emergence of new domains, pro-active and top down policies are sometimes necessary. Selection and upgrading of new topical domains should be the priority of universities and research institutes.

The difference between science and technology, or between pure and applied research, is far from clear-cut. It is important, therefore, that government funding covers this broad spectrum, supporting and encouraging radical new ideas with no obvious applications while, at the same time, selecting specific areas that are of economic importance. Even within these better focused programmes, there will be a need for basic research that has the potential to be useful for applications a decade or more from now. In general, the pursuit of new knowledge for the sake of knowledge is the realm of governments and universities. Taking new manufactured products to the market is the province of companies, although it is important that governments ensure that a suitable educated workforce is in place. However, bridging these two arenas and maintaining a balance between them will always be a challenge. Increasing synergies between research laboratories and industry should be a constant concern.

Question 3
How important are large Scientific Infrastructures on the European, Federal and Regional level?

The scientific community strongly supports a coherent and strategy-led approach to policy-making on new and existing pan-European and global research infrastructures as for instance promoted by ESFRI. The availability of open, competitive and quality-based access to international research infrastructures is vital to the further development of the Belgian R&D activities in areas such as particle physics (CERN), x-ray and neutron spectroscopy (ESRF, ILL), astronomy (ESO), and microbiology (EMBL). It is generally agreed that the Federal authorities (e.g. BELSPO) should be responsible for the coordination of access to the large international scientific infrastructures. A strict selection criterion based not only on the “science case”, but also on the “user needs” and the “application areas” seems appropriate.

On the Belgian level, a well developed and accessible inventory of scientific infrastructures is needed in order to avoid investment duplication and to facilitate cost-sharing where appropriate. Important initiatives have recently been taken in Flanders (e.g. Hercules project) to upgrade the research infrastructure facilities. A similar action is strongly supported by the scientists in Wallonia in view of the decrease in funding by the FNRS.

Question 4
Which are the important challenges for future research activities on the Federal and Regional level?

Research structure and management: general

The key role of universities and institutes in research and research training is well recognized by the various federal and regional science policy actors. They are strategically placed at the interplay of RTD, educational and regional development policies. Against a background of increasing worldwide competition, universities need to promote their areas of excellence, produce and attract the best researchers and develop links with European companies.

The universities however look up to important challenges in order to renew their position in the future “Research Landscape”. Through their multiple mission that encompasses teaching, research training, basic research, knowledge transfer to foster university-industry partnerships and public policy development, and not least, informing a wider “knowledge society”, they have, as institutions, a unique role to play. They may also play an important role in bridging the policy framework ‘gap’ between Federal and Regional actions in relation to research and regional development in the Enlarged Union. Universities need also encouragement to develop in a more efficient way the transfer from knowledge and technology to industry. A better synergy is needed between the public and private research sector, including an efficient transfer of technology between universities, research institutes and industry.

There is also an urgent need to translate society’s major challenges (energy, environment, natural resources, mobility, etc) for the next 30 years into R&D challenges. The criteria for success will be different from currently customary methods, will involve strong interrelationships of several participating actors and necessitate an assessment of R&D strength and weaknesses on a federal (regional?) level. The development of a long-term vision instead of a short-term/quick-win policy is mandatory.

The number of large Belgian based companies able to pursue independent research in Belgium is rather

limited if compared to, for instance, the Netherlands, Sweden, Switzerland, etc. This situation does not favour important research activities on a global scale. Concerning the role of smaller companies, administrative simplification and re-centralisation of funding, especially on the regional level, is urgently needed. Simplification of procedures for project application and management is mandatory on the European, federal and regional level. Within the framework of simplification, urgent action is needed in the well known problem of the European patent, and to satisfy the need for a reference corpus to share industrial properties among the actors.

Research structure and management: specific

To address the world's energy needs and demands over the next 20 to 30 years and beyond, a substantial increase in energy research and development is critical. The disciplines of chemistry, the biosciences and chemical, mechanical and electrical engineering will play increasingly important roles in new energy R&D areas. Collaboration among industry, academia, and governments will be essential in creating solutions for the increasingly complex technical problems. Consequently, technical innovation through R&D investments and collaboration will be crucial. A better awareness that environmental and energy technologies are intimately linked is necessary. It will enable the "reform" of our economy and industry instead of the hype "innovation"

Research careers

The scientific community is very concerned about the management of human resources in research. Their concerns are related to the ageing of the population and the disinterest of young people in a research career. Creation of a climate where research is considerate as attractive, especially for the youth, should be a priority on the agenda of ministries responsible for education. The pursuit of a high-level research career for motivated and competent scientists should be encouraged, and the necessary financing and attractive conditions provided.

At university level, ensure new Bachelor and Master Programmes which are flexible enough to allow for an increased student interest and mobility. Remove also the obstacles to mobility for postdoctoral students and academic staff (portability of grants and pensions, etc). Profiles of researchers, their working methods and approaches as well as their career trajectories are getting increasingly diverse, which calls for more flexible and responsive funding instruments and services that recognise researchers' individual needs.

The increasingly intensive competition for research funding, the low number of opening faculty positions, the non-existent tenured academic career path, the general lack of resources, the precarious work situation and the lack of academic career prospects are making the research career less attractive. These factors are reflected in the whole academic sector, and the lack of interest in international researcher mobility should be seen as only one facet of a more complex problem.

Question 5
What is the role and impact of the EU on the research strategy of Belgium and vice-versa?

EU – Belgium

In general the impact of the EU on the Belgian research activities is very positive. The EC established a clear research strategy through its successive Framework Programs (FPs). This succeeded in establishing a strong networking and a tradition of collaboration between the different EU science and technology actors, stimulated international cooperation and university-industry cooperation and enabled the funding of frontier research through the ERC grants and the ERA networks. The elaboration by the EC of a common vision in diverse research domains was recently implemented in European Technology Platforms and their specific Strategic Research Agendas. They may have an important impact on the future research activities of the Belgian universities, research institutes and companies. Overall the Belgian participation and success rate in the various EU programs is very satisfactory and has substantially increased the funding for research and innovation. It is of great importance for the federal and regional research strategy that Belgium can participate in the debates on the EU level, especially in relation to the new finance mechanisms and program implementations. Unfortunately the role of the coordination cells at the federal and regional levels is rather limited, in sharp contrast with the situation in other countries. This should be remedied.

Concerning the European Research Council (ERC), which came officially into existence on 2nd February 2007, all research actors in Belgium have responded with enthusiasm to this new initiative. It will enhance the performance of the local research system and upgrade the objectives in common of the ERC and the national funding bodies. Belgium was very successful in the first round of the ERC Starting Independent Researcher Grant, and did well in the ERC Advanced Investigator Grant competition. Key for the future of the ERC will be to ensure raising the budget and to enhance further a positive and supportive relationship between the ERC and the national funding agencies.

On the other hand, a number of problems can be identified related to EU programs: too much bureaucracy

and formalities; too much effort required to prepare proposals; the large number of partners in some projects; the rather low probability of success even for good proposals. Concerning new initiatives, the recent top-down launching of the European Institute of Technology (EIT) raises many questions on the level of financing, IP-rights, statute of the researcher, etc. It is not evident that the MIT model can be duplicated in Europe by the EIT.

Belgium – EU

Belgium will hold the presidency of the European Union from 1 July to 31 December 2010. The relevant federal ministries will all be involved in the preparations and consolidation work, as will the respective authorities at region and community level. The Belgian presidency should address a number of priorities which for instance have recently been formulated by the Flemish Research Policy Council. The main points to be considered are: the 3% target for R&D (1% Government); a substantial increase of the EU-budget for research and innovation with emphasis on the ERC and Marie Curie Actions; a cross-border funding of excellence centres; the importance of joint programming around large societal challenges and opportunities; the problem of medical radioisotopes related to nuclear reactors; the necessity of a common Intellectual Property Licence; the simplification of administrative procedures (See also VRWB Advies 126 “Voorbereiding Belgisch EU-Voorzitterschap, December 2008). Additionally, Belgium should strive for a greater European role in space data archiving, dissemination and analysis. On the strategy level, a better structured cooperation between the federal and regional authorities and between the universities and research institutions is proposed. Concerning the research strategy envisioned in the ERA, the federal Interuniversity Attraction Pole program and the regional strategic cluster initiative and Marshall Plan are interesting examples.

Respondents to the questionnaire

– ArcelorMittal - OCAS (Sven Vandeputte),
– Bekaert (Dominique Neerinck),
– BELSPO (Philippe Mettens),
– Burny Arsène,
– Busquin Philippe,
– Communauté française de Belgique, Ministère Ens. Sup et Recherche (Marcel Crochet),
– Crappe Michel,
– CYTEC Chemicals (Jean-Claude Vanovervelt),
– Electrabel (Marc Stubbe),
– Faculté Polytechnique de Mons (Anne Desmedt),
– FWO-Vlaanderen (Benno Hinnekint, Elisabeth Monard),
– FUNDP (Robert Sporken),
– FUSAGx (André Thewis),
– IMEC NV (Gilbert Declerck, Lydia Rottiers),
– KULeuven (Paul De Boeck),
– SCK/CEN (Eric van Walle),
– Solvay S.A. (Leopold Demiddeleer),
– UCL (Francis Delannay, Claude Remacle),
– UGent (Ignace Lemahieu, Luc Moens),
– UHasselt (Paul Janssen),
– ULB (Philippe Vincke),
– ULg (Pierre Wolper),
– VITO (Dirk Fransaer),
– VRWB (Karel Vinck)

Chapter 4

RECOMMENDATIONS

Readers of this report will draw their own conclusions from the analysis which has been performed by the Working Group and will hopefully shape their future conduct of action on these conclusions. It appears nevertheless opportune for BACAS to formulate some recommendations to public and private decision-makers at all relevant levels of authority, notably within the perspective of the Belgian Presidency of the European Union during the second semester of 2010.

The first recommendation is not new but it remains very timely; it concerns the financing of the R&D which must be restored to its past growth, if Belgium wishes to maintain its position in the European and global context. Government funding of R&D which has been traditionally weak should receive a new impulse and industry should find again the path of growth in its R&D funding. The investment made in R&D is a long term one but past achievements have demonstrated that it is worth the effort.

Within the effort to be made at public level, there is a clear need for injecting funds in research infrastructure. To ensure that these funds are well used, coordination between the various government bodies is essential. Strong regional and national infrastructural bases are enabling factors for participating actively in the development of European research infrastructures.

Human capital is an equally important asset in building the strength of a R&D system. It is imperative to attract more young people into the research career which should be attractive in terms both of career prospects and international mobility. The European Union should coordinate efforts of national and regional governments in this field, realizing a real European Researchers' Area which promotes internal European mobility and which acts as a pole of attraction for researchers of other parts of the World, notably from the emerging economies.

The future Belgian Presidency of the European Union should be responsive to the preoccupations of the scientific community concerning the growing and paralyzing weight of administration when proposing and managing European projects. It should further promote initiatives which have received an enthusiastic response from this community, in particular the European Research Council initiative and the Marie Curie action. An adequate cross border funding of centres of excellence is highly desirable.

In view of the many actors, both public and private, involved at all levels in R&D in Belgium, the widest possible consultation should be performed for defining the EU Presidency lines of action.

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